PROPOSED AMMONIA-UREA PLANT AT KWINANA

CSBP AND FARMERS LTD
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Report and Recommendations
of the
Environmental Protection Authority

Environmental Protection Authority
Perth, Western Australia

Bulletin 309   November 1987

ISSN 1030-0120

ISBN 0-7309-1630-8

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The Environmental Protection Authority (EPA) has assessed the proposal by CSBP and Farmers Ltd and Norsk Hydro a.s. (the Joint Partners or the proponent), presented in the Environmental Review and Management Programme (ERMP)/Draft Environmental Impact Statement (EIS) and submitted to the EPA by the Joint Partners. The proponent proposes to establish a $450 million ammonia/urea facility in the Kwinana industrial area which will produce 500 000 tonnes per annum (t/a) of ammonia. Approximately half of this ammonia is proposed to be utilised to manufacture 430 000 t/a of urea. The proposal calls for the storage of 30 000 tonnes of ammonia. The bulk of the finished product is proposed to be exported.

Following an extensive site selection process, initially by the Joint Partners and independently by the State, the proponent submitted a Notice of Intent outlining the environmental considerations associated with the proposal to the EPA in April 1986. The EPA advised that the preparation of an ERMP would be required. Due to the need to issue export licences the then Commonwealth Department of Arts, Heritage and Environment also required that a draft EIS be prepared. After a 10 week public review of the ERMP/Draft EIS documents, the EPA received 12 submissions on this project. Issues arising from these submissions as well as questions raised by the EPA were forwarded to the proponent for a response. These responses, together with the ERMP/Draft EIS document and submissions, have been taken into consideration during the assessment of this project.

During the assessment process it became apparent that the following major issues required detailed evaluation:

- **is Kwinana industrial area an environmentally acceptable region to locate the proposed plant?**

- **is the proponent's preferred site within the Kwinana industrial area as environmentally acceptable site?**

- **would the individual risk from the proposed plant be acceptable to the Authority?**

- **would the change to the cumulative risk from the proposed plant be acceptable to the Authority?**

- **even if the individual and cumulative risks from the plant are low, what other safeguards are necessary to make the plant into a safer proposal and to ensure adequate responses to emergency situations?**

- **would there be adequate fresh water available for the proposed plant at Kwinana without detrimentally affecting the existing or future users or having adverse impact on the environment?**

- **could the wastewater and cooling water from the plant be discharged into Cockburn Sound without detrimentally affecting the beneficial uses of the Sound?**

- **does the proposal provide adequate and appropriate control over the discharge of air emissions including fugitive emissions such that odour generation would be minimal and meet an acceptable level?**

- **would the noise generated by this proposal be low enough to be acceptable?**

- would the other environmental impacts arising from the construction and operation of such a facility be environmentally acceptable?

- would there be adequate monitoring and management to ensure that the plant was operated in an environmentally acceptable manner?

After undertaking its assessment, the Authority has reached the following conclusions:

- modern ammonia-urea plants can operate with minimum pollution and negligible odours;

- given that the risk level from the proposed plant is acceptable and given the proximity to infrastructure, Kwinana industrial area is an acceptable region in WA to locate the proposed Ammonia-Urea plant;

- the proposed site for the plant within the Kwinana industrial area is environmentally acceptable;

- the individual risk levels from the plant are low enough to be acceptable;

- the cumulative risk levels from the proposed plant are low enough to be acceptable;

- there is need for a Port Safety Management Plan and a Kwinana Emergency Plan;

- the process water for the plant can be obtained in an environmentally acceptable manner;

- the EPA does not have a detailed cooling water extraction proposal on which to make a comment;

- that discharge of nitrogen containing wastewater needs to be controlled such that it complies with the identified beneficial uses of Cockburn Sound;

- fugitive emissions and odours can be controlled and minimised; and

- with appropriate management and adequate monitoring, the other environmental impacts (eg solid waste disposal, aesthetics and landscaping, noise impacts etc) can be controlled and managed.

Given the above, the Authority believes that the proposed ammonia-urea plant at Kwinana is environmentally acceptable subject to the proponents commitments for environmental management made by the proponent and the EPA's recommendations in this report.

There are a number of other issues which have been assessed and discussed in this Assessment Report. The general conclusion is that these can be managed acceptably.

The Authority would require regular reporting from the proponent on the joint partners management and monitoring programme and would review and assess these reports in consultation with relevant interested bodies.

In this Assessment Report, the Authority has made the following recommendations and conclusions:

(1) The Environmental Protection Authority concludes that the proposal described in the ERMP/Draft EIS is environmentally acceptable and recommends that it could proceed subject to:

. the commitments made by the proponent for environmental management of the ammonia-urea plant and listed in Appendix 3 of this Report; and

. the EPA's recommendations in this Assessment Report.

(2) The Environmental Protection Authority concludes that the Kwinana industrial area is an environmentally acceptable region to locate the ammonia-urea plant.

(3) The Environmental Protection Authority concludes that the proponents preferred site for the plant within the Kwinana industrial area is environmentally acceptable.

(4) The Environmental Protection Authority recommends that a condition of approval should be the preparation in stages of a comprehensive and integrated hazard and risk management strategy, to the Authority's satisfaction.

This should consist of the following with the results being forwarded to the Environmental Protection Authority:

. the HAZOP review to be completed and submitted before mechanical construction commences and to be conducted in a manner approved by the EPA;

. a hazard analysis update (including a fire safety plan, and a plan detailing the management of the commissioning stage and a plan of emergency procedures) to be submitted before plant commissioning; and

. an audit of risk and hazards to be submitted to the EPA after two years of operation and upon request thereafter.

(5) The Environmental Protection Authority recommends that no more than 30 000 tonnes of ammonia (not including existing 10 000 tonne storage) should be stored at the Kwinana plant location without further referral to the EPA.

(6) The Environmental Protection Authority recommends that the proponent prepare a Plant Emergency Plan, taking into account all appropriate contingencies. This Plan should conform with requirements of the Kwinana Emergency Plan and the Port Safety Management Plan.

(7) The Environmental Protection Authority recommends that the Government prepare and implement, by a date to be determined by the Minister for Environment, an overall and integrated Kwinana Emergency Plan and an integrated Fremantle Port Safety Management Plan incorporating the Kwinana industrial area and its surrounds. The Port Safety Plan should be compatible and integrated with the Kwinana Emergency Plan.

(8) The Environmental Protection Authority recommends that Government, coordinated by the nominee of the Minister for Minerals and Energy, devise and implement a plan, to the satisfaction of the EPA, for restricting access (except to people with adequate protective clothing) within proximity of the proposed loading and off-loading facilities.

(9) The Environmental Protection Authority concludes that the proposal to discharge wastewater containing up to 20 kg/day of nitrogen into the Cockburn Sound would be environmentally acceptable only if an equivalent amount of nitrogen load being discharged from the CSBP complex was reduced.

(10) The Environmental Protection Authority recommends that the proponent submits a detailed report to the EPA for approval, before the plant commissioning, outlining the methods by which likely odours and fugitive emissions generated from the plant will be minimised or eliminated.

(11) The Environmental Protection Authority recommends that the Company's proposal for solid waste management and disposal from the site be submitted to the EPA for approval prior to completion of construction of the plant.

(12) The Environmental Protection Authority concludes that the plant process water can be supplied in an environmentally acceptable manner and recommends that the proponent's cooling water proposal be referred to the EPA for approval prior to the beginning of construction.

(13) The EPA recommends that the proponent undertakes periodic wastewater monitoring including:

- temperature of the wastewater discharge and of the surface waters of the Cockburn Sound at an appropriate distance from the point of discharge; and

- pH, nitrogen, total dissolved solids, and total suspended solids of the effluent.

The proponent should develop a monitoring programme and reporting arrangements to the satisfaction of the EPA which should indicate how environmental management will be modified in response to monitoring reports.

1. INTRODUCTION

The proponent, CSBP and Farmers Ltd and Norsk Hydro a.s. (the Joint Partners), proposes to construct and operate a facility in the Kwinana industrial area which will use 385 000 tonnes per annum (t/a) of natural gas to manufacture 500 000 t/a of ammonia, approximately half of which (250 000 t/a) will be used to produce 430 000 t/a of urea. Urea is a concentrated nitrogenous fertiliser currently imported from overseas.

The world's current ammonia production is predicted to increase substantially over the next 15 years to meet expected world demand. This will require 30-40 world scale ammonia plants similar to the one proposed at Kwinana to be constructed by the year 2000. The bulk of the finished product from the proposed WA plant is expected to be exported interstate and overseas.

The total cost of the project is approximately $450 million.

Following an extensive site selection process, initially by the Joint Partners and independently by the State, the proponents submitted a Notice of Intent to the EPA in April 1986 outlining the environmental considerations associated with the proposal. The EPA advised that the preparation of an Environmental Review and Management Programme would be required. The then Commonwealth Department of Arts, Heritage and Environment also required that a Draft Environmental Impact Assessment be prepared. After a 10 week public review period, which ended on 11 September 1987, of the ERMP/Draft EIS documents, the EPA received 12 submissions on this project. Issues arising from these submissions as well as issues raised by EPA were forwarded to the proponent for a response. This response (see Appendix 1), together with the ERMP/Draft EIS document and submissions, has been taken into consideration during the assessment of this project.

During the assessment process it became apparent that the following major issues required detailed evaluation:

- **is the Kwinana industrial area an environmentally acceptable region to locate the proposed plant?**

- **is the proponent's preferred site within the Kwinana industrial area an environmentally acceptable site?**

- **would the individual risk from the proposed plant be acceptable to the Authority?**

- **would the change to the cumulative risk from the proposed plant be acceptable to the Authority?**

- **even if the individual and cumulative risks from the plant are low, what other safeguards are necessary to make the plant into a safer proposal and to ensure adequate responses to emergency situations?**

- **would there be adequate fresh water available for the proposed plant at Kwinana without detrimentally affecting the existing or future users or having adverse impact on the environment?**

- **could the wastewater and cooling water from the plant be discharged into Cockburn Sound without detrimentally affecting the beneficial uses of the**

Sound? The Authority believes that these beneficial uses fall into the following three categories:

. direct contact recreation;

. commercial and recreational fisheries; and

. industrial (confined to several small zones on the eastern border of the Sound);

. does the proposal provide adequate and appropriate control over the discharge of air emissions including fugitive emissions such that odour generation would be minimal and meet an acceptable level?

. would the noise generated by this proposal be low enough to be acceptable?

. would the other environmental impacts arising from the construction and operation of such a facility be environmentally acceptable? and

. would there be adequate monitoring and management to ensure that the plant is operated in an environmentally acceptable manner?

As part of the Authority's investigations, it undertook the following actions:

. requested NSW Department of Environment and Planning (DEP) to provide expert assistance in reviewing the numerous risk studies conducted for this project and determining whether the proponent's preliminary risk analysis was carried out in an appropriate and acceptable manner;

. discussed the need for a Port Safety Management Plan with the Fremantle Port Authority including the details by which such an integrated plan can be developed, implemented and maintained;

. discussed the need for a Kwinana Emergency Plan with the State Emergency Service; and

. directed the matter of groundwater extraction and its consequences to the Water Authority of Western Australia for advice.

In addition, the Authority generated a number of questions, some arising from issues raised in the submission, and forwarded these to the Joint Partners for response.

The EPA finds the proponent's documentation on the proposal; the ERMP/Draft EIS (including the Preliminary Risk Analysis); and the response to the EPA questions and issues raised in the submissions to be comprehensive, and commends the Joint Partners.

The EPA has assessed the environmental aspects of the project discussed in this Assessment Report using information provided in the ERMP/Draft EIS documents, public and Government agencies' submissions, the proponent's response to issues raised in submissions and to the Authority's questions and the Authority's own investigations. The Authority acknowledges the expert advice on risk analysis provided by the NSW Department of Environment and Planning.

The Authority has reached the following conclusion and recommends accordingly:

(1) **The Environmental Protection Authority concludes that the proposal described in the ERMP/Draft EIS is environmentally acceptable and recommends that it could proceed subject to:**

- **the commitments made by the proponent for environmental management of the ammonia-urea plant and listed in Appendix 3 of this Report; and**

- **the EPA's recommendations in this Assessment Report.**

2. ASSESSMENT OF SITE SELECTION PROCESS AND OF ALTERNATIVES

2.1 REGIONAL SITE SELECTION PROCESS

The Joint Partners were appointed, in March 1986, by the State Government to enter into negotiations on a Framework Agreement for the project and to undertake a full feasibility study. In addition, the State Government requested the Joint Partners to conduct a detailed analysis of suitable sites within WA where the plant could be located.

Both the Government and the proponent-initiated studies adopted a similar site selection process. This consisted of the following methodology:

- compilation of relevant selection criteria;

- identification of a number of possible alternative site regions and localities; and

- through an iterative process of elimination, the selection of the appropriate site.

The Joint Partners' consultants undertaking this study chose six prospective sites for assessment. These were: one in Geraldton, two in Kwinana, two in Bunbury and one in Wagerup (see Figure 1). Table 1 summarises the qualitative analysis of sites presented in the ERMP and shows that Kwinana is the best location to site the plant.

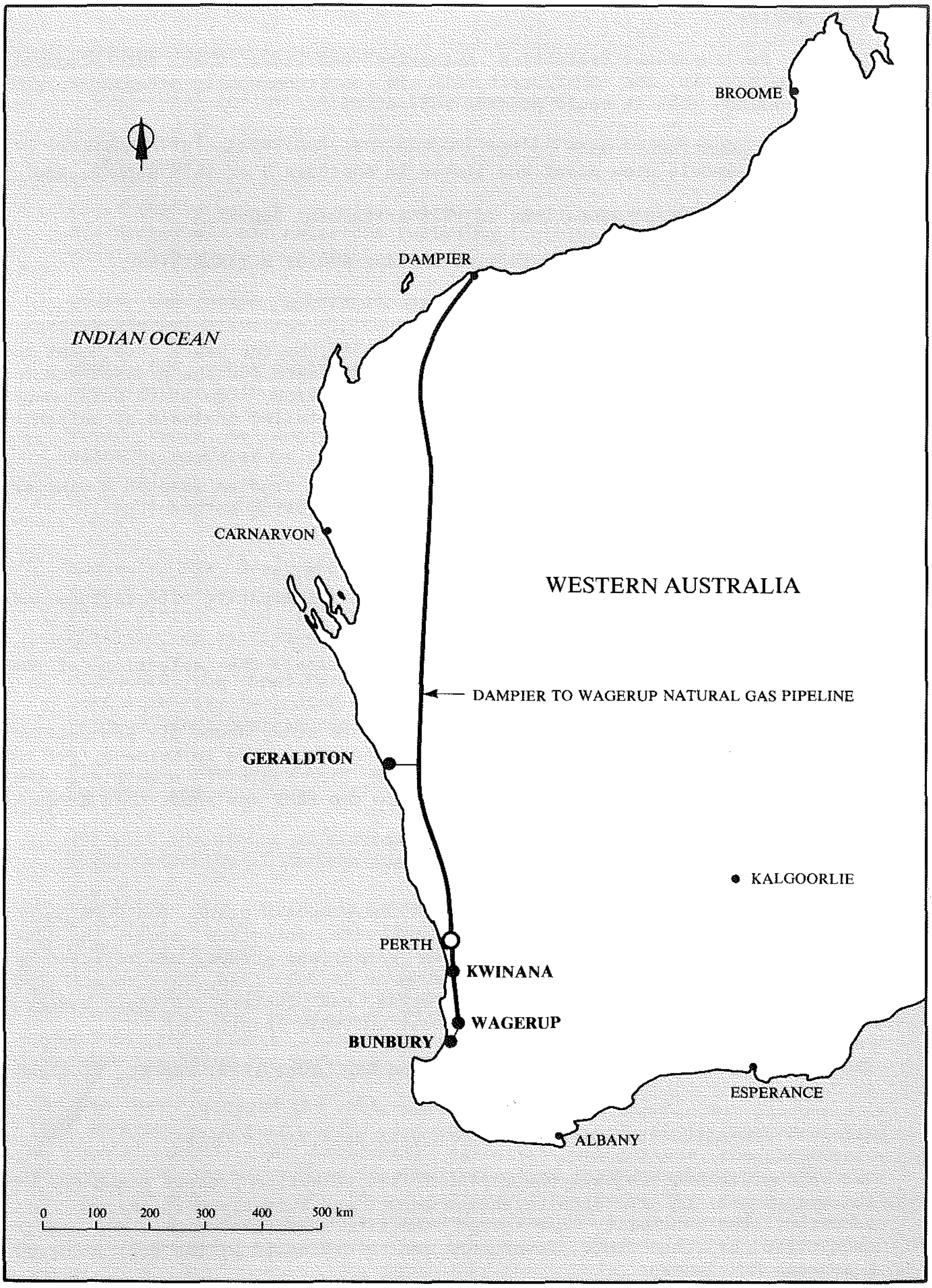
The ERMP states (p 1) that:

> "due to the regional importance of the proposed plant, the Government decided to commission an independent site selection study. The subsequent report, prepared by three consultant groups, was released by the Minister for Minerals and Energy on 23 July 1986. This report (DRD June 1986) concluded that most sites had factors in their favour. However, overall, 'Kwinana was the most suitable location'."

The ranking of the sites, presented in the DRD (June 1986) report, is shown in Table 2.

2.2 EPA ASSESSMENT OF THE REGIONAL SITE SELECTION PROCESS

The Authority has reviewed the regional site selection process presented by the proponent in the site selection report and summarised in the ERMP. In addition, the Authority has noted the site selection process and report undertaken by the State Government and co-ordinated by the Department of Resources Development.



Source: ERMP

Figure 1. Regional location.

Table 1. Summary of qualitative analysis of sites.

	Geraldton 'Narngulu'	Kwinana	Wagerup	Bunbury 'Port'	Bunbury 'Picton'
Compatibility with State objectives	+	+	+	+	+
Risks:					
. plant	O	O	O	●	O
. port storages	●	O	●	●	●
. pipelines	●	O	●	O	●
. projectiles	●	O	O	O	●
Social:					
. construction	●	O	●	●	O
. operation	O	O	O	O	O
Community perceptions	++	--	+	+	++
Landscape impact	O	O	●	●	O
Environmental impact:					
. flora/fauna	O	O	O	O	O
. liquid wastes	O	O	O	O	O
. gaseous wastes	O	O	O	O	O
. solid wastes	O	O	O	O	O
. anthropological	O	O	O	O	O
Lead time:					
. approvals	●	O	●	O	●
. infrastructure	●	O	●	●	●
LPG plant	●	O	O	O	O
Product transport:					
. ammonia	●	O	●	O	●
. urea	●	O	●	O	●
Transport efficiency:					
. road	O	O	O	O	O
. rail	O	O	O	O	O
. port	O	O	O	O	O
Land use/expansion	O	O	O	●	O
Skilled labour availability	●	O	●	●	●
Public sector infrastructure cost burden	++	+	++	++	++
Depletion of natural resources	O	O	O	O	O

● Major impact
O Minor impact
++ Strongly positive
\+ Positive
\- Negative
-- Strongly negative

Source: ERMP

Table 2. Summary of site analysis (Ranking from Government Report).

CRITERION	NARNGULU	KWINANA NORTH	KWINANA SOUTH	BUNBURY	PICTON
Engineering and Finance					
Capital Costs	3	2	1	5	4
Annual Costs	5	1	2	3	4
Other Considerations	5	1	2	3	4
Physical Environment and Land Use	1	3	4	5	2
Socio-Economic Issues					
Regional Issues	5	1	1	3	3
Site Issues	1	1	4	5	1
Transport	4	1	1	3	4
Community Risk	5	1	1	3	4

The EPA finds the methodology adopted by these studies to be appropriate and finds that the Kwinana industrial area is an environmentally appropriate region to locate the proposed ammonia-urea plant.

This assessment is based upon the fact that a key environmental issue concerns community risk. The Government site selection study states that:

> "the risk and hazard analysis showed that the level of risk at Geraldton is unacceptable under EPA guidelines. The risk levels at Bunbury are only marginally acceptable. Kwinana is well within the Guidelines." (DRD 1986 p 1).

The issue of risk and hazards likely to be generated by the proposed plant at Kwinana is discussed in Section 6.3 of this Assessment Report.

The other major environmental issue concerns the emission of wastes, especially the discharge of wastewater. The Authority's detailed assessment of this matter is discussed in Section 6.4.1 of this Assessment Report. In summary, the EPA believes that discharge of wastewater can be controlled and managed in an environmentally acceptable manner at Kwinana.

Finally, the issue of the adequate quantity and quality of water available for plant process (initially 6 million litres (mL) per day and now approximately half this amount), while not fully resolved at Kwinana, does not appear to be an environmental constraint preventing the proposed plant from proceeding within the Kwinana industrial area. This matter is further discussed in Section 6.5 of this Assessment Report.

Given the above, the Authority finds that Kwinana industrial area is an acceptable region to locate the ammonia-urea plant.

(2) The Environmental Protection Authority concludes that the Kwinana industrial area is an environmentally acceptable region to locate the ammonia-urea plant.

2.3 SITE SELECTION WITHIN KWINANA INDUSTRIAL AREA

Both the Joint Partners' and the Government's site selection studies identified two possible sites within Kwinana industrial area potentially suitable to locate the plant. These areas are shown in Figure 2 and discussed below:

. Kwinana North

The site lies within the boundaries of the BP Refinery adjacent to the Kwinana nitrogen plant. Access to the existing bulk berth requires that the urea storage shed be located separately and south of the fertiliser works; and

. Kwinana South

The site lies immediately south of the CSBP Fertiliser works and adjacent to the Western Mining Corporation Nickel Refinery.

The proponents prefer the Kwinana North site for economic and infrastructure integration reasons.

2.4 EPA ASSESSMENT OF SITE SELECTION WITHIN KWINANA INDUSTRIAL AREA

The EPA has assessed the site alternatives available within the Kwinana industrial area, including the two options discussed in the site selection reports and finds the proponent's preferred site at Kwinana North to be appropriate and acceptable from an environmental point of view (see also Section 6.3 of this Report for a discussion of risk and hazards).

(3) The Environmental Protection Authority concludes that the proponent's preferred site for the plant within the Kwinana industrial area is environmentally acceptable.

2.5 ASSESSMENT OF ALTERNATIVE PROJECT OPTIONS

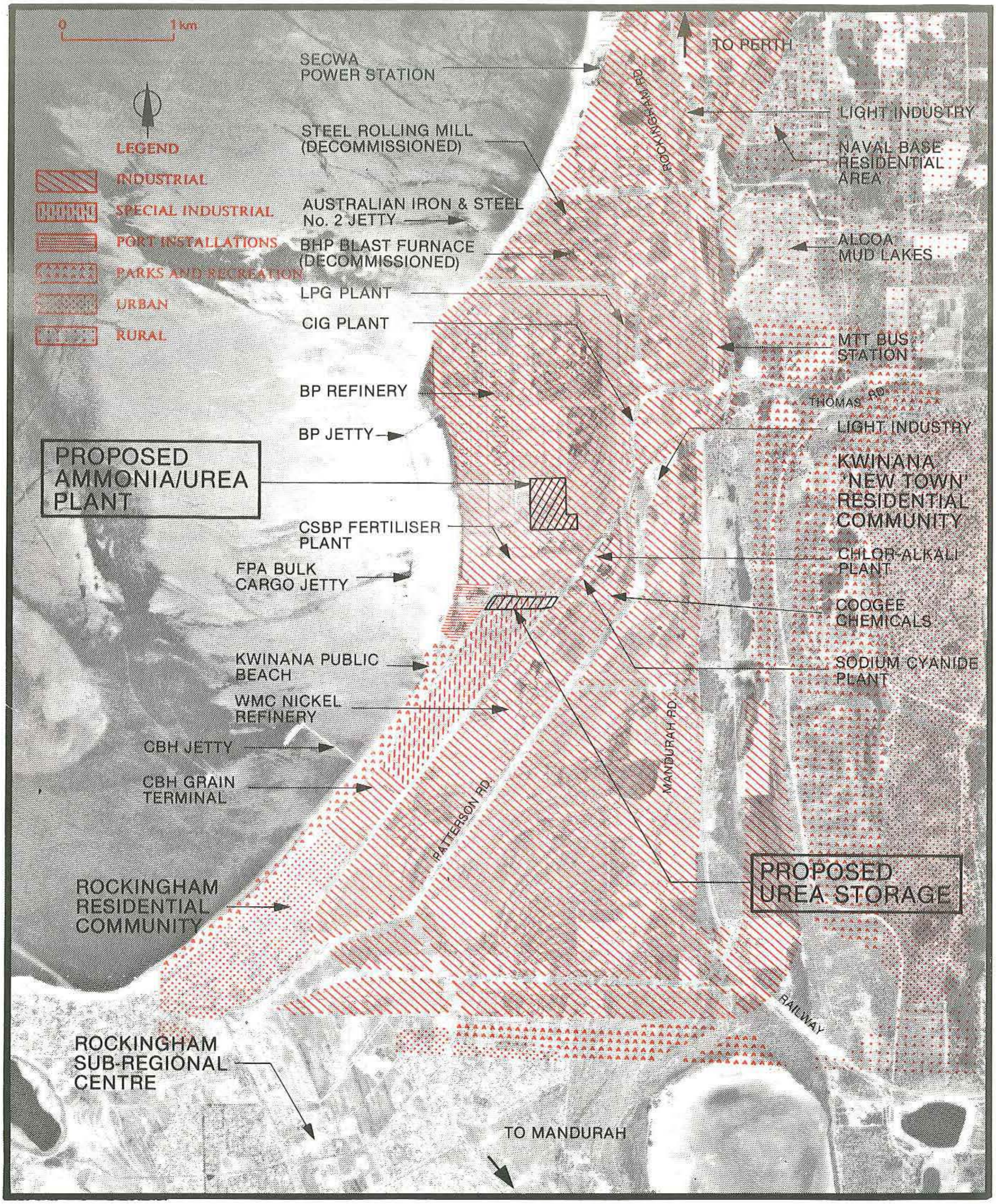
2.5.1 THE 'NO-PROJECT' OPTION

The proponent has argued that the project would generate a number of benefits to the local, State and Federal Governments and the community. The consequences of a 'no-project' option would be the loss of these potential benefits.

2.5.2 ALTERNATIVE TECHNOLOGY

A number of alternative technologies exist to manufacture ammonia, for the urea synthesis process and for the urea finishing process. The Joint Partners have chosen natural gas rather than coal, heavy oil or water as the basic raw material for ammonia manufacture. The Joint Partners have also chosen an evaporation (rather than crystallisation) process for urea synthesis, and granulation (rather than prilling) for urea finishing.

All of the above alternatives generally, have economic rather than environmental consequences and hence the proponent's preferred technology for the manufacture of ammonia and urea is acceptable to the Authority.



Source: ERMP

Figure 2. Sites within Kwinana and zoning.

2.5.3 AMMONIA STORAGE

The proponent prefers to store the required 30 000 tonnes of ammonia in a single refrigerated storage tank. Alternative configuration of storage is possible. This matter is further discussed in Section 6.3.6.4 of this Assessment Report.

2.5.4 ALTERNATIVE COOLING SYSTEM

The ammonia-urea plant needs to be cooled (cooling load 240-250 megawatts). Four cooling options exist and have environmental consequences. These options are shown schematically in Figure 3. The options are:

2.5.4.1 Air Cooling

Air cooling requires forcing air across the surface of heat exchanger fins. This option would use minimum water. However, force draft fans would mean that a potentially high level of noise could be generated. Technical means of controlling this noise exist.

2.5.4.2 Cooling Tower

This method dissipates heat by evaporation of a portion of the cooling water in a cooling tower. Part of the water loss in the system is through evaporation drift (water lost as mist or droplets entrained by the circulating air and discharged to the atmosphere). The other part of the water loss is by 'blow-down' where the cooling water is intentionally bled or discharged from the system to maintain an acceptable level of dissolved salts in the circulating water, which would otherwise concentrate due to evaporative losses.

