Kwinana ammonia project, Kwinana Industrial Area

Wesfarmers CSBP Limited

Report and recommendations
of the Environmental Protection Authority

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Summary and recommendations

Wesfarmers CSBP Limited (CSBP), the proponent, proposes to construct and operate a 650 tonne per day (tpd) ammonia plant to replace its existing 300 tpd ammonia plant at its Kwinana site. The site is within the Kwinana heavy industrial area and is located about 33 km south of Perth. This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment on the environmental factors, conditions and procedures relevant to the proposal.

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

Relevant environmental factors

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

(a) Marine water quality;

(b) Air quality;

(c) Greenhouse gas (carbon dioxide);

(d) Noise; and

(e) Public safety (risk).

Conclusion

The EPA has concluded, on the basis of the information available, that the proposal by CSBP to construct and operate the new ammonia plant to replace its existing plant at Kwinana can be managed in an environmentally acceptable manner, provided the conditions recommended in Section 4 and set out in detail in Appendix 3, are imposed.

The EPA has also concluded that, in comparison with the existing ammonia plant, the proposal represents an overall improvement with respect to public safety and environmental performance.

Recommendations

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

1. That the Minister considers the report on the relevant environmental factors of Marine water quality, Air quality, Greenhouse gas (carbon dioxide), Noise, and Public safety (risk), as set out in Section 3;

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

    - the proposal can be managed in an environmentally acceptable manner, provided there is satisfactory implementation by the proponent of the commitments and recommended conditions set out in Appendix 3; and
    - in comparison with the existing ammonia plant, the proposal represents an overall improvement with respect to public safety and environmental performance;

3. That the Minister impose the conditions and procedures recommended in Appendix 3.

Conditions

The EPA recommends that the following conditions, which are set out in formal detail in Appendix 3, be imposed if the proposal by CSBP to construct and operate the new ammonia plant at Kwinana is approved for implementation:

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

(b) in order to manage the relevant factors and EPA objectives contained in this bulletin, and subsequent conditions and procedures authorised by the Minister for the Environment, the proponent shall be required to have in place, prior to implementation of the proposal, an environmental management system with components such as those adopted in Australian Standards AS/NZ ISO 14000 series.

Contents

Tables

Figures

Appendices

1. Introduction and background

Wesfarmers CSBP Limited (CSBP), the proponent, proposes to construct and operate a 650 tonne per day (tpd) ammonia plant to replace its existing 300 tpd ammonia plant at its Kwinana site. The site is within the Kwinana heavy industrial area and is located about 33 km south of Perth (Figure 1).

Ammonia is used in the manufacture of chemicals and fertilisers, including ammonium nitrate, sodium cyanide and concentrated nitrogen fertilisers. It is also used extensively in nickel refining.

The existing ammonia plant was commissioned in 1967 by the Kwinana Nitrogen Company Pty Ltd which was acquired by CSBP in 1987. This plant is currently the only ammonia manufacturing plant in Western Australia, and it is now approaching the end of its operating life with its output currently being reduced to about 250tpd as a result of its age.

Consumption of ammonia in Western Australia, however, has outstripped the capacity of CSBP's existing ammonia plant, resulting in the need to import ammonia since 1991. Recent expansions in CSBP's downstream production of ammonium nitrate and sodium cyanide, together with growing demand for locally manufactured ammonia-based fertilisers, have further increased the quantities of ammonia which have to be imported. The current development of nickel cobalt laterite projects in the Eastern Goldfields and the development and expansion of other nickel projects in the State will also result in a significant increase in the demand for ammonia.

The proposed new plant is expected to meet the State's projected ammonia demand until the year 2005. It will also reduce the current importation of ammonia.

Under Section 38 of the *Environmental Protection Act 1986*, the ammonia project proposal was referred to the Environmental Protection Authority (EPA) in May 1997. The EPA determined to formally assess the proposal at a Consultative Environmental Review (CER) level. The CER document (Dames & Moore, 1997), which describes the proposal and its environmental effects, was available for public review from 1 December 1997 to 31 December 1997. One public submission was received during the review period. The issues raised in the submission and CSBP's response to these issues were considered by the EPA in this Report.

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

One submission was received from the Conservation Council, and a copy of this submission and the proponent's response to this submission is included in Appendix 1. References are listed in Appendix 2, and recommended conditions and procedures and proponent's commitments are provided in Appendix 3.

2. The proposal

The proposed ammonia project involves construction and operation of:

- a new 650tpd ammonia plant; and
- ancillary equipment to support the ammonia plant including:
  - installation of a 25 tonne per hour (tph) natural gas fuelled steam boiler for use during plant start-up and shutdown operations;
  - "polishing water unit" to produce boiler quality feed water by treating demineralised water from an existing CSBP water treatment plant; and
  - a cooling water tower.

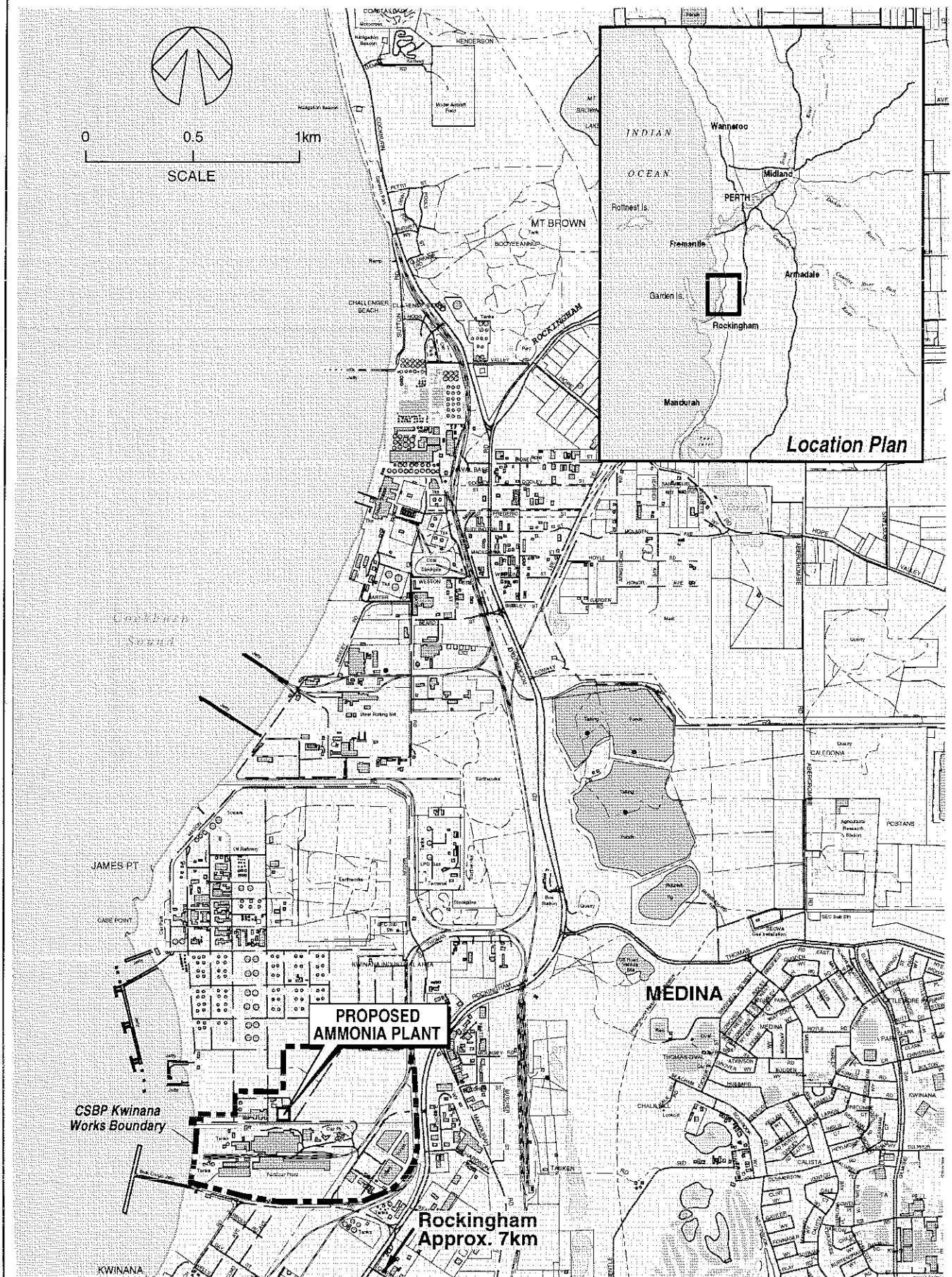

Figure 1. Location map.

The proposed project will also utilise a number of existing CSBP facilities during its operation. There is no increase in the existing storage of ammonia, and natural gas will continue to be piped to the plant with no storage on site.

This project does not include the transport and distribution of ammonia throughout the State. These components will be the subject of separate and specific notification/approval to the EPA and relevant authorities.

The new ammonia plant will be located immediately to the east of the existing ammonia plant (Figures 1 and 2) in order to connect into existing pipelines and to facilitate integration of the plant with the existing storage facilities and downstream users (Figure 3).

A preliminary layout of the components of the proposed plant is shown in Figure 4. The general arrangement of the plant will include the following sections:

- reforming;
- synthesis loop;
- carbon dioxide removal;
- heat exchange/cooling;
- water polishing unit;
- ammonia synthesis;
- power generation;
- process and motor control centre;
- refrigeration;
- groundwater bore; and
- storage.

The new ammonia plant will incorporate the Haldor Topsøe technology, for which a license was made available to CSBP by Technipetrol SpA of Italy. Many plants of various sizes using this technology are currently in operation around the world. It is widely recognised as a safe, reliable, efficient and conventional technology.

The process flow diagram (Figure 5) shows various stages of the ammonia production process, which include:

- desulphurisation of natural gas feed (methane);
- reforming of methane and steam to carbon monoxide and hydrogen;
- shift conversion of carbon monoxide to carbon dioxide;
- removal of carbon dioxide by absorption;
- purification of synthesis gas by methanation;
- compression of the synthesis gas;
- synthesis of ammonia from synthesis gas; and
- refrigeration and storage of ammonia.

The CER document (Dames & Moore, 1997) provides a detailed description of the above process stages and the expected composition of the gas at these stages.

Following commissioning and stabilisation of the new plant, the existing plant would be shutdown and in due course dismantled.

The main characteristics of the proposal are summarised in Table 1. The potential impacts of the proposal predicted by the proponent in the CER document (Dames & Moore, 1997) and their proposed management are summarised in Table 2.

