

KWINANA ETHANOL BIO-REFINERY

Primary Energy Pty Limited

**Report and recommendations
of the Environmental Protection Authority**

**Environmental Protection Authority
Perth, Western Australia
Bulletin 1248
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Environmental Impact Assessment Process Timelines

Date	Progress stages	Time (weeks)
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1. Introduction and background

This report provides the Environmental Protection Authority's (EPA's) advice and recommendations to the Minister for the Environment on the proposal by Primary Energy Pty Limited to construct and operate an ethanol refinery in the East Rockingham Industrial Park to produce ethanol, aqueous ammonia and fertiliser.

Section 44 of the *Environmental Protection Act 1986* (EP Act) requires the EPA to report to the Minister for the Environment on the outcome of its assessment of a proposal. The report must set out:

- The key environmental factors identified in the course of the assessment; and
- The EPA's recommendations as to whether or not the proposal may be implemented, and, if the EPA recommends that implementation be allowed, the conditions and procedures to which implementation should be subject.

The EPA may include in the report any other advice and recommendations as it sees fit.

The proposal was referred to the EPA on 5 July 2006. Based on the information provided, the EPA considered that while the proposal had the potential to have an effect on the environment, the proposal, as described, could be managed to meet the EPA's environmental objectives. Consequently it was notified in *The West Australian* newspaper on 31 July 2006 that, subject to preparation of a suitable Environmental Protection Statement (EPS) document, the EPA intended to set the level of assessment at EPS.

The proponent has prepared the EPS document which accompanies this report (Umwelt Australia Pty Limited (Umwelt), 2007). The EPS document sets out the details of the proposal, potential environmental impacts and appropriate commitments to manage those impacts. The EPA notes that the proponent has consulted with relevant stakeholders.

The EPA considers that the proposal can be managed to meet the EPA's environmental objectives, subject to the EPA's recommended conditions being made legally binding.

The EPA therefore has determined, under Section 40 of the EP Act, that the level of assessment for the proposal is EPS, and this report provides the EPA advice and recommendations in accordance with Section 44 of the EP Act.

2. The proposal

Primary Energy Pty Limited (Primary Energy) proposes to construct and operate an ethanol refinery (bio-refinery) on a 19 hectare (ha) site in the IP14 East Rockingham Industrial Park which adjoins the southern boundary of the Kwinana Industrial Area (Figures 1 and 2).

The proposed bio-refinery will convert wheat and other grains into:

- bio-fuel, or fuel grade ethanol;
- bio-gas (predominantly methane), which will fuel generators to produce electricity;
- aqueous ammonia, a precursor of fertiliser; and
- fertiliser.

Wheat and grain is to be transported by conveyor from the Co-operative Bulk Handling (CBH) facility that is located immediately to the south of the site. Base fertiliser material such as rock phosphate will be imported via the Kwinana Bulk Cargo Jetty, which is approximately 1.7km by road to the north of the bio-refinery site. The proposal is described in detail in the proponent's EPS document (Umwelt, 2007).

The key components of the proposal are summarised in Table 1 below:

Table 1: Summary of key proposal characteristics

Element	Description
Site location	45km south-west of Perth, within the IP14 East Rockingham Industrial Park and Kwinana Industrial Area
Site area	19 ha
Products generated	Fuel grade ethanol – 160 ML/a Fertiliser - 350,000 t/a Aqueous ammonia - 16,000 t/a
Inputs	Wheat or other grains, starch and wheat dust - 400,000 t/a Fertiliser input material (trace elements and granular phosphate)- 280,000 t/a
Hours of operation	Construction – 7am – 7pm, Monday to Saturday Operation – 24 hour day, 7 day week Transport of ethanol - Monday to Saturday Transport of aqueous ammonia and fertiliser - Monday to Friday
Power generation	23 MW
Net reduction greenhouse gases	400,000 t/a of CO _{2-e}
Water requirements	50,000 kL/a, sourced from Sepia Depression Line or alternative source

Abbreviations:

ha – hectare

kL/a – kilolitres per annum

ML/a – megalitres per annum

MW – megawatts

t/a – tonnes per annum

-e - equivalent

The potential impacts of the proposal are described in detail in the EPS document (Umwelt, 2007).