This may be part of the proponent's preferred option for plant cooling. The consequence of this cooling option is the use of a large quantity of relatively 'fresh' water which could be extracted from the shallow groundwater resources in the Kwinana industrial area.

2.5.4.3 Sea-water Cooling

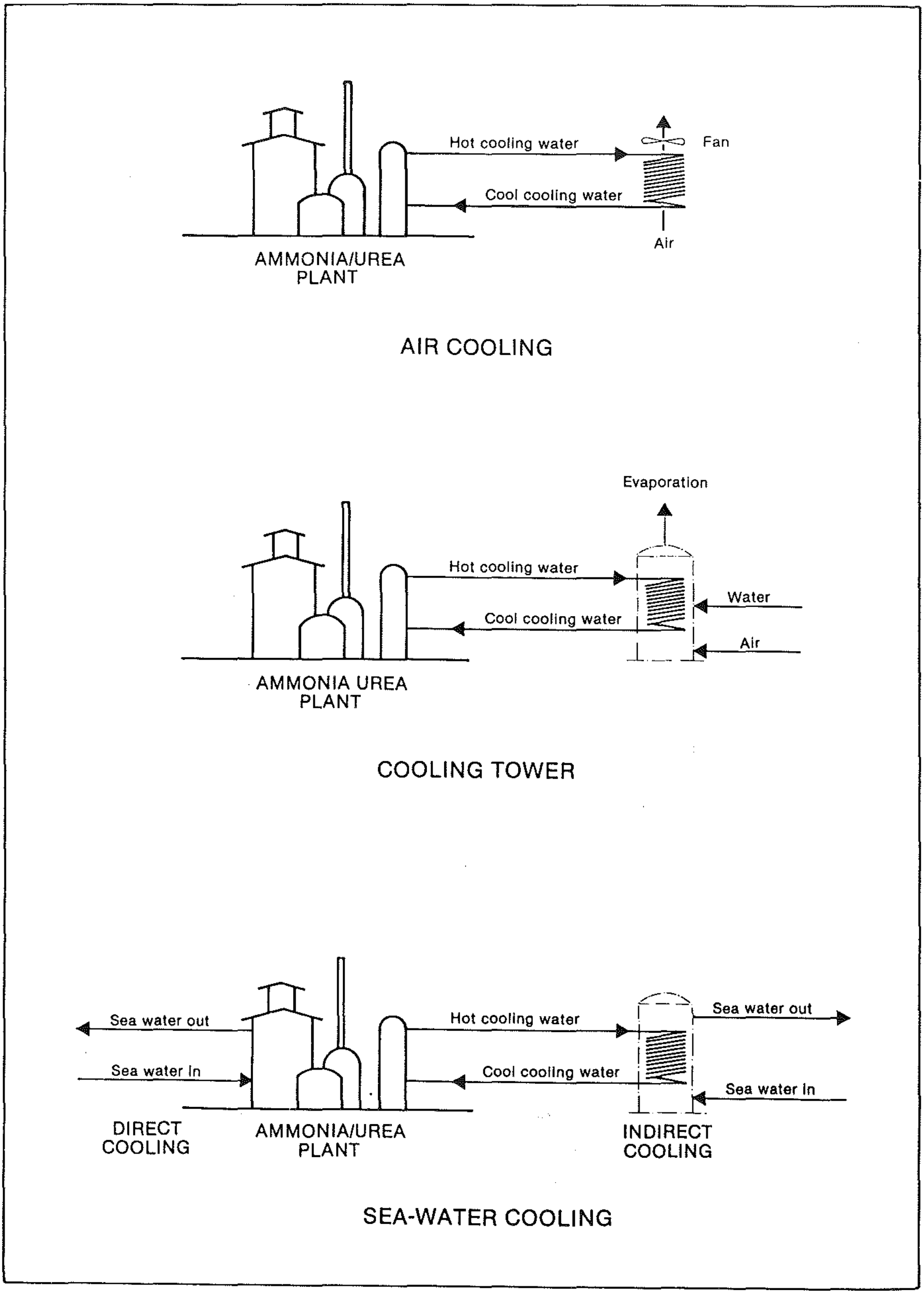
This option involves the pumping of a large quantity of sea water from Cockburn Sound through heat exchange units and then pumping it back into the Sound at an elevated temperature. A similar method of cooling is currently being used by CSBP and BP at Kwinana and was used by BHP for their blast furnace plant. The environmental concern is the impact of the thermal load into the Sound.

2.5.4.4 A Combination of Two or More of these Options

2.5.5 ASSESSMENT OF ALTERNATIVE COOLING SYSTEMS

The ERMP (p30-32) provides a detailed analysis of the above options, particularly of the sea-water cooling option. The four critical parameters in this option are:

- the quantity of sea-water intake/output (which can vary from 8 600-18 050 cubic metres per hour (m^3/hour));
- the temperature rise of the output which would vary from 5-10^oC depending on intake quantity;



Source: ERMP

Figure 3. Cooling options.

- the chlorine component of the output (chlorine is added to intake sea water to control fouling); and

- the length of output pipeline from shore and the diffuser configuration.

By varying these parameters, a chosen dilution factor (dilution of the plant's warm sea-water output to that of the surrounding receiving waters) can be maintained. Using EPA's broad guidelines (DCE Bulletin 103) the proponent has identified an optimum dilution factor of 50 which, if achieved, could make this thermal discharge environmentally acceptable.

However, the ERMP states that without a 1 kilometre discharge pipeline into the Sound, the maximum dilution for total sea water cooling discharge that can be achieved through a 10 metre depth (foreshore) pipe discharge would be thirty-fold. In addition to the high capital and operation costs of sea water intake and outfall systems, there are some practical constraints in having long outfall pipes in the vicinity of the project site. Given these reasons, the Joint Partners have discounted the total sea-water cooling option.

The proponent's preferred cooling option is a mixture of air and water cooling. As mentioned previously, 240-250 MW of cooling is required. The ERMP states that an economical arrangement had been found to be division of this load such that approximately 140 MW would be air-cooled and approximately 100 MW would be water-cooled. This would require approximately 200 m^3/hour of make-up water (of the 264 m^3/h of total water requirement of the plant) which is proposed to be supplied from groundwater. The proponent has now informed the EPA that to minimise water consumption the Joint Partners will make a commitment to having 190 MW of air-cooling and 50 MW of water-cooling using groundwater, sea water or wastewater (see Section 6.5).

The environmental consequences of this proposal are discussed in Sections 6.4 and 6.5 of this Assessment Report.

3. DESCRIPTION OF THE PROPOSAL

3.1 <u>INTRODUCTION</u>

As mentioned previously, it is proposed to manufacture 500 000 tonnes per annum (t/a) of ammonia with half (250 000 t/a) the ammonia production capacity being utilised to produce 430 000 t/a of urea. The ERMP states that:

> "The proponents are presently investigating the availability of increasing the production capacity of the plants to about 575 000 t/a of ammonia and 500 000 t/a of urea." (ERMP p 34)

The major inputs and outputs of the proposed plant are shown in Table 3.

An artist's impression of the proposed ammonia-urea plant is shown in Figure 4.

Table 3. Major inputs and outputs of the proposed plant in tonnes per annum (t/a).

MAJOR INPUTS			MAJOR OUTPUTS		
Natural Gas	385 000	t/a	Ammonia	500 000	t/a
Process water	500 000	m^3/a	Urea	430 000	t/a
Cooling water	1 600 000	m^3/a	Water vapour from cooling tower	1 800 000 (232 m^3/h)	t/a
Process air	6 200 000	t/a	Wastewater	467 000	m^3/a
Urea - formaldehyde	2 400	t/a	Carbon dioxide	315 000	t/a
Miscellaneous process chemicals	2 700	t/a	Cooling tower blow-down water	44	m^3/h
			Other wastewater	11.2	m^3/h
			Nitrogen	6.6	t/a
			Flue gas	303	t/h

Source: ERMP.

3.2 MAIN COMPONENTS

The plant's main components consist of the following:

. 1 500 tonnes per day ammonia plant covering 2.4 hectares and being about 40 m in height*;

. 1 300 tonnes per day urea plant* including the granulation section covering 0.6 ha;

. 30 000 tonne refrigerated (-33°C) ammonia storage tank consisting of a single steel shell structure with a diameter of 45 m and height of 30 m. The tank would incorporate a secondary, pre-stressed concrete, full-height containment bund;

. plant utility consisting of a water demineralisation plant, steam and power generation, an electrical substation, nitrogen storage and electrical air compressors. Plant utility would be grouped together in one area (0.5 ha). Total plant power generation would be 15 MW;

. urea storage and export facilities with a 470 m x 55 m x 15 m storage facility storing 100 000 tonnes of urea. Transfer of urea from the plant would be by covered conveyers, especially to the bulk cargo ship loading facility;

. a 44 m x 11 m x 6.7 m cooling tower capable of circulating 10 000 m^3/h of water;

. effluent treatment facilities; and

. plant infrastructure including two storey administration offices, stores and workshops buildings, canteen, firehouse and gatehouse.

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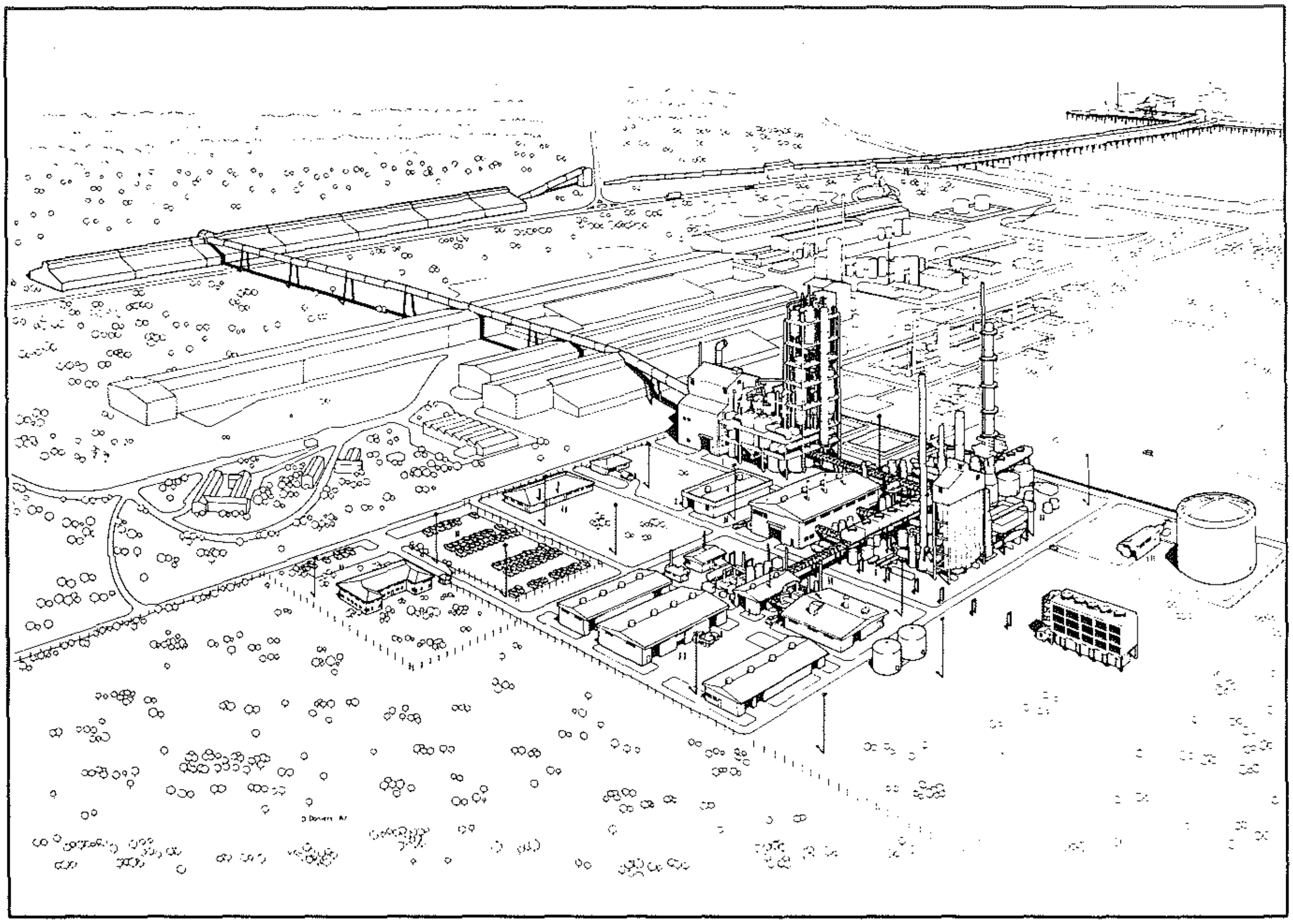
*Both the ammonia and urea plants have some structures which are close to or less than 80 m high. However, the general height of the plant is 40 m.



Source: ERMP

Figure 4. Artist's impression.

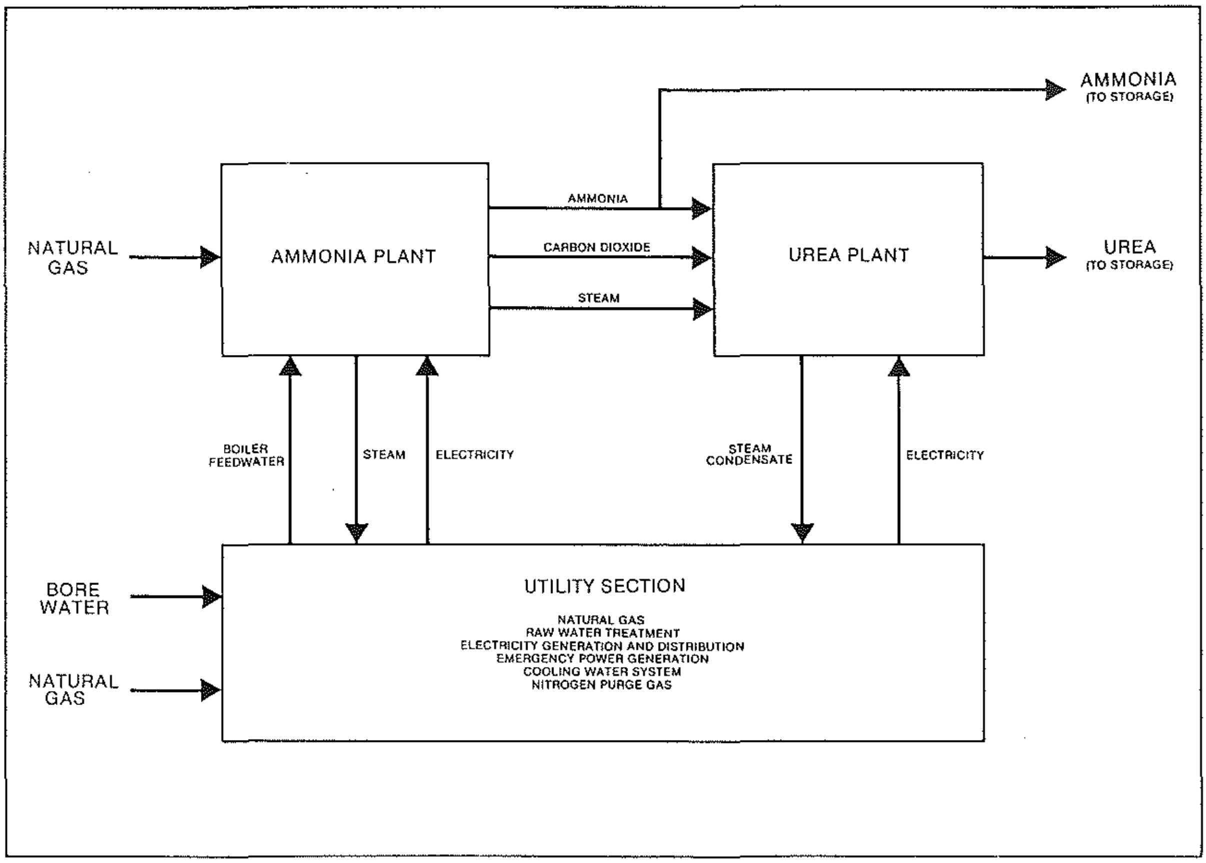
3.3 THE PROCESS

The interaction between the ammonia and urea processes is shown in Figure 5. The ERMP states that this interaction is complementary in that:

- "the ammonia produced in the ammonia plant is used as feedstock in the production of urea;
- carbon dioxide, a by product from the ammonia plant, is used as feedstock for the urea plant;
- the process used to produce ammonia generates waste heat, whereas the process used to produce urea requires the addition of heat. Heat transfer between the two processes is accomplished via the use of steam; and
- process steam condensate (water) produced by the urea plant can be used to complement process water usage in the ammonia plant". (ERMP p 36)

3.3.1 AMMONIA PROCESS DESCRIPTION

The natural gas feedstock comprises methane, other hydrocarbon gases and condensate. The Wesfarmers liquified petroleum gas extraction plant at Kwinana, now under construction, would extract condensate and butane/propane from natural gas. An additional proposal soon to be assessed proposes to extract ethane from natural gas at Kwinana.



Source: ERMP

Figure 5. Interaction between the ammonia and urea processes.

Methane, when combined with steam, produces hydrogen which when reacted with nitrogen (obtained from air) produces ammonia. The carbon component of natural gas reacts with the oxygen component of the air and steam to form carbon dioxide, which is proposed to be removed and later reacted with ammonia to form urea.

3.3.2 UREA PROCESS DESCRIPTION

Carbon dioxide and ammonia are reacted to form urea and water via an intermediate compound known as ammonium carbonate. The water is then evaporated and the concentrated urea formed into granules.

3.4 PLANT WASTE PRODUCTS AND DISPOSAL

3.4.1 LIQUID DISCHARGES

The ERMP states that the major source of liquid wastes during normal plant operation may be up to 44 m^3/h of cooling tower blow-down wastewater having characteristics shown in Table 4. The balance (11.2 m^3/h) of the liquid effluent would consist of:

- 1.3 m^3/h of blow-down from steam generation plants;
- 8.7 m^3/h of neutralised regeneration water from demineralisation plants; and
- 1.2 m^3/h of condensate from air compressors.

Table 4. Characteristics of cooling tower blow-down wastewater.

. total dissolved solids	3 000 mg/L
. alkalinity, expressed as carbonates (dissolved)	1 040 mg/L
. chlorides (dissolved)	800 mg/L
. calcium (dissolved)	700 mg/L
. sodium (dissolved)	440 mg/L
. sulphates (dissolved)	290 mg/L
. magnesium (dissolved)	240 mg/L
. suspended solids	100 mg/L
. dispersant	5 mg/L
. free chlorine (biocide)	0.3 - 1.0 mg/L
. pH	6.8 - 7.2 mg/L
. temperature	27.0 - 30.0 mg/L
. heavy metals	NIL

Source: ERMP

The ERMP states that:

"Domestic sewage from amenity facilities will be treated in a septic system in accordance with the requirements of the Town of Kwinana and the Water Authority of Western Australia." (ERMP p 51).

3.4.2 ATMOSPHERIC DISCHARGES

The estimated atmospheric discharges would be:

- 4 m^3/h of drift (fine droplets) water from cooling tower;

- 232 m^3/h of evaporated water vapour;

- 6 900 t/h of air from cooling tower steam plume;

- chlorine (1.4 ppm) within the cooling tower water vapour plume;

- 303 t/h flue gas consisting of nitrogen, oxygen and inert gases, and products of combustion (water vapour and carbon dioxide), together with about 170 ppm (0.35 g/m^3) of oxides of nitrogen (expressed as NO_2) and 0.8 ppm (2.3 x 10^{-3} g/m^3) of sulphur oxides (expressed as SO_2);

- 102 t/h flue gases from utility power generation turbine and auxiliary boiler systems. These gases will principally comprise nitrogen (from air), together with products of combustion and about 100 ppm (0.2 g/m^3) of oxides of nitrogen (expressed as NO_2) and 0.8 ppm (2.3 x 10^{-3} g/m^3) of sulphur oxides (expressed as SO_2).

  The combined discharge from the ammonia reformer utility power generation and auxiliary boiler will contain 152 ppm (0.31 g/m^3) of oxides of nitrogen (expressed as NO_2) and 0.7 ppm (2 x 10^{-3} g/m^3) of sulphur oxides (expressed as SO_2); and

- vents from the carbon dioxide removal section of the ammonia process will discharge 40 t/h of carbon dioxide containing small concentrations of water vapour (2.1% by weight) and hydrogen (0.007%, by weight) at a height of approximately 80 m above ground level.

Other air discharges from the plant would be:

- 2.3 t/h of air from the scrubber vent servicing the urea synthesis and evaporation section, containing water vapour and ammonia (1.0% by weight);

- 482 t/h of air from the scrubber vent servicing the urea granulation section containing water vapour (7.4% by weight) and urea dust (40 mg/m^3 of air); and

- 9 kg of ammonia per year from the ammonia ship loading operations.

3.4.3 SOLID WASTE

The ERMP states that the proposed plant would not be producing any industrial waste except used catalysts.

3.4.4 NOISE EMISSIONS

Predicted noise emissions (and possible variations) are shown in Table 5. Table 5 shows that excess noise would be attenuated to 68 dB(A) within 120 m from the centre of the ammonia plant.

3.5 <u>OTHER INFORMATION RELEVANT TO THE PROPOSAL</u>

- The plant will operate continuously (24 hours) at full production.

- Once every two years, plant will be stopped for planned maintenance and catalyst change. This procedure normally takes three days.

- The total size of the site is 30 hectares.

- Groundwater extraction is proposed from six bores 1 km away from the plant. Groundwater is expected to be extracted from the Tamala Limestone aquifer which occupies a zone between 17-28 m below surface.

- The plant will be surrounded by a security fence, and access to the site would be via the gatehouse.

- Sewerage and domestic solid waste would be disposed of according to the requirements of Kwinana Town Council, Water Authority of Western Australia and Health Department of Western Australia.

- Construction and assembly are expected to take 25 months and the construction phase would require a workforce of approximately 1 200 personnel.

- In order to provide access for unloading heavy plant components, a temporary land groyne would be constructed on the foreshore. This structure would be removed once all plant components have been delivered.

- Construction activities would be carried out between 7 am and 6 pm, Monday to Friday and on Saturday mornings.

- The plant workforce would be up to 200 persons.

Table 5. Noise Emissions.

DISTANCE (m)	FREQUENCY (Hz)/A-WEIGHTING FACTOR								COMBINED NOISE LEVEL (dB(A))
	63/-26.2	125/-16.1	250/-8.6	500/-3.2	1 000/0.0	2 000/1.2	4 000/1.0	8 000/-1.1	
100	70	65	61	59	58	56	53	40	63
200	63	58	54	52	49	46	41	25	54
400	56	50	45	42	38	32	24	1	44
600	50	44	39	34	29	21	9	0	36
800	46	40	34	28	21	11	0	0	30
1 000	43	36	29	22	13	2	0	0	25
2 000	29	19	10	0	0	0	0	0	10

(Source: ERMP)

- The construction phase is planned to start in January 1988 (assuming all approvals are granted) and production expected to commence in October 1990.

4. DESCRIPTION OF THE EXISTING ENVIRONMENT

4.1 THE BIO-PHYSICAL ENVIRONMENT

The zoning of the areas surrounding the proposed ammonia-urea plant is shown in Figure 2. The plant site is 30 hectares in total and located towards the northern end of the Becher-Rockingham beach ridge plain.

The meteorological aspects of the site consist of the sea breeze/land breeze phenomena reinforced by a katabatic wind from the Darling Scarp. The area experiences strong westerly winter winds while strong easterly winds predominate in summer. The Det Norsk Veritas Risk Analysis document (ERMP Volume 2) has taken low night-time winds, average conditions, afternoon strong breezes, and occasional high winds as representative wind conditions in their consideration of the modelling of the gas dispersion characteristics.

The proposed ammonia-urea plant site has generally been cleared of native vegetation although some original vegetation does exist at the boundary. The surrounding area has recently been planted at the edges with *Eucalyptus* by CSBP as part of the landscaping for its existing works.

4.2 LAND USE, ZONING AND TRAFFIC

4.2.1 LAND USE

The site is located in the Kwinana industrial area which has been used for industrial development since 1955. The existing land uses within the area and their proximity to the proposed ammonia-urea plant site are shown in Figure 2.

The ERMP discusses population distribution in the areas surrounding the Kwinana industrial area and concludes that the nearest major residential area is approximately 2 kilometres inland to the south-east.

4.2.2 ZONING

The proposed site is currently zoned 'industrial' under the Town of Kwinana Town Planning Scheme No 1. Town Planning Scheme No 2 is currently in preparation.

4.2.3 TRAFFIC

The site is located in proximity to Kwinana Beach Road and Patterson Road.

4.3. COCKBURN SOUND AND AIR QUALITY OF KWINANA

Cockburn Sound and its environment have been described adequately in the ERMP. For further information, 'Cockburn Sound Environment Study' (DCE 1979) is available at the EPA Library.

Similarly 'The Kwinana Air Modelling Study' (DCE 1982) detailing the atmospheric environment of Kwinana is available at the EPA Library.

The reference documents detailing the environment of Kwinana are:

- Kwinana Cumulative Risk Analysis (Technica 1987)
- Kwinana Industrial Area Environmental Study, Volumes I & II (Institute of Environmental Sciences, Murdoch University, December 1986).

5. REVIEW OF SUBMISSIONS

The ERMP was released for public review on 24 July 1987 for a 10 week period which ended on 11 September 1987.

A total of 12 submissions were received: eight from Government departments and four from the public.

The main issues addressed in all submissions are indicated in Table 6. Points raised within these broad issues are discussed in Section 6 of this Assessment Report.

Table 6. Summary of submissions.

ISSUE	NUMBER OF SUBMISSIONS WHICH DISCUSSED THIS ISSUE
1. <u>RISK AND HAZARDS</u>	
Need for Hazard and operability study	1
Risk assessment	1
2. <u>AIR POLLUTION</u>	
Air emissions	2
Health effects of air emissions	1
Aerosols	1
3. <u>WASTES</u>	
Liquid wastes	3
Catalysts	2
4. <u>GROUNDWATER USAGE</u>	
Groundwater extraction	4
5. <u>OTHER</u>	
Emergency procedures	3
Employment	1
Noise	1
Traffic/rail crossing	1

Appendix 2 provides a more detailed analysis of the issues raised and comments made in the submissions received by the Environmental Protection Authority. Appendix 2 also includes the list of people and Government departments making submissions.

Major issues raised in the submissions are:

5.1 RISK AND HAZARDS

- Hazard and operability studies.
- Risk assessment methodology.

5.2 AIR POLLUTION

- Air emissions - cumulative data not given.
- Health effects of air emissions.
- Aerosols generated.

5.3 WASTES

- Effects of liquid waste disposal into Cockburn Sound.
- Disposal of catalyst wastes.

5.4 GROUNDWATER USAGE

- Effect on supplies for other nearby users.
- Enhanced movement of pollution plume towards Cockburn Sound and other industries.
- Water mining leading to intrusion of salt into coastal aquifers.

5.5 OTHER

- Emergency planning.
- Employment opportunities for Kwinana/Rockingham people.
- Noise control - occupational health.
- Increased traffic load at Mason Road/Rockingham Road junction.
- Railway crossing safety.

6. ASSESSMENT OF ENVIRONMENTAL IMPACTS

6.1 INTRODUCTION

In section 2.2 of this Assessment Report, the Authority concluded that the Kwinana industrial area is an acceptable region to locate the proposed ammonia urea plant.

The development of an ammonia-urea plant at the Kwinana site will generate environmental issues requiring management. These include the following:

. construction phase impacts;

. impacts of risk and hazards;

. other environmental impacts due to the emission of wastes;

. environmental impacts due to water resource extraction; and

. occupational health, traffic and social impacts.

The Joint Partners, being aware of the need to have in place the highest level of management controls and safeguards and to generate a minimum impact in the Kwinana area, have made a number of commitments to ensure that these objectives would be met (see Appendix 3 of this Assessment Report for a list of the proponent's management commitments).