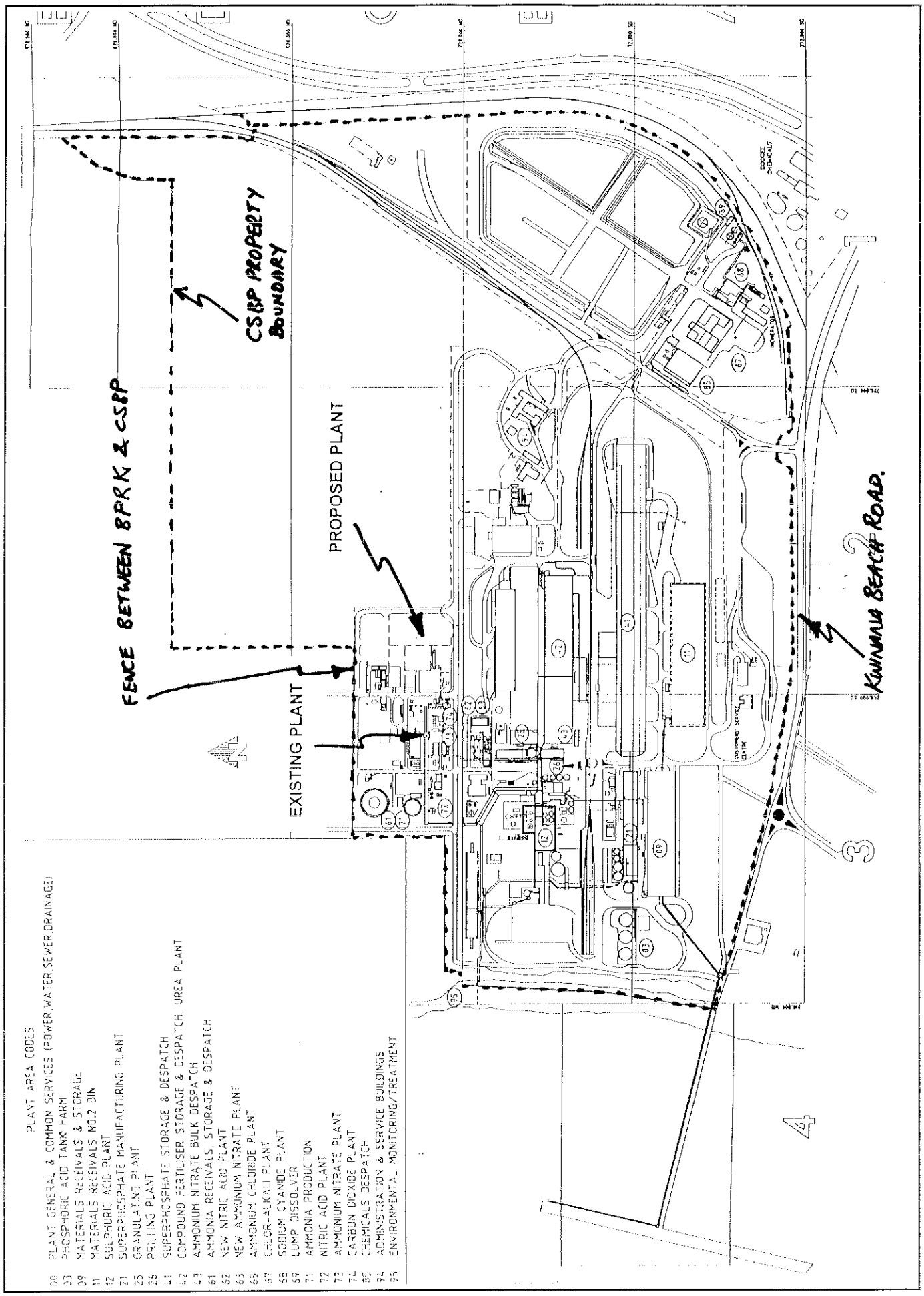

Figure 2. Proposed ammonia plant location.

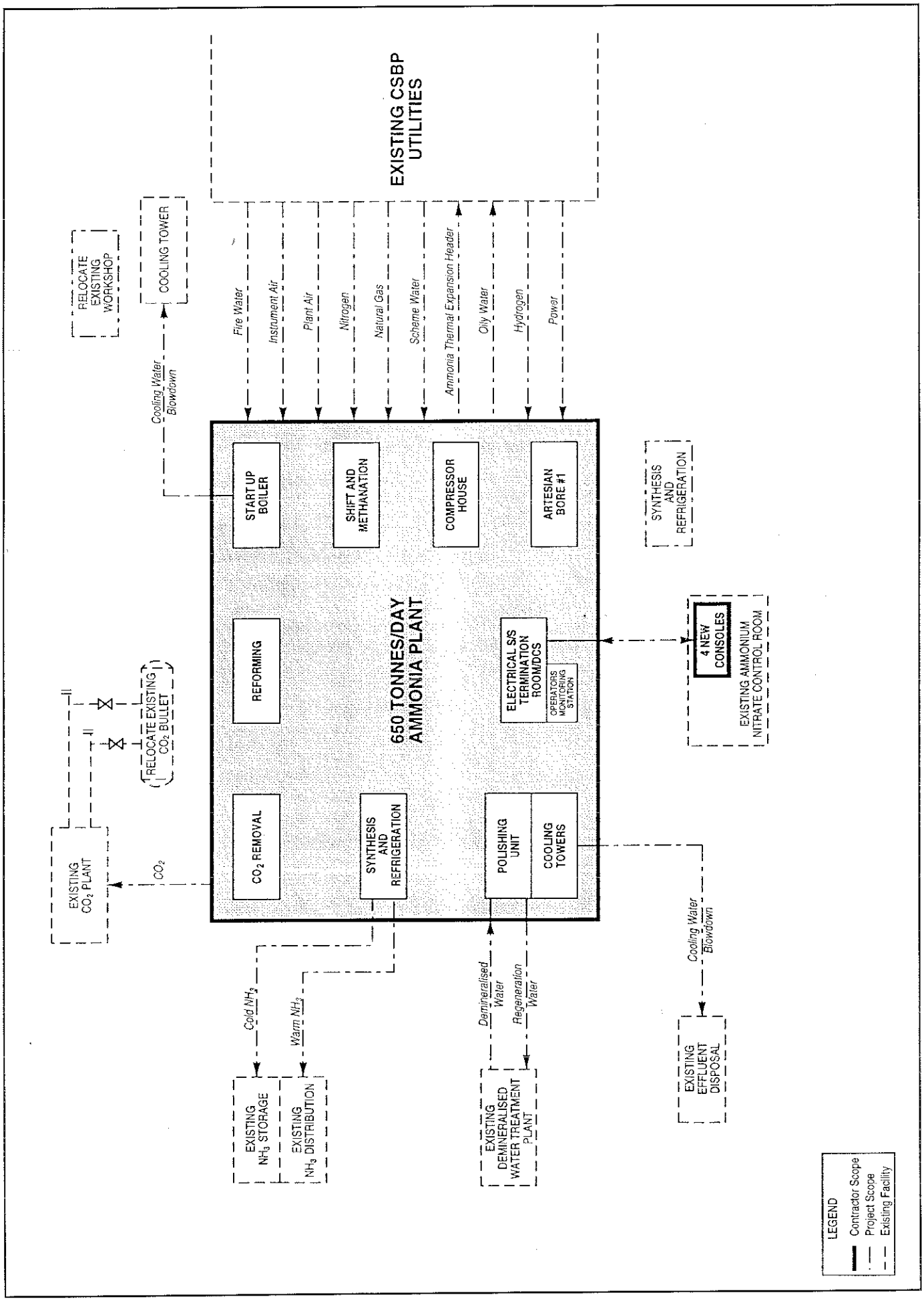

Figure 3. Project integration with existing CSBP facilities.

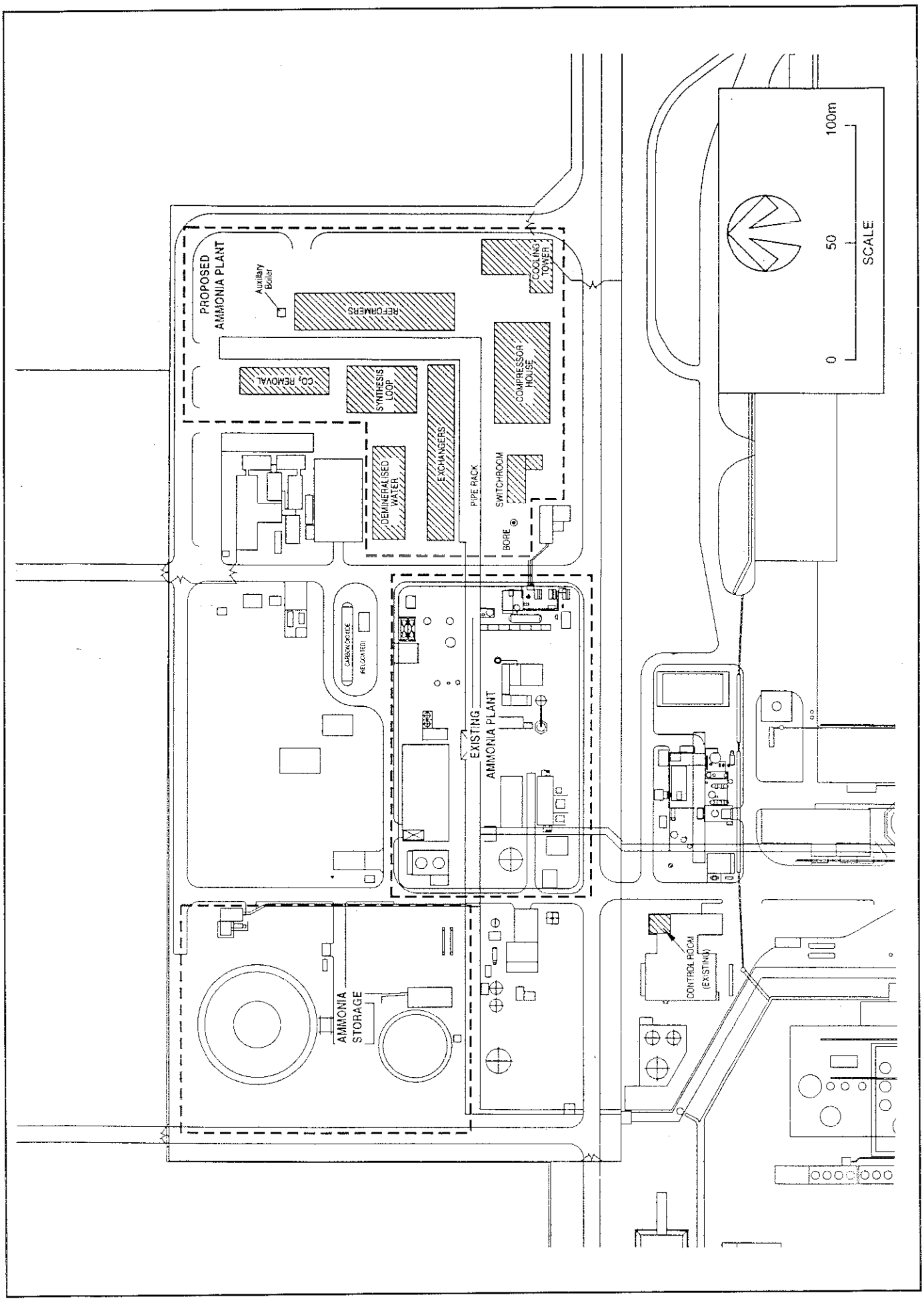

Figure 4. Proposed ammonia plant layout.

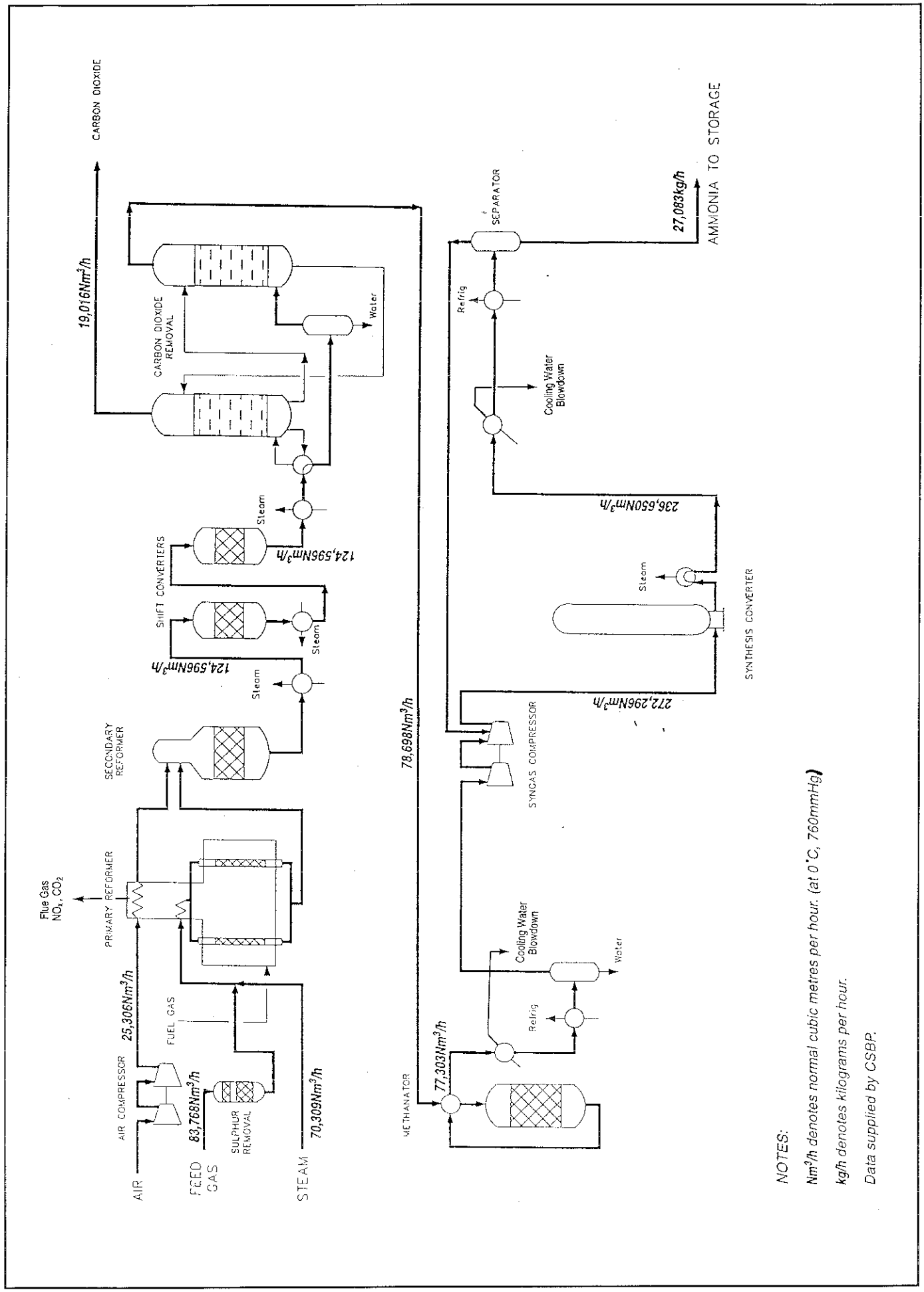

Figure 5. Process flow chart.