3. Consultation

During the preparation of the EPS, the proponent has undertaken consultation with government agencies and key stakeholders. Consultation occurred mainly through provision of a website, telephone conversations and personal discussion, newspaper articles and a community information brochure. The proponent also held a community information day, and presented an overview of the proposal at the Kwinana Community and Industries Forum. A summary of stakeholder consultation is provided in Table 2.

A number of environmental issues such as noise, air quality, odour, and clearing of native vegetation were raised by the stakeholders. The agencies, groups and organisations consulted, the comments received and the proponent's response are detailed in Section 6.0 of the EPS (Umwelt, 2007).

The EPA considers that the consultation process has been appropriate and that reasonable steps have been taken to inform the community and stakeholders on the proposed development.

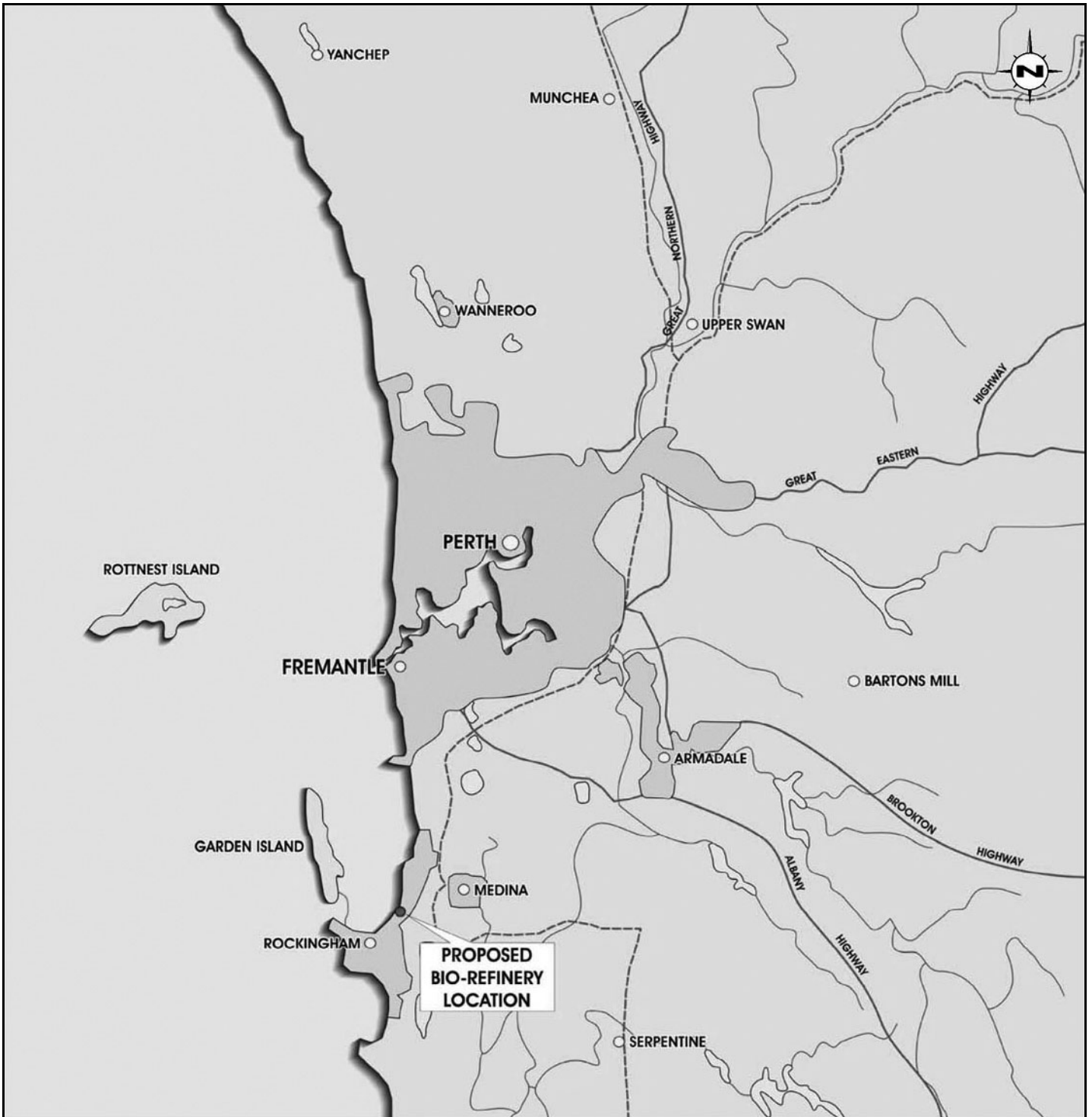


Figure 1: Locality plan of the Kwinana ethanol bio-refinery (Umwelt, 2007)



Figure 2: Location of the Kwinana ethanol bio-refinery (Umwelt, 2007)

Table 2: Summary of stakeholder consultation

Method	Description
Website	The Kwinana Ethanol Bio-Refinery website was designed to provide an overview of the proposed bio-refinery, the results of specialist studies, and ways to receive further information and to provide feedback. To date, five responses have been received via the website feedback form.
Telephone Information	Information regarding the proposed bio-refinery was provided by telephone to representatives of the community groups. This information included an overview of the proposal, ways to receive further information and to provide feedback.
Newspaper Articles	Newspaper articles providing an overview of the bio-refinery and the details of ways to receive more information or provide feedback were run in the two local papers, namely the Sound Telegraph and the Weekend Courier. The bio-refinery was first announced in the Weekend Courier on 21 April 2006.
Community Information Brochure	A community information brochure was designed to provide an overview of the proposed bio-refinery and inform the community of ways to receive more information or provide feedback. The brochure was distributed to local residents in North Rockingham, users of Wells Park, local environment groups and attendees of the Kwinana Community and Industries Forum.