6.2 CONSTRUCTION STAGE IMPACTS

The construction of the project, over approximately a 25 month period, would have the following impacts on the Kwinana industrial area:

. the generation of dust;

. the generation of noise;

. discharge of contaminated stormwater (especially grease and oils from construction equipment); and

. possible impacts due to the loss of vegetation caused by excessive site clearance.

The Authority believes that the proponent needs to liaise closely with the relevant control agencies, including the Kwinana Town Council, during the construction phase to ensure that no issues arise during that period which could adversely affect the environment or inconvenience the local population. In particular the proponent needs to ensure that:

. stormwater runoff is properly filtered for grease and oil before discharge to Cockburn Sound;

. generation of noise is kept to a minimum. Times of operation may need to be controlled to meet this objective;

. dust is adequately suppressed by sprinkler watering practices;

. site clearance is kept to the minimum; and

. appropriate landscaping and tree planting is undertaken at an early stage to minimise the visual impact of the plant.

6.3 RISK AND HAZARD IMPACTS

6.3.1 INTRODUCTION

The manufacture of ammonia generates risk and hazards. The major hazard identified for the proposal relates to the loss of containment of pressurised gases or liquids (refrigerated or stored under pressure), namely ammonia, methane, hydrogen and chlorine.

The Authority has discussed its position on the issues of risk and hazards from industrial projects previously (see DCE Bulletin 257; and EPA Risk and Hazard Statement in Bulletin 278, May 1987).

The Authority believes that the quantitative assessment of risk to the community is an important part of the environmental evaluation of such proposals. Historical records show that industrial accidents occur, and that technical safeguards have their limitations. However, with proper planning, review and controls during the plant design, commissioning and operational stages, risk and hazards can, in most cases, be reduced to a level that the community is prepared to tolerate.

The term 'hazard' is used to describe a set of conditions that could lead to a harmful accident. 'Risk' is defined in terms of both the likelihood of a hazard, and the consequences of that hazard, ie "the probability that a hazard, in terms of a specific level of loss or injury to people or property, will occur in a specific period of time" (Pomeroy 1982).

Risk assessment methodology consists of the following elements:

- HAZARD IDENTIFICATION OR DEFINITION: ie identification of potential hazards or hazard events;

- RISK ESTIMATION: ie determination of the likely severity of the consequences of the event and its products with the likely frequency of the event; and

- EVALUATION OF RISK AND HAZARDS: ie guidelines or standards of assessment and an evaluation of the risk.

There has been a preliminary assessment of risk (ERMP Volume 2) for the proposed ammonia-urea plant by the risk consultants Det Norsk Veritas (DNV) for the 1 500 t/day ammonia plant including 30 000 tonnes refrigerated storage of ammonia at Kwinana. The Authority subsequently initiated a review of the previously undertaken risk analyses, by the NSW Department of Environment and Planning (DEP). On the basis of Det Norsk Veritas credentials (see Appendix 4) and from advice provided by DEP, the Authority accepts the preliminary analysis presented in the ERMP as an acceptable and appropriate assessment of the risk and hazards associated with the proposed plant including 30 000 tonnes refrigerated storage of ammonia at the Kwinana site.

6.3.2 HAZARD IDENTIFICATION

The ERMP Volume 2 identifies the major hazards associated with ammonia-urea plants to be those which arise if there were loss of containment of ammonia, methane, hydrogen or chlorine. Of these, the major concern is with ammonia and methane given that the storage of hydrogen and chlorine is relatively low.

Ammonia is a toxic and pungent colourless flammable gas that forms a dense vapour cloud if released. At atmospheric pressure, ammonia boils at -33°C and needs to be cooled at -33°C if storage at atmospheric pressure is desired.

The toxic effects of ammonia are summarised in Table 7.

Table 7. Toxic effects of ammonia.

VAPOUR CONCENTRATION ppm vol/vol (parts per million)	GENERAL EFFECT	EXPOSURE PERIOD
25 (TLV)*	Odour, detectable by most persons.	Maximum for 8 hour working period.
100	No adverse effect for average worker.	Deliberate exposure for long periods not permitted.
400	Immediate nose and throat irritation.	No serious effect after 1/2-1 hour.
700	Immediate eye irritation.	No serious effect after 1/2-1 hour.
1 700	Convulsive coughing. Severe eye, nose and throat irritation.	Could be fatal after 1/2 hour.
2 000 - 5 000	Convulsive coughing. Severe eye, nose and throat irritation.	Could be fatal after 1/4 hour.
5 000 - 10 000	Respiratory spasm. Rapid asphyxia.	Fatal within minutes.

* TLV (Threshold limit value) is the average concentration to which nearly all workers might be repeatedly exposed for a normal eight hour work day, every day, without adverse effect.

Source: ERMP Vol 2.

On the other hand, methane is not toxic except as a simple asphyxiant. Once released, methane rapidly forms a dense cloud which is flammable between 5% and 15% (vol) in air but is not explosive when unconfined.

6.3.3 RISK ESTIMATION

Risk estimation seeks to measure the likelihood of an event (of some stated magnitude) occurring and the likelihood and nature of the consequences that follow. In essence, risk estimation consists of multiplying the failure frequency by the severity, ie calculation of the consequences of an event or incident. An event (or an unwanted event) is defined as an action or accident leading to fatalities.

6.3.3.1 Identification of Unwanted Events and their Likelihood of Failure

The Det Norsk Veritas Report (ERMP Volume 2) identified a number of possible unwanted events through information and experience previously obtained from other studies, and from design data provided by the Joint Partners. The DNV Report notes that probability factors such as wind direction, stability and the duration of a release are involved in the assessment of the final outcome of a release or event. The document identifies a number of potential hazardous events (see Table 8) which are examined in the risk analysis. Failure rates used in the DNV study are as shown in Table 9.

6.3.3.2 Calculation of Severity of Consequences

The DNV Report (ERMP Volume 2) discusses the methodology by which accident consequences analysis are undertaken. By using passive dispersion and vapour cloud models, downwind concentrations of the loss of containment of ammonia and other gases are calculated for various meteorological conditions.

The toxic gas concentrations are then converted into a toxic dose (based on the time an individual may be exposed) and this in turn is used to calculate the likelihood of an individual being killed at any point downwind.

Gas dispersion model results for ammonia release are shown in Table 10.

6.3.4 RISK ESTIMATION RESULTS

The risk levels that would be generated by the proposal for the Kwinana site are presented in the ERMP. These risk levels for 100% outdoors are shown in Figure 6. The ERMP Volume 2 states that:

> "The (resultant risk) contours show that the one in a million risk level does not approach residential areas or other areas where individuals at particular risk would be expected to reside or visit frequently for significant periods." (DNV p 71)

In addition the DNV document concludes that:

> "from the risk contour map and calculations of maximum toxic dose it is concluded that the risk of lethal concentrations of ammonia or chlorine gas reaching local population centres is negligible for a range of toxic gas release scenarios. This is the case even for weather conditions most unfavourable to swift dispersion of vapour cloud." (DNV p 75)

6.3.5 EVALUATION OF RISK AND HAZARDS

Given that the EPA had a number of new industrial plants to evaluate, the Authority sought expert advice and recently released a set of guidelines on the "Evaluation of Risk and Hazards of Industrial Development on Residential Areas in Western Australia" (EPA Bulletin 278, May 1987). For new industrial installations, the relevant guidelines for assessment are as below:

> "The following are proposed by the Authority, as a guide for the assessment of the fatality risk acceptability of new industrial installations:
>
> . The Authority has taken note of how decisions on risks are taken in other parts of the world. In the light of that knowledge the Authority will classify decisions into three categories. These are as follows:
>
> - a small level of risk which is acceptable to the Environmental Protection Authority;
>
> - a high level of risk which is unacceptable to the Authority and which warrants rejection; and

Table 8. Potential Hazardous Events Examined in Risk Analysis.

LOCATION	EVENT(S)
Natural Gas Feed Line	Major leak or rupture.
Ammonia Plant	Major leak or rupture - vessels of warm, pressurised liquid ammonia.
Ammonia Plant	Major leak or rupture - vessels of refrigerated ammonia at -33°C.
Urea Plant	Major leak or rupture - urea reactor system (leading to ammonia release).
Refrigerated Ammonia Storage Tank	Failure of inner steel tank (leading to release of liquid to bunded volume).
Ammonia Export Pump	Major release from pump when operating. Valve rupture while pump is operating (including both suction and discharge valves with associated gasket/flange joints between valves and pump). Major leak from valve while pump is operating.
Ammonia Pipeline from Plant to Wharf	Major leak or rupture in pipeline. Major leak or rupture in ESD operated isolation valve at start of wharf.
Ammonia Marine Loading Arm	Major leak or rupture.
Shipping Channel	- Ship to ship collision. - Grounding. - Contact damage with fixed structure. - Fire/explosion onboard. - Tank material failure. (Leading to release of ammonia or urea).
Water Treatment Plant	Major leak or rupture in liquid chlorine drum.

Source: Preliminary Risk Analysis. Det Norske Veritas 1987.

- a middle level of risk, which subject to further evaluation and appropriate actions may be considered to be acceptable to the Authority.

. An individual risk level in residential zones of less than one in a million a year is so small to be acceptable to the Environmental Protection Authority.

Table 9. Failure Rates Used In This Study.

COMPONENT	TYPE OF FAILURE	FAILURE RATES	REFERENCES IN ERMP VOL 2
Valve	Minor Major Rupture	1.00×10^{-6}/hr) 1.00×10^{-8}/hr) 1.00×10^{-9}/hr)	12
Gasket/Flange Joints	Minor Major Rupture	0.30×10^{-6}/hr) 1.40×10^{-8}/hr) 1.50×10^{-9}/hr)	12
Pipework	Minor Major Rupture	1.60×10^{-8}/km hr) 5.70×10^{-9}/km hr) 1.14×10^{-9}/km hr)	12
Pump	Major release while pumping	1.14×10^{-8}/hr	4
Pressure Vessels	Catastrophic	1.00×10^{-5}/yr	12
Turbine	Disc fragments	0.30×10^{-6}/hr	2
Refrigerated Storage Tank: Full Height Bund Wall	Failure leading to ammonia released into annulus	31.90×10^{-6}/yr	Fault tree analysis
Loading Arm	Major Release	11.50×10^{-6}/yr	Fault tree analysis

Source: Preliminary Risk Analysis. Det Norske Veritas 1987.

- An individual risk level in residential zones exceeding ten in a million a year is so high as to be unacceptable to the Environmental Protection Authority.

- Where the preliminary risk level in residential zones has been calculated to be in the range one in a million to ten in a million a year, the Authority will call for further evaluation of the risks associated with the project. The Authority may then be prepared to recommend that the project be acceptable subject to certain planning and technical requirements.

- A major technical requirement will be the commissioning of a Hazard and Operability Study (HAZOP) at a appropriate stage or stages of the project. Such a study is an effective technique for discovering potential hazards and operating difficulties at the design stage. Significant reductions of hazards, and in the number of problems encountered in operations, as a result of such studies are possible. The Hazard and Operability Study should be undertaken by the proponent with a qualified person, approved by the Authority, who will be required to certify to the Authority that the study was carried out in a proper manner. This study should explore all feasible ways of reducing hazards. The proponent may be required to update the risk analysis, and make the results public." (EPA, May 1987)

Table 10. Gas Dispersion Model.

A. Results for 9 840 kg Ammonia Cloud.

AMMONIA IN CLOUD kg	WEATHER CATEGORY	DOWNWIND RANGE.		
		10 000 ppm m	1 700 ppm m	500 ppm m
9 840	B4	413	946	1 528
	D4	492	1 119	2 680
	F2	551	1 344	4 285

B. Results for Continuous Ammonia Releases.

RELEASE kg/s	WEATHER CATEGORY	10 000 ppm m	1 700 ppm m	500 ppm m
5.0	B4	58	194	245
5.0	D4	215	515	1 040
5.0	F2	356	1 060	2 230
9.2	B4	26	181	326
9.2	D4	144	352	690
9.2	F2	493	1 500	3 220

Note: 10 000 ppm - LC50 (lethal toxic concentration 50%)
1 700 ppm - LC5 (lethal toxic concentration 5%)
500 ppm - IDLH (Immediately dangerous to life or health)

Source: Preliminary Risk Analysis. Det Norske Veritas 1987.

6.3.6 RISK ASSESSMENT

The Environmental Protection Authority sought expert assistance from the NSW Department of Environment and Planning to review the likely risk levels to be generated for this proposal and whether the preliminary risk analysis discussed in ERMP Volume 2 was undertaken in an appropriate and acceptable manner. DEP has advised the Authority that likely risk levels to be experienced from the proposed plant would be as presented in the ERMP. This analysis agrees with the risk results for the proposal as shown in Figure 6.

6.3.6.1 Assessment of Risk Levels in Complying with EPA Guidelines

The Authority believes that subject to compliance by the proponent of the EPA recommendations regarding risk and hazards (as outlined in this Report), the outdoor risk levels for this plant would be so low as to be acceptable to the EPA.

Figure 6. Risk results.

Contours show risk levels per million years

Source: ERMP

However, the Authority is aware that even with adequate and appropriate safeguards, residual risk from the plant remains and needs to be properly managed by the Joint Partners. This is due to the fact that there are limitations in technology, and accidental failures of material and components will occur, however infrequently. In addition, human error is possible.

6.3.6.2 Further Risk-Related Issues Arising from this Proposal

The Authority has previously undertaken two assessments for hazard-associated industries in the Kwinana area. These are for the CSBP and Farmers chlor-alkali plant (EPA, September 1985) and the Wesfarmers Kleenheat Gas LPG extraction plant (EPA, April 1986). The Authority's experience of Kwinana was augmented by the EPA Chairman's visit to Europe to review a number of industries, particularly ammonia-urea plants. Given this experience, the Authority concludes that the likely risk generated by the proposed ammonia-urea plant is low, meets all the EPA guidelines, and hence would be acceptable to the Authority. However, the proposal still raises a number of risk-related issues, some identified in the submissions to the Authority, which need to be addressed. These issues are:

(a) Risk Management Strategy

An appropriate risk management strategy needs to be developed to manage the following:

. design, construction and commissioning of the plant; and

. methods for ensuring that the plant is appropriately maintained and that risk does not increase due to the ageing of the plant.

The Authority's assessment of the above matter is discussed in Section 6.3.6.3.

(b) Ammonia Storage and Loading

The following concerns have been expressed:

. the ERMP states that the storage of ammonia would be in a single 30 000 tonne storage vessel. Question has been raised whether 3 x 10 000 storage vessels (or some other configuration of storage vessels) may not be more appropriate;

. given that the ammonia hold-up in the 1 800 m export pipe is approximately 80 tonnes, there appears to be a need to have further control over the export pump and the export pipes; and

. the loading operation with the mobile loading area may need further management.

The Authority's assessment on the above matters is discussed in Section 6.3.6.4.

(c) Emergency Planning

It has been commented that:

. the proponent needs to prepare an emergency plan for the project;

- there should be a Port Safety Management Plan;

- there should be a Kwinana (Regional) Emergency Plan covering all contingencies including industrial accidents;

- all industries in Kwinana need to develop emergency plans; and

- all of the emergency plans should be integrated and interdepartmental, and coordinated by Government.

The Authority's assessment of the above matter is discussed in Section 6.3.6.5.

(d) Management of Plant Operations

This matter raises the following issues:

- the need for appropriate training of plant operators and a strategy by which human error due to inadequate training or irresponsibility due to intoxication etc, is prevented or managed; and

- the Company's safety objectives and management structure should be appropriate for ongoing management of the plant's risk and hazards.

The Authority's assessment of the above matter is discussed in Section 6.3.6.6.

(e) Cumulative Risk

This issue concerns the acceptability of cumulative risk, due to a 'domino' effect, within the Kwinana industrial area, especially for the ammonia-urea plant.

The Authority's assessment of this matter is discussed in Section 6.3.6.7.

6.3.6.3 Risk Management Strategy

A risk management strategy contains details on how the risk and hazards from an industrial installation are to be managed. The proponent's risk management strategy consists of the following:

- making a commitment to undertake a Hazard and Operability (HAZOP) study for the plant; and

- making a commitment that the plant will utilise modern technology in terms of plant instrumentation and computer process control to ensure stable operating conditions. The range of critical safety interlock systems to be included would be designed to detect any deviation or imbalance in flow, temperature, pressure, vacuum or level, and would initiate automatic plant shut-down in an emergency situation.

The Authority believes that the risk and hazards from the proposed plant can be made acceptable if appropriate action is taken. The proponent has already made commitments to undertake some of the risk management steps required. The Authority believes that the following are also necessary:

- an assurance from the proponent that the most appropriate and reliable equipment will be used in the construction of the plant. (This matter needs to be addressed in the HAZOP for the plant);

- adequate supervision during the construction stage. (The Authority would refer this matter to the appropriate regulatory agencies);

- a hazard analysis update including a fire safety study, a study detailing the management of the commissioning stage and a plan of emergency procedures to be completed before plant commissioning (the proponent has made commitments to undertake some of these studies); and

- regular auditing of risk and hazards after commissioning.

Accordingly, the Environmental Protection Authority recommends as follows:

(4) The Environmental Protection Authority recommends that a condition of approval should be the preparation in stages of a comprehensive and integrated hazard and risk management strategy, to the Authority's satisfaction.

This should consist of the following with the results being forwarded to the Environmental Protection Authority:

- **the HAZOP review to be completed and submitted before mechanical construction commences and to be conducted in a manner approved by the EPA;**

- **a hazard analysis update (including a fire safety plan, and a plan detailing the management of the commissioning stage and a plan of emergency procedures) to be submitted before plant commissioning; and**

- **an audit of risk and hazards to be submitted to the EPA after two years of operation and upon request thereafter.**

6.3.6.4 <u>Assessment of Ammonia Storage and Loading</u>

Ammonia has been manufactured and stored at Kwinana since 1969. Currently there is a 10 000 tonne refrigerated storage tank which has operated at Kwinana for almost 20 years without a major incident.

The Joint Partners' proposal calls for the additional on-site storage of 30 000 tonnes of ammonia in a single, refrigerated, full-height bunded tank. The question arose whether some other configuration, say 2 x 15 000 tonne tanks or 3 x 10 000 tonne tanks, was more appropriate from a safety point of view.

This matter was brought to the attention of the proponent who has responded with additional information. In essence, the general conclusion is that, while the consequences of a major event would be reduced, the likelihood of the failure of components (tank connections, outlet valves etc) will increase by having two or three tanks.

The Joint Partners have made the following response on this matter:

> "The potentially hazardous events considered by our consultant were failure of the inner steel tank (leading to release of liquid to the bunded volume) and major leakage from pipework external to the tank. Based on a preliminary fault-free analysis, the chance of a major release from the storage tank was estimated at less than one in fifty thousand years.

The overall risk from the plant was found to be very low, well within the EPA guidelines for risk to the public. It can be seen from the risk contours that the risk from the storage tank is not the main source of risk associated with the plant, and in the opinion of both Norsk Hydro as (based on its experience in operating ammonia plants) and Det Norsk Veritas, the use of multiple storage tanks instead of one 30 000 tonne tank would not significantly reduce the risk associated with ammonia storage. They conclude that the increased failure probability would cancel out any reduction in consequences." (Supplement Draft EIS)

The Authority accepts the information provided by both Norsk Hydro a.s and DNV and concludes that the risk associated with a single refrigerated 30 000 tonne storage tank would be acceptable to the EPA.

However, the Authority believes that any additional storage of ammonia at the proposed site should require further environmental assessment including a risk analysis.

(5) The Environmental Protection Authority recommends that no more than 30 000 tonnes of ammonia (not including existing 10 000 tonne storage) should be stored at the Kwinana plant location without further referral to the EPA.

Two pipelines are proposed from the storage tank to the wharf. One pipe would be a 250 mm diameter liquid line and the other a 100 mm diameter vapour return line. Each pipeline is approximately 1 800 m long.

There would be two export pumps, each with the capacity to deliver 626 tonnes per hour of ammonia. These pumps are proposed to be controlled from a central facility and can be stopped by the activation of a load-out Emergency Shut-Down (ESD) System.

The Joint Partners were requested to provide further safeguard details on how this system, especially the pipelines, would be managed from a safety point of view. The proponent has provided the following information on this matter:

"Detailed information on the pipeline design is not available yet; however the materials of construction will be suitable for the operating temperature of $-33^{o}C$ and will comply with Australian standards.

The safeguards proposed for the pipeline are discussed in Sections 4.2.6.3, 5.3.5 and 6.1.4 of the PRA (ERMP Volume 2). The main safeguards are:

. comprehensive quality assurance programme covering manufacture and installation of pipelines, pipeline supports and valves;

. corrosion protection of pipeline;

. valves to be welded onto the pipework where possible;

. pressure monitoring of pipeline during operation for automatic operation and activation of ESD valves on sudden pressure drop;

. isolation valves at each end of the pipeline and at the start of the wharf, working off an emergency shut-down system to minimise the amount of ammonia released if a pipe failure occurs;

- the line will be insulated and cooled prior to loading to minimise vapour generation during loading;

- the line will be protected from overpressure by a safety relief valve;

- as a safety precaution, the pipeline will be patrolled during the loading operation;

- the line will be protected by impact barriers wherever there is a potential for damage by vehicles;

- between shipments, the line will be depressurised and left full of ammonia vapour at slightly above atmospheric pressure; and

- the export pipeline will be subjected to a full hazard and operability (HAZOP) study prior to the commissioning of the plant.

In addition to this, it is proposed that:

- breathing apparatus will be made available to workers in the pipeline vicinity during loading; and

- the above-ground ammonia pipeline will be clearly identified, including the use of warning signs.

These safeguards are aimed at preventing, detecting and limiting a loss of containment from the pipeline. It should be noted that about nine shiploads of ammonia will be exported per year and that the pipeline will be pressurised about nine weeks of the year.

As a result of this infrequent use and the management and design safeguards outlined above, the risk from the pipeline will be minimal." (Supplement to the draft EIS)

The final issue relating to ammonia storage and loading concerns the adequacy of safeguards for the bulk cargo jetty. The Det Norsk Veritas document (ERMP Volume 2) reviewed this matter in some detail and concluded that the risk to the surrounding areas, calculated for the loading of an ammonia ship, was low and considered acceptable. This conclusion was reached on the basis that the ammonia export pipeline would be adequately protected from outside damage and that, in the event of a pipeline failure, the quantity of ammonia released would be minimised by the Emergency Shut-Down (ESD) System, which would automatically close isolation valves along the pipeline, including one at each end of the pipeline and at the start of the wharf.

The Joint Partners have now provided additional information on the safeguards proposed for the bulk cargo jetty and the marine loading arm:

". comprehensive quality assurance programme covering the manufacture and installation of the pipeline and loading arm;

- comprehensive procedures covering every aspect of the tanker loading operation;

- pressure monitoring of pipeline and loading arm during operation to enable automatic isolation of the wharf pipeline and loading arm by an emergency shut-down system acting on sudden pressure loss to minimise the amount of ammonia released in the event of a failure;

. limitation of other activity on the wharf during tanker loading operations; only electrical equipment approved for hazardous areas will be permitted to be energised for loading of ammonia; procedures to warn against and prevent non-approved activities during loading will be implemented;

. stationing of an operator on the wharf during the entire loading operation to watch the pipeline, report any malfunctions and to guard against any other activities interfering with loading;

. corrosion protection for the pipeline and loading arm;

. valves to be welded onto pipework (not flanged), where possible;

. pipeline and loading arm to be cooled prior to liquid loading to reduce vapour generation during loading;

. emergency shut-down shore-based system which will automatically activate the Speed Seal emergency release coupling and close the wharf isolation valves;

. provision of adequate fire fighting facilities on the wharf; and

. loading arm to be stored between shipments and maintained, installed and commissioned according to a strict set of procedures.

Further to these precautions, it is planned to develop a management plan for ship loading with the Fremantle Port Authority. It is proposed that the plan would include:

. definition of emergencies (eg fire, gas leaks);

. organisation of emergency control teams;

. escape routes and assembly points for personnel;

. liaison requirements with local and State authorities, EPA and the general public in event of an emergency;

. procedure for warning fire brigades and hospitals;

. management of vehicle access to the wharf during loading; and

. provision of breathing apparatus to anyone going onto the wharf during loading." (Supplement to the draft EIS)

6.3.6.5 <u>Emergency Planning</u>

A number of points have been raised on this issue (see Section 6.3.6.2(c)). The Authority agrees that given the hazardous nature of the chemicals being manufactured or stored at the proposed plant, there is a need for integrated emergency planning by all concerned.

(6) The Environmental Protection Authority recommends that the proponent prepare a Plant Emergency Plan, taking into account all appropriate contingencies. This Plan should conform with requirements of the Kwinana Emergency Plan and the Port Safety Management Plan.

The Authority is aware that a number of 'emergency' plans exist for the Kwinana area. However, the Authority believes that there is a need for an integrated regional Kwinana Emergency Plan. This matter was first raised during the LPG extraction plant assessment (EPA April 1986). The EPA believes that with the establishment of the ammonia-urea plant at Kwinana, the Kwinana region has reached a stage where an integrated Kwinana Emergency Plan is now required. This plan should cover contingencies arising not only from the Kwinana industrial area, but from the surrounding areas of Garden Island (incorporating contingency planning for nuclear powered warships) and the area covering the municipalities of Cockburn, Kwinana and Rockingham (particularly for designating appropriate routes for the safe transport of hazardous materials).

The State Emergency Services in a submission to the Authority has made comments which include the following:

> "There are a number of Disaster Plans and Schemes in existence which impinge upon the Kwinana Industrial Complex and management of possible hazard events within that area.
>
> There is perceived to be a requirement for a form of integrated emergency management system to ensure timely application of overall emergency response as part of a Kwinana Industrial Complex Plan. Such a management system would foreseeably draw together existing private arrangements, statutory responsibilities and community counter disaster arrangements. (State Emergency Services submission)

A major component of emergency planning within the Kwinana region lies with the Fremantle Port Authority (FPA). Currently FPA has a number of plans including a 'Fire and Counter Disaster Plan'. The EPA has discussed the need for a Port Safety Management Plan with the Fremantle Port Authority which concurs that such an integrated plan is necessary, given the extra movement of ships transporting hazardous materials within the Port.

Given the above, the Authority makes the following recommendation:

(7) The Environmental Protection Authority recommends that the Government prepare and implement, by a date to be determined by the Minister for Environment, an overall and integrated Kwinana Emergency Plan and an integrated Fremantle Port Safety Management Plan incorporating the Kwinana industrial area and its surrounds. The Port Safety Plan should be compatible and integrated with the Kwinana Emergency Plan.

6.3.6.6 <u>Management of Plant Operations</u>

The Joint Partners have made the following commitments on this matter:

". Security around the plant will be ensured by the installation of chain-link boundary fences, with access to the plant via a single gatehouse and emergency exits.

. All employees will be trained in the safe work practices and emergency procedures appropriate to the operation of the plant and handling of all associated materials.

. Written work permits for plant maintenance will be required, to ensure safety of the workforce and effective operation of the plant.

. Installation of equipment and alterations to existing equipment will undergo a detailed check procedure on the design, including hazard and operability analyses, prior to requisition.

. Plant operator training will be provided, based on the experience available to the proponents from their existing ammonia/urea establishments. Some personnel will have practical training in these plants."

The Authority believes that given the competence of the Australian partner in the project, CSBP, in managing industrial plants from a safety and an environmental viewpoint, the management of plant operations would be acceptable. In addition the Authority notes that Norsk Hydro a.s. is the world's largest producer of fertiliser and operates a number of ammonia-urea plants with a very good safety record.

6.3.6.7 <u>Cumulative Risk</u>

In its assessment of the CSBP and Farmers chlor-alkali proposal, the Authority recommended that a cumulative risk study for the Kwinana industrial area be undertaken (EPA September 1985). This study was conducted by the UK firm Technica and released in March 1987 (Technica March 1987).