Table 1. Summary of key proposal characteristics

Proposal Characteristics	Unit	Current Plant	Proposed Plant	Comment
Capacity	tpd NH_3	~ 270	650	Increased 2 to 3 times
	tpa NH_3	~ 70,000	225,000	Increased in total but reduced per unit NH_3 via
Natural Gas Consumption (energy efficiency)	GJ/t NH_3	50-54	32-34	
	PJ/yr	3.5 to 3.8	7.2 to 7.7	improved process technology and improved energy efficiency
Location	-	CSBP Kwinana	CSBP Kwinana	No change
Gaseous emissions:				
NO_x (as NO_2)	kg/t NH_3	1.5	0.54	Reduced
	kg/d	366	350	Reduced
CO_2	t/t NH_3	2.9	1.8	Reduced
	tpd	800	1,200	Increased
Fugitive Gases				
• NH_3	-	to atmosphere	flared	Reduced through oxidation to NOx
• H_2	-	to atmosphere	flared	Reduced through oxidation to water vapour
Aqueous discharge:				
Cooling System (including polishing unit blowdown)	-	single pass, salt water	recirculating treated sub artesian water	
• Flow	tpd	70,000	2,100	Much reduced
• Heat Load	MW	4.8 to Cockburn Sound	0.15 to Cockburn Sound, majority to atmosphere	Reduced to Cockburn Sound
• Nitrogen	kg/d	60 - 70	6 - 10	Reduced
• Phosphorus	kg/d	2.4	6	Increased but well within CSBP licence limit of 500 kg/d
Oily water				De-oiled to contain less than 30ppm of oil
Noise				
• at boundaries	dB(A)	56 at BP boundary	about 59 at BP boundary	Complied with assigned noise level of 65 dB(A)
• at nearest residential area	-	no discernible impact	no discernible impact	No change
Individual risk of ammonia plant at CSBP boundary:-				
• BPRK fence	deaths/mill/yr	< 50	< 50	Reduced
• Kwinana Beach Rd	deaths/mill/yr	< 10	< 10	Reduced
• Nearest residential	deaths/mill/yr	< 1	< 1	Reduced

Table 2. Proponent's summary of potential impacts and proposed management.

General Factor	*Site Specific Factor*	*EPA Objective*	*CSBP Management Plan*	*Impact*
Marine environmental quality	*Phosphorus*	*Maintain or improve the quality of marine water consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA 1993); and* *Maintain or improve marine water and sediment quality consistent with the draft Environmental Quality Objectives (EQO's) and Environmental Quality Criteria (EQC's) in the Southern Metropolitan Coastal Waters Study (DEP, 1996)*	• *Phosphate discharge (6kg/ day) originates from cooling water treatment programme.* • *Discharge from this source is insignificant against background of total site phosphate discharge.* • *Additional phosphate discharge from new ammonia plant will not:* - *cause CSBP to exceed its current or anticipated DEP licence.* - *have any discernible additional impact on Cockburn Sound.* • *CSBP in consultation with Kwinana Branch of DEP has introduced modifications to processes and procedures in major phosphate source operations which have reduced average discharges by about 190kg/day.* • *Work to effect further reductions is proceeding.*	*No discernible additional environmental impact.*
	Nitrogen	*Maintain or improve the quality of marine water consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA 1993); and* *Maintain or improve marine water and sediment quality consistent with the draft Environmental Quality Objectives (EQO's) and Environmental Quality Criteria (EQC's) in the Southern Metropolitan Coastal Waters Study (DEP, 1996).*	• *Technology selected will reduce N discharges originating from ammonia manufacture operations from current level of 60-70 kg/d to approximately 10 kg/d*	*Reduced environmental impact*
Greenhouse Gas Emissions	NO_x	*Ensure that gaseous emissions meet acceptable standards and requirements of Section 51 of the Environmental Protection Act 1986 (all reasonable and practicable measures are taken to minimise discharges).*	• *Process technology selected will result in reduced unit discharges of NO_x due to ammonia manufacturing activities from current level of 106 ppm to 70 ppm and mass load from 366kg/d to 350kg/d. Emissions are expected to reduce from 1.5kg to 0.54 kg per tonne of ammonia produced.*	*Reduced impact.*

Table 2 (cont'd)

General Factor	*Site Specific Factor*	*EPA Objective*	*CSBP Management Plan*	*Impact*
	CO_2	*Ensure that greenhouse gas emissions meet acceptable standards and requirements of Section 51 of the Environmental Protection Act 1986 (all reasonable and practicable measures are taken to minimise discharges).*	*• Process technology selected will result in unit emissions being reduced from 2.9tCO_2/tNH_3 to 1.8t CO_2/tNH_3. This level is equivalent to world's best practice.* *• Mass load will increase from 800 tCO_2/d to 1200 tCO_2/d.* *•Mass load is a very small proportion of Australia's total discharge.* *• Expanded output will displace imports of NH_3 the manufacture of which would generate equivalent or greater CO_2 emissions.* *• CSBP recovers some CO_2 for industrial uses and will seek to expand this recovery.* *• CSBP has a voluntary "Greenhouse Challenge" agreement with the Australian Government covering all its operations.*	*Increased local emission but no additional global impact.*
Noise	*Noise impact on adjacent land uses*	*Protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring that noise levels meet statutory requirements and acceptable standards (proposed Environmental Protection (Noise) Regulations, 1997.*	*• The number and intensity of noise generators in the new plant is comparable to that in the existing facility.* *• The plant and key noise generators are located further from the nearest CSBP boundary than is the case with the existing plant.* *• Performance guarantees to ensure individual items comply with relevant noise regulations are included in agreements with the plant contractor.* *• The number and dispersal of potential noise sources means noise modelling is of limited value in these circumstances.* *• CSBP will survey noise levels following commissioning of the plant and implement amelioration steps as necessary.*	*Noise impact comparable to existing facility. New plant will meet regulations at CSBP boundary.*
Public Safety	*Risk and Hazards*	*Ensure that risk is as low as reasonably achievable and compiles with acceptable standards including the EPA's criteria for individual fatality risk off-site, acceptable criteria for societal risk, and the DME's requirements in respect of public safety.*	*• New plant will reduce risk levels at CSBP boundary.* *• New plant will itself comply with all EPA risk guidelines.* *• Other unrelated risk generators on the CSBP site cause overall risk contours to exceed current guidelines in some places on CSBP's boundary.* *• CSBP in consultation with relevant authority is developing programmes to manage and/or ameliorate these risk issues.* *• Construction of this project will not affect other CSBP operations.* *• CSBP will develop a safety management system as part of this project in compliance with DME requirements.*	*Reduced individual risk.*

3. Environmental factors

3.1 Relevant environmental factors

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

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

(a) Marine water quality;

(b) Air quality;

(c) Greenhouse gas (carbon dioxide);

(d) Noise; and

(e) Public safety (risk).

The above relevant factors were identified from the EPA's consideration and review of all environmental factors (preliminary factors) generated from the CER document and the submissions received, in conjunction with the proposal characteristics (including significance of the potential impacts), the adequacy of the proponent's response and commitments, and the effectiveness of current management. On this basis, the EPA considers that groundwater and solid waste factors and other issues raised in the submissions do not require further evaluation by the EPA because it has been demonstrated that they will be adequately managed.

The EPA notes that the new ammonia plant does not use arsenic trioxide catalyst, thus eliminating the problem associated with disposal of arsenic trioxide waste (CER, Table 6). The EPA also notes the proponent's commitment on decomissioning of the existing plant (Appendix 3).

The identification of relevant environmental factors is summarised in Table 3, and a summary of their assessment is set out in Table 7.

The relevant environmental factors are discussed in Sections 3.2 to 3.6 of this report.

3.2 Marine water quality

Description

The major effluents to be discharged from the new ammonia plant operations are cooling tower blowdown, boiler condensate polishing unit blowdown, and boiler system blowdown (about 2,000 tpd total). Other minor effluents from the plant include condensates from process air equipment and synthetic gas intercooler, and de-oiled water (contains a maximum of 30ppm of oil). These effluents will be discharged into the existing CSBP's site-wide liquid effluent handling system, prior to being discharged into Cockburn Sound via the existing CSBP licensed diffuser. In the effluent handling system, the effluents are directed to a containment pond system and the pond contents are monitored before being discharged into Cockburn Sound.

The current DEP licence conditions for CSBP site-wide operations require all process wastewaters, except storm water, to be discharged to the environment via the diffuser. The licence conditions stipulate daily discharge limits for total nitrogen, orthophosphate and pH. The licence conditions also require annual monitoring for contaminants in the effluents including cadmium, mercury, fluoride, arsenic, tin, manganese, zinc, copper and chromium.

Table 3. Identification of relevant environmental factors (CSBP Kwinana Ammonia Project)

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
POLLUTION			
Marine water quality	• Major effluents are cooling water blowdown (about 2,000 tpd), boiler condensate polishing unit blowdown, and boiler system blowdown. Other effluents include condensates and de-oiled water. • Effluents will be discharged into Cockburn Sound, via existing CSBP's site-wide liquid effluent handling system, and CSBP's licensed diffuser.	Conservation Council: CSBP should commit to reduce phosphorus discharge from its overall operations by another 10-20%, as any increase in phosphorus loading into Cockburn Sound, no matter how small, is a matter of concern.	**Considered to be a relevant environmental factor**
Groundwater quality	• 6,000m3/day cooling water make-up will be required. • Water will be drawn from an aquifer below CSBP site, via two artisian bores currently licensed by Water and Rivers Commission (WRC). • Containment of liquid effluent on-site.		No expected impacts on groundwater quality, due to on-site containment practices. Monitoring of condition of the artisian aquifer in accordance with WRC licence will continue. **Factor does not require further EPA evaluation.**
Air quality	• Oxides of nitrogen are major emissions from the primary reformer (main source), the use of the start-up boiler and the flare. Minor emissions of sulphur dioxide, chlorine from the cooling tower and fugitive emissions of ammonia and other gases.	DEP Kwinana supports the new plant to replace an ageing existing plant. DEP: more information on the efficiency and effectivenes of the flare operation, NOx control and chlorine emission is required.	**Considered to be a relevant environmental factor**

FACTOR	PROPOSAL COMPONENT WITH POSSIBLE IMPACT	GOVERNMENT AGENCY AND PUBLIC COMMENTS	IDENTIFICATION OF RELEVANT ENVIRONMENTAL FACTORS
POLLUTION (Continued)			
Greenhouse gas (carbon dioxide)	• 400,000 tpa of carbon dioxide is produced , mainly from combustion processes (primary reformer, start-up steam boiler and flaring of gases) and from the carbon monoxide conversion/carbon dioxide removal processes. • carbon dioxide emissions almost double those from the exiting ammonia plant	Conservation Council: CSBP's commitment to reduce the total greenhouse gas emissions by 20% between year 1995 and 2000 should become an environmental condition for the project.	**Considered to be a relevant environmental factor**
Noise	The main noise sources are the process compression section and the flare.	DEP: More information on the frequency and duration of the flare operation and estimated noise levels for the flare is required.	**Considered to be a relevant environmental factor**
Solid wastes	• Catalysts utilised in the process require disposal (Table 3 of CER lists the major catalysts, their life expectancy and proposed disposal). • current disposal mechanisms includes off-site disposal, recycling and reuse in fertiliser production.		The new plant does not use arsenic trioxide as a catalyst, therefore eliminates disposal problem. Current management of solid wastes is satisfactory, and will continue for the new plant. **Factor does not require further EPA evaluation.**
SOCIAL SURROUNDINGS			
Public safety (risk)	The major sources of risk are toxic gas release of ammonia.	The DME/DEP: Although no major problem is anticpated, clarification on a number of technical issues relating to the QRA is required from the proponent.	**Considered to be a relevant environmental factor**

With the existing ammonia plant, the majority of cooling water supply is provided by a single pass seawater extracted from Cockburn Sound, as part of the BP Refinery cooling system. About 70,000 tpd of seawater is required for cooling prior to being discharged back into Cockburn Sound via CSBP's outfall. This discharge of cooling seawater currently contributes to nutrient loading (60-70 kg/day of nitrogen and 2.4 kg/day of phosphorus) as well as heat loading into Cockburn Sound water (about 4.8 MW).