Personal Discussion	Residents in North Rockingham and users of Wells Park were approached in order to inform residents and users of Kwinana Beach and Wells Park of the proposed bio-refinery and provide opportunities for questions and feedback. Approximately 80 people were consulted using this method.
Community Information Day	A community information day was held to present an overview of the proposal, the findings of specialist studies, and to provide opportunities for questions to be asked of the project team. The community information day was attended by four people representing three environmental groups, namely Conservation of Rockingham Environment, the Kwinana Progress Association and the Kwinana Watchdog Group.
Community Presentation	Two presentations were made to the Kwinana Community and Industries Forum (CIF) to present an overview of the proposal and the findings of specialist studies. Approximately 40 to 50 people representing community, industry and government attended the CIF

4. Key environmental factors

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

- (a) Air Quality and Odour;
- (b) Noise; and
- (c) Vegetation

The key environmental factors are discussed in Sections 4.1 – 4.3. The description of each factor shows why it is relevant to the proposal and how it will be affected by the proposal. The assessment of each factor is where the EPA decides whether or not a proposal meets the environmental objective set for that factor.

4.1 Air Quality and Odour

Description

Air Quality

The proposed bio-refinery consists of four main processing units; the ethanol plant, anaerobic digester plant, the fertiliser plant and a Combined Heat and Power Plant (CHPP) as shown in Figure 3. The atmospheric emissions from the CHPP and the steam generation process within the ethanol plant have the greatest potential to impact on air quality. The main gaseous emissions from the bio-refinery will be particulate matter (PM₁₀ and PM_{2.5}), nitrous oxides (NO_x), sulphur dioxide (SO₂), carbon monoxide (CO), and volatile organic carbons (VOC's) (predominantly ethanol) as shown in Table 3.