The Technica Report, "Kwinana Cumulative Risk Analysis", concludes that:

> "The level of individual (cumulative) risk associated with the future case (which includes the proposed ammonia-urea plant) is still low in comparison with the EPA guidelines.
>
> Because some of the proposed plants (including ammonia-urea) contain major inventories of hazardous materials, they have the potential to increase the probability of large scale incidents impacting the community. However, the frequency of such impacts is very small." (Technica 1987 p iii)

On the ammonia-urea plant proposal, Technica identified the shipping loading operation to be one of concern and commented that:

> "The ship export of refrigerated anhydrous ammonia from Cockburn Sound is expected to be of significant (risk), and is highlighted as requiring detailed analysis by the proponents" (Technica 1987 p 43)

The Technica report also commented that:

> "Future plans to develop the Kwinana industries (including ammonia/urea) could involve the use of some of the jetties in Cockburn Sound for loading or off-loading hazardous materials. These operations would increase the risk to the public using the beach close to the loading/off-loading points." (Technica 1987 p 44)

The Authority concurs with the concern expressed by Technica.

(8) The Environmental Protection Authority recommends that Government, coordinated by the nominee of the Minister for Minerals and Energy, devise and implement a plan, to the satisfaction of the EPA, for

restricting access (except to people with adequate protective clothing) within proximity of the proposed loading and off-loading facilities.

6.3.6.8 Conclusion on the Assessment of Risk and Hazards

The EPA concludes that if:

- the proponent's proposed safeguards and the Authority's recommendations on the risk and hazard assessment are implemented; and

- the plant is operated in a responsible manner

then the likely risk generated from the plant would be low enough to be acceptable to the Environmental Protection Authority.

6.4 ENVIRONMENTAL IMPACTS FROM THE EMISSIONS OF WASTES

The ERMP identified a number of waste products being generated from the plant which would require treatment and/or disposal. These include:

- liquid wastes;

- atmospheric emissions; and

- solid wastes.

6.4.1 LIQUID WASTE IMPACTS

6.4.1.1 Liquid Waste Treatment and Disposal Discussed in the ERMP

The proposed liquid waste treatment and disposal for this project, outlined in the ERMP, has been presented in Section 3 of this Assessment Report. In summary this proposal consists of:

- collection of process water, a quantity of bleed-off (44 m^3/h of cooling tower blow-down water), variable quantities of stormwater runoff plus approximately 11 m^3/h of wastewater from other sources; and

- disposal of the abovementioned wastewater to Cockburn Sound via the existing CSBP drain.

6.4.1.2 Environmental Impacts of Wastewater Discharge Outlined in the ERMP

The proponent has argued in the ERMP (p 83-84) that environmental impacts associated with the liquid wastewater disposal into the Cockburn Sound would be minimal and should be considered acceptable because:

- nitrogen, thermal loads, salinity and ionic ratio are the main parameters of environmental concern in the discharge wastewater;

- the maximum estimated nitrogen contribution of 7 t/a from the proposed plant would only have a marginal effect upon the nutrient status of the Sound, as it represents about 2% of the long-term objective (365 t/a) for nitrogen loading to the Sound, which currently is almost being met;

- given the insignificant 2% increase in nitrogen load to the Sound, there should be negligible impact upon the seagrass community;

- the potential impact of nutrients in a semi-enclosed waterbody is related to total loading and cannot be ameliorated by high dilution at outfall. Consequently, there would be no advantage gained in this regard by locating the outfall further off shore or by achieving high discharge momentum and consequent dilution;

- the cooling tower blow-down (flow rate 44 m^3/h) will be discharged at a temperature of 27-30°C, and will be thoroughly mixed within the discharge drain with a much larger volume (3 000 m^3/h) of presently discharged wastewater at a temperature of 30-50°C. Consequently, the combined discharge temperature will be 30-48°C, which is 15-33°C higher than the water temperature in Cockburn Sound during winter and 5-23°C higher than that during summer;

- Investigations undertaken by the proponent have shown that the wastewater discharge at 37°C was sufficiently mixed and diluted within approximately 90 m from the outfall to reduce the surface water temperature to within 3°C of ambient. During higher wind and sea conditions, this dilution envelope would be significantly smaller;

- The proponent has concluded that the additional heat loading due to the blow-down discharge from the proposed plant will have negligible additional effect to that presently occurring. The maximum temperature of the combined outfall will in fact be marginally less than presently occurs;

- The effluent salinity of 3 000 mg/L would essentially provide a freshwater inflow to Cockburn Sound (where the concentration of total dissolved solids is approximately 35 000 mg/L) that is not significantly different to natural groundwater inflows and upwellings that occur at various locations in the Sound. Rapid mixing with salt water in the CSBP drain will ensure that salinity variations essentially reflect background conditions at the time of discharge into Cockburn Sound;

- As the effluent discharge will be concentrated groundwater extracted from beneath the proposed plant site, its ionic ratio will be the same as that of groundwater presently flowing into Cockburn Sound; and

- Given the above, the Joint Partners conclude that the effluent from the proposed plant will have negligible effect upon the resident biota near the outfall, which have presently accommodated the substantially greater existing discharge of heated, nutrient-enriched wastewater. The thermal plume from the existing discharge has been shown to rapidly dilute and diffuse. Under the conditions proposed, fish will be able to successfully avoid any heated water that may be encountered immediately adjacent to the outfall by either lateral or vertical migration.

6.4.1.3 <u>Wastewater Issues Raised in Submissions</u>

A number of concerns were raised in submissions to the EPA. These concerns included the following:

- what impact would cooling water antifoulant, eg ALfloc 7348, chlorine etc, have on the receiving ecology of Sound?

- would hydrocarbons be discharged in the wastewater? This hydrocarbon could be sourced from plant equipment, eg lubricants, or could come from contamination in the groundwater intake;

- could heavy metals such as zinc or chromium get into the wastewater (and hence be discharged to the Sound) from any electrolytic protection of water-cooled heat exchanges which might be used in the process?

- could contaminated groundwater containing pesticides get into the cooling tower and be eventually discharged to the Sound?

- what impact is the CSBP's current discharge having on the surrounding Sound's ecology and would the 'cumulative' impact due to the proposed ammonia-urea plant be environmentally acceptable?

6.4.1.4 Proponent's Response to Wastewater Issues Raised in Submissions

The proponent's response is included as Appendix 1 of this Assessment Report. On the wastewater issues raised, the 'supplement to the ERMP' states the following:

- The concentration of ALfloc in the cooling tower blow-down water is given as 5 ppm in Section 4.5.2 of the ERMP. This will be reduced to 4 ppm after combination with other liquid discharges within the plant and then to about 70 ppb by combination with salt water discharge within the CSBP pipeline. The manufacturer's data sheet indicates that ALfloc 7348 has no effect on fish at 1 000 ppm. This was based on a four-day static fish toxicity study on trout and bluegills. Therefore, ALfloc 7348 poses no threat to the marine environment of Cockburn Sound. The dosage of ALfloc 7348 to the cooling water system will be controlled and the concentration in the effluent checked periodically as part of the effluent monitoring programme.

  Similarly, chlorine would be diluted to a very small level by the time it reaches the Sound;

- The only petroleum hydrocarbons which could occur in the liquid discharge from the plant would be oil used as a lubricant in the plant equipment. Spent oil changed from machinery will be sold for reprocessing. Normal operating and maintenance procedures will require that any oil leaks be attended to immediately. Any spillages will be mopped up and cleaned up using standard techniques with dry absorbents and biodegradable solvents.

  There will be a separate sewerage system for any oily water which will allow any such water to be diverted to sumps for retention and skimming.

  Consequently, the amount of oil entering the wastewater system is expected to be nil or very low and any concentration of hydrocarbon would be further diluted in the CSBP drain water;

- Joint Partners propose to extract groundwater a large distance away from any contaminated groundwater. The extracted groundwater would normally be tested as the ammonia-urea process requires clean water; and

- The present discharge of warm return salt water from CSBP's open drain is sufficiently mixed and diluted with 90 m radius of the outfall to reduce the surface water temperature to within $3^{o}C$ of ambient.

The proponent has concluded that the proposed plant's addition to the existing heat load at the CSBP outfall will be negligible, because the maximum temperature of the combined outfall will, in fact, be marginally less than the present situation. This is because the additional wastewater flow is only a fiftieth of the existing warm seawater cooling return flow, and the wastewater is cooled before discharge by sixty hours' residence time in the holding ponds and/or dilution with cooler runoff.

6.4.1.5 Further Information Provided by the Proponent

The proponent has provided further information that due to the fact that increased air cooling, from 140 MW to 190 MW, is now proposed, the quantity of cooling tower blow-down being discharged to the Sound may be lower than that proposed in the ERMP.

6.4.1.6 EPA Assessment of Proposed Wastewater Disposal

Cockburn Sound is a valuable recreational asset of the Perth region, and at the same time, is the focus for the region's water-oriented heavy industries and related services.

The Authority has identified a number of beneficial uses of the Sound which fall into the following three categories:

- Direct contact recreation;
- Commercial and recreational fisheries; and
- Industrial (confined to several small zones on the eastern border of the Sound).

The water quality criteria for direct contact recreation and fisheries are similar and achievement of the criteria for these beneficial uses would preserve the Sound as a viable ecosystem and thereby sustain it as a valuable conservation and recreational resource.

The Authority has reviewed the existing discharges of wastewater into the Sound (see Table 11) and has compared them with those being experienced in 1979 when the 'Cockburn Sound Environmental Study' was completed (see Table 12). These tables show that between 1978 and 1987 the total nitrogen load entering the Sound has fallen from approximately 5 000 kg/day to approximately 1 300 kg/day, a four-fold reduction. This reduction has improved the water quality and with improved water quality, according to Hillman (1986), 'seagrass dieback in the South (of the Sound) appears to have ceased and there is evidence of recolonisation by seagrasses in some areas'. While the Authority is satisfied that progress has been made to reduce the pollution load, especially nutrients into the Sound, the Authority believes that further reductions are required to protect the beneficial uses of the Sound.

The EPA is aware that the Cockburn Sound Environmental Study (DCE 1979) recommended that total nitrogen input should be reduced to "levels occurring in the late 1960s before regional dieback of seagrass occurred southward from James Point, in an attempt to limit further dieback of seagrass in the Mangles Bay - Southern Flats area .... (at that time) the total nitrogen load was somewhat below 1 000 kg/day". (p 92)

The proposed ammonia-urea plant would discharge 20 kg/d or 2% of the long-term objective of total nitrogen discharge to be allowed into the Sound. The Authority accepts that this is a very small quantity compared to both past and current industrial discharges of nitrogen into the Sound. While the proposed total nitrogen discharge from the ammonia-urea plant into Cockburn

Table 11. Existing discharge into Cockburn Sound.

	OWEN ANCHORAGE				COCKBURN SOUND								
	ROBBS JETTY	WATSONS	HIDES ETC	TOTAL OWEN ANCHORAGE	WOODMANS POINT WWTP	SEC KWINANA	BHP	AIS	BP	KNC	CSBP INCLUDES KNC	POINT PERON WWTP	TOTAL COCKBURN SOUND
Volume Ml/day	1.4	0.8	0.1	2.3	0	1000	0	0	400	61	86	0	1486
Temperature (°C) Elevation	0°	0	0		0	+10	0	0	+8-10		+5-33°	0	
pH	6.2-7.8	6.1-7.2	6.6-7.1	6.1-7.8	0		0	0			6.0	0	
Suspended Solids (kg/day)	700-1400	1182	590	2472-2772	0		0	0	(a) 2880			0	2880
BOD (kg/day)	1344-3500	1667	818	3829-5985	0		0	0				0	
Total N (kg/day)	122-126	147	154	413-427	0	110	0	0	82	583	1083	0	1275
Total P (kg/day)	5.8-10.4	35.5	0.4	41.7-46.3	0	220	0	0		0	300	0	520
Sulphides (kg/day)					0		0	0	42			0	42
Phenolics (kg/day)			1.2	1.2	0		0	0	163			0	163
Cadmium (kg/day)					0		0	0				0	
Chromium (kg/day)			12.5	12.5	0		0	0				0	
Lead (kg/day)					0		0	0				0	
Mercury (kg/day)			12.5	12.5	0		0	0				0	
Arsenic (kg/day)					0		0	0				0	
Fluoride (kg/day)					0		0	0			200-300	0	200-300
Hydrocarbons (kg/day)									500				500

Note: Blank space in columns denotes no results available or analyses were not performed.

(a) The majority of suspended solids are algal growth from circular separators.

Table 12. 1979 discharge into Cockburn Sound.

	OWEN ANCHORAGE				COCKBURN SOUND								
	ROBBS JETTY	OTHER MEAT	HIDES ETC	TOTAL OWEN ANCHORAGE	WOODMANS POINT WWTP	SEC KWINANA	BHP	AIS	BP	KNC	CSBP INCLUDES KNC	POINT PERON WWTP	TOTAL COCKBURN SOUND
Volume ML/day	2.2	1.5	0.3	4.0	30	1000	0.5	175	332	65	81	1.1	1620.0
Temperature (°C) Elevation	0°	0°	0°		0°	+10°	+5°	+7	+8-10	+5-33°	+5-33°	0	
pH Alteration							0	0					
Suspended Solids (kg/day)	3600	1640	960	6200	4000		4	1225	261		(a)	20	5510.0
BOD (kg/day)	5450	2300	1200	8950	8900							25	8925.0
Total N (kg/day)	310	190	120	620	1422	110	0.9	49	322	2725	3075	6.8	4986.0
Total P (kg/day)	71	34	3	108	261	220	0.1	2	7.9	47.2	3275	9.7	3776.0
Sulphides (kg/day)					300				59.2				892.0
Phenolics (kg/day)	<0.1	<0.1	1.1	1.1					514				516.2
Cadmium (kg/day)	<0.1	<0.1	<0.1	<0.1	<0.1		<0.1			<0.1	4.3	<0.1	4.3
Chromium (kg/day)	<0.1	<0.1	21.7	21.7	2.6	-	<0.1	0.2	0.6	<0.1	2.5	<0.1	5.9
Lead (kg/day)	<0.1	<0.1	<0.1	<0.1	1.6	-	<0.1	0.5	1.3	<0.1	0.35	<0.1	3.8
Mercury (kg/day)	<0.1	<0.1	<0.1	<0.1	0.1	-	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	0.3
Arsenic (kg/day)	<0.1	<0.1	0.3	0.3	0.3		<0.1	0.4	1.2	<0.1	<0.1	-	2.0
Fluoride (kg/day)					24.0						6050		
Hydrocarbons (kg/day)									1000				1000.0

Note: Blank space in columns denotes no results available or analyses were not performed.

Dashes or hyphens denotes concentration was determined to be the same as Cockburn Sound waters.

(a) Approximately 350 tonnes per day of gypsum in slurry form is discharged from CSBP, however, the ration of solids to dissolved matter varies greatly depending on the sampling point.

Sound is low, the Authority believes that the current CSBP nitrogen discharge to the Sound needs to be reduced by an equivalent amount.

(9) The Environmental Protection Authority concludes that the proposal to discharge wastewater containing 20 kg/day of nitrogen into the Cockburn Sound would be environmentally acceptable if an equivalent amount of nitrogen (2 kg/d) load being discharged from the CSBP complex was reduced.

The other major parameter of concern is the thermal load of the wastewater. The Authority's calculations verify the proponent's modelling and the conclusion reached in the ERMP that "the additional heat loading due to the blow-down discharge from the proposed plant will have negligible additional effect to that presently occurring". (ERMP p 83)

The Authority also concludes that the salinity and ionic ratio of the wastewater would have negligible impact on the Sound.

In summary, the Authority has assessed the proponent's proposal to discharge wastewater into Cockburn Sound and finds the proposal environmentally acceptable if an equivalent quantity of nitrogen was reduced from the CSBP complex. The EPA will be requiring comprehensive monitoring of the ammonia-urea plant wastewater disposal system (see Recommendation 13) to ensure that the beneficial uses of the sound are maintained. Finally, the Authority will be reviewing:

. the environmental performance of all industries discharging into the Sound to ensure that pollutants into the Sound are reduced to an acceptable level; and

. the long-term objectives for the pollutants to ensure that the chosen acceptable level will enhance and maintain the beneficial uses of the Sound.

6.4.2 ATMOSPHERIC EMISSIONS AND THEIR IMPACTS

6.4.2.1 Atmospheric Emissions Outlined in the ERMP

The proposed atmospheric emissions generated by this proposal, outlined in the ERMP, have been presented in Section 3 of this Assessment Report. The bulk of these emissions are nitrogen, oxygen and carbon dioxide. There will also be minor emissions of ammonia, sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and chlorine (see Table 3).

The major atmospheric discharges will be:

. 85 t/h carbon dioxide;

. 100 kg/h nitrogen oxide as NO_2 (0.31 g/m^3); and

. 0.7 kg/h sulphur dioxide (2×10^{-3} g/m^3).

6.4.2.2 Issues Related to Atmospheric Emissions

The issues relating to this matter, identified in submissions are:

. would there be odour generated from the plant?

- would the emitted carbon dioxide, sulphur dioxide and nitrogen oxides cause localised odour problems or smog, or have impact on the planet's atmospheric conditions?

- would there be (urea) dust emitted from the plant?

- would the biocide proposed for the cooling tower cause local air pollution?

- is there any likelihood of contaminated groundwater from other industries going through the cooling tower and generating air discharges?

6.4.2.3 Proponent's Response to Atmospheric Emission Issues

The proponent's response to the above issues is included as Appendix 1 of this Assessment Report. In summary, this response consists of the following:

- The gaseous emissions mentioned in the ERMP are process vents, which are either flared or released from high level to allow rapid dispersion. None of these emissions are likely to cause any odour problems off-site or on-site. The predicted ground level concentrations for these gases are of orders of magnitude less than the population identification odour thresholds and are unlikely to cause any health problems. The only other possible source of odour would be fugitive ammonia or process gas leaks which cannot be tolerated (by the proponent) because of in-plant safety requirements.

  The final design of the plant will be subject to a full HAZOP study before commissioning of the plant, as well as any subsequent changes to design before implementation. This will ensure that the safety standards set for the plant are adhered to and will minimise the likelihood of plant failure and, therefore, the possibility of odour generation. Specific routines and controls will be developed for all types of maintenance operations to be carried out in the plants. This will involve the use of written work permits for each job where all safety procedures will be specified, including their method of control and how the item maintained is to be tested before recommissioning.

  The proponent confirms the commitment that adequate measures will be taken, both during the design stage and during the commissioning and operation stages of the plant development to prevent odour generation from process vents, leaks and accidental gas releases.

- The proponent states that the carbon dioxide emission would be equivalent to the carbon dioxide emission from a 130 MW gas-fired power station, that the nitrogen oxide emission would be equivalent to the nitrogen oxide emission from a 145 MW gas-fired power station and the sulphur dioxide emission would be equivalent to the sulphur dioxide emission from a 75 MW gas-fired power station.

  A 145 MW power station would be small compared to either Muja (1 200 MW) or Kwinana (900 MW) power stations. The proponent argues that the additional loads of carbon dioxide and nitrogen oxides will not be large compared to the existing load from the Kwinana area and would not cause an impact on the planet's atmosphere. The proponent further states that the nitrogen oxide and sulphur dioxide emissions comply with the relevant National Health and Medical Research Council (NHMRC) criteria. The proponent concludes that using results from the Kwinana Air Modelling

Study (KAMS) of 1982, the sulphur dioxide emission from the proposed plant would be equivalent to about 0.03% of the expected sulphur dioxide load in Kwinana assuming maximum natural gas conversion as outlined in Section 8.5.1(iii) of the KAMS report.

The proponent notes that the ERMP evaluation was based on using sulphur mercaptan odourised natural gas. It is now understood that the project will be supplied with non-unodourised gas, resulting in substantial reduction of the expected sulphur dioxide emission.

. The proponent states that there will be a small amount of urea dust from the plant. The main sources of the urea dust will be the urea granulator and urea cooler, the air streams from which are scrubbed in the urea dust scrubber prior to release to atmosphere. This dust concentration of the air exhaust is well within the guidelines of the NHMRC (40 mg/m^3 compared with the 250 mg/m^3 guideline). In addition, the air will be discharged to atmosphere at a height of 45 m about ground level. The proponent states that management of the urea dust emission will be done through detailed attention to the design and construction of the urea dust scrubber and related process equipment (crushing, screening and de-dusting circuit).

It is concluded by the proponent that the urea dust generation would not be a serious problem.

. The proponent states that the main biocide (with the potential of air emission) to be used in the cooling water system would be chlorine gas to control algae. The quantity of chlorine used would be 10 kg/h. Residual chlorine will be principally lost in the cooling tower steam plume and a lesser amount in the cooling tower blow-down water.

The concentration in the cooling steam plume was estimated by the proponent to be 1.4 ppm. The impact and odour generation from chlorine in the air plume are concluded by the proponent to be insignificant given the dilution and dispersion of the chlorine in the rising plume of steam.

The impact of chlorine in the atmosphere on the biological environment is considered negligible by the proponent when comparing the emission with the NHMRC guideline standard (0.002 g/m^3 cf 0.2 g/m^3 guideline standard). In terms of the impact of the emission on beneficial uses, the proponent believes the chlorine emission would have to be considered acceptable.

. As the existing groundwater pollution plume in the Safety Bay sand extends over a part of the area proposed for the ammonia-urea plant production bores, the design and specification of these bores must ensure that no leakage can occur across the clay seal separating the Safety Bay sand from the limestone.

If this leakage did occur, it would be possible for contaminated water to enter the water supply to the plant. The concern raised is the possibility of these contaminants being volatilised in the cooling tower and causing emission problems.

After reviewing this matter, the proponent concludes that the likelihood is that this will not occur because the abstraction is from a different aquifer, but if this did occur the project would require an alternative source of water because only clean water can be used as process water.

To prevent the possibility of this happening, the proponent proposes to install monitor bores between the production bores and the Nufarm plume to monitor the migration of the plume. In addition, bores will be installed to monitor the migration of the saltwater wedge to the west of the plant site.

The other concern expressed is that spray could pose a health risk through bacterial contamination. This is unlikely due to chlorination of water to kill bacteria, algae and other microbes. This, along with other factors (such as prevailing wind direction), makes it unlikely that cooling tower spray will be a health problem. However, this and other possible occupational health issues will be addressed by the proponent in more detail in the design stage of the project.

6.4.2.4 <u>EPA Assessment on Normal Atmospheric Emissions</u> (except discharge of sulphur dioxide)

The Authority is aware that the normal atmospheric emissions from the proposed plant at Kwinana would be relatively low and would be acceptable to the EPA.

The Authority notes that appropriate air emission standards will be set under the works approval and licensing processes of the Environmental Protection Act (see Section 7.3).

6.4.2.5 <u>EPA Assessment on the Discharge of Sulphur Dioxide</u>

The Authority is aware that the discharge of sulphur dioxide (SO_2) is a sensitive issue in the Kwinana region.

The KAMS study published in 1982 indicated that SO_2 concentrations in the residential areas of Wattleup and Hope Valley were of concern. The report indicated that residents living in these areas may be subjected to over 200 hours each year when SO_2 concentrations exceed 500 micrograms per cubic metre ($\mu g/m^3$) and 30-50 hours where the concentrations exceed 1 000 $\mu g/m^3$.

Recently, many industries in Kwinana have converted from burning fuel oils containing 2.5-3.5% sulphur to natural gas which contains less than 0.1% sulphur. This change has resulted in a marked reduction in SO_2 concentrations in surrounding residential areas. Measurements suggest that SO_2 concentrations at monitoring stations in Hope Valley and Wattleup would exceed 700 $\mu g/m^3$ for only 2-3 hours each year.

The Authority's review has shown that the additional SO_2 emitted from the various emission points in the ammonia-urea plant would be low and would not significantly increase the SO_2 concentrations in Kwinana and are not expected to measurably increase the number of hours when SO_2 levels are above a level of 700 $\mu g/m^3$.

Given the above, the Authority concludes that the discharge of 0.7 kg/h of sulphur dioxide ($2 \times 10^{-3} g/m^3$) is acceptable to the EPA.

6.4.2.6 <u>EPA Assessment on the Generation of Odours and Fugitive Emissions</u>

The Authority believes that there should be no (ammonia) odours or fugitive emissions from the plant during normal operations. The proponent should aim to minimise the likelihood of fugitive emissions, during atypical conditions, to a frequency low enough to be acceptable to the Authority. The Authority notes the proponent's commitment to consider, among others, the matter of preventing fugitive emissions from the plant during the design stage of the HAZOP analysis.

(10) The Environmental Protection Authority recommends that the proponent submits a detailed report, before the plant commissioning, outlining the methods by which likely odours generated from the plant will be minimised or eliminated.

6.4.2.7 Monitoring of Atmospheric Emissions

Monitoring of atmospheric emissions would be specified in the licence conditions under the provisions of the Environmental Protection Act 1986 (see Section 7.3).

6.4.3 SOLID WASTE DISPOSAL

6.4.3.1 The Proponent's Solid Waste Proposal

The sources of solid waste from the plant are used catalyst and adsorbents plus domestic solid waste.

The catalyst types are as shown in Table 13.

Table 13. Solid wastes catalyst types, application and main compounds.

CATALYST	APPLICATION	MAIN COMPOUNDS
Catalyst 50-2	Hydrodesulphurization	Nickel & molybdenum oxides
Catalyst 32-4	Sulphur removal	Zinc oxide
Catalyst 57-3	NG steam reforming	Nickel oxide
Catalyst 54-3	Secondary steam reforming	Nickel & aluminium oxides
Catalyst 54-4	Secondary steam reforming	Nickel oxide
Catalyst 15-4, 15-5	High temperature shift	Iron & chromium oxides
Catalyst 53-1	Low temperature shift	Copper & zinc oxides
Catalyst 11-3	Methanator	Nickel oxide
Catalyst 35-4	Ammonia synthesis	Magnetite
	Hydrogen removal	Platinum

Source: ERMP

The volumes of catalysts that would be disposed of at any one time and the expected catalyst life are shown in Table 14.

The proponent states that the Det Norsk Veritas document (ERMP Volume 2) concludes that the process catalysts will not pose any particular hazard during normal operation, although precautionary measures will be necessary to minimise dust exposure during handling, particularly for catalysts where nickel compounds are present.

The proponent has categorised the spent catalysts requiring disposal as follows:

- those which contain only non-toxic compounds, eg Fe_2O_3 or AL_2O_3, and can be safely disposed of on any landfill site;
- those containing a high proportion of recoverable metals such as the nickel, platinum or copper-based catalysts which can be sold for their

Table 14. Catalyst volumes and expected lifetime.

CATALYST	VOLUME (m^3)	EXPECTED LIFE (y)
Feed gas desulphurization	19.8	5
Feed gas desulphurization	85.0	4
Primary reformer	30.3	3
Secondary reformer	41.0	5
Carbon monoxide conversion - HT shift	72.0	3
Carbon monoxide conversion - LT shift	100.0	3
Methanation	39.0	5
Ammonia synthesis	80.0	5
Hydrogen removal	0.7	9

Source: ERMP

metal content; and

. those containing significant proportions of elements which can be toxic to the environment, such as chromium or copper, which will be disposed of by approved means.

The proponent now informs the EPA that other options to be explored include the possible use of spent catalysts in CSBP's superphosphate mixtures to provide trace elements (Cu, Zn, Mo) required by plants and crops.

6.4.3.2 <u>EPA Assessment on Solid Waste Disposal</u>

The Authority has reviewed the information provided by the proponent and concurs that the process catalysts being discussed would mainly be non-hazardous.

However, the Authority believes that there is a need to develop a long-term solid waste disposal strategy for spent catalysts.

(11) The Environmental Protection Authority recommends that the Company's proposal for solid waste management and disposal from the site be submitted to the EPA for assessment and approval prior to completion of construction of the plant.