The proposed plant will use a recirculating evaporative cooling system, thus reducing the heat load currently produced by the seawater cooling system (from 4.8 to 0.15 MW). The mass loading of nitrogen will also be significantly reduced (from 60-70 kg/day to 10 kg/day of nitrogen), as a result of improvements in ammonia recovery in the blowdown condensate and condensate recycling.

Due to the use of sodium hypochlorite (to control the development of biota) and zinc phosphate (to inhibit corrosion) in the cooling system, the cooling water blowdown would contain about 0.1 to 0.2 ppm of free chlorine, 1.5 mg/L of zinc (or about 1 tpa of zinc) and an increased mass loading of phosphorus (from 2.4 kg/day to 6 kg/day). It is expected that, following further mixing and dilution with other liquid effluents from CSBP works (8.3 fold dilution) and within the diffuser mixing zone (135 fold dilution and background zinc concentrations of between 0.01 and 0.015 mg/L), there would be a negligible concentration of sodium hypochlorite and between 0.011 and 0.016 mg/L of zinc being discharged into Cockburn Sound (outside the mixing zone). The increased mass loading of phosphorus will be within the current CSBP site-wide licensed discharge limit of 500 kg/day of phosphorus (DEP Kwinana, 1997).

Table 4 below shows nitrogen and phosphorus loading in effluent from the new plant compared to that from the existing plant and the 1995 European Fertiliser Manufacturers' Association Best Available Technique Guidelines (EFMA BAT, 1995).

Table 4. Comparison of nutrient loading in effluents

Effluent		**CSBP Site Licence Limit**	**Existing Plant (250tpd)**	**Proposed Plant (650tpd)**	**EFMA-BAT**
Mass loading (kg/day)	Nitrogen	1,000	60-70	10	100
	Phosphorus	500	2.4	6	N/A
Unit loading (kg/tonne NH_3)	Nitrogen	N/A	0.3	0.015	0.1
	Phosphorus	N/A	0.01	0.01	N/A

About 6,000 m^3/day of make-up water will be required for the new cooling system (for blowdown, evaporation and wind losses). This water will be drawn from the existing artesian bores at CSBP's Kwinana site, which are licensed by the Water and Rivers Commission for a total production of 8,000 m^3/day.

Water quality outside the mixing zone should meet acceptable standards recommended in the draft Western Australian (WA) Guidelines for Fresh and Marine Waters (EPA, 1993). The Draft WA guidelines are largely drawn from the Australian Water Quality Guidelines for Fresh and Marine Waters (ANZECC, 1992). In the Southern Metropolitan Coastal Waters Study (1991-1994) report (DEP, 1996), the recommended environmental quality criteria are based on both the draft WA guidelines and the ANZECC guidelines. The Study report also recommends a number of environmental quality objectives, aiming to maintain biodiversity, ecosystem integrity, aquatic life for human consumption, recreational values and aesthetic values.

The submission from the Conservation Council, whilst supporting the project, indicates that as any increase in phosphorus loading into Cockburn Sound, no matter how small, is a matter of concern. Therefore CSBP should commit to reduce phosphorus discharge from its overall operations by another 10-20%.

Assessment

The area considered for assessment of this factor is the plant site and the marine environment within and outside the mixing zone of the diffuser in Cockburn Sound. Effluent quality must be managed so that ambient water quality meets acceptable standards at the boundary of the mixing zone.

The EPA's objective in regard to this environmental factor is to ensure that quality of marine water and sediment in Cockburn Sound are maintained or improved, by ensuring that the effluent quality and water quality at the boundary of the mixing zone comply with the following statutory and acceptable standards:

- the DEP's licence limits for effluent discharge;
- acceptable standards recommended in the draft WA Water Quality Guidelines for Fresh and Marine Waters (EPA, 1993); and
- the environmental quality criteria and environmental quality objectives recommended in the Southern Metropolitan Coastal Waters Study (1991-1994) report (DEP, 1996).

The EPA recognises that the use of recirculating evaporative cooling system in the new plant will reduce the heat load to Cockburn Sound currently produced by the seawater cooling system.

The EPA notes that the new ammonia plant will result in about 85% reduction in the mass loading of nitrogen compared with the existing plant. Although the mass loading of phosphorus from the new plant will be 2.5 times that of the existing plant, the actual discharge quantity is very small compared to those generated from other operations on the CSBP site. Furthermore water quality surveys indicate that Cockburn Sound waters are nitrogen limited (DEP, 1996). The contribution of nitrogen and phosphorus from the new plant will not result in the current DEP licensed discharge limits being exceeded.

The EPA also notes that there has been a significant continual reduction of phosphorus and nitrogen discharges from CSBP Kwinana site into Cockburn Sound (CER, Figure 10, and DEP Kwinana, 1997), and the proponent's intention to achieve a near zero discharge of nutrients from its Kwinana site (CER, page 35).

The DEP advised that on the basis of the modelling and monitoring of CSBP's diffuser, and the background zinc concentrations in Cockburn Sound (obtained from BP Refinery), the concentrations of zinc from the CSBP site are expected to meet the draft WA guidelines and the DEP's environmental quality criteria of 0.02 mg/L for zinc, for the maintenance of ecosystem integrity. However, the mass loading from the new ammonia plant is about 20% of the total zinc loading into Cockburn Sound from the Kwinana industry (DEP, 1996).

The DEP expects that monitoring requirement for the whole CSPB site, including that for zinc, will be reviewed, following the completion of the consultative process when the environmental quality objectives and criteria for Cockburn Sound waters can be clearly determined (DEP, 1996).

The DEP considers that the proposed discharge into Cockburn Sound, and the proponent's intention to achieve near zero discharge of nutrients for CSBP Kwinana in future are consistent with the recommended environmental quality objectives.

Having particular regard to the:

(a) reduction in nitrogen loading and heat loading into Cockburn Sound;

(b) negligible potential impacts of phosphorus and chlorine on marine water quality of Cockburn Sound;

(c) proposed effluents meeting the current DEP licensed discharge limits for nutrients; and

(d) proposed discharge being consistent with the draft recommended water quality guidelines, environmental quality criteria and objectives for Cockburn Sound,

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

3.3 Air quality

Description

The new ammonia plant is expected to produce similar gaseous emissions to the existing plant, but at smaller quantities, due to improved technology and energy efficiency.

Under normal operating conditions, the primary reformer is the main source of oxides of nitrogen emissions. Minor emissions of oxides of nitrogen will be generated from the use of the start-up boiler and the flare. Table 5 below shows a comparison of the oxides of nitrogen output (expressed as nitrogen dioxide) between the new ammonia plant and the existing plant

Table 5. Comparison of expected oxides of nitrogen outputs

Oxides of Nitrogen Output	Existing Plant (70,000 tpa)	Proposed Plant (225,000 tpa)
- Concentration, ppmv	106	70
- Total Mass Loading, kg/day (as NO_2)	366	350
- Unit Discharge, kg NO_2/tNH_3	1.5	0.54

Notes: All concentrations for oxides of nitrogen are referenced to an oxygen content of 7% vol/vol dry basis and 0°C and 101.3kPa.

The Australian Environment Council/National Health and Medical Research Council guidelines (AEC/NHMRC, 1986) stipulate an emission standard of 350 mg/m3 (or 175 ppm) as nitrogen dioxide (NO2) and an ambient air quality goal of 0.16 ppm (1 hour average) for NO2. The draft National Environment Protection Measure (NEPM) has recommended a NO2 standard of 0.125ppm (1 hour average) and 0.03ppm (1 year average).

The concentration and the total load of oxides of nitrogen from the new plant are expected to be lower than those from the existing plant, despite its increased capacity. This is due to a combination of the use of low oxides of nitrogen burners in the primary reformer, improved energy efficiency of the new plant, and removal of ammonia from purge and flash gases prior to recycling to the reformer as fuel.

As with the existing plant, since the concentrations of sulphur in the natural gas stream are small and any sulphur in the feed gas is removed (by a catalyst bed) before it enters the reformer, sulphur dioxide emissions from new plant would be negligible, despite the increased capacity (estimated concentration in the flue gas from the primary reformer and the auxiliary boiler is 0.2mg/m^3). Under the *Environmental Protection (Kwinana) (Atmospheric Wastes) Policy 1992* (the Kwinana EPP), although Maximum Permissible Quantities (EPA, 1992a) for sulphur dioxide emissions are set for the CSBP sulphuric acid plant operations, no discharge criteria has been set or required for the existing ammonia plant. The DEP is pursuing a statistical approach to determination of Maximum Permissible Quantities in consultation with Kwinana industries. The requirement for a redetermination was identified in recommendation 5.8 of the Towards Optimising Kwinana Final Report (Dames & Moore for the Kwinana Industries Co-ordinating Committee, 1996). It is likely that, through the redetermination process, the Maximum Permissible Quantities for sulphur dioxide emissions for the whole CSBP site would be amended.

Fugitive emissions of ammonia and other gases may be released from upset conditions and routine maintenance. These emissions are currently captured and vented, but will be combusted in a flare to be installed as part of the project, to minimise any odour problem. The DEP's draft air discharge criteria recommends a design ground level concentration of 0.59 ppm (3 minute average) for ammonia at the nearest residential area.

Emissions of chlorine from the cooling tower would be very small (estimated as 1.4ppm in the steam plume compared with the AEC/NHMRC emission standard for chlorine of 200 mg/m^3 or 67ppm) and would be below the recommended design ground level concentration of 0.012 ppm (3 minute average) for chlorine at the nearest residential area (DEP's draft air discharge criteria).

Assessment

The area considered for assessment of this factor is the plant site and surrounding premises and properties. This is the area that gaseous emissions must be controlled to meet acceptable standards and air quality guidelines.

The EPA's objective in regard to this environmental factor is to ensure that gaseous emissions from the new plant meet :

- the air quality standards and limits stated in the Kwinana EPP and other relevant air quality standards/guidelines ; and
- the requirement of Section 51 of the *Environmental Protection Act 1986*, to take all reasonable and practicable measures to minimise all discharges.

On the basis of the information provided by the proponent and the advice from the DEP, the EPA considers that the potential impacts of emissions of chlorine from the cooling tower and fugitive emissions of ammonia and other gases would be minimal and would meet the relevant acceptable standards and guidelines at the nearest residential area. The installation of a 40m flare to combust the fugitive emissions under upset conditions and routine maintenance would minimise odour problems under these conditions.

Sulphur dioxide emissions from the new plant are still very small in comparison to those from other CSBP operations, and will not cause any exceedance of the Kwinana EPP. The EPA understands that the sulphur dioxide emissions from the whole of CSBP operations in Kwinana will be reviewed through the Kwinana industry-wide redetermination process.