Table 3. Bio-refinery gaseous emissions (maximum emission rates)

Pollutant	Emissions (g/s)
PM ₁₀	7.1
NO _x	3.6
SO ₂	0.002
CO	8.9
VOC's (Ethanol)	2.2

Source: Appendix D and E (Heggies, 2006a)

Eleven 2 MW CAT G3520C gas engines will be used to generate heat and power. The exhaust from these engines will be heated to 600°C prior to flowing through four Thermal Drying Units. Exhaust gases from the Thermal Drying Units will be passed through cyclones and cooled to 50°C via a condenser unit. Cooled and condensed exhaust gases will then be passed through a knock-out drum to remove residual liquid, including dissolved NO_x. The gas stream will then be passed through biofilters where the exit temperature to the atmosphere will be approximately 40°C.

The biofilters are designed to remove odour and VOC emissions from the exhaust gas exiting the thermal driers. Emissions of inorganic gases (CO, SO₂ and NO_x) will also be significantly reduced through biofilter activity and the removal of condensate out from the gas stream.

Six steam generating boilers will be constructed, however, only four will be operational at any one time. Each boiler has its own stack to atmosphere. The natural gas boilers will utilise low NO_x burners.

A bio-gas flare will be constructed at the site. However, the flare will not be used during normal operating mode or during maintenance of the plant, and will only be used in the event of an emergency.

Ammonia emissions are not expected to be significant during operation of the bio-refinery. The facility will incorporate a closed system with vapour return for aqueous ammonia load-out.

Primary Energy commissioned Heggies (2006a) to undertake a detailed air quality impact assessment for the bio-refinery, utilising the AUSPLUME Gaussian Plume Dispersion Model software developed by EPA Victoria, Version 6.0. The results were reviewed by Air Assessments (2006, pers. comm., 7 December), as shown in Appendix 4 of the EPS. The sensitive receivers surrounding the bio-refinery include the caravan park at North Rockingham (650m southwest), Kwinana Township (3700m northeast), and Wells Park (180m northwest). The modelling results are described in detail in Section 5.3.1 and Appendix 4 of the EPS (Umwelt, 2007).