6.5 ENVIRONMENTAL IMPACTS DUE TO WATER RESOURCE EXTRACTION AND UTILISATION

The proponent has informed the Authority that the initial engineering study for the project defined the amount of process water required (for steam raising) to be about 65 m^3/h and the amount of make-up water for cooling to be about 200 m^3/h. This was the quantity of water which was discussed in the ERMP. The proponent further states that:

"The 200 m^3/h for cooling was required to remove about 100 MW of heat load in the plant; a further 150 MW was assumed to be air cooled. The 100 MW was determined partly by process parameters, ie available temperature differential (ΔT) between the process and the cooling medium, and partly by technology constraints.

For the engineering study an air temperature of 35°C was nominated as the design temperature. Based on a study of additional data from Perth Meteorological Bureau for the last 20 years it has been found that the design temperature can be lowered to 28°C. This reduction allows us (the joint partners) to transfer an additional 50 MW cooling load to air. Thus the remaining cooling load dependent on water is about 50 MW.

The above represents a reduction in the amount of make-up water for cooling purposes to about 100 m^3/h.

The total groundwater requirement is thus reduced from 265 m^3/h (approximately 2.1 million m^3/year) to about 165 m^3/h (approximately 1.3 million m^3/year).

In the detailed design stage of the project it will be possible to investigate further with the process licenser of the urea plant and the engineering contractor if the remaining water consumption could be reduced further." (proponent's letter dated 3 November)

The proponent further informs the Authority that negotiations are currently being undertaken between the Joint Partners and the Water Authority of Western Australia regarding the availability of this quantity of water and the possible sources from which this water can be obtained. The likely outcome of these discussions may be that the proponent would obtain plant process water (65 m^3/h) from shallow groundwater and the rest (100 m^3/h for water cooling) will require further investigations. Possible sources for cooling water consist of treated sewage effluent, seawater or groundwater.

The Water Authority of Western Australia, commenting on the original proposal, stated in its submission that:

"The proposed use of a large volume (approximately 1.5 x $10^6 m^3$) of fresh groundwater for cooling purposes is of concern to the Water Authority in view of the limited availability of fresh groundwater in the Kwinana Industrial Area, and the large potential demand. The commitment of this volume of water to the Ammonia Urea plant may prohibit any further extensive development of the aquifer within about 2 km of the Wellfield. It is understood a project involving a Petrochemical plant is being planned on an adjoining site which will have a considerable fresh water requirement. This and other future developments in the area may need to consider the use of scheme water or more distant groundwater resources for their fresh water requirements.

The Kwinana area will be proclaimed as a Groundwater Control Area under the Rights in Water and Irrigation Act early next year. The Water Authority will not permit use of the fresh groundwater resources in this area for cooling systems that are not viable.

The Water Authority is continuing its liaison with the proponents on the viability of alternative cooling systems for the plant, to ensure that optimum benefit from development of the fresh groundwater resources in the area is achieved." (Water Authority submission 25 September 1987)

The Water Authority has subsequently informed the EPA that the new proposal (to extract 65 m^3/h) of shallow groundwater would be acceptable in terms of water resource extraction and its environmental consequences. The Water Authority and the proponent are currently negotiating on the matter of cooling water sources.

Given the above, the EPA concludes that:

- an adequate quantity of process water (65 m^3/h) can be made available for the proposal, at Kwinana;

- this resource can be extracted without detrimental environmental impacts; and

- the proponent's preferred option of a combination of air-cooling and water cooling needs to be further reviewed and assessed by the EPA if it is likely to have significant environmental consequences.

(12) The Environmental Protection Authority recommends that the proponent's water cooling proposal be referred to the EPA for assessment and approval prior to the beginning of construction.

The Authority believes that the proponent needs to manage the freshwater resource to achieve optimum utilisation as well as producing minimum wastewater requiring disposal.

6.6 OCCUPATIONAL HEALTH AND SOCIAL IMPACTS

6.6.1 INTRODUCTION

The following matters are identified for discussion in this section:

- matters which could affect the health or safety of personnel in the proposed plant;

- traffic impacts;

- noise; and

- visual impact.

6.6.2 OCCUPATIONAL HEALTH AND SAFETY

The EPA acknowledges that the responsibility for assessing acceptability of risk levels within the proposed plant rests with the Commissioner for Occupational Health, Safety and Welfare (DOHSW). Accordingly, the Authority notes that the proponent needs to liaise with DOHSW.

6.6.3 TRAFFIC IMPACTS

The Main Roads Department has made the following points in their submission on this matter:

> "The additional traffic load placed on the Mason Road/Rockingham Road junction may well increase the delays currently being experienced by traffic at this location during peak periods. Whilst overall daily traffic volumes would not cause any capacity problems, any coincidence of shift change times with the BP Refinery would obviously increase queue lengths and delays for turning traffic.
>
> A new rail crossing will be created where the new access road crosses the Kwinana loop line. Whilst it appears that this crossing will be an internal crossing on the CSBP site and beyond the scope of the Railway Crossing Protection Committee, nevertheless application of the normal protection guidelines indicates that a minimum level of flashing light

control would be provided to protect the new crossing." (Main Roads Department submission)

The proponent has provided the following response on the above points.

"It was concluded in Section 7.4 of the ERMP that the extra traffic generated during both construction and operation of the plant would not significantly increase road traffic and lead to congestion on Rockingham/ Paterson Road. However, the Mason/Rockingham Road junction was not looked at specifically in the ERMP.

Delays occur at the Mason/Rockingham Road junction late in the afternoon when employees from industries along Mason Road travel home. If it appears that the traffic from the project significantly aggravates this problem, it may become necessary for the Main Roads Department to install traffic lights to regulate the flow of traffic.

The requirement for traffic protection on a new rail crossing will be determined by Westrail but it is expected that a flashing light control would be a minimum requirement." (supplement to the draft EIS)

The Authority believes that the whole matter of traffic movement and the optimisation of the road network system within Kwinana needs to be reviewed in the Kwinana Emergency Plan (see Recommendation 7).

6.6.4 NOISE IMPACTS

The matter and means of controlling noise impacts during the construction stage has already been discussed in Section 6.2 of this Assessment Report.

The proponent has shown that noise from the operation stage would not impact on the local residents. However, with the increase in air cooling, there is a likelihood that excess noise levels may be generated.

The Authority believes that the proponent needs to measure the background levels of the nearest residential area (Medina/Calista) and design the plant so that the noise levels generated should not significantly exceed the background noise levels.

The Authority notes that the proponent has made a commitment to ensure that the local residential background levels are not exceeded and that excess noise from the plant would not be a nuisance problem in the Kwinana region.

6.6.5 VISUAL IMPACT

The ERMP states that:

"In the long term, supplementary bunding of road verges and screen planting along Patterson Road will significantly reduce the cumulative impact of industry in this location. CSBP is a participant in the State Government's Landscape improvement initiatives for the Kwinana area."

The Authority concludes that given the industrial nature of the Kwinana area, the visual impact from the proposed plant would be acceptable.

7. ENVIRONMENTAL MANAGEMENT AND MONITORING

The environmental assessment process in Western Australia places a great deal of emphasis on the management of environmental impacts and the monitoring of both the management programme and the impacts to ensure that appropriate steps are taken to ameliorate and minimise adverse affects.

7.1 ENVIRONMENTAL MANAGEMENT OUTLINED IN THE ERMP

The environmental management commitments made by the proponent are listed in Appendix 3 of this Assessment Report. The Joint Partners' key commitments to environmentally manage the proposal are:

. DESIGN:

Australian and international standards will be used in the design of the facilities.

A HAZOP study of the final design will be conducted.

The process licensers' design philosophy will be adhered to.

The process will be designed to meet or improve on current emission guidelines.

. CONSTRUCTION:

Liaison with local authorities will be maintained to ensure that impacts associated with noise, dust and traffic are minimised.

Construction activity will be restricted to normal construction industry working hours.

Dust suppression watering practices will be implemented.

All construction materials and practices will be in accordance with the relevant Australian and international codes.

. OPERATION:

The plant site will be attractively landscaped, and buildings will be aesthetically designed and have neutral colouration for compatibility with the surrounding industrial setting.

Ongoing control of dust will be implemented.

Noise levels within the plant and at the plant boundaries will be in accordance with statutory requirements.

Operational stability will be achieved by duplication of critical equipment, a high level of automation and intensive training of operators.

The plant will be highly instrumented and computer-controlled, and will be equipped with interlock systems which, upon initiation on carefully selected process or equipment performance criteria, will ensure a safe emergency shut-down of the plant.

Regular preventative maintenance programmes will be implemented to minimise plant component failures.

The plant will normally produce minimal solid wastes. Septic systems will be provided for the sanitary system waste.

All liquid and gaseous waste products will be regularly monitored and disposed of in an environmentally safe manner and in accordance with statutory requirements to the satisfaction of the EPA.

Surface runoff from the process areas of the plant will be channelled into holding ponds and appropriately treated before disposal to Cockburn Sound.

A fire protection system will be incorporated in accordance with the requirements of the plant design and the Western Australian Fire Brigades Board. This system will be equipped with a separate fire main, with permanent hydrants appropriately located around the plant, together with foam generators for possible ammonia leaks. All plant personnel will be trained in the appropriate fire-fighting techniques.

The fire-fighting capability of CSBP's Kwinana works, and the Kwinana Industries Mutual Aid Group, established by industrial operators in the Kwinana industrial area, will be available for emergency assistance.

Security around the plant will be ensured by the installation of chain-link boundary fences, with access to the plant via a single gatehouse and emergency exits.

All employees will be trained in safe work practices and emergency procedures appropriate to the operation of the plant and the handling of all associated materials.

Written work permits for plant maintenance will be required, to ensure the safety of the workforce and effective operation of the plant.

Installation of equipment and alterations to existing equipment will undergo a detailed check procedure on the design, including hazard and operability analyses, prior to requisition.

Plant operator training will be provided, based on the experience available to the proponent from their existing ammonia-urea establishments. Some personnel will have practical training in these plants.

On-site aid facilities will be provided, together with support from CSBP's Kwinana works facilities, which include the availability of an ambulance and an occupational health nurse during normal working hours.

7.2 ENVIRONMENTAL MANAGEMENT AND MONITORING PROGRAMME

At the time that the ERMP was released, no decision had been made by the proponent as to final plant design or details of treatment and disposal of wastes. Details of a monitoring programme were not provided although the proponent has made commitments to undertake management and monitoring of the project (see Appendix 3). Other matters needing consideration have been identified in this Assessment Report with recommendations that, as appropriate, the proponent submits regular reports to the Authority on environmental performance.

The Authority believes that the proponent needs to develop a monitoring programme and reporting arrangements.

(13) The EPA recommends that the proponent undertakes periodic wastewater monitoring including:

- **temperature of the wastewater discharge and of the surface waters of the Cockburn Sound at an appropriate distance from the point of discharge; and**

- **pH, nitrogen, total dissolved solids, and total suspended solids of the effluent.**

The proponent should develop a monitoring programme and reporting arrangements to the satisfaction of the EPA which should indicate how environmental management will be modified in response to monitoring reports.

7.3 COMPLIANCE WITH PART V OF THE ENVIRONMENTAL PROTECTION ACT 1986

Preparation of the ERMP and its assessment by the EPA represents only one part of the formal approval process required by the Environmental Protection Act 1986.

Prior to commencing construction of the plant, the proponent is required under Section 53 of the Environmental Protection Act to lodge an application for "Works Approval". This application must be supported with detailed technical information on all aspects of the plant which may be of environmental concern. If the application is deemed to be acceptable to the Authority, then approval to proceed with construction of the plant will be granted subject to conditions which are designed to ensure that:

- the plant is constructed and operated in a manner which is environmentally acceptable;

- undertakings given by the proponent during the assessment process are fulfilled; and

- environmental conditions set on the proposal by the Minister for Environment are implemented.

Only when the plant has been constructed and commissioned in accordance with the "Works Approval" will the Authority issue a licence to operate the plant. The operating licence may again be subject to conditions which ensure that the plant is operated in an environmentally acceptable manner.

The EPA will continue to monitor the operations of the plant for compliance with the conditions of Licence and Works Approval.

8. CONCLUSION

This Assessment Report is submitted to provide an environmental input to decision making on the proposed ammonia-urea plant at Kwinana. In preparing this Report, the Authority has considered a range of documentation and technical information and has been assisted by contributions from the public and other government agencies.

While in the past ammonia-urea plants used to have a reputation for being polluting and odourous industries, technology has dramatically advanced in the last 20 years such that modern plants can be operated with minimum pollution and negligible odours.

There are presently two ammonia plants in Kwinana which have operated safely for 20 years. There is also a 10 000 ammonia storage tank which has operated without a major incident since 1969. The Authority identified a number of issues regarding the proposal which required detailed assessment. After undertaking its assessment, the Authority has reached the following conclusions:

- **modern ammonia-urea plants can operate with minimum pollution and negligible odours;**
- **given that the risk level from the proposed plant is acceptable and given the proximity to infrastructure, Kwinana industrial area is an acceptable region in WA to locate the proposed Ammonia-Urea plant;**
- **the proposed site for the plant within the Kwinana industrial area is environmentally acceptable;**
- **the individual risk levels from the plant are low enough to be acceptable;**
- **the cumulative risk levels from the proposed plant are low enough to be acceptable;**
- **there is need for a Port Safety Management Plan and a Kwinana Emergency Plan;**
- **the process water for the plant can be obtained in an environmentally acceptable manner;**
- **the EPA does not have a detailed freshwater extraction proposal on which to make a comment;**
- **that discharge of nitrogen containing wastewater needs to be controlled such that it complies with the identified beneficial uses of the Sound;**
- **fugitive emissions and odours can be controlled and minimised; and**
- **with appropriate management and adequate monitoring, the other environmental impacts (eg solid waste disposal, aesthetics and landscaping, noise impacts etc) can be controlled and managed.**

There are a number of other issues which have been assessed and discussed in this Assessment Report. The general conclusion is that these can be managed acceptably.

The Authority would require regular reporting from the proponents on the joint partners management and monitoring programme and would review and assess these reports in consultation with relevant interested bodies.

The Authority concludes that the proposed ammonia-urea plant at Kwinana is acceptable on environmental grounds subject to compliance by the proponent with the commitments given (as listed in Appendix 3 of this Assessment Report) and subject to the adoption and implementation of the Authority's recommendations.

9. REFERENCES

Department of Conservation and Environment, July 1980. A Study for Sound Management - A Summary of the Findings of the Cockburn Sound Environmental Study.

Department of Conservation and Environment, April 1981. Water Quality Criteria for Marine and Estuarine Waters of Western Australia. Report of the Working Group established by the Environmental Protection Authority.

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Department of Conservation and Environment, September 1985. Proposed Chlor-Aklali Plant CSBP & Farmers Pty Ltd. Report and Recommendations by the Environmental Protection Authority.

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Environmental Protection Authority, May 1987. Environmental Protection Authority Risks and Hazards of Industrial Developments of Residential Areas in Western Australia.

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Technica 1987. Kwinana Cumulative Risk Analysis.

APPENDIX 1

Supplement to the Draft Environmental Impact Statement and proponent's response to issues raised in submissions and to the EPA questions.

CSBP & FARMERS LTD
NORSK HYDRO a.s

PROPOSED AMMONIA/UREA PLANT

SUPPLEMENT TO THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

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October 1987

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INTRODUCTION

The Environmental Review and Management Programme/draft Environmental Impact Statement (ERMP/draft EIS) prepared by the proponents, CSBP & Farmers Ltd and Norsk Hydro a.s (1987), was released for public comment between 4 July and 11 September 1987, together with the associated preliminary risk analysis (PRA) (Det norske Veritas 1987). During this ten-week period, a total of twelve submissions were received from both members of the public and State Government agencies with specific interest in the project who responded to a request for comments from the Environmental Protection Authority (EPA).

This document addresses issues raised by the submissions and provides a supplement to the draft EIS. The supplement serves as a means by which the proponents need to respond to the submissions as required under the Commonwealth Environmental Protection (Impact of Proposals) Act, 1974 (as amended). Together with the draft EIS and comments received, the supplement forms the final EIS which will be assessed on behalf of the Commonwealth Minister for Arts, Sport, the Environment, Tourism and Territories and the Treasurer by the Department of Arts, Sport, the Environment, Tourism and Territories. Concurrently, the State EPA will make its own assessment in order to make recommendations to the Minister for the Environment.

The EPA has provided the proponents with the following two documents:

- a list of questions developed by the EPA after consideration of the ERMP/draft EIS and submissions received. This is included as Appendix A;

- a summary of the submissions, which is included as Appendix B.

Accordingly, this supplement is structured to respond to both documents. Sections 1 to 4 inclusive discuss in detail the issues of risks and hazards, air quality, water and wastewater and solid waste raised by the EPA questions (Appendix A). In Section 5, a response is given to each of the submissions as summarized by the EPA (Appendix B).

1 RISKS AND HAZARDS

1.1 AMMONIA STORAGE STRATEGY

The proposed ammonia storage tank along with safety precautions is described in Section 3.3.4 of the PRA report by Det norske Veritas, together with Section 4.4.4 of the ERMP. The tank would be designed to comply with API620.

The risks associated with the storage tank are discussed in Sections 5.2, 5.3 and 6.1.3 of the PRA.

The potentially hazardous events considered by our consultant were failure of the inner steel tank (leading to release of liquid to the bunded volume) and major leakage from pipework external to the tank. Based on a preliminary fault-tree analysis, the chance of a major release from the storage tank was estimated at less than one in fifty thousand years.

The overall risk from the plant was found to be very low, well within the EPA guidelines for risk to the public. It can be seen from the risk contours that the risk from the storage tank is not the main source of risk associated with the plant and, in the opinion of both Norsk Hydro a.s (based on its experience in operating ammonia plants) and Det norske Veritas, the use of multiple storage tanks instead of one 30,000 t tank would not significantly reduce the risk associated with ammonia storage. They conclude that the increased failure probability would cancel out any reduction in consequences. These comments are included as Appendices C and D.

1.2 SAFEGUARDS FOR THE BULK CARGO JETTY

The ammonia export line facilities and the mobile loading arm are described in Section 3.3.5 of the PRA and Section 4.4.4 of the ERMP.

The risks and safety precautions associated with the pipeline along the wharf and with the mobile loading arm are discussed in Sections 5.2, 5.3, 6.1.4 and 6.1.5 of the PRA. Det norske Veritas concluded that the risk to surrounding areas, calculated for the loading of an ammonia ship, was low and considered acceptable.

This was on the basis that the ammonia export pipeline would be adequately protected from outside damage and that, in the event of a pipeline failure, the quantity of ammonia released would be minimized by the Emergency Shut Down (ESD) system, which would automatically close isolation valves along the pipeline, including one at the start and end of the bulk cargo jetty.

The safeguards proposed for the bulk cargo jetty and the marine loading arm include the following:

- comprehensive quality assurance programme covering the manufacture and installation of the pipeline and loading arm;

- comprehensive procedures covering every aspect of the tanker loading operation;

- pressure monitoring of pipeline and loading arm during operation to enable automatic isolation of the wharf pipeline and loading arm by an emergency shut-down system acting on sudden pressure loss to minimize the amount of ammonia released in the event of a failure;

- limitation of other activity on the wharf during tanker loading operations; only electrical equipment approved for hazardous areas will be permitted to be energized for loading of ammonia; procedures to warn against and prevent non-approved activities during loading will be implemented;

- stationing of an operator on the wharf during the entire loading operation to watch the pipeline, report any malfunctions and to guard against any other activities interferring with loading;

- corrosion protection for the pipeline and loading arm;

- valves to be welded onto pipework (not flanged), where possible;

- pipeline and loading arm to be cooled prior to liquid loading to reduce vapour generation during loading;

- emergency shut-down shore-based system which will automatically activate the Speed Seal emergency release coupling and close the wharf isolation valves;

- provision of adequate fire fighting facilities on the wharf; and

- loading arm to be stored between shipments and maintained, installed and commissioned according to a strict set of procedures.

Further to these precautions, it is planned to develop a management plan for ship loading with the Fremantle Port Authority. It is proposed that the plan would include:

- definition of emergencies (e.g. fire, gas leaks);

- organization of emergency control teams;

- escape routes and assembly points for personnel;

- liaison requirements with local and State authorities, EPA and the general public in event of an emergency;

- procedure for warning fire brigades and hospitals;

- management of vehicle access to the wharf during loading; and

- provision of breathing apparatus to anyone going onto the wharf during loading.

1.3 SAFETY OF 1,800 m AMMONIA EXPORT PIPELINE

The pipeline facilities are described in Section 3.3.5 of the PRA and Section 4.4.4 of the ERMP.

Detailed information on the pipeline design is not available yet; however, the materials of construction will be suitable for the operating temperature of -33°C and will comply with Australian standards.

The safeguards proposed for the pipeline are discussed in Sections 4.2.6.3, 5.3.5 and 6.1.4 of the PRA. The main safeguards are:

- comprehensive quality assurance programme covering manufacture and installation of pipelines, pipeline supports and valves;
- corrosion protection of pipeline;
- valves to be welded onto the pipework where possible;
- pressure monitoring of pipeline during operation for automatic operation and activation of ESD valves on sudden pressure drop;
- isolation valves at each end of the pipeline and at the start of the wharf, working off an emergency shut-down system to minimize the amount of ammonia released if a pipe failure occurs;
- the line will be insulated and cooled prior to loading to minimize vapour generation during loading;
- the line will be protected from overpressure by a safety relief valve;
- as a safety precaution, the pipeline will be patrolled during the loading operation;
- the pipeline will be protected by impact barriers wherever there is a potential for damage by vehicles;
- between shipments, the line will be depressurized and left full of ammonia vapour at slightly above atmospheric pressure; and
- the export pipeline will be subjected to a full hazard and operability (HAZOP) study prior to the commissioning of the plant.

In addition to this, it is proposed that:

- breathing apparatus will be made available to workers in the pipeline vicinity during loading; and
- the above-ground ammonia pipeline will be clearly identified, including the use of warning signs.

These safeguards are aimed at preventing, detecting and limiting a loss of containment from the pipeline. It should be noted that about nine shiploads of ammonia will be exported per year and that the pipeline will be pressurized about nine weeks of the year.

As a result of this infrequent use and the management and design safeguards outlined above, the risk from the pipeline will be minimal.

2 AIR QUALITY

2.1 ODOURS

Sources and concentrations of gaseous emissions are given in Section 4.5.2 of the ERMP/draft EIS. The bulk of the atmospheric emissions are nitrogen, oxygen, and carbon dioxide (all odourless and components of air). Ammonia, sulphur oxides, nitrogen dioxide and chlorine emissions are minor but do have odours. Section 4.4.8 on effluent treatment facilities indicates how these gaseous emissions are handled to limit their impact on the surrounding environment.

The gaseous emissions mentioned in the ERMP are process vents, which are either flared or released from high level to allow rapid dispersion. None of these emissions are likely to cause any odour problems off-site or on-site and this is discussed in Section 7.5 of the ERMP. The predicted ground level concentrations for these gases are orders of magnitude less than the population odour thresholds and are unlikely to cause any health problems.

The only other possible source of odour would be fugitive ammonia or process gas leaks which cannot be tolerated because of in-plant safety requirements. The proposed engineering and operating philosophy of the plant (discussed in Section 4.3.5 of the PRA) places a very strong emphasis on safety, both in the design, construction and commissioning of the plant and in the subsequent operation and maintenance. It will be a major task for both operation and maintenance personnel to keep a close watch on any potential leaks of gases or liquids or equipment malfunctions which might lead to hazardous situations. As mentioned in the above section of the PRA and Section 4.10.1 of the ERMP, to assist with this task, gas monitoring systems and equipment condition monitors will be installed in the plants, as required.

The final design of the plant will be subject to a full HAZOP study before commissioning of the plant, as well as any subsequent changes to design before implementation. This will ensure that the safety standards set for the plant are adhered to and will minimize the likelihood of plant failure and, therefore, the possibility of odour generation. Specific routines and controls will be developed for all types of maintenance operations to be carried out in the plants.

This will involve the use of written work permits for each job where all safety procedures will be specified, including their method of control and how the item maintained is to be tested before recommissioning.

The proponents confirm their commitment that adequate measures will be taken, both during the design stage and during the commissioning and operation stages of the plant development to prevent odour generation from process vents, leaks and accidental gas releases.

2.2 QUANTITY OF CARBON DIOXIDE, NITROGEN OXIDES AND SULPHUR OXIDES DISCHARGED

The sources of carbon dioxide and nitrogen oxide emissions from the proposed plant are:

- primary reformer flue gases
- auxiliary boiler flue gases
- carbon dioxide vent.

The discharge rate and concentration of carbon dioxide, nitrogen oxides and sulphur dioxide from each source are given in Section 4.5.2 (atmospheric discharges) of the ERMP. These figures were used to calculate the carbon dioxide, nitrogen oxide and sulphur dioxide loads. The loads were calculated to be:

- 85 t/h carbon dioxide
- 100 kg/h nitrogen oxides as NO_2 (0.31 g/m^3)
- 0.7 kg/h sulphur dioxide (2×10^{-3} g/m^3).

To put these loads into proper perspective, it was calculated that the carbon dioxide emission would be equivalent to the carbon dioxide emission from a 130 MW gas-fired power station, that the nitrogen oxide emission would be equivalent to the nitrogen oxide emission from a 145 MW gas-fired power station and the sulphur dioxide emission would be equivalent to the sulphur dioxide emission from a 75 MW gas-fired power station. These calculations were based on the following assumptions:

- The emissions from the auxiliary boiler would be typical of a boiler using North-West Shelf natural gas.

- The gas energy to electricity conversion efficiency of a steam turbine based power station would be 30% on a lower heating value basis.

A 145 MW power station would be small compared to either Muja (1,200 MW) or Kwinana (900 MW) power stations. It can be seen that the additional loads of carbon dioxide and nitrogen oxides will not be large compared to the existing load from the Kwinana area. The nitrogen oxide and sulphur dioxide emissions comply with the relevant Australian Environment Council and National Health and Medical Research Council (NHMRC) (1986) criteria as indicated in Section 6.2 of the ERMP. Using results from the Kwinana Air Modelling Study (KAMS) of 1982, the sulphur dioxide emission from the proposed plant would be equivalent to about 0.03% of the expected sulphur dioxide load in Kwinana assuming maximum natural gas conversion as outlined in Section 8.5.1(iii) of the KAMS report (Department of Conservation and Environment 1982).

The EPA has indicated that this is the order of magnitude of the sulphur dioxide impact on the total sulphur dioxide load in the Kwinana area, and that it is insignificant.

It should also be noted that the ERMP evaluation was based on using sulphur mercaptan odourized natural gas. It is now understood that the project will be supplied with unodourized gas, resulting in substantial reduction of the expected sulphur dioxide emission.

2.3 (UREA) DUST CONTROL

Apart from the likelihood of some dust generation during the construction of the proposed plant, notwithstanding the dust control measures that will be employed to minimize nuisance, the only regular emission of dust will be a small amount of urea dust from the urea dust scrubber.

The main sources of the urea dust will be the urea granulator and urea cooler, the air streams from which are scrubbed in the urea dust scrubber prior to release to atmosphere, as described in Section 4.2.2 of the ERMP.

As discussed in Sections 4.5.2, 6.2 and 6.3 of the ERMP, the dust concentration of the air exhaust is well within the guidelines of the NHMRC (40 mg/m^3 cf the 250 mg/m^3 guideline). In addition, the air will be discharged to atmosphere at a height of 45 m above ground level.

It is expected that a proportion of the dust will settle on the paved plant areas and will be collected in stormwater runoff. It was estimated that stormwater and washdown runoff containing traces of urea dust will result in an average nitrogen inflow to Cockburn Sound of 20 kg/d. This will have a marginal effect on the nutrient status of Cockburn Sound as discussed in Section 6.3.2.

Management of the urea dust emission will be through detailed attention to the design and construction of the urea dust scrubber and related process equipment (crushing, screening and de-dusting circuit).

During plant operation, management will be by means of operation of the urea granulation process (including the urea dust scrubber) at design specification, regular monitoring of the gaseous emission from the scrubber and maintenance of good housekeeping in and around the plant.