The EPA notes that oxides of nitrogen are the only significant gaseous emissions from the plant under normal operating conditions, which are mainly generated from the primary reforming process. Despite the increase in the plant capacity, the emission concentration and the total load of oxides of nitrogen from the new plant would be lower than those from the existing plant (34% reduction in concentration, and 4% reduction in total load (as NO_2)). This is because the new plant has a much lower unit discharge of oxides of nitrogen (per tonne of ammonia produced) than that from the existing plant (64% reduction in unit discharge), as a result of improved technology and energy efficiency in the new plant.

The proposed emission concentration of nitrogen dioxide (NO2) from the new plant would be well within the AEC/NHMRC emission standard. The EPA also notes that the DEP's monitoring results at Hope Valley show that ambient air quality resulting from NO_X emissions from the Kwinana region have been meeting both the AEC/NHMRC guideline and the draft NEPM standard for NO2, since 1991.

Having particular regard to the:

(a) the reduction in the emissions of oxides of nitrogen, in terms of an overall reduction (mass loading) and a reduction per tonne of ammonia produced (unit discharge), as a result of improved technology and energy efficiency in the new plant ;

(b) use of the flare to minimise emissions of ammonia and other gases, particularly under abnormal operating conditions; and

(c) the estimated gaseous emissions meeting the relevant air quality standards and guidelines,

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

3.4 Greenhouse gas (carbon dioxide)

Description

Carbon dioxide is the only significant greenhouse gas produced by the project, mainly in combustion processes (primary reformer, start-up steam boiler and flaring of gases) and from the carbon monoxide conversion/carbon dioxide removal processes. Table 6 below shows the expected carbon dioxide outputs from the new plant, comparing with the existing plant.

Table 6. Comparison of expected carbon dioxide outputs

Output	Existing Plant	Proposed Plant
Ammonia, tpa	70,000	225,000
Carbon dioxide		
Mass Loads		
- From process, tpa	97,000	285,000
- From reformer, tpa	104,000	115,000
- **Total,** tpa	**201,000**	**400,000**
Unit discharge, t CO_2/tNH_3	2.90	1.80

The unit discharge of carbon dioxide (per tonne of ammonia produced) from the new plant is lower than that from the existing plant. This is because the unit energy consumption of the new plant (between 33 and 35GJ/tNH_3) is lower than that of the existing plant (more than 50GJ/tNH_3), as a result of improved efficiency in the reforming process and the generation of electrical energy using steam from the waste heat recovery boiler. The CER states that this is consistent with the European Fertiliser Manufacturers' Association best practice guidelines (European Fertiliser Manufacturers' Association, 1995). However, the total quantity of carbon dioxide produced by the new plant almost doubles that produced by the existing plant, due to the higher capacity of the new plant. Of the total carbon dioxide produced from the new plant, about 100,000 tpa or 25% will be recovered as a compressed liquid for sale to industrial users and the remainder (300,000tpa) will be vented to atmosphere. In the event of increased demand for carbon dioxide, CSBP would investigate the possibility of expanding its carbon dioxide recovery facility.

CSBP is a signatory to the Federal Government's "Greenhouse Challenge Programme", which is an agreement for a reduction in greenhouse gases from CSBP's whole operations. CSBP has set a target to reduce overall greenhouse gas emissions by 20% between 1995 and the year 2000.

The submission from the Conservation Council indicates that CSBP's commitment to reduce the total greenhouse gas emissions by 20% between year 1995 and 2000 should become an environmental condition for the project.

Assessment

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

The EPA's objective in regard to this environmental factor is to ensure that greenhouse gas emissions meet acceptable standards and requirements of Section 51 of the *Environmental Protection Act 1986* (all reasonable and practicable measures are taken to minimise greenhouse gas discharge), through the adoption of the following EPA's provisional policy:

- calculation of the greenhouse gas emissions associated with the project (using acceptable methodology developed for Australia);

- specific measures adopted to limit greenhouse gas emissions for the project;
- estimated global emission credit (greenhouse gas offsets) achieved through implementation of the proposal.

Proponents are also encouraged to enter into the C21 'Greenhouse Challenge' voluntary agreement programme for the estimation, reporting and auditing of greenhouse gas emissions, whether on a project specific basis, company wide arrangement or within an industrial grouping, as appropriate.

The EPA notes that whilst there will be an increase in the overall carbon dioxide emissions with the new plant, due to its higher capacity (3.2 times the capacity of the existing plant), the unit discharge of carbon dioxide (per tonne of ammonia produced) will be significantly reduced (45% reduction), through improved technology and energy efficiency. The proponent will recover about 25% of the total carbon dioxide produced from the new plant, as a compressed liquid, for sale to industrial users.

The EPA also notes that, from a global perspective, the increased capacity of the new plant will displace the importation of ammonia, which would generate equivalent or greater carbon dioxide emissions.

The EPA considers that although the new ammonia plant is not a major contributor to greenhouse gas emissions (less than 0.07% of the total greenhouse gases emitted in Australia and less than 1% of the total greenhouse gases emitted in Western Australia), the proposed target set by CSBP, as a signatory to the "Greenhouse Challenge" programme to reduce greenhouse gas emissions from CSBP's whole operation by 20% between 1995 and the year 2000, and CSBP commitment to include the new ammonia plant in the annual reporting of Greenhouse gas inventories, are appropriate measures to minimise the emissions.

Having particular regard to the:

(a) significant reduction in the unit discharge of carbon dioxide;

(b) from a global perspective, reductions in carbon dioxide emissions, as a result of ammonia import substitution and recovery of carbon dioxide as compressed liquid; and

(b) the proponent's adoption of the EPA's provisional policy on greenhouse gases, and proposed target and commitment to limit emissions of carbon dioxide,

it is the EPA's opinion that the project can be managed to meet the EPA's objective for greenhouse gases.

3.5 Noise

Description

The closest residential areas are North Rockingham and Medina, both about 3 kms from the new ammonia plant (Figure 1).

The major noise sources from the new plant are the process compression section and the flare operations. Some equipment (eg. pumps) located within 35m of the closest site boundary is also expected to contribute to the noise emissions at the boundary.

The pressure requirement for the new plant will be less than that for the existing plant, through the use of lower pressure ammonia production technology. The new plant will also incorporate centrifugal compressors driven by steam turbines (similar design to those installed in CSBP's new nitric acid plant, which have not shown any effect in noise levels at CSBP's boundary). Thus an overall reduction in the noise power levels from the new plant could be expected.

The results of a boundary noise survey undertaken by CSBP in March 1997 indicated that the noise level at the CSBP/BP Refinery boundary, which is the closest boundary to the new ammonia plant site, was approximately 56dB(A). It is estimated that the operation of the new ammonia plant would increase the noise levels in this area by between 2 and 3dB(A) to a total of

58-59dB(A). This increase in noise levels is a result of the new plant being located closer to the CSBP/BP Refinery boundary than the existing plant (Figures 1 and 2).

Although the CER states that the periodic use of the flare may result in noise levels exceeding 65dB(A) at the closest CSBP's site boundary, additional information provided by the proponent during the EPA assessment indicates that the noise levels generated from the operation of the new plant, including the flare, will meet the assigned noise levels

The new *Environmental Protection (Noise) Regulations 1997* were gazetted on 31 October 1997, to come into effect on 31 January 1998. These regulations replace the existing *Noise Abatement (Neighbourhood Annoyance) Regulations 1979.* The new regulations set assigned noise levels for various types of premises such as noise sensitive, commercial and industrial and utility premises. For "industrial and utility" premises, such as CSBP operations and other industries located in the Kwinana industrial area, the assigned noise levels are 65 dB(A) for 90% of the time (L_{A10}), which are 5 dB(A) below the current acceptable noise levels of 70 dB(A).

The DEP licence conditions for the existing plant do not stipulate any requirements for noise emissions, due to the anticipated gazettal of the new noise regulations.

Assessment

The area considered for assessment of this factor is the CSBP site and surrounding premises and properties.

The EPA's objective in regard to this factor is to protect the amenity of nearby residents from noise impacts resulting from activities associated with the project by ensuring that noise levels comply with the new *Environmental Protection (Noise) Regulations 1997.*

The EPA notes that the current noise level at the CSBP/BP Refinery boundary, which is the closest boundary to the new ammonia plant site is about 9dB(A) below the assigned noise level of 65 dB(A). Although the noise levels from the new plant are expected to increase by 2 to 3 dB(A), they are still below the assigned noise level. This increase is due to the new plant being located closer to the CSBP/BP Refinery boundary than the existing plant and is not expected to cause any noticeable change in the nearest residential area about 3 km from the CSBP site.

In regard to the noise emission from the periodic use of the flare, the DEP advised that the proponent's specification of 85 dB(A) at 1m for the selection of the flare and the proponent's commitment to report to the DEP on the verification of the compliance with specifications for the flare and other equipments, are considered appropriate noise management measures for this project.

Having particular regard to the:

(a) results of the noise estimation indicating acceptable noise impact at the site boundary as well as at the nearest residential areas; and

(b) proponent's commitments on noise management to ensure that the proposal will meet the requirements of the new noise regulations,

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

3.6 Public safety (risk)

Description

The EPA has established acceptable criteria and management principle for off-site individual fatality risk (EPA, 1992b and 1992c) for new industrial developments with a potentially hazardous nature, such as the new ammonia plant. The criteria are as follows:

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

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

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

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

Although the EPA has not yet established any criteria for societal risk, it recognises the need to develop these criteria in the near future. As an interim measure, the societal risk levels should meet the limits suggested for the Kwinana industrial area (AEA, 1995).

The EPA's management principle is that risks should be reduced to a practicable minimum.

In general, the major sources of risk to neighbouring plants and the public from the operation of an ammonia plant are toxic gas release of ammonia and explosion of hydrogen gas.

The new ammonia plant will incorporate improved control systems and be designed for higher reliability and low risk of fire, explosion and accidental release. The new plant will utilise the existing ammonia refrigerated storage on site and will incorporate improved storage of other chemicals.

The management of risk and hazards, including the management of dangerous goods on site, will be via a Safety Management System (SMS), which will be approved by the Department of Minerals and Energy (DME) and subject to third party auditing. The new SMS will be integrated with the site SMS for the whole CSBP Kwinana operations, including the ammonia terminal.

In addition to the SMS, the Environmental Management Safeguards for the existing plant include HAZOP, risk analysis, environmental management system consistent with the ISO 14000. The status of these are detailed in Table 9 of the CER (page 38).

CSBP has recently completed a Quantitative Risk Assessment (QRA) of the existing ammonia plant, a preliminary QRA of the new ammonia plant and site wide QRAs comparing the overall risk contours for each of the two ammonia plants (Quantarisk, 1997). Societal risk analysis was also carried out for the new plant and the results are expressed in an F-N curve, which is a log-log plot of cumulative frequency (F) of incidents causing N or more fatalities, versus N.

The results of the above risk analyses indicate that the major risk contributors are the toxic dispersions of ammonia gas arising mainly from the loss of containment or loss of control of the liquid ammonia inventories within the process. The predicted risk levels associated with the new ammonia plant meet the EPA individual risk criteria (Figure 6), and would be within the acceptable societal risk limits (Figure 7).