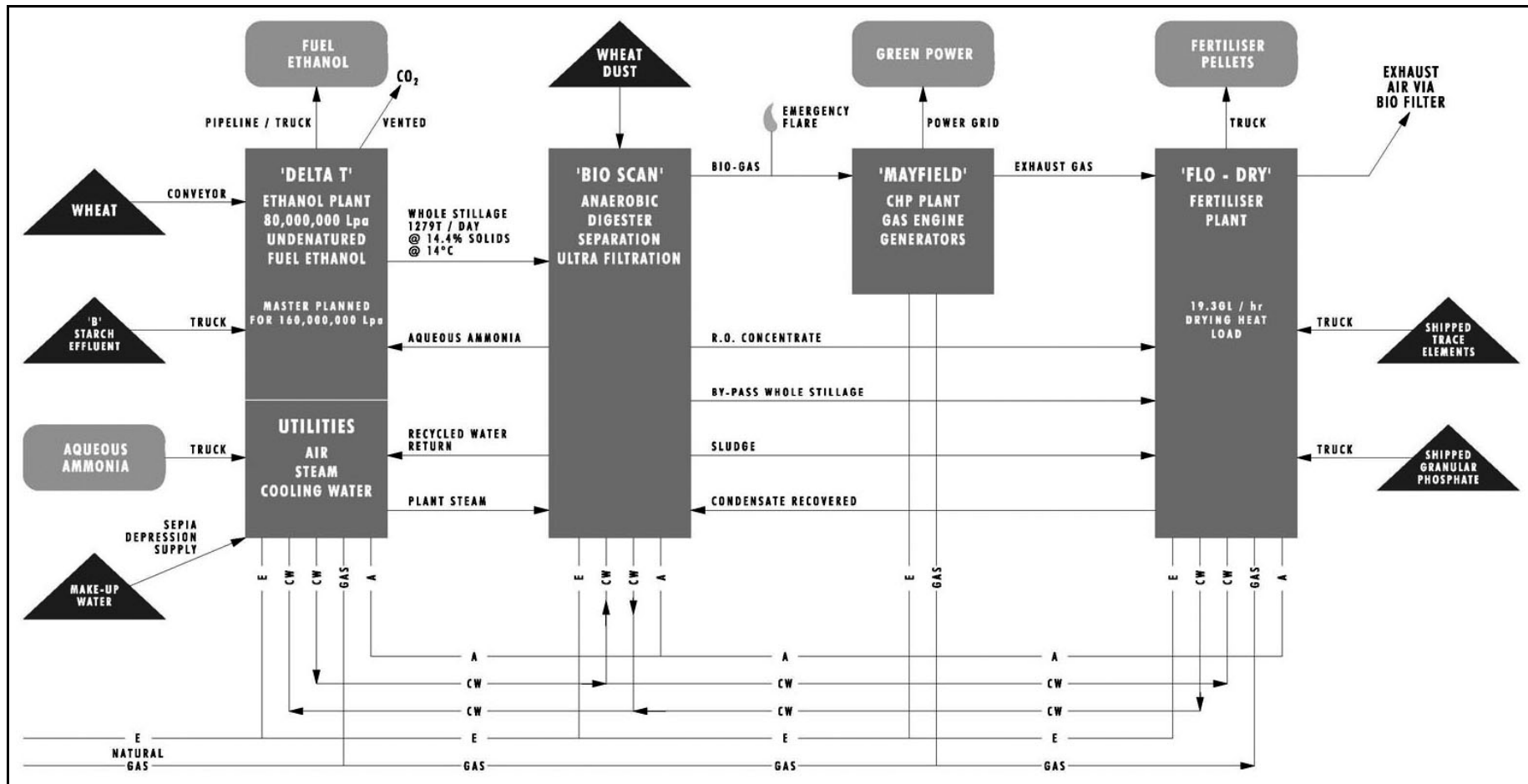


Figure 3: Process diagram for the proposed Kwinana ethanol bio-refinery (Umwelt, 2007)

The model predicted that the ground level concentrations (GLC's) of pollutants from the bio-refinery (in isolation) would be well below relevant health standards at receiver locations, as shown in Table 4.

The ozone limiting method was used to estimate the conversion of NO_x to nitrogen dioxide (NO₂).

Table 4. Predicted ground level concentration of gaseous emissions from the bio-refinery

Pollutant	Averaging Time	Ground Level Concentrations ¹ (% Criteria ²)		
		Wells Park	Caravan Park	Kwinana Township
NO _x (µg/m ³)	1 Hour	200	42	0.08
	Annual	5	0.8	0.03
NO ₂ (µg/m ³)	1 Hour	7 (3%)	21 (9%)	0
SO ₂ (µg/m ³)	24 Hour	0.02 (0.01%)	0.02 (0.01%)	0.02 (0.01%)
PM ₁₀ (µg/m ³)	24 Hour	Negligible	Negligible	-
CO (mg/m ³)	8 Hour	0.3 (3%)	0.08 (1%)	0.02 (0.2%)
Ethanol ³ (mg/m ³)	1 Hour	0.08 (4%)	0.06 (3%)	0.01 (1%)

Source: Table 10, 12, 13, 15-19 (Heggies, 2006a)

1) GLC's under worst case meteorological conditions

2) Criteria – NEPM criteria used for NO₂, SO₂, PM₁₀, and CO. New South Wales impact assessment criteria used for VOC's (for ethanol)

3) Modelling assumed 100% VOC's emitted as ethanol

The model predicted that the cumulative GLC's of pollutants at receiver locations would be below the relevant health criteria, as presented in Table 5.