Granulated urea product will be stored in a clean, dry environment inside a specially designed storage building as described in Section 4.4.4. Transfer of urea from the plant to the storage building will be via an enclosed conveyor. From the storage building to the ship loader, a high capacity covered conveyor will be used to transfer the urea, with provision in the design for a dust extraction system if needed.

The urea granulation process, as described in Section 4.2.2, is known to produce a very sturdy free-flowing granule. This is enhanced by the addition of urea-formaldehyde solution to the granulator. Consequently, there is very little dust produced in the conveying or storage of granulated urea.

The potential sources of urea dust within the granulation plant are the fluid bed granulator and cooler, oversize crusher and screens. These items of equipment will be under suction from the urea dust scrubber, with the whole granulation plant enclosed in a building.

It was concluded by the proponents that urea dust generation would not be a serious problem.

2.4 IMPACT OF COOLING WATER BIOCIDE

The biocide assumed for the ERMP was chlorine gas. This is not to be confused with the biocide dispersant Nalfloc discussed in Section 3.1.2 of this supplement. The quantity of chlorine used was given as 10 kg/h in Section 4.4.6 of the ERMP. It is used up in the cooling tower circuit in the process of controlling algae. Residual chlorine will be principally lost in the cooling tower steam plume and a lesser amount in the cooling tower blow-down water.

The concentration in the cooling tower steam plume was estimated to be 1.4 p.p.m. in Section 4.5.2. The impact and odour generation from chlorine in the air plume was discussed in Sections 6.2 and 7.5, and concluded to be insignificant. This allowed for the dilution and dispersion of the chlorine in a rising plume of steam.

The impact of chlorine in the atmosphere on the biological environment was considered negligible when comparing the emission with the NHMRC guideline standard (0.002 g/m^3 cf 0.2 g/m^3 guideline standard). In terms of the impact of the emission on beneficial uses, the chlorine emission would have to be considered acceptable.

2.5 COOLING TOWER PLUME

As described in Sections 5.3 and 6.1 and Appendix B of the ERMP, there are several contaminated plumes in the shallow Safety Bay Sand aquifer originating from a number of sources including the Nufarm chemical plant, the BP refinery and the CSBP gypsum ponds.

It is proposed to abstract groundwater for the plant from the Tamala Limestone aquifer, which underlies the Safety Bay Sand aquifer and is believed to be sealed from this aquifer by a thin clay layer. There is some contamination of the groundwater from this aquifer in the vicinity of Nufarm's plant, which is believed to have been caused during the construction of their bores.

As the pollution plume in the Safety Bay Sand extends over a part of the area proposed for the ammonia/urea plant production bores, the design and specification of these bores must ensure that no leakage can occur across the clay seal separating the Safety Bay Sand from the limestone.

If this leakage did occur, it would be possible for contaminated water to enter the water supply to the plant. The concern raised by the EPA is the possibility of these contaminants being volatilized in the cooling tower and causing emission problems.

It is unlikely that this will occur because the abstraction is from a different aquifer, but if this did occur, the project would require an alternative source of water because only clean water can be used as process water.

It is proposed to install monitor bores between the production bores and the Nufarm plume to monitor the migration of the plume. In addition, monitor bores will be installed to monitor the migration of the saltwater wedge to the west of the plant site.

The location of the production bores is currently being discussed with the Water Authority on the basis of modelling studies by the proponents' consultants. Regardless of the final locations, groundwater monitoring of the type referred to above will be undertaken.

A concern raised in the submissions is that drift (fine droplets) from the cooling tower could pose a health risk through bacterial contamination. This is unlikely due to chlorination of water to kill bacteria, algae and other microbes. This, along with other factors (such as prevailing wind direction), makes it unlikely that cooling tower spray will be a health problem. However, this and other possible occupational health issues will be addressed in more detail in the design stage of the project.

3 WATER AND WASTEWATER

3.1 CHEMICAL

3.1.1 Criteria used for evaluating environmental impact of wastewater discharge on Cockburn Sound

The criteria used in Section 6.3 on the impacts of liquid discharges on Cockburn Sound were from EPA Bulletin 103, 'Marine and estuarine water quality criteria'. Where the applicable criteria varied with the individual uses, the most rigorous criteria were used - the criteria for the harvesting of molluscs for food. The parameters considered included nutrients and other biostimulants, temperature, salinity and ionic ratio. It was concluded that the proposed discharges complied with these criteria either before or shortly after (within 100 m) release to Cockburn Sound.

The criterion used for nitrogen load in Section 6.3 was the long-term nitrogen load aim of 1,000 kg/d established in the Cockburn Sound study (Department of Conservation and Environment 1979). It was concluded that the estimated contribution of 20 kg/d of nitrogen from the proposed plant would have only a marginal effect on the nutrient status of the Sound, being 2% of the long-term objective, and should therefore have a negligible impact on the seagrass. The proponents recognize the critical need to minimize nitrogen losses and will adopt appropriate operational practices to achieve this objective.

In terms of temperature, the additional heat load from the proposed plant will have negligible effect. The maximum temperature of the combined outfall will, in fact, be marginally less than presently occurs.

In terms of salinity and ionic ratio, the liquid effluent will provide an inflow of essentially freshwater not significantly different to natural groundwater inflows and upwellings occurring in the Sound now. Mixing of the effluent with saltwater in the existing CSBP drain will mean that salinity variations essentially reflect background conditions at the time of discharge into Cockburn Sound.

Recent changes in CSBP policy propose that all seawater return leaves via the existing CSBP undersea pipeline instead of via the open chain outfall.

Effects on the biota near the outfall will be negligible and are discussed further in Section 3.4.2 below.

The only significant substances being released into Cockburn Sound which are not naturally present in seawater in abundant amounts are chlorine and nitrogen. Both of these elements will be greatly diluted before and after discharge to the Sound, and are not expected to significantly add to present loads going into Cockburn Sound.

3.1.2 Nalfloc 7348

It is proposed to use a cooling water antifoulant in the cooling water system. For the purpose of the study, Alfloc 7348 (or Nalfloc 7348, the British trade name) was nominated as being a typical locally marketed product suitable for the duty. Alfloc acts to improve the performance of a cooling water system by assisting the biocide (chlorine) to penetrate microbiological slime deposits and dispersing the neutralized deposits within the cooling water system so that they are removed via the cooling water blow-down.

Product bulletin sheets for Alfloc 7348 are attached (Appendix E) showing that the chemical has low oral toxicity, but that over-exposure to the neat solution may cause skin and eye irritation.

The concentration of Alfloc in the cooling tower blow-down water is given as 5 p.p.m. in Section 4.5.2 of the ERMP. This will be reduced to 4 p.p.m. after combination with other liquid discharges within the plant and then to about 70 p.p.b. by combination with saltwater discharge within the CSBP pipeline.

The manufacturer's data sheet indicates that Alfloc 7348 has no effect on fish at 1,000 p.p.m. This was based on a four-day static fish toxicity study on trout and bluegills.

Therefore, Alfloc 7348 poses no threat to the marine environment of Cockburn Sound. The dosage of Alfloc 7348 to the cooling water system will be controlled and the concentration in the effluent checked periodically as part of the effluent monitoring programme.

3.1.3 Petroleum hydrocarbons in discharge water

The only petroleum hydrocarbons which could occur in the liquid discharge from the plant would be oil used as a lubricant in the plant equipment. Spent oil changed from machinery will be sold for reprocessing. Normal operating and maintenance procedures will require that any oil leaks be attended to immediately because of the possibility of damage to the equipment, fires and the hazard of slippery surfaces. Any spillages will be mopped up and cleaned up using standard techniques with dry absorbents and biodegradable solvents.

There will be a separate sewerage system for any oily water which will allow any such water to be diverted to sumps for retention and skimming.

Consequently, the amount of oil entering the wastewater system is expected to be nil or very low and any concentration of hydrocarbon would be further diluted in the CSBP drain water.

Skimmed oil will be disposed of off-site by truck and the clean water will then enter the stormwater pond for neutralization before being mixed with the CSBP return salt water as discussed in Section 4.4.8 of the ERMP.

3.1.4 Electrolytic protection of water-cooled heat exchangers

The large process units in the plant will be air-cooled.

All the major water-cooled heat exchangers in the plants will be built using duplex stainless steel, which does not require electrolytic protection. The only heat exchangers that may need electrolytic protection would be the small exchangers, such as lube oil coolers. In this case, protection would be achieved by using impressed current and/or sacrificial anodes such as magnesium alloys. Corrosion prevention water treatment schemes should not be necessary.

This means there will not be any heavy metals such as zinc or chromium, or any phosphorus contamination of the cooling tower blow-down.

3.1.5 Present nitrogen load to Cockburn Sound via the CSBP outfall

This question would be more appropriately directed at CSBP and not the joint proponents. The ammonia/urea plant will be operated separately from CSBP's existing activities at Kwinana.

The present combined discharge of nitrogen from Kwinana Nitrogen Company Pty Ltd and CSBP is around the long-term objective of 1,000 kgN/d, as indicated in Section 5.2.3 of the ERMP.

The additional nitrogen load from the plant, estimated to be up to 7 t/a or 20 kg/d on average, represents about 2% of the present discharge and the long-term objective for the Sound. Thus, the long-term objective for nitrogen load to Cockburn Sound will not be adversely affected by the proposed plant.

3.2 PHYSICO-CHEMICAL

3.2.1 Dilution of wastewater before discharge to Cockburn Sound.

The normal rate of discharge of wastewater from the proposed plant will be 55 m^3/h as discussed in Section 6.3 of the ERMP.

Before discharge to Cockburn Sound, this wastewater will be mixed with approximately 3,000 m^3/h of return saltwater cooling water from CSBP in the CSBP return saltwater system.

This represents a dilution of:

$$\frac{3{,}000}{55} = 54 \text{ (approximate)}$$

a considerable dilution factor.

The effect of periodic runoff from paved areas of the plant, including stormwater and washdown water, will be to increase the dilution of the normal effluent before it enters the CSBP return saltwater system.

3.2.2 Maximum temperatures of the liquid effluent streams (excluding cooling tower blow-down)

The liquid effluent streams consist of the 44 m^3/h cooling tower blow-down and a combined effluent of 11 m^3/h from other sources as described in Section 4.5.2 of the ERMP.

The temperature of these other liquid effluent streams is not exactly known at this stage, but would be expected to be hotter than the cooling tower blow-down (27-30°C), up to a maximum of 100°C (say) for the steam generation plant blow-down. Nevertheless, the additional heat load will not be of any significance due to the following factors:

- The streams are diluted by at least a factor of five in the holding ponds and normally have a residence time of sixty hours in the ponds, which allows some cool down, as well as equalization.

- The stream will lose some heat by evaporation, etc. between the source and the holding pond.

- The combined liquid of 55 m^3/h is further diluted about fifty times by combining with the hot seawater cooling stream from CSBP before going into Cockburn Sound. This gives a dilution of at least 250 times for these other liquid effluent streams.

3.2.3 Impacts of warm water discharge on Cockburn Sound

The likely impact of the warm water discharge from the plant was discussed in Section 6.3.2 of the ERMP. It was found that the present discharge of warm return saltwater from CSBP's open drain was sufficiently mixed and diluted within a 90 m radius of the outfall to reduce the surface water temperature to within 3°C of ambient. As discussed in Section 3.1.1 above, recent changes in CSBP policy propose that all seawater return leaves via the CSBP undersea pipeline. Mixing and cooling is expected to occur just as quickly as from the open drain, and probably more so because the wastewater will be discharging into colder water on the seabed.

It was concluded that the proposed plant's addition to the existing heat load at the CSBP outfall will be negligible, because the maximum temperature of the combined outfall will, in fact, be marginally less than the present situation. This is because the additional wastewater flow is only a fiftieth of the existing warm seawater cooling return flow, and the wastewater is cooled before discharge by sixty hours' residence time in the holding ponds and/or dilution with cooler runoff.

3.2.4 Additional cost of having air cooling only

The cooling system study conducted for the project is summarized in Section 3.6 of the ERMP. This involved a consideration of alternatives based on economic and environmental issues of the total cooling load of the plant (240 MW).

The final air/water cooling split was 140 MW air cooling/100 MW water cooling. This represents an optimum of minimum environmental effects and cost implications for the project. In other words, it represents maximum economic use of air cooling. There is no experience of total air cooling in urea plants anywhere at this time. Because of the temperature difference between the process and ambient conditions and because of the temperature limitations of metals, it is essential to use water cooling in certain areas of the process.

Of the 100 MW of water cooling, 30 MW was essential. The other 70 MW was determined on an economic basis for each of the large and small heat exchangers. It was concluded that to use less water cooling would impose an economic penalty on the project.

If any of the economic factors affecting the cooling split change during the design stage of the project, then the situation will be reassessed and, where possible, the proponents will attempt to increase the use of air cooling if it is economic to do so.

3.3 PHYSICAL ENVIRONMENT

3.3.1 Volume and constituents of CSBP discharge

Details on the present discharge from the CSBP pipeline outfall are given in Sections 5.2.3 and 6.3 of the ERMP, where they are relevant to the environmental acceptability of the new project, i.e. where the project will be adding to existing loads in the discharge. These details are flow rate, temperature, nitrogen and salinity.

Requests for details on any other constituents should be properly addressed to CSBP and not the joint proponents.

3.4 BIOLOGICAL ENVIRONMENT

3.4.1 Biological studies in the outfall area

The overall biology of the Sound and its pollution problems have been summarized in Sections 5.2.2 and 5.2.3 of the ERMP. The main problem of recent times has been eutrophication of the Sound and subsequent loss of seagrass. Recent reports have stated that reductions in nitrogen loadings have significantly reduced eutrophication and halted the loss of seagrass. The seagrass has been reported to be growing back in some places (Hillman 1986).

To the proponents' knowledge, there have been no detailed biological studies in the outfall area other than visual observations by divers inspecting the undersea pipeline for CSBP. There does not appear to be much life in the area due to the loss of seagrass, but there are mussel beds and fish do pass through the outfall area.

3.4.2 Can biota near the beach outfall accommodate the existing plus future wastewater discharge?

The effects upon biota of wastewater discharge from the CSBP open drain outfall is discussed in Section 6.3.3 of the ERMP. It was considered that any biota in the area would have accommodated the present discharge and that the proposed discharge from the ammonia/urea plant would have negligible additional impact. This situation would also apply to the current CSBP practice of discharging all wastewater via the undersea pipeline.

To the proponents' knowledge, there have been no detailed studies indicating the impact of the present wastewater discharge on biota.

3.5 GROUNDWATER

The proposal to abstract groundwater for the plant from a series of bores located near the plant site was evaluated by Groundwater Resource Consultants (GRC) as appended to the ERMP and concluded that the quantity of water required could be provided from the shallow limestone aquifer; however, it is probable that there would be landward migration of the saltwater wedge which would require monitoring. It was recommended that allowance be made for construction of additional bores east of the site for use at a later stage. The eastern borefield would be located about 1 km due east of the plant site borefield as shown on the attached map (Appendix F).

Additional work has now been done by GRC in consultation with the proponents and the Water Authority to evaluate the proposed abstraction in more detail. Computer modelling was done using the USGS 'Modflow' software to simulate the proposed pumping over a 1,000-day period to predict the extent of saltwater intrusion and the degree of saline upconing under the expected range of hydraulic and recharge conditions using a series of abstraction scenarios. These scenarios were:

- plant site borefield (as described in ERMP)
- plant site and eastern borefield
- eastern borefield.

The results of this modelling are now being discussed with the Water Authority to reach an acceptable solution from the point of view of groundwater resource management.

It appears that the plant site borefield option is the least desirable from the point of view of likely migration of the saline interface of the underlying aquifer and degradation of groundwater quality. While this is more a question of a groundwater resource impact than an environmental impact, the proponents will make the results of the modelling available to the EPA once agreement has been reached with the Water Authority. The conclusions and recommendations reached by the consultants are attached (Appendix F).

3.6 REUSE OF WATER AND WASTEWATER

3.6.1 Wastewater strategy and reuse of water

Section 4.4.8 of the ERMP describes the effluent treatment and recovery facilities.

Examples of water reuse proposed for the plant are as follows:

- Where possible, process condensate is reused; e.g. ammonia plant process condensate is stripped and treated for reuse.

- The use of evaporative scrubbing for the disposal of urea plant process condensate and dust recovered from the urea granulation emissions. Figure 4.4 of the ERMP illustrates this. The urea plant process condensate can also be used as demineralization plant feedwater.

- Containment and transfer to the urea plant of aqueous ammonia produced during initial reduction of the ammonia plant synthesis catalyst.

- Urea spillages and strong nitrogen solution effluents are to be collected via a drainage network and used for the dissolving of spilled solid urea for reprocessing in the urea synthesis plant.

The above examples of water reuse are also examples of wastewater strategies to minimize nitrogen losses and liquid effluent.

- Oily water: As discussed in Section 3.1.3 above, any oily water will be diverted to holding sumps for retention and skimming of oil. Recovered oil will be removed by a truck and disposed of off-site and the clean water redirected to the main holding pond for neutralization.

- Water treatment plant effluent: Acidic or alkaline effluents from the water treatment plant will be neutralized in a small holding pond before being pumped into the main holding pond.

- Holding pond: The main holding pond will be of about 3,400 m^3 capacity. It will provide a hold-up or residence time of about sixty hours for the normal combined liquid effluent. This will provide sufficient time for equalization of the combined effluent and discharge to Cockburn Sound via the CSBP outfall in a controlled manner. The pond will also be used to collect stormwater before discharge to Cockburn Sound and would also act as a containment pond for an accidental release of urea solution enabling recycle back to the process.

4 SOLID WASTE

Solid waste sources and disposal are discussed in Sections 4.5.2 and 6.4 of the ERMP. The sources of solid waste are used catalyst and adsorbents, plus domestic solid waste. Product safety data sheets are appended to the PRA.

Domestic solid waste will be disposed of to sanitary landfill to the satisfaction of the local authorities.

Det norske Veritas considered that the process catalysts will not pose any particular hazard during normal operation, although precautionary measures will be necessary to minimize dust exposure during handling, particularly for catalysts where nickel compounds are present (Section 4.2.2 of PRA).

The catalyst types are as follows:

Catalyst	Application	Active compounds
Catalyst 50-2	Hydrodesulphurization	Nickel and molybdenum oxides
Catalyst 32-4	Sulphur removal	Zinc oxide
Catalyst 57-3	NG steam reforming	Nickel oxide
Catalyst 54-3	Secondary steam reforming	Nickel oxide
Catalyst 54-4	Secondary steam reforming	Nickel oxide
Catalyst 15-4,15-5	High temperature shift	Iron and chromium oxides
Catalyst 53-1	Low temperature shift	Copper and zinc oxides
Catalyst 11-3	Methanator	Nickel oxide
Catalyst 35-4	Ammonia synthesis	Magnetite
	Hydrogen removal	Platinum

Some of the catalysts contain the active compounds on an inert ceramic carrier such as alumina.

The volumes of catalysts that would be disposed of at any one time and the expected catalyst life are given below:

Catalyst	Volume (m^3)	Expected life (y)
Feed gas desulphurization	19.8	5
Feed gas desulphurization	85.0	4
Primary reformer	30.3	3
Secondary reformer	41.0	5
Carbon monoxide conversion - HT shift	72.0	3

Catalyst	Volume (m^3)	Expected life (y)
Carbon monoxide conversion - LT shift	100.0	3
Methanation	39.0	5
Ammonia synthesis	80.0	5
Hydrogen removal	0.7	9

It can be seen that the volumes are not large and do not require regular disposal.

The traditional method of disposal by BP/Kwinana Nitrogen Company Pty Ltd for spent catalysts has been to sell them for their metal content (nickel, copper) or to dispose of them as landfill.

The three categories of catalyst or spent catalyst are as follows:

- those which contain only non-toxic compounds, e.g. Fe_2O_3 or Al_2O_3, and can be safely disposed of on any landfill site;

- those containing a high proportion of recoverable metals such as the nickel, platinum or copper-based catalysts which can be sold for their metal content;

- those which can not be sold for their metal content and which contain significant proportions of elements which can be toxic to the environment, such as chromium, will be disposed by approved means.

Other options to be explored by the proponents include the possible use of spent catalysts in CSBP's superphosphate mixtures to provide trace elements (Cu, Zn, Mo) required by plants and crops.

5 RESPONSES TO SUBMISSIONS

The EPA has provided the proponents with a summary of the submissions received to the ERMP/draft EIS (Appendix B). This section provides responses to the comments raised in the submissions.

Submissions 1.1 and 1.2

The emergency procedures are discussed in Sections 4.10.6 and 8.4 of the ERMP and Section 4.3.8 of the PRA. As discussed, the proponents will liaise with the relevant local authorities, including the local Counter-Disaster Advisory Committee and local industries, in developing an emergency response plan for the plant.

Submissions 2.1, 5.2, 6.2, 6.3 and 11.1

Responses to questions 2.5 and 3.5 from the EPA cover most of the comments/concerns raised here. The modelling work done by GRC takes into account the current annual groundwater abstraction by existing industry, local government, urban, agricultural and other users.

The modelling also takes into account the natural recharge rate of the aquifer (2,300 m^3/d/km) as agreed with the Water Authority.

Sea water desalination would not be an economic means of supplying fresh water to the plant.

The groundwater north of the site will be monitored to observe the migration of the Nufarm contaminant plume.

The impacts of the cooling tower blow-down on Cockburn Sound are considered in Section 6.3 of the ERMP and the response to question 3 of the EPA questions.

Submissions 3, 5.1 and 5.4

The ERMP summarized the results of the site selection study commissioned by the proponents which concluded that the Kwinana site was the most economically attractive of all the sites considered and that it was the safest of the south-west sites. This was confirmed by a separate study commissioned by the State Government.

Although the plant is large, the PRA and ERMP have shown that:

- the risk from the project to residential areas is well within the EPA guidelines, and that there is an ample buffer zone between the proposed plant and residential areas;
- the contribution to cumulative risk in the Kwinana industrial area will be very small as confirmed by the Kwinana cumulative risk study;
- the risk to employees of neighbouring industries is within generally adopted criteria for individual risk to adjacent industry;

- the impact on the environment from noise and gaseous, liquid and solid wastes will be very small, and represents only a small increase to existing pollutant levels.

Submissions 4.2 and 6.4

These comments have been addressed in the answer to EPA question 2.2.

Submissions 5.3

The ERMP indicated in Sections 2.5, 4.7 and 4.9 the employment benefits to the community as being a construction workforce of up to 1,200 and permanent employment of up to 200 people for operation of the plant. Figure 4.7 of the ERMP details the construction workforce with respect to time and trades required.

The proponents expect that the majority of the permanent jobs could be filled from persons in the Kwinana/Rockingham area as many of the job skills already exist in this community. All employees will receive on-site training in specific skills. Currently, approximately 54% of CSBP's employees at the Kwinana works are from the Kwinana/Rockingham areas.

The construction workforce will most likely be drawn from the Perth metropolitan area, including Kwinana and Rockingham. Again, many of the skills required here, as described in Section 4.7, are available in the Kwinana/Rockingham areas.

Indirect employment from the project, conservatively estimated at double the number of people directly employed, will also stimulate the local community. The indirect employment will be for people involved in the support industries of supplying goods and services and ongoing contract maintenance services.

Consequently, the comment in this submission that employment in the area will hardly be relieved is not accurate. There will be significant opportunities for employment of the local community.

Submissions 6.5 and 11.4

These comments have been addressed in the answers to EPA questions 3.1(a), 3.1(e) and 3.6(a).

Submissions 6.6 and 11.2

These comments are addressed in the answers to EPA questions 3.1(a), 3.1(b) and 3.1(d).

Submissions 6.7 and 11.3

These comments are addressed in the answers to EPA question 4.1.

Submission 6.8

This is an occupational health question and is not required to be addressed in an ERMP.

The comment is briefly addressed in the answer to EPA question 2.1. It is intended that this matter will be addressed in more detail during the design phase of the project.

Submission 7.1

This comment has been addressed in the answers to EPA questions 3.1(a), 3.1(b), 3.2(a), 3.2(c), 3.4(a), 3.4(b) and 3.6(a).

Submission 7.2

The licensing and monitoring of all effluent discharges is a matter for the EPA and the proponent will comply with any licensing requirements imposed as a condition of approval.

Submission 7.3

This comment has been addressed in the answer to EPA question 3.1(a).

Submission 8.1

The act was not listed because it has now been incorporated into the Environmental Protection Act, 1986 which was listed.

Submission 8.2

As discussed in Section 4.6 of the ERMP, the design of the plant will restrict the maximum noise from equipment to 85 dB(A) at 1 m. This will generally mean that no worker in the plant will be exposed to an LeqA8* of more than 85 dB(A) and this latter requirement will be considered during the design phase.

* LeqA8: The amount of noise that a worker can be exposed to in eight hours (in dB(A)).

Submission 8.3

This comment is addressed in the answer to EPA question 2.5. Again, this is an occupational health issue and will be addressed in more detail during the design phase of the project.

Submission 8.4

The proponents will exercise normal duty of care in preparation of emergency procedures and these procedures will be available for review by Department of Occupational Health, Safety and Welfare (DOSHWA) if so required.

Submission 8.5

The medical and first aid facilities are referred to in Sections 4.10.6 and 8.8 of the ERMP.

The proponents will liaise with all relevant local and State authorities in reviewing the design of medical and first aid procedures and facilities for the plant.

Submission 8.7

The proposed training, maintenance and operation safety procedures for the project are discussed in Sections 4.10.2, 4.10.3 and 4.10.5 of the ERMP, and Section 4.3.7 of the PRA.

All employees will be thoroughly trained in areas relevant to their work, including safety procedures. Maintenance and inspection procedures (including work permits) will be developed to protect maintenance workers and to prevent unsafe situations from developing. Operation manuals will be developed which outline how various situations are to be handled by operators.

When alterations to existing equipment or installation of new equipment are suggested, detailed check procedures on the design, including a HAZOP study, will be undertaken before any work is approved.

Submission 8.8

The proponents have committed to conduct a HAZOP study of the final plant design. This study will meet the EPA's guidelines for HAZOP as defined in Bulletin 278, May 1987. The results of the HAZOP study will be made available to DOSHWA on request.

The primary objective of the HAZOP study is to review the hazards and operability of the process as designed. This does include consideration of occupational health matters, but mostly these matters are considered more fully in the detailed design stage of the plant, following the HAZOP review.

Submission 8.9

The proponents are committed to develop emergency procedures for the plant prior to commissioning. This is discussed in Section 4.10.6 of the ERMP.

Submission 8.10

As discussed in Section 5.5.1 of the PRA, the estimation of individual risk (per year) to an employee will be approximately one-quarter of the level shown, when the normal shift period is taken into account. This assumes that a person working in the plant is present for one-quarter of the year (i.e. 2,000 hours out of 8,760 hours).

The comment is correct in that risk to employees should be estimated by FAR (fatality accident rate), but this is related to annual risk (FAR of 1 = 87 fatalities per million years). FAR calculations for employees are not a requirement of the EPA but, nevertheless, an issue for the proponent.

Submission 8.11

This comment is covered by the response to submission 8.8.

This is an occupational health issue and will be considered as part of the safe operating and maintenance procedures for the plant.

As mentioned in Section 4.10.1 of the ERMP, a HAZOP study will be conducted during the design phase of the project. This will cover all sections of the plants and will include areas where hazardous chemicals are present.

Submissions 9.1, 9.2 and 9.3

Section 4.10.6 of the ERMP addresses emergency procedures. There will certainly be a requirement in the emergency plan for notification to the police in the event of an emergency, depending on the scale of the emergency and the type of response required. Accordingly, the Western Australian Police will be consulted in the review of the emergency plan, as they should be in planning for 'public safety'.

Submission 12.1

It was concluded in Section 7.4 of the ERMP that the extra traffic generated during both construction and operation of the plant would not significantly increase road traffic and lead to congestion on Rockingham-Paterson Road. However, the Mason-Rockingham Road junction was not looked at specifically in the ERMP.

Delays occur at the Mason-Rockingham Road junction late in the afternoon when employees from industries along Mason Road travel home. If it appears that the traffic from the project significantly aggravates this problem, it may become necessary for the Main Roads Department to install traffic lights to regulate the flow of traffic.