Cumulative risk levels from CSBP total operations at Kwinana exceed the EPA's criteria at a number of points along the site boundaries (Figure 8). The exceedance is caused by other CSBP existing facilities on site, which were designed and constructed before the EPA risk criteria were developed. However, the new ammonia plant contributes to a slight contraction of the fifty in a million per year cumulative risk contour on the northern site of the site

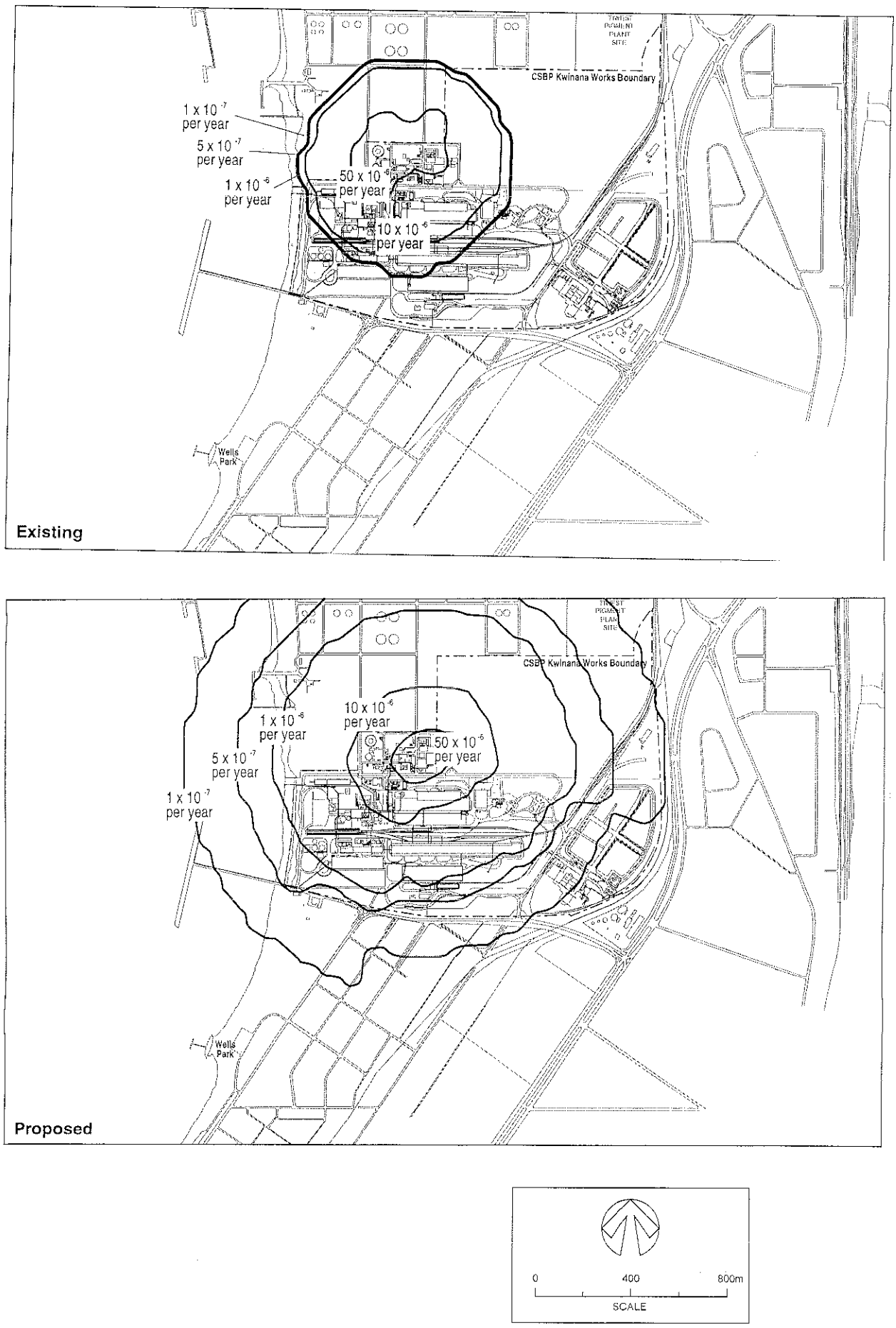

Figure 6. Individual fatality risk contours for existing and proposed ammonia plant.

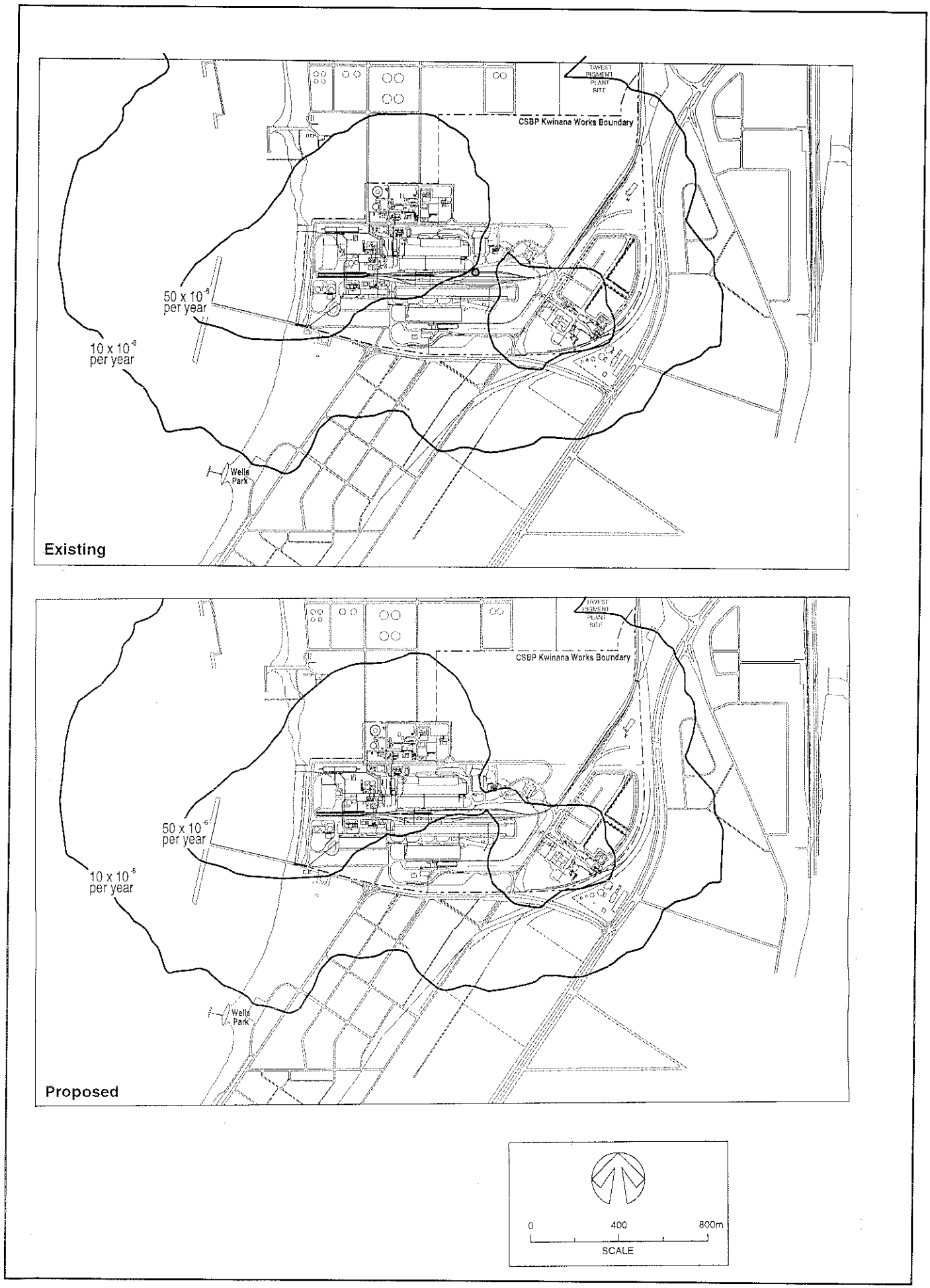

Figure 7. Cumulative fatality risk contours for the whole CSBP site.

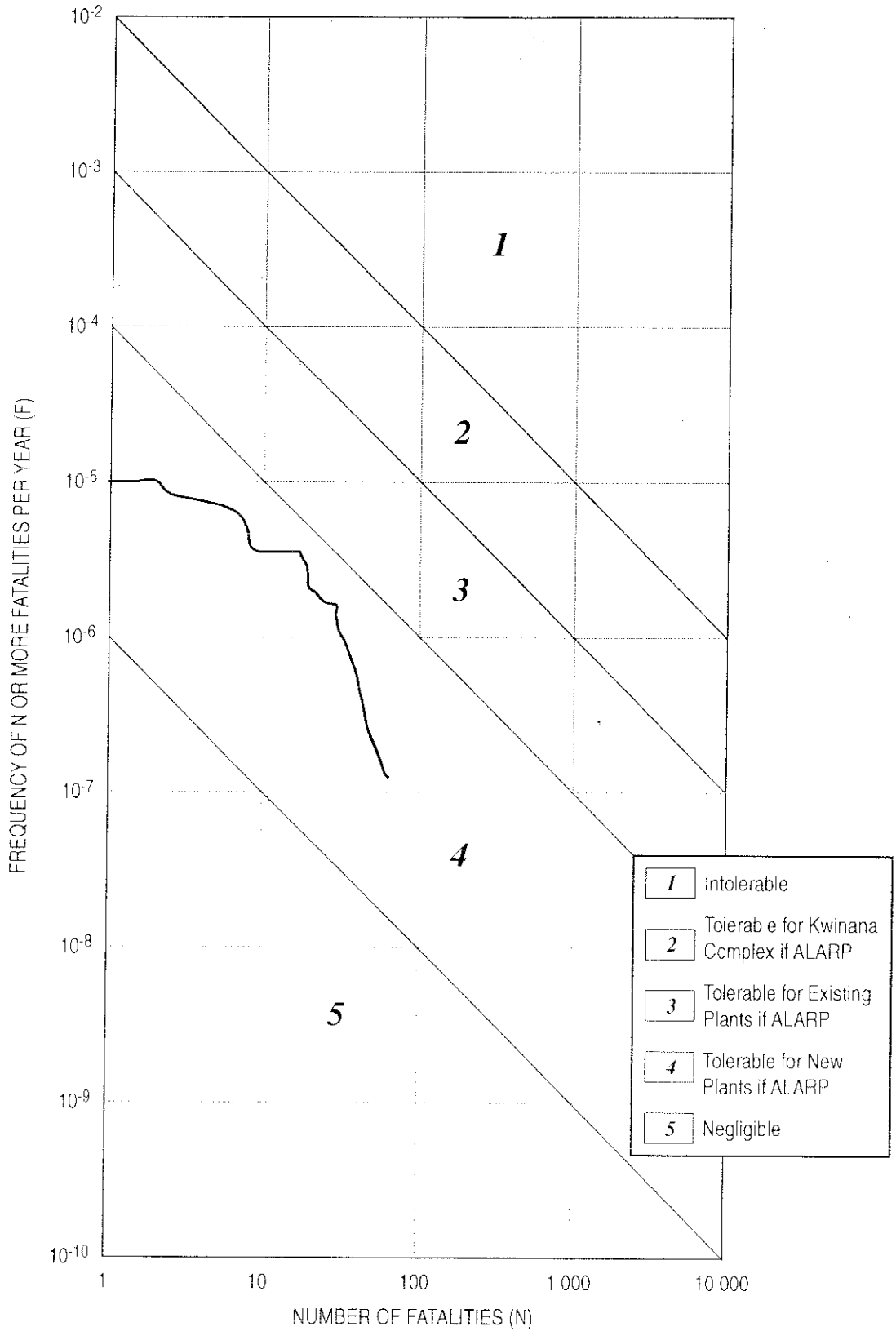

Figure 8. Societal risk for the proposed plant.

Assessment

The area considered for assessment of this factor is the plant site and surrounding premises and properties. This is the area within which risk levels must be controlled to meet the EPA's criteria and DME's requirements.

The EPA's objective in regard to this environmental factor is to ensure that risk is as low as reasonably achievable and complies with acceptable standards including the EPA's criteria for individual fatality risk off-site, acceptable criteria for societal risk, and the DME's requirements in respect of public safety.

As a result of its technical review of the QRA reports, the DME considers that the QRA provides a reasonable representation of the risks from the new ammonia plant, given the limitations of the technical information available to date.

The EPA notes that the risk contours for the new ammonia plant meet the EPA's individual risk criteria the nearest residential areas and Wells Park (Figure 6), and just meet the criteria at the CSBP/BP Refinery boundary. The EPA considers that the proponent's commitments to revise the preliminary QRA prior to plant construction and to conduct a final QRA prior to plant commissioning, to determine more accurately the risk contours at the boundary and the risk reduction to the site cumulative risks, are appropriate measures. The revised QRA will include knock-on effects, loss of control releases, mitigation measures to reduce risk to as low as reasonably practical (ALARP), and sensitivity analysis with respect to probit equations and weather data.

With respect to cumulative risk from the whole CSBP operations, the EPA notes that the exceedance of the EPA criteria at CSBP site boundary is due to other activities on the site and the new ammonia plant contributes to a slight contraction of the fifty in a million per year risk contour on the northern site of the site. The EPA considers that it is appropriate for the proponent to continue to address and manage this issue, through risk management and amelioration plans, in consultation with the relevant authorities including the DME and DEP.