Submission 12.2

The requirement for traffic protection on a new rail crossing will be determined by Westrail, but it is expected that a flashing light control would be a minimum requirement.

REFERENCES

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Det norske Veritas. 1987. Preliminary risk analysis of an ammonia/urea plant for CSBP & Farmers Ltd and Norsk Hydro a.s. Sydney: Det norske Veritas.

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APPENDIX A
EPA QUESTIONS

ENVIRONMENTAL PROTECTION AUTHORITY

1 MOUNT STREET, PERTH, WESTERN AUSTRALIA 6000

Telephone (09) 222 7000

The General Manager
CSBP & Farmers Ltd
40 The Esplande
PERTH WA 6000

Attention: Steve Fitzpatrick

Your Ref:
Our Ref: 107/85/1 BP:lb
Enquiries: Bill Pradhan

AMMONIA-UREA PLANT PROPOSAL

The EPA in undertaking its assessment of the joint partners proposal for a Ammonia-Urea Plant at Kwinana requests a response on the following questions which includes a summary of issues raised by public submissions as well as information required by the Authority. A number of submissions, including submissions from Government agencies have already been forwarded to you for comment. The joint partners comments on those submissions plus the answer to the following questions will constitute the response required under the Commonwealth Environmental Protection (Impacts of proposals) Act 1984 (as amended). This response will also assist the EPA in expediting the finalisation of its assessment.

1. RISK AND HAZARDS

1.1 The ERMP states that the storage of Ammonia would be in 30 000 tonnes storage vessels. While the risk generated by this storage vessel appears to be low, the EPA would appreciate a discussion on the likely risk generated due to a variation in the storage configeration eg 3 x 10 000 tonnes storage vessels etc.

1.2 Please discuss in more detail the safeguards proposed for the Kwinana Bulk Cargo Jetty as well as the means by which the risk associated with the mobile loading arm will be managed.

1.3 Please discuss the safety details of the 1 800 metre ammonia transport pipelines. This should include the safeguards to prevent loss of containment.

2. AIR POLLUTION

2.1 Please discuss how odour generation from the plant will be prevented (eg through HAZOP and maintenance schedule).

2.2 Please compare the quantity of carbon dioxide and nitrogen oxides from the proposed plant to other sources in order to put the plant; discharges into an overal perspective.

2.3 Please discuss the likelihood of (urea) dust generation from the proposed plant and safeguards proposed.

2.4 Please discuss the biocide proposed for the cooling tower and its likely (if any) air pollution consequences.

2.5 Is there any likelihood of contaminated groundwater from other industries going through the cooling tower and generating air discharges?

3. WATER AND WASTEWATER

3.1 CHEMICAL

(a) What criteria was used to conclude that the discharged wastewater will have no adverse effect on the Sound?

(b) What is the toxicity of Nalfloc 7348? What will its concentration be in the discharge? Is this concentration likely to be toxic to the marine environment?

(c) What concentration and load of petroleum hydrocarbons (if any) are likely to be in the discharge?

(d) What sort of electrolytic protection will be used in the coolant water system? If anodes are used, will they cause discharges of heavy metals?

(e) What is the present load of nitrogen being discharged per annum through the CSBP pipe and/or drain? How does it compare with what is proposed to be discharged?

3.2 PHYSICO-CHEMICAL

(a) What is the dilution factor of the wastwater discharged to the drain prior to marine discharges?

(b) What are the maximum temperatures of the liquid effluent streams (besides the temp of blow downwater) from the plant?

(c) Please discuss the likely impacts of warm water discharge into the Sound.

(d) What is the extra cost of having air cooling only?

3.3 PHYSICAL ENVIRONMENT

(a) Please provide volume and constituents of the present wastewater discharge from the CSBP drain.

3.4 BIOLOGICAL

(a) Have any biological studies been carried out at the proposed outfall area?

(b) Can the biota within the area of the existing beach outfall, 'accommodate' the present (plus future) wastewater discharge?

3.5 GROUNDWATER

Please discuss the environmental implications of withdrawing groundwater, for the proposed plant, from the Kwinana Industrial Area.

3.6 REUSE OF WATER AND WASTEWATER

(a) Please discuss the reuse of water and wastewater strategy investigted by the joint partners for this proposal.

4. SOLID WASTE

4.1 Where will the solid waste be disposed of? Please discuss quantity and quality of waste and the waste disposal options investigated.

R.A.Field

wP R A FIELD
DIRECTOR
EVALUATION DIVISION

22 September 1987

0265BPAMM

APPENDIX B
EPA SUMMARY OF SUBMISSIONS

APPENDIX B
EPA SUMMARY OF SUBMISSIONS

The EPA has summarized the content of each submission received. These summarized submissions have been numbered and are presented below. The submission numbers are quoted in Section 5 of the supplement.

Submission 1

1.1 Emergency procedures response plan will require liaison with local police, fire authorities, ambulance and nearby industries.

1.2 Considers that liaison should be established with the local Counter-Disaster Advisory Committee (which carries out community disaster planning).

Submission 2

2.1 Concern that groundwater extraction proposal could have far reaching effects involving many established premises. Suggest that a detailed study be prepared (including groundwater maps and published text) to indicate area that may be affected. Should be an involvement of EPA and Water Authority in this to ensure no detrimental effect to other users or the environment.

Submission 3

3.1 No comment to offer on this proposal.

3.2 Should consideration be given to two of the alternative sites, Bunbury Port and Picton, which may have an impact on Leschenault Inlet, this organization would like the opportunity to consider the proposal.

Submission 4

4.1 Agree that indication of gaseous emissions from the proposed plant.

4.2 Oxides of nitrogen, oxides of sulphur and chlorine as stated in the ERMP will be very low; however, suggested that it may be more relevant to indicate the emissions as cumulative effects, i.e. in addition to the emissions of these gases from existing industries.

4.3 Consider that there is little likelihood of atmospheric pollution problems for agricultural pursuits around the Kwinana area.

Submission 5

5.1 Strong objection to the plant being built in the Kwinana industrial strip.

Reasons:

- too large and too close to populated areas;

- will increase existing pollution by a variety of noxious gases;

- concern that leakage of ammonia into the atmosphere could cause a catastrophe.

5.2 Concern that water usage could jeopardize groundwater requirements of other existing industries and domestic usage. (Suggest that these companies install sea water desalinization for their fresh water requirements.)

5.3 View that unemployment in the Kwinana/Rockingham areas will hardly be relieved by the establishment of such a plant, as the report indicated that staff for construction and operations will have their base in Perth.

5.4 Suggest that the proposed plant should be built in the Pilbara region where the population is sparse.

Submission 6

6.1 PRA and ERMP have made a thorough assessment of potential environmental impacts of proposed plant, storage facility and export terminal.

6.2 With natural groundwater movement past the plant at 100 m^3/h and current estimated requirements of 264 m^3/h, groundwater is being mined at a rate of 164 m^3/h. Consider that water mining should not be allowed, particularly if expansion requires increased draw as it enhances the salt water intrusion into coastal fresh water aquifers.

6.3 Rate of groundwater extraction may result in accelerated movement of the pollution plane from Nufarm towards both Cockburn Sound and adjoining industries. This may cause harmful effects in the Sound and expense to industry.

6.4 Proponent should indicate total emissions of oxides of nitrogen and other contaminants apart from concentration so that comparison can be made with current emission of these pollutants by existing Kwinana-based industries.

6.5 Concern about nitrogen from urea plant resulting in additional nitrogen loading imposed on Cockburn Sound. Suggest that existing nitrogen processing industries controlled by CSBP at Kwinana monitor operations so that no additional nitrogen loading is imposed on the Sound.

6.6 Should identify and qualify the treatment chemicals contained in approximately 60 m^3/h of aqueous waste.

6.7 Should clarify contaminants expected and possible treatment required prior to disposal of the iron-based catalysts.

6.8 Assessment of odour effects should include health factors as well as limits of odour detection, e.g. mentioned detection of sulphur oxides is between 20 and 30 p.p.m., respiratory effects of exposure to sulphur oxides can occur as low as 1-3 p.p.m.

Submission 7

7.1 Liquid discharges - Ensure that effluent discharged to Cockburn Sound would not have a detrimental effect on its waters, flora and fauna.

7.2 EPA license all effluent discharges and they are regularly monitored to ensure standards are maintained.

7.3 Water quality criteria for Cockburn Sound be minimum standard for effluents discharging to the Sound.

Submission 8

8.1 Noted that Noise Abatement Act, 1972 (as amended) is not listed in the statutory requirements in the EIA.

8.2 Suggest that the design which achieves 85 dB(A) 1 m from any item of equipment is a design which also ensures that no worker in the plant is exposed to an LeqA8 of more than 85 dB(A).

8.3 Ensure that aerosols generated do not pose a hazard to workers or public, e.g. spray drift contamination of atmosphere, fresh air intake of air conditioning system, Legionnaires disease.

8.4 DOSHWA must be consulted in the plant's emergency procedures prior to commissioning. Procedures must include provisions for early detection alarm system, evacuation procedures, rescue and an action plan for resuscitation, first aid and ready access to emergency treatment facilities. Strategically placed eye wash and shower facilities on site.

8.5 Should be consulted in design of appropriate medical and first aid procedures and facilities for the plant.

8.6 Considers that PRA has addressed issues of occupational health and safety concerns.

8.7 Proponent should train staff in plant operation and maintenance and ensure that they are adequately protected in the hazardous task of maintenance.

8.8 Request involvement in the HAZOP studies.

8.9 Emergency procedures should be developed before plant commissioning. Ensure adequate fire fighting facilities and SCBA be provided throughout the plant.

8.10 PRA document - Risk to employee should be estimated by FAR (fatality accident rate), not by estimating 'approximately one-quarter of the risk contour level shown'.

8.11 Employee exposure to hazardous chemicals should be considered during the HAZOP studies so that exposure can be minimized by engineering control at the design stage.

Submission 9

9.1 No provisions for a warning to be given to Western Australian Police in emergency procedures.

9.2 Would expect to be consulted in the development of emergency procedures.

9.3 Should be involved in planning for public safety.

Submission 10

10.1 No formal comment.

Submission 11

11.1 Concern about large draw of borewater from under the plant site as it may:

- adversely affect blow-down from the cooling tower;
- cause contamination of Cockburn Sound;
- interfere with the effects of other industries to contain their own contamination problems.

11.2 Noted omission of any reference to corrosion inhibitors.

11.3 Disposal of one of the proposed catalysts raises concern as it contains chromium.

11.4 Efforts should be made to minimize total input of nitrogen to Sound.

11.5 Well prepared document (ERMP), easy to follow.

Submission 12

12.1 Additional traffic load on Mason Road—Rockingham Road junction would increase delays currently experienced by traffic at this location during peak periods.

12.2 A new rail crossing where the new access road crosses the Kwinana loop line will require minimum level of flashing light control to protect the new crossing.

APPENDIX C
NORSK HYDRO a.s COMMENTS

To: E.Holte, CSBP Farmers Ltd, Perth, WA, Australia

From: T.K.Jenssen, Corporate Health, Environment & Safety, Norsk Hydro, Oslo

RISK RELATED TO SIZE OF LIQUID AMMONIA STORAGE TANKS.

The risk to the surrounding area near a liquid ammonia storage tank is connected to the probability of failure to the tank including piping, fittings, valves, etc. and the corresponding release, evaporation, spreading and dispersion.

Ammonia in gas phase at the boiling point is considerably less dense than air. It thus behaves like a buoyant plume when released into the air. This "light" behaviour can, however, change when high concentrations of aerosols are present or the cooling effect of the air above the ammonia liquid pool is strong. This is dicussed to some detail below.

When liquid ammonia is stored at atmospheric pressure a leakage will give an evaporating pool at the ground. If the liquid jet is reflected by a wall or other installations, or if the boiling of the liquid from the ground is very vigorous, some aerosols may be formed which may "float" in the gas, but this phenomena will only have local and temporary effects on the gas cloud. Due to the cooling effect of the air the gas cloud may, however, be neutral or slightly heavier than air.

In cases of pressurised storage of ammonia a leakage will cause the formation of aerosols both from condensed ammonia and condensed water vapour from the air. This cloud will spread like a heavy gas cloud and stay near the ground for long distances.

The identification of worst credible events is a very critical point in a risk assessment. If a total rupture of the tank is considered to be a releavant case the accidenet scenarios will differ somewhat to a situation where a pipe rupture is the case of interest. Both categories of accidents will be discussed here with respect to storage tank volume.

In case of at total tank rupture the gas phase in the tank will escape by the rupture and will due to its buoyancy not expose people at ground level at some distance. The evaporation of gas from the ground will reach its maximum when the pool has spread out to the bund walls. The difference in the size of the pool and thus the evaporation rate, in the case of a 30,000 t tank and a 15,000 t tank is small, and the difference in gas concentration will also be small.

The pipe rupture scenario will develop quite similarly for both tanks. The pool will grow until the bund is fully occupied and the evaporation rate will decrease as the ground temperature decreases. The exposure towards surrounding areas can remain for a long period in both cases, and if the gas reaches residential areas at dangerous or irritating concentrations, measures should be taken in both cases.

The probability of failure in the installation is proportional to the number of components in the system (i.e. valves, flanges, etc.). By installing another tank the accident probability increases. The following conclusion can thus be drawn: The risk potential is not significantly reduced by installing two 15,000 t storage tanks for liqiud ammonia in stead of one 30,000 t tank

APPENDIX D
DET NORSKE VERITAS COMMENTS

Ad		
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	Rec 16 OCT 1987	
A		
B		
C	Ans	

DET NORSKE
VERITAS

AUSTRALIA, NEW ZEALAND AND
SOUTH PACIFIC REGION

2nd Floor 165 Walker Street
North Sydney N.S.W. 2060
Telex no 26447 DNV
Fax 929 8792
Telegr adr. Noritas, Sydney, N.S.W.
Tel (02) 922 1966
BANKERS. National Australia Bank
A/c No 082318 269330

13th October, 1987.

Mr S R Fitzpatrick
CSBP & Farmers Ltd
40 The Esplanade
PERTH WA 6000

AMMONIA UREA PROJECT

Reference: CSBP & Farmers Letter of 10 October, 1987 and attached EPA letter of 22 September, 1987.

One issue questioned by the EPA is the ammonia storage tank capacity (Question 1.1). The EPA would appreciate a discussion on the likely risk generated by a variation in the storage configuration. e.g. single 30,000 t tank versus 3 x 10,000 t vessels.

The existing proposal is for a single 30,000 tonne tank with a full height concrete bund wall. The predominant risks associated with this are:

1. Rupture, major leakage or overfilling of the tank leading to spillage of ammonia into the annular space between the tank and the surrounding bund wall. The evaporation of ammonia from this annular space is dependent mainly on heat input to the spilled ammonia from surfaces within the annulus.

2. Rupture or major leakage from tank connections, outlet valves or pipework external to the bund wall.

The effect of variations in storage configuration on the above risks are mainly as follows:

A Change in the number of tanks(to say 3 x 10,000 tonne)s will affect the risks source components of frequency (A), consequences (B) and (C)location as follows:

(A) Frequency of Risk events

i) The number of components which may fail will increase generally by a factor of 3 or more eg.
Tanks: (3 times)
Valves: (at least 3 times or more if flexibility is provided for

isolating tanks and their associated valves.
Pipework: at least 3 times or more to reach additional tank locations.

Some modification in frequency of failure may be applied to allow for components not being in a hazardous condition (eg empty) and for the flexibility available for inspection and maintenance. This is a factor normally considered in a final Risk Analysis after detailed design and Hazard and Operability Studies.

ii) The number of hazardous operations which may lead to a release will generally increase by a factor of 3. Response times available (eg. between high level alarm and overfilling) will be lessened with smaller tanks.

iii) Generally the cost of providing 3 smaller tanks, associated valves and safety features etc will be substantially greater than that for the larger tank. For the same cost, more safety can generally be provided by a single tank and its critical components provided it is, as proposed, within the normal range of proven design.

In analysing the frequency of risk events the standard of component quality, reliability and safety of operations would need to be assessed.

iv) The effect of increased frequency of risk events must be determined in conjunction with their consequences and the perspective of other risk levels in the vicinity.

B) Consequences

(i) The release quantities from the tanks will depend on the design of the tanks and bund walls and will generally be reduced due to the smaller scale of each of the three tanks. The reduction however will be in relation to surface area and heat flow rather than volume which will follow a 2/3 power law subject to certain minimum dimensions eg. the annular clearance provided for access. Reduction of tank size from 30,000 to 10,000 will therefore be likely to result in reduction to about half the release volume and rate.

The distance to a given consequence level (eg. concentration or dose) however is roughly proportional to the square root of release volume or rate. Accordingly the hazard distance for a 10,000 t tank will be about 70% that of a 30,000 t tank, given equal release heights. However, the 10,000 t tank will be much lower (nearly half the height) of the 30,000 t tank which will increase ground level concentrations to about that of the larger tank.

The consequence input to the risk assessment is unlikely to change significantly for tanker release events.

ii) Releases from tank connections, valves and pipework are determined mainly by the size of the component (no change likely) and the pressure. The pressure will be reduced marginally for 10,000 t tanks due to lower heads involved.

C) Locations

The location of each source has a direct effect on the risk levels within its hazard zones. As three tanks will require a larger area the position of the outer tanks will effect the risk contours up to the hazard distance involved.

SUMMARY

A number of factors will constitute marginal effects to increase or decrease risk levels surrounding the tanks. This can only be determined accurately by risk assessment of the detailed design and operational arrangements.

From a number of other studies of variations to storage for ammonia and similar products, DnV can state that the major difference resulting from variations within normal design ranges derives from the actual locations and design and operating details rather than from the number of tanks involved. It is our conclusion that where risk contour shape and locations are critical, risk analysis provides a useful input to layout consideration's; but in general it is advisable to determine tank requirements in accordance with plant design requirements and good engineering practice with risk analysis as a check.

In the case of the CSBP & Farmers proposal we consider the latter case to be appropriate.

Yours faithfully
for **DET NORSKE VERITAS**

J R CASTLEMAN
Manager, Technical Services.

APPENDIX E
ALFLOC 7348 PRODUCT BULLETIN SHEETS

Cooling Water Chemicals | **Product Bulletin**

'ALFLOC' 7348

LIQUID COOLING WATER BIODISPERSANT

PRODUCT BENEFITS

* Aids in removing and dispersing slime deposits.
* Helps maintain heat transfer efficiency.
* Increases time between turn arounds.
* Can increase penetrating power of chlorine.
* Helps improve efficiency of chlorination.
* Low BOD and no effect on fish* at 1000 ppm.
* Minimal environmental impact.

PRINCIPAL USES

ALFLOC 7348 can improve performance of systems fouled with microbiological slime by removing and dispersing these deposits. ALFLOC 7348 helps achieve longer plant operation between turn around time in cooling systems. ALFLOC 7348 has been shown to be an effective biodispersant in both recirculating and oncethrough cooling systems. ALFLOC 7348 can help increase effectiveness in clorination of slime deposits and shows no chlorine demand.

Toxicity tests demonstrate no effect on fish* at 1000 ppm.

ALFLOC 7348 aids in alkaline cleaning of slimed equipment.

When used with other ALFLOC cooling water chemicals, ALFLOC 7348 becomes part of a complete program for protecting your cooling water systems.

NOTE: ALFLOC 7348 is intended for industrial use only, not for use in potable water systems.

DOSAGE

Normal dosage of ALFLOC 7348 is in the range of 5.0-30 ppm in the recirculating water and 0.5-3.0 ppm in once-through water. If the system is heavily fouled, dosages of 20-30 ppm of product may be necessary to assist in cleaning and maintaining a clean system.

Contact your Catoleum representative for assistance in determining the correct dosage for your system conditions.

* Four-day static fish toxicity study on trout and bluegills.

(continued on reverse side)

CATOLEUM PTY. LTD.

HEAD OFFICE: ANDERSON STREET, BOTANY, N.S.W.2019 Telephone: (02) 666 7733 Telex: 25673

SALES OFFICES:
N.S.W. — BOTANY, NEWCASTLE
VIC. — MELBOURNE
QLD. — BRISBANE, MACKAY, TOWNSVILLE, GLADSTONE
TAS. — LAUNCESTON, LATROBE
S.A. — ADELAIDE, WHYALLA
W.A. — KWINANA
N.Z. — AUCKLAND, NEW PLYMOUTH, ROTORUA
FIJI — SUVA (ICI)
P.N.G. — LAE (ICI), PORT MORESBY (ICI)

GENERAL DESCRIPTION

ALFLOC 7348 is a liquid non-ionic dispersant with the following properties:-

Colour	Pale Green
Odour	None
Specific Gravity	1.02
pH (1% solution)	5.0
Viscosity (@ 26°C)	273 cp
Freeze-Thaw Recovery	Complete
Flash Point (COC)	232°C
Pour Point	-27°C
BOD (5-day)	3 mg 02 uptake/gm product

FEEDING

ALFLOC 7348 should be fed neat to a location in the system where it will be uniformly mixed and thoroughly distributed. ALFLOC 7348 is non-corrosive to materials normally used in feeding systems. Mild steel pumps, feed lines and storage tanks are satisfactory for handling ALFLOC 7348.

HANDLING

KEEP OUT OF REACH OF CHILDREN.

CAUTION: May cause irritation to skin and eyes. Avoid contact with skin, eyes and clothing. Do not take internally. In case of contact, wash skin with soap and water; for eyes, immediately flush with large amounts of water for at least 15 minutes, and get medical attention. Remove contaminated clothing and wash before reuse.

SHIPPING & STORAGE

ALFLOC 7348 is shipped in 200 litre non-returnable steel drums. It is recommended that ALFLOC 7348 be stored no longer than 12 months in your plant.

CATOLEUM

MATERIAL SAFETY DATA SHEET

ALFLOC 7348	EMERGENCY TELEPHONE No. (02) 76-0444

SECTION 1 – PRODUCT

MANUFACTURER'S NAME AND ADDRESS	CATOLEUM PTY LTD ANDERSON ST, BOTANY. N.S.W. 2019. TELEPHONE NO: (02) 666-7733.
TRADE NAME: ALFLOC 7348	CHEMICAL FAMILY: ORGANIC
PRODUCT TYPE	A NON-IONIC COOLING WATER ANTIFOULANT.

SECTION 2 – HAZARDOUS INGREDIENTS

MATERIAL OR COMPONENT	
A non-ionic dispersant type surfactant material. It has a low oral toxicity and is non-flammable.	

UN NUMBER N/A

HAZCHEM CODE: N/A

SECTION 3 – PHYSICAL PROPERTIES

APPEARANCE AND ODOUR	A pale green liquid with no distinctive odour.	pH (1% solution)	5.0
BOILING POINT (°C)	N.A.	VOLATILES (% VOLUME)	N.A.
VAPOUR PRESSURE (KILOPASCALS)	N.A.	EVAPORATION RATE (BUTYLACETATE = 1)	N.A.
VAPOUR DENSITY (AIR = 1)	N.A.	MELTING POINT	N.A.
SOLUBILITY IN WATER, % BY WT.	< 1.	[illegible], Specific gravity (20°C)	1.02

SECTION 4 – FLAMMABILITY AND EXPLOSIVE PROPERTIES

FLASH POINT (°C) – METHOD: Non-flammable	FLAMMABILITY LIMITS IN AIR (% VOLUME)	LOWER N.A.	UPPER N.A.
FIRE EXTINGUISHING MEDIA	CO_2, Foam, Dry Chemical		
SPECIAL FIRE FIGHTING PROCEDURES	None		
UNUSUAL FIRE AND EXPLOSION HAZARDS	None		

ALFLOC 7348

SECTION 5 – HEALTH HAZARD DATA

TOXICITY DATA

Threshold Limit Value – Not established.

Effects of overexposure – May cause skin and eye irritation.

Material is considered to have low oral toxicity.

EMERGENCY AND FIRST AID PROCEDURES

EYES

Immediately wash with large amounts of water for at least fifteen (15) minutes and report to First Aid.

SKIN

Wash well with water and finally with soap and water.

INHALATION

Treat symptomatically.

INGESTION

Do not induce vomiting. Immediately call a physician.

ALFLOC 7348

SECTION 6 – REACTIVITY DATA

STABILITY. *(Please tick appropriate box)*

STABLE ☒ CONDITIONS TO AVOID None

UNSTABLE ☐

MATERIALS TO AVOID

None

HAZARDOUS DECOMPOSITION PRODUCTS

None

HAZARDOUS POLYMERIZATION:

WILL NOT OCCUR ☒ CONDITIONS TO AVOID None

MAY OCCUR ☐

SECTION 7 – SPILL OR LEAK PROCEDURES

STEPS TO TAKE IN CASE MATERIAL IS RELEASED OR SPILLED

Use absorbant material to contain small spills. Any large spill should be contained and recovered for use or waste disposal.

WASTE DISPOSAL METHOD

Dispose of by complete combustion or burial. Material has limited water solubility (< 1%).

SECTION 8 – SPECIAL PROTECTION INFORMATION

TYPE OF RESPIRATORY PROTECTION REQUIRED

VENTILATION: LOCAL EXHAUST ☐ MECHANICAL (GENERAL) ☒

SPECIAL (Specify) ______ OTHER (Specify) ______

PROTECTIVE GLOVES Rubber or PVC **EYE PROTECTION** Safety goggles.

OTHER PROTECTIVE EQUIPMENT

ALFLOC 7348

SECTION 9 – SPECIAL PRECAUTIONS

HANDLING AND STORAGE PRECAUTION

Store in a dry place.

OTHER PRECAUTIONS

Viscous dispersant type surfactants are slippery.
Avoid accidents by immediate clean-up of any spillage.

N.A. - Not available.

N/A. - Not applicable.

This Material Safety Data Sheet is essentially similar in format to OSHA-20 and also conforms to ACIC recommendations. An expanded layout has been used to emphasise First Aid Procedures, Safe Product Handling and to provide relevant toxicological information. Where applicable specific chemical composition details are provided to allow the product to be classified according to UN Number, UN Hazard Class, HAZCHEM coding, etc.

The information contained herein is based on data available to Catoleum Pty. Ltd. from both our own technical sources and from recognised published references and is believed to be both accurate and reliable.

Catoleum Pty. Ltd. has made no effort to censor nor to conceal deleterious aspects of this product.

Since we cannot anticipate or control the many different conditions under which this information and our products may be used, each user should review these recommendations in the specific context of the intended application and confirm whether they are appropriate.

Due care should be taken to make sure that the use or disposal of this product is in compliance with appropriate Federal, State and Local Government regulations.

PREPARED BY: B. F. Hogan
B.F. HOGAN.

TITLE: TECHNICAL OFFICER.

DATE: 26.10.82.

APPENDIX F
GROUNDWATER RESOURCE CONSULTANTS CONCLUSIONS AND RECOMMENDATIONS

4.0 CONCLUSIONS

1. The Eastern Borefield layout (Option 3) is the most acceptable of the proposed borefield layouts from a water resource viewpoint. The easterly migration of the saltwater interface across the CSBP works is predicted to be less than 100 m and there will be no upconing of saline water in the fresh water aquifer where the wedge underlies the aquifer.

2. The combined plant site and Eastern Borefield configuration (Option 2) may cause deterioration in groundwater quality within three years, but there is insufficient hydrogeological information to enable this deterioration to be forecast with absolute certainty.

   Additional monitoring is required to determine whether this option is acceptable or not in the long term.

3. Pumping from the plant site borefield is predicted to cause migration of the saline interface and degradation of groundwater quality within three years.

4. The limestone aquifer is highly permeable so that the cone of drawdown influence will be very slight, albeit laterally extensive. The drawdown will be less than 0.7 m at a distance of 1 km from the borefield. Similarly, the predicted drawdowns within the borefield should not induce the upconing of deeper more saline water through the shallow fresh water.

RECOMMENDATIONS

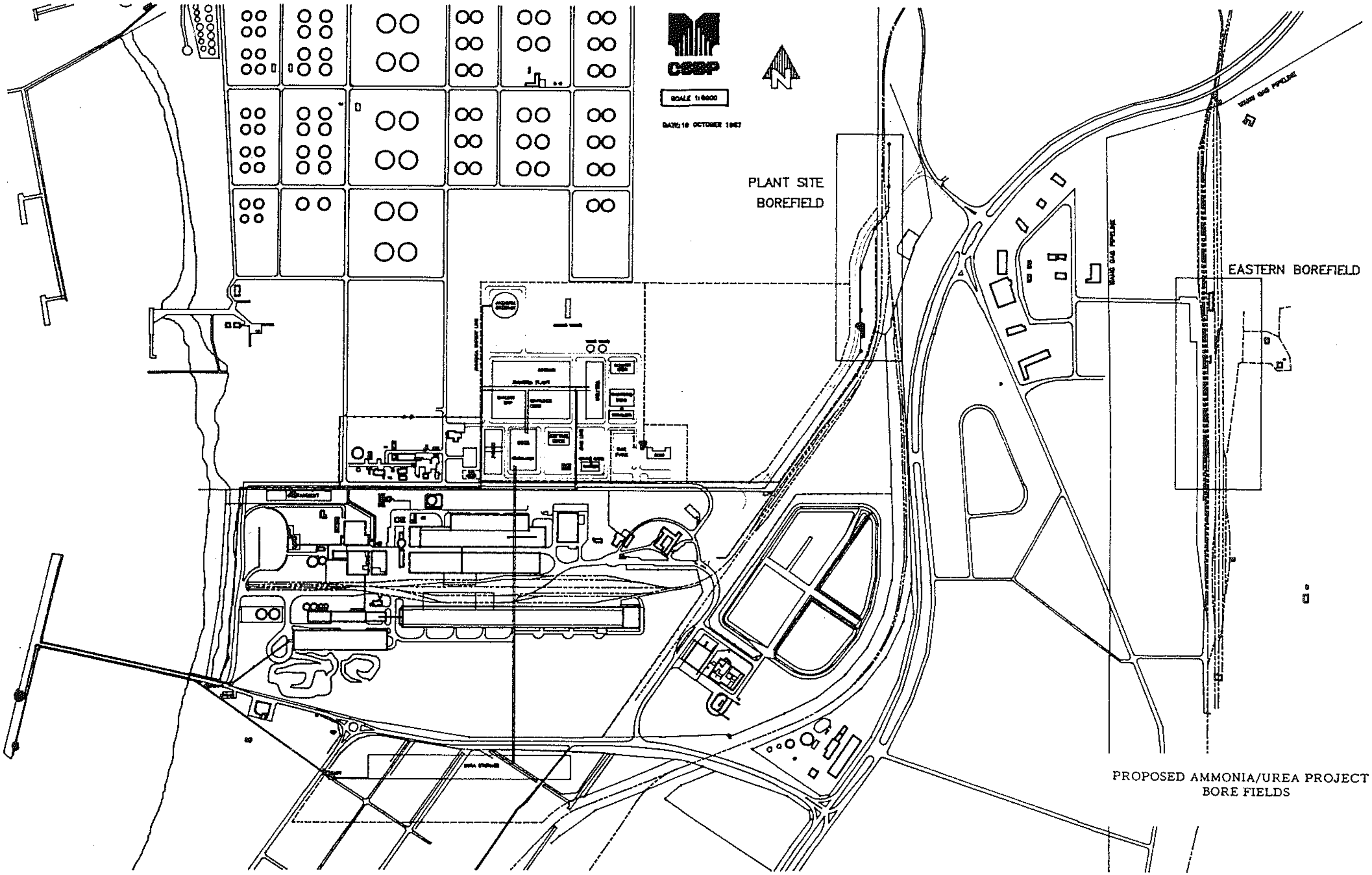
1. The Eastern Borefield layout is the most acceptable from the point of view of groundwater resource management and potential environmental impacts and the project is recommended on the assumption all water supplies are drawn from the eastern borefield.

2. The Combined Borefield option (Option 2) should be considered on a trial basis, to gather more hydrogeological data and to assess the long term viability of this option. Two bores should be drilled on the plant site, together capable of producing one-third of the water supply requirement (2,100 kL/d). The balance can be drawn from four of the six bores in the Eastern Borefield. If the monitoring data indicates a deterioration in groundwater quality at the plant site or unaccceptable migration of the saltwater interface the two bores can be decommissioned and all water supply demands met by the existing Eastern Borefield.

3. Monitoring bores are required on and close to the saltwater interface in both the Safety Bay Sand and Tamala Limestone Aquifers. Several monitoring bores are required inland from the Nufarm project to observe the migration of the Nufarm contaminant plume which may move eastward in response to abstraction from the eastern borefield.

M.S. CHANDLER
Project Consultant

15955-001
GRC225



PROPOSED AMMONIA/UREA PROJECT
BORE FIELDS

APPENDIX 2

REVIEW OF SUBMISSIONS

This appendix contains the review of submissions from Government Departments (including individuals and groups) who have made comments, to the EPA, on this proposal.

A total of 12 submissions were received. Four submissions were from the public and eight were from Government Departments.

The main issues addressed in all submissions are indicated in Table 1 of the Assessment Report.

This appendix also contains the list of Government Departments and others who made submissions to the EPA on the proposed ammonia-urea plant at Kwinana.

REVIEW OF SUBMISSIONS (contd)

HAZARDS AND RISKS

HAZOP STUDIES (HAZARD AND OPERABILITY)

It was recommended that employees' exposure to hazardous chemicals should be considered during the HAZOP studies so that exposure could be minimised by engineering control at the design stage.

RISK ASSESSMENT

One submission commented on the methodology used for calculating risk to the employee. It said that the risk should have been estimated by FAR (Fatality Accident Rate) on similar plants rather than by estimating approximately one quarter of the risk contour level shown.

AIR POLLUTION

AIR EMISSIONS

Submissions said that the ERMP should have indicated total emissions of oxides of nitrogen and other contaminants (ie in addition to the emission of these gases from existing industries) in order to show the cumulative effects.

HEALTH EFFECTS OF AIR EMISSIONS

One submission expressed the view that apart from consideration of gaseous emissions in terms of detectability of odour, the health effects of the emissions should have been considered. For example it said that the ERMP mentioned that odour from sulphur oxides could be detected between 20 to 30 ppm yet respiratory effects of exposure could be as low as 1 to 3 ppm.

AEROSOLS

In relation to the cooling system of the plant, a submission said that it was important to ensure that aerosols generated did not pose a hazard to workers or the public for example through fresh air intake of the air conditioning system or by spray drift contamination of the atmosphere.

WASTES

LIQUID WASTES

One submission said that effluent discharged into Cockburn Sound should not have a detrimental effect on the waters and its flora and fauna.

Concern was expressed about disposal of nitrogen waste from the urea plant resulting in additional nitrogen loading imposed on Cockburn Sound. It was suggested that existing nitrogen processing industries at Kwinana, monitor operations to ensure that additional nitrogen loading was not imposed on the Sound.

There was a suggestion to combine liquid effluent from the plant with that of some nearby industry for disposal in a tailings dam.

REVIEW OF SUBMISSIONS (contd)

CATALYSTS

It was requested that there be clarification of contaminants expected in iron-based catalysts and possible treatment required prior to disposal.

One submission was concerned about disposal of one of the catalysts containing chromium. It said that the non-leachability of the chromium needed to be assured in any proposed landfill site.

GROUNDWATER USAGE

GROUNDWATER EXTRACTION

A number of submissions were concerned about the groundwater extraction proposal.

One submission suggested that a detailed study be prepared including groundwater maps and texts to indicate the area that may be affected. It said that there should be involvement of EPA and the Water Authority to ensure no detrimental effect to other users or the environment.

It was mentioned that the water usage could affect groundwater requirements of other existing industries and domestic usage.

There were a few suggestions of alternative sources of water supply. One suggestion was that a seawater desalinisation plant could provide the freshwater requirements of the plant. Another suggestion was that nearby industries with an excess of process water such as condensate could supply some of the required process water. Another alternative was to locate the bores away from the plant site and other industries.

Submissions were concerned that the groundwater extraction could interfere with efforts of other industries to contain their own contamination problems. It was pointed out that the rate of groundwater extraction could result in accelerated movement of a pollution plume from a neighbouring industrial plant towards both Cockburn Sound and adjoining industries.

A submission commented that groundwater movement past the plant is 100 m^3 per hour with current estimated requirements of 264 m^3 per hour and therefore groundwater would be mined at 164 m^3 per hour. The view was expressed that water mining should not be permitted, and if there were expansion that the increased draw would enhance salt water intrusion into coastal aquifers.

Another submission said that the large draw of bore water would lead to worsening quality of bore water resulting in increased blowdown from the cooling tower and from there, higher contaminant levels being released into Cockburn Sound.

OTHER

EMERGENCY PROCEDURES

Some submissions suggested that there be consultation and liaison with local groups and government authorities in the development of an emergency procedures response plan for the proposed plant.

REVIEW OF SUBMISSIONS (contd)

A number of suggestions were made about facilities for inclusion in the emergency procedures plan.

Submissions requested that a port safety management plan and integrated Kwinana emergency plan be developed.

EMPLOYMENT OPPORTUNITIES

Concern was expressed that the establishment of the plant would hardly contribute employment opportunities for the people of the Kwinana/Rockingham area as the report indicated that staff for construction and operations would have their base in Perth.

NOISE

It was noted that the Noise Abatement Act, 1972 (as amended) was not listed in the statutory requirements in the report.

One submission requested that no worker in the proposed plant be exposed to a noise level of more than 85dB(A).

TRAFFIC/RAILWAY CROSSING SAFETY

It was pointed out that additional traffic load on Mason Road/Rockingham Road junction would increase delays experienced by traffic at this location during peak periods.

A submission said that a new rail crossing where the new access road crossed the Kwinana loop line would require a minimum level of flashing light control to protect users of the new crossing.

ERMP/PRA

Some submissions expressed the view that the reports were well prepared. The ERMP was seen to have made a thorough assessment of potential environmental impacts of the proposed plant, storage facility and export terminal.

THE PROPOSAL

Two submissions indicated that they had no comment to offer on the proposal.

OBJECTION

One submission was strongly opposed to the proposed plant being built in the Kwinana Industrial strip. Reasons given were that it was too large and too close to populated areas, it would increase pollution, and that leakage of ammonia into the atmosphere could result in a catastrophe. It was recommended that the plant be relocated in the Pilbara region where the population is sparse.

REVIEW OF SUBMISSIONS (contd)

LIST OF RESPONDENTS

Main Roads Department
State Planning Commission
WA State Emergency Service
Town of Kwinana
Department of Occupational Health, Safety and Welfare
J P Vogel
The Royal Australian Chemical Institute
WA Police Department
Department of Agriculture
Cockburn Sound Conservation Committee
Government Chemical Laboratories
Waterways Commission

APPENDIX 3

Management Commitments made by the Proponent in the ERMP, in the Preliminary Risk Analysis document (ERMP Volume 2) and in the proponent's supplement response to issues raised in submissions and to issues raised by the EPA.

CSBP & FARMERS LTD
NORSK HYDRO a.s

PROPOSED AMMONIA/UREA PLANT

MANAGEMENT COMMITMENTS

- Prepared by -

Kinhill Engineers Pty Ltd
47 Burswood Road
Victoria Park, WA 6100

Tel. (09)362.5900
Ref. PE7039/K15:B

November 1987

MANAGEMENT COMMITMENTS

1 OPERATIONAL PHILOSOPHY

- The incorporation of safety aspects into operations will commence with the selection of technologies and plant design that will minimize the risk of plant failure and human error. During the design phase, the proponents will undertake a Hazard and Operability (HAZOP) study in conjunction with the technology suppliers and engineering contractors to further enhance the plant's safety. In the procurement and construction phase, close attention will be paid to the quality control systems, both in vendors' equipment fabrication and in the plant construction.

- The philosophy for the automatic or manual shut-down procedure is developed based on maximum safety of the operators and equipment and the minimum disturbance to the environment.

2 DESIGN

2.1 General

- The process licensors' design philosophy will be adhered to.

- Operational stability will be achieved by duplication of critical equipment, a high level of automation and intensive training of operators.

- A check will be made on the final design to verify consistency with assumptions made in the preliminary risk analysis.

- If any of the economic factors affecting the cooling split change during the design stage of the project, then the situation will be reassessed and, where possible, the proponents will attempt to increase the use of air cooling if it is economic to do so.

2.2 Standards

- Appropriate Australian and international standards will be used in the design of the facilities.

- The ammonia storage tank will be designed to comply with API620.

- In accordance with recommended practice, the plant will be designed to a higher standard for earthquakes than required for normal structures.

2.3 Layout

- The design and layout of the plant will provide protection against damage and avoid the placement of equipment in vulnerable positions where impacts from vehicles could occur. The layout will also take into account plant operability, maintenance and access for escape and rescue.

2.4 Aesthetics

- The plant site will be attractively landscaped, and buildings will be aesthetically designed and have neutral coloration for compatability with the surrounding industrial setting.

2.5 Safety features

- All employees will be trained in the safe work practices and emergency procedures appropriate to the operation of the plant and handling of all associated materials.

- The process will be designed to meet or improve on current emission guidelines.

- The plant will be highly instrumented and computer-controlled, and will be equipped with interlock systems which, upon initiation from carefully selected process or equipment performance criteria, will ensure a safe emergency shut-down of the plant.

- Gas monitoring systems and equipment condition monitors will be installed in the plants, as required.

- Vapour detectors will be provided in the annular space of the ammonia storage tank, to provide early warning of ammonia releases and enable prompt emergency action to minimize vapour emissions (e.g. through the application of foam).

2.6 Water supply

- Where the clay seal separating the Safety Bay Sand from the limestone exists, the design and specification of the production bores will ensure that no leakage can occur across this seal.

3 CONSTRUCTION

- Liaison with local authorities will be conducted to ensure that impacts associated with noise, dust and traffic are minimized.

- Construction activity will be restricted to normal construction industry working hours.

- Dust suppression watering practices will be implemented.

- All construction materials and practices will be in accordance with the relevant Australian and international codes.

4 OPERATIONS

4.1 General

- Ongoing control of dust will be implemented.

- The dosage of anti-foulant (Alfloc 7348 for example) to the cooling water system will be controlled.

- Procedures will be developed and written for the operation of the plant, including automatic or manual shut-down.

4.2 Maintenance

- Regular preventative maintenance programmes will be implemented to minimize plant component failures.

- All maintenance tasks will require a written work permit, where all safety procedures will be specified, including their method of control and how the item maintained is to be tested before recommissioning.

- The routine checks on the plant and equipment, which will be carried out both continuously by the operators and periodically by the plant inspectors, will ensure that any unsafe or environmentally unacceptable leak or operating condition is detected and corrected. The plant management will be responsible for ensuring that all agreed routines are carried out and for making all personnel (including outside contractors working at site) aware of all the operational and personnel safety requirements on the site. Such requirements include familiarization with and adherence to all operational, safety and work routines, as well as personal safety requirements.

4.3 Management structure

- The plant will have an independent organization for its operation and maintenance, backed up by a Management Agreement with CSBP & Farmers Ltd and a Technical and General Assistance Agreement with Norsk Hydro a.s.

- In the setting up and operation of this structure, the plant will be able to draw on the extensive experience of both companies in relation to management of operations in the Kwinana region and that of operation of the ammonia/urea industry in particular.

- Policies will be set for the following areas:

  - industrial relations
  - safety and health
  - recruitment and training
  - public relations
  - environmental control.

5 HANDLING, STORAGE AND TRANSPORT

5.1 Products

5.1.1 Urea

- During plant operation, urea dust will be managed by operating the urea granulation process (including the urea dust scrubber) at design specification, regular monitoring of the gaseous emission from the scrubber, and maintenance of good housekeeping in and around the plant.

- Transfer of urea from the plant to the storage building will be via an enclosed conveyor. From the storage building to the ship loader, a high capacity covered conveyor will be used, with provision in the design for a dust extraction system if needed.

5.1.2 Ammonia

- The use of valves and other fittings that contain copper, zinc or silver, or their alloys, will be avoided in all facilities handling ammonia.

Export pump

- The pumps will stop automatically on activation of the emergency shutdown (ESD) system, and will be fitted with pressure differential alarms between suction and discharge.
- Ammonia vapour detectors will be strategically positioned around the pump and valves and set to operate the ESD system at a specific concentration level.
- If a no-flow signal is received from flow switches installed on the discharge flow meter, the ESD system will be activated.

Ammonia export pipeline

- The materials of construction will be suitable for the operating temperature of -33°C and will comply with Australian standards.
- A comprehensive quality assurance programme will be prepared covering manufacture and installation of pipelines, pipeline supports and valves.
- Corrosion protection of the pipeline will be provided.
- Valves will be welded onto the pipework where possible.
- Pressure monitoring of pipelines will be provided during operation for automatic operation and activation of ESD valves on sudden pressure drop.
- Isolation valves will be installed at each end of the pipeline and at the start of the wharf, working off an ESD system to minimize the amount of ammonia released if a pipe failure occurs.
- The line will be insulated and cooled prior to loading to minimize vapour generation during loading.
- The line will be protected from overpressure by a safety relief valve.
- As a safety precaution, the pipeline will be patrolled during the loading operation.
- The pipeline will be protected by impact barriers wherever there is a potential for damage by vehicles.
- Between shipments, the line will be depressurized and left full of ammonia vapour at slightly above atmospheric pressure.
- The export pipeline will be subjected to a full HAZOP study prior to the commissioning of the plant.
- Breathing apparatus will be made available to workers in the pipeline vicinity during loading.

- The above-ground ammonia pipeline will be clearly identified, including the use of warning signs.

Bulk cargo jetty and marine loading arm

- A comprehensive quality assurance programme will be prepared, covering the manufacture and installation of the pipeline and loading arm.
- Comprehensive procedures covering every aspect of the tanker loading operation will be developed.
- Pressure monitoring of the pipeline and loading arm will be undertaken during operation to enable automatic isolation of the wharf pipeline and loading arm by an ESD system acting on sudden pressure loss in order to minimize the amount of ammonia released in the event of a failure.
- Other activity on the wharf during tanker loading operations will be limited.
- Only electrical equipment approved for hazardous areas will be permitted to be energized for loading of ammonia.
- Procedures to warn against and prevent non-approved activities during loading will be implemented.
- An operator will be stationed on the wharf during the entire loading operation to watch the pipeline, report any malfunctions and to guard against any other activities interfering with loading.
- Corrosion protection will be provided for the pipeline and loading arm.
- Valves will be welded onto pipework (not flanged), where possible.
- The pipeline will be cooled prior to liquid loading to reduce vapour generation during loading.
- Shore-based ESD system will automatically activate the Speed Seal emergency release coupling and close the wharf isolation valves.
- Adequate fire-fighting facilities will be provided on the wharf.
- The loading arm will be stored between shipments and maintained, installed and commissioned according to a strict set of procedures.
- Although the concept of a mobile loading arm is considered reasonable, the proponents will investigate the feasibility of a permanently installed loading arm at the wharf.

5.2 Raw materials

5.2.1 Natural gas

- Safeguard systems will be designed to ensure that the natural gas fuel is shut off by a trip system in the event of a flame out or other furnace or fired boiler failure events.

5.2.2 Methyldiethanolamine (MDEA)

- Gloves and eye protection will be worn during MDEA handling operations.

- Contact with aluminium, copper, zinc and magnesium alloys will be avoided in the MDEA handling area.

5.2.3 Nitrogen

- The plant will have a continuous supply of nitrogen (for process purging) from a nitrogen gas distribution system in the Kwinana region, as well as from a plant storage of liquid nitrogen equipped with separate evaporator capacity to ensure safe and quick handling of hazardous developments in the plant.

6 ENVIRONMENTAL ISSUES

6.1 Gaseous wastes

- All gaseous waste products will be regularly monitored and disposed of in an environmentally safe manner and in accordance with statutory requirements to the satisfaction of the Environmental Protection Authority (EPA).

6.2 Odours

- The proponents confirm their commitment that adequate measures will be taken, both during the design stage and during the commissioning and operation stages of the plant development, to prevent odour generation from process vents, leaks and accidental gas releases.

6.3 Liquid wastes

- All liquid waste products will be regularly monitored and disposed of in an environmentally safe manner and in accordance with statutory requirements to the satisfaction of the EPA.

- Surface runoff from the process areas of the plant will be channelled into holding ponds and appropriately treated before disposal to Cockburn Sound.

- Acidic or alkaline effluents from the water treatment plant will be neutralized in a small holding pond before being pumped into the main holding pond.

- Spent oil changed from machinery will be sold for reprocessing.

- Normal operating and maintenance procedures will require that any oil leaks be attended to immediately because of the possibility of damage to the equipment, fires and the hazard of slippery surfaces. Any spillages will be mopped up and cleaned up using standard techniques with dry absorbents and biodegradable solvents.

- There will be a separate sewerage system for any oily water which will allow any such water to be diverted to sumps for retention and skimming. Recovered oil will be removed by a truck and disposed of off-site and the clean water redirected to the main holding pond for neutralization.

6.4 Solid wastes

- The plant will normally produce minimal solid wastes. Septic systems will be provided for the sanitary system.

- Domestic solid waste will be disposed of to sanitary landfill to the satisfaction of the local authorities.

- The disposal of used catalysts will be as follows:

  - those that contain only non-toxic compounds, e.g. Fe_2O_3 or Al_2O_3, will be safely disposed of on any landfill site;

  - those containing a high proportion of recoverable metals, such as the nickel, platinum or copper-based catalysts, will be sold for their metal content;

  - those that cannot be sold for their metal content and that contain significant proportions of elements which can be toxic to the environment, such as chromium, will be disposed by approved means.

- The proponents will explore other options, including the possible use of spent catalysts in CSBP & Farmers Ltd's superphosphate mixtures to provide trace elements (Cu, Zn, Mo) required by plants and crops.

6.5 Noise

- Noise levels within the plant and at the plant boundaries will be in accordance with statutory requirements.

6.6 Monitoring

- Monitor bores will be installed between the production bores and the Nufarm contaminant plume to monitor the migration of the plume.

- Monitor bores will be installed to monitor the migration of the saltwater wedge to the west of the plant site.

- The concentration of anti-foulant (Alfloc 7348 for example) in the effluent will be checked periodically as part of the effluent monitoring programme.

- The groundwater abstracted for the plant process and cooling water will be regularly monitored for contaminants.

6.7 Reporting

- The proponents will make the results of any monitoring available to the relevant authorities.

7 OCCUPATIONAL HEALTH

7.1 General

- Occupational health issues will be addressed in detail in the design stage of the project.

7.2 Medical care

- On-site first aid facilities will be provided, together with support from CSBP & Farmers Ltd's Kwinana works facilities, which include the availability of an ambulance and an occupational health nurse during normal working hours.

- The proponents will liaise with all relevant local and State authorities in reviewing the design of medical and first aid procedures and facilities for the plant.

8 SAFETY

8.1 HAZOP study

- The final design of the plant will be subject to a full HAZOP study before commissioning of the plant, as will any subsequent changes to design before implementation. This will ensure that the safety standards set for the plant are adhered to and will minimize the likelihood of plant failure.

- The HAZOP study will meet the EPA's guidelines for HAZOP, as defined in Bulletin 278, May 1987.

- The results of the HAZOP study will be made available to the Department of Occupational Health, Safety and Welfare on request.

- Installation of new equipment and alterations to existing equipment will undergo a detailed check procedure on the design, including HAZOP analyses, prior to requisition.

8.2 Emergency procedures

- The emergency response plan for the plant will provide effective understanding of credible accident scenarios within the plant and adjacent facilities and the necessary responses in terms of plant and personnel. In view of the short time available for response, planning and training for immediate recognition of emergencies and evacuation to safe areas for toxic releases is essential. The plan will be implemented before start-up and tested at regular intervals.

- A plan for public safety and awareness will be developed, including procedures for emergencies.

- Apart from the emergency procedures worked out for the specific operational requirements, prior to the commissioning of the plant, procedures will be developed to cover the requirements of the site, including:

  - definition of emergencies (e.g. fire, gas leaks);

  - organization of emergency control teams;

  - escape routes and assembly points for personnel;

  - liaison requirements with local and State authorities, the State Energy Commission of Western Australia and the general public;

  - warnings to fire brigades, hospitals and the police.

- The proponents will liaise with all relevant public authorities, including the local Counter-Disaster Advisory Committee, and nearby industrial operators in the development of emergency procedures. Copies of the procedures will be made available to all bodies affected.

8.3 Fire protection

- A fire protection system will be incorporated in accordance with the requirements of the plant design and the Western Australian Fire Brigades Board.

- The fire protection system will be supplied from a separate tank and pumping system fed from the production bores, with back-up from the scheme water main. Permanent hydrants will be situated at selected locations around the plant, together with foam generators in areas of the plant where ammonia leaks could occur.

- All plant personnel will be trained in the appropriate fire-fighting techniques.

- The fire-fighting capability of CSBP & Farmers Ltd's Kwinana works, and the Kwinana Industries Mutual Aid Group, established by industrial operators in the Kwinana industrial area, will be available for emergency assistance.

8.4 Ship loading management plan

- The proponents intend to develop a management plan for ship loading with the Fremantle Port Authority. The plan will include:

  - definition of emergencies (e.g. fire, gas leaks);

  - organization of emergency control teams;

  - escape routes and assembly points for personnel;

  - liaison requirements with local and State authorities, the EPA and the general public in the event of an emergency;

  - procedure for warning fire brigades and hospitals;

  - management of vehicle access to the wharf during loading;

  - provision of breathing apparatus to anyone going onto the wharf during loading.

8.5 Auditing

- Regular safety audits of the plant will be undertaken.

8.6 Security

- Security around the plant will be ensured by the installation of chain-link boundary fences, with access to the plant via a single gatehouse and emergency exits.

- Security patrols of the plant will be carried out.

- During ship loading, the export pipeline will be regularly inspected.

8.7 Training

- All employees will be trained in the safe work practices and emergency procedures appropriate to the operation of the plant and handling of all associated materials.

- Plant operator training will be provided, based on the experience available to the proponents from their existing ammonia/urea establishments. Some personnel will have practical training in these plants.

- Maintenance and inspection procedures (including work permits) will be developed to protect maintenance workers and to prevent unsafe situations from developing.

- Operation manuals will be developed which outline how various situations are to be handled by operators.

APPENDIX 4

Letter from Det Norske Veritas regarding Risk Analysis.

DET NORSKE
VERITAS

AUSTRALIA, NEW ZEALAND AND
SOUTH PACIFIC REGION
2nd Floor 165 Walker Street
North Sydney N.S.W. 2060
Telex no 26447 DNV
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Tel (02) 922 1966
BANKERS: National Australia Bank
A/c No 082318 269330

12th November, 1987.

The Chairman
Environment Protection Authority
Department of Conservation & Environment
1 Mount Street
PERTH W.A. 6000

Dear Sir

We refer to our preliminary Risk Analysis Study for the proposed Ammonia Urea Plant for CSBP and Farmers and Norsk Hydro.

The study was carried out by Messrs J.R. Castleman, M.F. Jarman and A.J. Irvine of Det norske Veritas. The results of the study are reported in Veritas Report No. 70104 completed on the 31st March, 1987.

Copies of this report have been forwarded to your office on our behalf by Kinhill Engineers, Perth.

We advise that in its internationally recognised role as an independent Classification and Certification body, Det norske Veritas conducts its studies with an objective independent approach. Our aim is to provide assessment based on factual non-biased information and impartial analysis. Internal quality assurance measures are adopted to help ensure objectivity and high technical standards. As a result we contend that risk analysis studies may be utilised for planning and approval purposes by responsible authorities. Detailed information on Det norske Veritas, its activities and independence from the proponents has been previously forwarded to your office for your records.

Should clarification of any aspect of our report be required we would be prepared to assist at your request.

Yours faithfully,

G. CEDERCREUTZ
Regional Manager

J.R. CASTLEMAN
Manager, Technical Services