The predicted societal risk for the new plant would be acceptable, as long as ALARP risk reduction methods are applied. The EPA notes that the proponent will take into account the recommendations to reduce the risks (Quantarisk, 1997), in the HAZOP study and detailed engineering design prior to construction.

The EPA also notes the proponent's commitment to develop and implement a construction safety management plan and procedures to manage occupational and public risk during construction period, where construction activity is occurring around operating plant.

Having particular regard to the:

(a) predicted compliance with the EPA's criteria for individual fatality risk off-site;

(b) implementation of the ALARP principle to ensure that societal risk levels are acceptable;

(c) proponent's commitments to manage and minimise risk during the construction and operation of the project; and

(d) contribution to a slight reduction in the cumulative risk for the whole CSBP site,

it is the EPA's opinion that the proposal can be managed in an environmentally acceptable manner in regard to public safety and risks.

4. Conditions

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

In developing recommended conditions for each project, the EPA's preferred course of action is to have the proponent provide an array of commitments to ameliorate the impacts of the proposal

on the environment. The commitments are considered by the EPA as part of its assessment of the proposal, and following discussion with the proponent the EPA may seek additional commitments.

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

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

Having considered the proponent's commitments and the information provided in this report, the EPA has developed a set of conditions which the EPA recommends be imposed if the proposal by CSBP to construct and operate a 650 tonne per day (tpd) ammonia plant to replace its existing 300 tpd ammonia plant at its Kwinana site, is approved for implementation. These conditions are presented in Appendix 3. Matters addressed in the conditions include the following:

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

(b) in order to manage the relevant factors and EPA objectives contained in this bulletin, and subsequent conditions and procedures authorised by the Minister for the Environment, the proponent shall be required to prepare, prior to implementation of the proposal, environmental management system documentation with components such as those adopted in Australian Standards AS/NZ ISO 14000 series.

5. Conclusions

The EPA has concluded, on the basis of the information available, that the proposal by CSBP to construct and operate the new ammonia plant to replace its existing plant at Kwinana, can be managed in an environmentally acceptable manner, provided that the conditions recommended in Section 4 and set out in Appendix 3, are imposed.

The EPA has also concluded that, in comparison with the existing ammonia plant, the proposal represents an overall improvement in public safety and environmental performance aspects.

6. Recommendations

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

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

1. That the Minister considers the report on the relevant environmental factors of Marine water quality, Air quality, Greenhouse gas (carbon dioxide), Noise, and Public safety (risk), as set out in Section 3;

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

   - the proposal can be managed in an environmentally acceptable manner, provided there is satisfactory implementation by the proponent of the commitments and recommended conditions set out in Appendix 3; and
   - in comparison with the existing ammonia plant, the proposal represents an overall improvement in public safety and environmental performance aspects;

3. That the Minister impose the conditions and procedures recommended in Appendix 3.

Table 7. Summary of Assessment of Relevant Environmental Factors (CSBP Kwinana Ammonia Project)

RELEVANT FACTOR	RELEVANT AREA	EPA OBJECTIVES	EPA ASSESSMENT	EPA ADVICE
Marine water quality	CSBP site and marine environment within Cockburn Sound.	Maintain or improve the quality of marine water consistent with the draft WA Guidelines for Fresh and Marine Waters (EPA, 1993); and Maintain or improve marine water and sediment quality consistent with the draft Environmental Quality Objectives (EQO's) and Environmental Quality Criteria (EQC's) in the Southern Metropolitan Coastal Waters Study (DEP, 1996).	The use of recirculating evaporative cooling system will reduce the heat load to Cockburn Sound currently produced by the seawater cooling system. The new plant will result in a 85% reduction in the mass loading of nitrogen. Mass loading of phosphorus will be 2.5 times that of the existing plant, but the actual discharge quantity is very small compared to those generated from other operations on the CSBP site and Cockburn Sound waters are nitrogen limited. Nitrogen and phophorus from the new plant will not cause an exceedance in the current DEP licensed discharge limits. Although concentrations of zinc from the CSBP site are expected to meet the draft WA guidelines and the DEP's environmental quality criteria of 0.02 mg/L for zinc, zinc loading from the plant is about 20% of total loadings from Kwinana industry. Monitoring requirement for the whole CSPB site, including that for zinc, will be reviewed, following the completion of the consultative process when the EQOs and EQCs for Cockburn Sound waters can be clearly determined. Proponent intends to achieve near zero discharge of nutrients for CSBP Kwinana in future.	Having particular regard to the: • reduction in nitrogen loading and heat loading into Cockburn Sound; • negligible potential impacts of the proposed discharge on marine water quality of Cockburn Sound; • proposed dicharge meeting the current DEP licensed dischage limits for nutrients; and • proposed discharge being consistent with the draft recommended water quality guidelines, environmental quality criteria and objectives for Cockburn Sound, it is the EPA's opinion that the proposal can be managed to meet the EPA's objective.

Air quality	CSBP site and surrounding premises and properties.	Ensure that gaseous emissions meet the air quality standards and limits stated in the Kwinana EPP and other relevant air quality standards/guidelines, and the requirement of Section 51 of the *Environmental Protection Act 1986* (ie. take all reasonable and practicable measures to minimise all discharges).	Potential impacts of emissions of chlorine and fugitive emissions of ammonia and other gases would be minimal and meet the relevant acceptable standards and guidelines at the nearest residential area The 40m flare to combust the fugitive emissions under upset conditions and routine maintenance would minimise odour problems. Sulphur dioxide emissions from the new plant are very small in comparison to those from other CSBP operations, and will not cause any exceedance of the Kwinana EPP. Emission concentration and the total load of oxides of nitrogen from the new plant would be lower than those from the existing plant. The proposed emission concentration of nitrogen dioxide (NO2) from the new plant would meet the AEC/NHMRC emission standard. and would not cause exceedance of the AEC/NHMRC ambient air guideline and the draft NEPM standard for NO2.	Having particular regard to the: • reduction in the emissions of oxides of nitrogen, in terms of an overall reduction (mass loading) and a reduction per tonne of ammonia produced (unit discharge), as a result of improved technology and energy efficiency in the new plant ; • use of the flare to minimise emissions of ammonia and other gases, particularly under abnormal operating conditions; and • estimated gaseous emissions meeting the relevant air quality standards and guidelines, it is the EPA's opinion that the proposal can be managed to meet the EPA's objective.
Greenhouse gas (carbon dioxide)	The global environment.	Ensure that greenhouse gas emissions meet acceptable standards and requirements of Section 51 of the Environmental Protection Act 1986 (all reasonable and practicable measures are taken to minimise greenhouse gas discharge).	Although there will be an increase in the overall carbon dioxide emissions with the new plant, due to its higher capacity, the unit discharge of carbon dioxide will be significantly reduced, through improved technology and energy efficiency. Proposal is not a major contributor to greenhouse gas emissions. The new plant will emit less than 0.07% of the total greenhouse gases emitted in Australia (comparing with less than 0.04% currently) or less than 1% of total greenhouse gases emitted in Western Australia (comparing with less than 0.5% currently). Out of this, about 25% will be recovered for sale, as a compressed liquid. Proposed target set by CSBP, as a signatory to the "Greenhouse Challenge" programme is to reduce greenhouse gas emissions from CSBP's whole operation by 20% between 1995 and the year 2000. The project will be included in the annual greenhouse gas reporting.	Having particular regard to the: • significant reduction in the unit discharge of carbon dioxide; • from a global perspective, reductions in carbon dioxide emissions, as a result of ammonia import substitution and recovery of carbon dioxide as compressed liquid; and • the proponent's adoption of the EPA's provisional policy on greenhouse gases, and proposed target and commitment to limit emissions of carbon dioxide, it is the EPA's opinion that the project can be managed to meet the EPA's objective.
Noise	CSBP site and surrounding premises and properties.	Protect the amenity of nearby residents from noise impacts resulting from activities associated with the proposal by ensuring that noise levels meet statutory requirementsin the 1997 *Environmental Protection (Noise) Regulations.*	Current noise level at the CSBP/BP Refinery boundary, which is the closest boundary to the new ammonia plant site is about 9dB(A) below the assigned noise level (of 65 dB(A)). Noise levels from the new plant are expected to increase by 2 to 3 dB(A) which are still below the assigned noise level, due to the use of lower pressure technology and quieter centrifugal compressors driven by steam turbine. Proponent has made adequate commitments on noise management.	Having particular regard to the results of noise estimation and CSBP's commitment to meet the new noise regulations, it is the EPA's opinion that the project can be managed to meet the EPA's objective.

Public safety (risk)	CSBP site and surrounding premises and properties.	Ensure that risk is as low as reasonably achievable and complies with acceptable standards including the EPA's criteria for individual fatality risk off-site, acceptable criteria for societal risk, and the DME's requirements in respect of public safety.	The EPA's individual risk criteria for the new plant will need to be met at the plant fence line and at residential areas for the new ammonia plant. Exceedance of the EPA criteria at CSBP site boundaries is due to other activities on the site and it is appropriate for the proponent to continue to address and manage this issue, in consultation with the relevant authorities including the DME and DEP. The predicted societal risk for the new plant remains acceptable as long as risk reduction methods are applied to make it as low as reasonably practical (ALARP). Proponent has made adequate commitments to ensure compliance with the EPA's risk criteria, and to manage and reduce risks.	Having particular regard to the: • predicted compliance with the EPA's criteria for individual fatality risk off-site; • implementation of the ALARP principle to ensure that societal risk levels are acceptable; and • proponent's commitments to manage and minimise risk during the construction and operation of the project, it is the EPA's opinion that the proposal can be managed to meet the EPA's objectives.

Appendix 1

Submission from the Conservation Council of WA/Proponent's Response

CONSERVATION COUNCIL
OF WESTERN AUSTRALIA INC.
79 Stirling Street, Perth 6000
Phone (09) 220 0652 Fax (09) 220 0653

23 December, 1997

The Chair
Environmental Protection Authority
141 St George's Terrace
PERTH WA 6000

Attention: Ms Nguyen

RE: KWINANA AMMONIA PROJECT, CSBP - CER

The Conservation Council welcomes this proposal as a step in the right direction towards waste minimisation and cleaner production. We are delighted that the proponent has carefully addressed our concerns about emissions, waste products and greenhouse gases. The proponent also consulted with us during the preparation of the CER and discussed our concerns with us. Consequently the results of this process are satisfactory in most respects.

However we still have some concerns on the following issues:

1. Phosphorus emissions: We realise that the phosphorus emitted by this plant is very small and unlikely to adversely effect Cockburn Sound. However the situation in the Sound is so critical that any increase in phosphorus emissions, no matter how small, is a matter of concern. Perhaps CSBP would commit to reduce phosphorus emissions for its overall operations by another 10 - 20% in order to ensure that the effects of this plant are negligible.

2. Greenhouse emissions: This plant will produce more carbon dioxide than the present plant although the emissions per tonne of ammonia are reduced. We are pleased that CSBP has joined the Greenhouse Challenge and we hope that their commitment to reduce their total greenhouse gas emissions by 20% between 1995 and 2000 is achievable and could become a condition of this proposal also.

3. Proponent commitments: We could not find a list of commitments by the proponent. Management objectives are not the same thing. We would like to see some specific commitments with targets for phosphorus emissions and greenhouse gases, together with a promise that action will be taken if the commitments are not met. These commitments must be incorporated into binding conditions by the Minister.

Apart from these deficiencies the proposal is welcome and we trust that you will ensure that it becomes an example of how new technology can reduce emissions while improving the company's manufacturing efficiency.

Yours sincerely

Rachel Siewert
Co-ordinator

CSBP
A.C.N. 008 668 371

FACSIMILE TRANSMISSION

TO:	DEPARTMENT OF ENVIRONMENTAL PROTECTION	**ATTENTION:**	MS XUAN NGUYEN
FAX NO:	9222 7157	**DATE:**	30 DECEMBER 1997
FROM:	STEVE FITZPATRICK, WESFARMERS CSBP LIMITED	**NO. PAGES:**	2
SUBJECT:	CER - KWINANA AMMONIA PROJECT		

Contact this telephone number if transmission is not successful or all pages are not received. 93274438

Dear Xuan

Thank you for your fax of 24 December 1997 with a copy of the submission from the Conservation Council.

Our response is as follows:

Phosphorus emissions.

CSBP is committed to reducing phosphorus discharges to Cockburn Sound well beyond the small increase from the proposed ammonia plant.

In the DEP's Southern Metropolitan Coastal Waters Study we committed to reducing site discharges to near zero by 2021, but we expect to achieve that target well beforehand.

We are currently investigating site effluent discharges and effluent handling systems with a target of reducing these discharges to near zero by 2000 (about the time the new ammonia plant is commissioned).

Our DEP licence contains continuous improvement targets for nutrient discharge from Kwinana and the licence limit for phosphorus is to reduce from 400 kg/day to 300 kg/day in July 1998. As can be seen from Figure 10 of the CER, we are already achieving well below the current and proposed licence limits

As Figure 10 shows, our current performance at Kwinana indicates a significant reduction in P discharges in the January to June 97 period and again in the July to December 97 period (down by 60% on 1996 levels). This is a result of cleaner production in our superphosphate manufacture plant where we have been recycling scrubber effluent back into the product

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FACSIMILE TRANSMISSION

stream in a planned manner. This modification to the process is now part our standard operating procedures and we believe that further reductions in phosphorus loss may be achievable as we gain more experience with the procedure.

Against this background of a strong and continuing reduction of phosphorus discharges and our clear compliance with the DEP licence, a specific commitment to reduce overall phosphorus emissions by another 10 to 20% as part of this proposal seems unnecessary.

Greenhouse Emissions.

We do not believe the commitments in our Greenhouse Challenge Agreement should be a condition of this proposal because the Agreement relates to all of our existing operations.

The Greenhouse Challenge Agreement we signed earlier this year did not include greenhouse emissions from the proposed ammonia plant. At the time of the signing of the agreement, we had not committed to an ammonia plant and so it was not included in a quantitative sense, but the possibility was foreshadowed.

Nevertheless we will still achieve the reductions in greenhouse emissions in our agreement with the Commonwealth Government based on existing operations at Kwinana.

We will commit to include the proposed ammonia plant in our Greenhouse Challenge reporting programme when the plant becomes operational. While this will increase the total emissions from our Kwinana works it is the best that can be achieved with current low energy technology for ammonia plants. In global terms, if we were not to manufacture the ammonia it would have to be imported from plants which generate at least as much greenhouse gas.

As requested, we will supply a list of commitments before 8 January.

Regards

Steve Fitzpatrick
Manager - Environmental Planning

cc Rob Keogh, Peter Anver, Sri Sridharan

Appendix 2

References

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Appendix 3

List of recommended Ministerial Conditions and proponent's consolidated commitments

Statement No.

DRAFT

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

Title: Kwinana Ammonia Project, Kwinana Industrial Area

Proposal: Construction and operation of a 650 tonne per day (tpd) ammonia plant to replace the existing 300 tpd ammonia plant, at CSBP Kwinana site (immediately to the east of the existing ammonia plant), which is located within the Kwinana heavy industrial area, Town of Kwinana, about 33 km south of Perth, as documented in schedule 1 of this statement.

Proponent: Wesfarmers CSBP Limited

Proponent Address: 40 The Esplanade, PERTH WA 6000

Assessment Number: 1140

Report of the Environmental Protection Authority: Bulletin 882

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

1 Implementation

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

2 Proponent Commitments

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

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

3 Environmental Management System

3-1 In order to manage the environmental impacts of the project, and to fulfil the requirements of the conditions and procedures in this statement, prior to construction, the proponent shall be required to have in place an Environmental Management System with components such as those adopted in Australian Standards AS/NZS ISO 14000 series, to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

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

4 Decommissioning Management Plan

4-1 At least six months prior to decommissioning of the new ammonia plant, the proponent shall prepare a Decommissioning Management Plan to the requirements of the Environmental Protection Authority on advice of the Department of Environmental Protection.

This Plan shall address:

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

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

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

4-2 The proponent shall implement the Decommissioning Management Plan required by condition 4-1.

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

5 Changes to Implementation

5-1 Where, in the course of implementing the proposal, the proponent seeks to change any aspect of the proposal as documented in schedule 1 of this statement in any way that the Minister for the Environment determines, on advice of the Environmental Protection Authority, is not substantial, those changes may be effected.

6 Proponent

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

6-2 Any request for the exercise of that power of the Minister referred to in condition 6-1 shall be accompanied by a copy of this statement endorsed with an undertaking by the proposed replacement proponent to carry out the proposal in accordance with the conditions and procedures set out in the statement.

6-3 The proponent shall notify the Minister for the Environment of any change of proponent contact name and address within 30 days of such change.

7 Commencement

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

7-2 Where the proposal has not been substantially commenced within five years of the date of this statement, the approval to implement the proposal as granted in this statement shall lapse and be void. The Minister for the Environment will determine any question as to whether the proposal has been substantially commenced.

7-3 The proponent shall make application to the Minister for the Environment for any extension of approval for the substantial commencement of the proposal beyond five years from the date of this statement.

7-4 Where the proponent demonstrates to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority that the environmental parameters of the proposal have not changed significantly, then the Minister may grant an extension not exceeding five years for the substantial commencement of the proposal.

8 Compliance Auditing

8-1 The proponent shall submit periodic Performance and Compliance Reports, in accordance with an audit program prepared in consultation between the proponent and the Department of Environmental Protection.

8-2 Unless otherwise specified, the Department of Environmental Protection is responsible for assessing compliance with the conditions contained in this statement and for issuing formal clearance of conditions.

8-3 Where compliance with any condition is in dispute, the matter will be determined by the Minister for the Environment.

Note

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

Schedule 1

PROPOSAL

The new ammonia plant will be located immediately to the east of the existing ammonia plant at the CSBP site, within the Kwinana Industrial Area (attached Figures 1 and 2).

The ammonia project involves construction and operation of:

- a new 650tpd or 225,000 tpa ammonia plant; and
- ancillary equipment to support the ammonia plant including:
  - installation of a 25 tonne per hour (tph) natural gas fuelled steam boiler for use during plant start-up and shutdown operations;
  - "polishing water unit" to produce boiler quality feed water by treating demineralised water from an existing CSBP water treatment plant; and
  - a cooling water tower.

The proposed plant will be intergrated with a number of existing CSBP facilities during its operation (attached Figure 3).

This project does not include the transport and distribution of ammonia throughout the State.

The preliminary layout of the components of the proposed plant is shown in Figure 4 (attached). The general arrangement of the plant will include the following sections:

- reforming;
- synthesis loop;
- carbon dioxide removal;
- heat exchange/cooling;
- water polishing unit;
- ammonia synthesis;
- power generation;
- process and motor control centre;
- refrigeration;
- groundwater bore; and
- storage.

The main characteristics of the proposal are summarised in Table 1 (attached).

The new ammonia plant will incorporate the Haldor Topsøe technology, for which a license was made available to CSBP by Technipetrol SpA of Italy.

The process flow diagram (attached Figure 5) shows various stages of the ammonia production process, which include:

- desulphurisation of natural gas feed (methane);
- reforming of methane and steam to carbon monoxide and hydrogen;
- shift conversion of carbon monoxide to carbon dioxide;
- removal of carbon dioxide by absorption;
- purification of "synthesis gas" by methanation;
- compression of the "synthesis gas";
- synthesis of ammonia from "synthesis gas"; and
- refrigeration and storage of ammonia.

Following commissioning and stabilisation of the new plant, the existing plant will be shutdown and in due course dismantled.

PROPOSAL TABLE AND FIGURES

Table 1: Summary of key proposal characteristics

Proposal Characteristics	Unit	Proposed Plant
Capacity	tpd NH_3	650
	tpa NH_3	225,000
Natural Gas Consumption (energy efficiency)	GJ/t NH_3	32-34
	PJ/yr	7.4
Water Consumption	tpd	6,000 (makeup)
Location	-	CSBP Kwinana
Gaseous emissions:		
NO_x (as NO_2)	kg/t NH_3	0.54
	kg/d	350
CO_2	t/t NH_3	1.8
	tpd	1,200
Fugitive Gases -		
• NH_3	-	flared
• H_2	-	flared
Aqueous discharge:		
Cooling System (including polishing unit blowdown)	-	recirculating treated
	-	sub artesian water
Flow	tpd	2,100
Heat Load	-	mainly to atmosphere
Nitrogen	kg/d	6 - 10
Phosphorus	kg/d	6
Oily water	-	de-oiled to contain less than 30ppm of oil
Noise at boundaries	59 dB(A) at BP boundary	will comply with regulations
Individual risk at CSBP boundary:-		
• BPRK fence	deaths/mill/yr	< 50
• Kwinana Beach Rd	deaths/mill/yr	< 10
• Nearest residential	deaths/mill/yr	< 1

Schedule 2

Proponent's Consolidated Environmental Management Commitments

KWINANA AMMONIA PROJECT, KWINANA INDUSTRIAL AREA (1140)

WESFARMERS CSBP LIMITED

COMMITMENT	OBJECTIVE	ACTION	TIMING	WHOSE ADVICE	MEASUREMENT/ COMPLIANCE CRITERIA
1. CSBP will minimise the impacts of discharges of phosphorus and nitrogen from the Kwinana Ammonia Project.	To protect the biota and amenity of Cockburn Sound.	• By selecting processes and equipment which give rise to the lowest discharges of nitrogen and phosphorus. (The selection of cooling water treatment process is of particular significance). • By continuing the implementation of measures to reduce discharges from other sources on CSBP's Kwinana site.	• Before construction. • By 1 January 2000	DEP	• Confirmation of advice on expected N+P discharges contained in CER. • Monitoring and reporting site discharges as required under current licence conditions
2. CSBP will seek to reduce discharges of greenhouse gases from the Kwinana Ammonia Project.	To minimise the effects of global warming arising from the discharge of greenhouse gases to the atmosphere.	• By implementing commercially viable opportunities to recover and reuse CO_2 discharged from the Kwinana Ammonia Project. • By incorporating, where practicable, advances in ammonia catalyst technologies which reduce the generation of CO_2 from the production of ammonia.	• Ongoing. • Ongoing.	Office of Greenhouse Challenge.	Include new ammonia plant in annual reporting of Greenhouse Gas inventories.
3. CSBP will ensure that noise generated from the Kwinana Ammonia Project will not exceed current regulations.	To maintain the amenity of nearby industrial, residential and recreational areas.	• By specifying the procurement of equipment which complies with current requirements. • By conducting noise surveys of the operating plant and implementing noise abatement measures if non-compliance is detected.	• Before construction. • Within 6 months of commissioning.	DEP	Reporting of results of surveys and agreeing plans to achieve attenuation if required.
4. CSBP will minimise the risk to the community arising from the operation of the Kwinana Ammonia Project.	To protect the nearby communities from exposure to unacceptable levels of risk to health and safety.	• By preparing and implementing a comprehensive Safety Management system for the operation of the plant. • By incorporating risk reduction measures recommended by Quantarisk into plant design.	• Before commissioning. • Completed as at 1/1/1998.	DME	• Approval of the SMS by relevant authorities. • Regular independent audit of compliance with the SMS reported to the DME.
5. CSBP will minimise the risk to persons involved in construction of the KAP from the operation of adjacent plants on the Kwinana site.	To protect the health and well being of people employed in the construction of the KAP.	By preparing and implementing a Construction Safety Management Plan.	Before construction.	DEP DME	Auditing and reporting as required by the plan.
6. CSBP will revise the preliminary risk assessment for the project.	To demonstrate compliance with EPA criteria at fenceline with BP and reduction of cumulative risk level for whole CSBP site.	Revise preliminary risk assessment and include knock-on effects, loss of control releases, mitigation measures to meet ALARP, sensitivity analysis with respect to probit equations and weather data.	Before construction.	DME DEP	The EPA's criteria for individual fatality risk off-site.
7. CSBP will conduct a final quantified risk assessment on the project.	To confirm that the final plant design meets EPA risk criteria and that there is a reduction in risk for the whole CSBP site.	Conduct final risk assessment taking into account final plant design.	Before commissioning.	DME DEP	The EPA's criteria for individual fatality risk off-site.
8. CSBP will decommission the existing ammonia plant, following commissioning and stabilisation of the new plant.	To ensure that decommissioning is carried out in an environmentally acceptable manner.	Prepare and implement a Decommissioning Management Plan.	At least 6 months before decommissioning.	DEP	The EPA's requirement.