Table 5. Predicted cumulative ground level concentrations of pollutants

Pollutant	Averaging Time	Ground Level Concentrations ¹ (% Criteria ²)		
		Wells Park	Caravan Park	Kwinana Township
NO _x (µg/m ³)	1 Hour	259	124	103
	Annual	17	13	12
NO ₂ (µg/m ³)	1 Hour	80 (35%)	89 (39%)	103 (46%)
SO ₂ (µg/m ³)	1 Hour	100 (19%)	100 (19%)	100 (19%)
	24 Hour	15 (7%)	15 (7%)	15 (7%)
	Annual	2 (3%)	2 (3%)	2 (3%)
PM ₁₀ (µg/m ³)	24 Hour	35 (69%)	35 (69%)	-
CO (mg/m ³)	8 Hour	4 (43%)	4 (41%)	4 (40%)
Ethanol ³ (mg/m ³)	1 Hour	0.08 (4%)	0.06 (3%)	0.01 (0.5%)

Source: Table 10, 12, 13, 15-19 (Heggies, 2006a)

1) GLC's under worst case meteorological conditions

2) Criteria – NEPM criteria used for NO₂, SO₂, PM₁₀, and CO. New South Wales impact assessment criteria used for VOC's (for ethanol)

3) Modelling assumed 100% VOC's emitted as ethanol

Ground level concentrations were also predicted at five locations within the adjacent recreational reserve to predict the potential effects of gaseous emissions on vegetation. Results were compared to the World Health Organisation (WHO) standard for the protection of vegetation from impacts of NO_x. Modelling indicated that possible exceedances of WHO vegetation-based criteria for NO_x may occur at the receptors within the recreation reserve if the biofilter is modelled as a 'volume source' (Section 6.4 of Heggies, 2006a). When the

biofilter was modelled as a ‘stack source’, no exceedences occurred. In addition, background monitoring data indicates that the GLC’s of NO_x within the recreation reserve may already be elevated.

The proponent has committed to monitoring NO_x levels in the adjacent recreation reserve to ensure impacts from NO_x emissions on vegetation are acceptable.

Odour

The predominant source of odorous emissions from the bio-refinery will be the exhaust gases from the four bio-filters. The ‘Flo-Dry’ bio-filters will be designed to meet an odour concentration of 250 odour units (OU) and the total odorous emission rate is not expected to exceed 6950 OU m³/s under maximum case air flow rate of 27.8 m³/s (100,000 m³/hour) for the four bio-filters.

Primary Energy commissioned Heggies (2006a) to assess odour impacts from the proposed bio-refinery. A screening procedure was used, to demonstrate that odour could meet the two-part ‘green-light’ criterion at sensitive premises as outlined in EPA draft Guidance No. 47 ‘Interim Guidance on Odour as a Relevant Environmental Factor’. Modelling predicted that odour concentrations will be well below the odour criteria as shown in Table 6.

Table 6. AUSPLUME predictions for odour (worst case)

	Predicted Odour Levels (OU)	
	99.5 th percentile (3 minute average)	99.9 th percentile (3 minute average)
Criteria*	2	4
Recreational Reserve	0.5	0.3
Caravan Park	0.03	0.008

Source: Table 8 (Heggies 2006a)

* 2-part ‘green-light’ criterion outlined in draft Guidance No. 47

The proponent has committed to maintaining the efficiency of the biofilters and outlined operational procedures to ensure that plant-upset conditions are minimised. Redundancies and contingency measures have been incorporated into the bio-refinery’s design to minimise odorous emissions. The contingencies for odour control include the capacity to:

- stop processing digested sludge from the thermal drying plants (principle source of odour generation) for maintenance or periods of plant upset;
- redirect air discharge from the thermal drying plants into the any of the four biofilters if maintenance of one is required. Each bio-filter will be designed to process up to 40,000 m³/hour. As a result, the required total air flow of 100,000 m³/hr could be accommodated by three bio-filters with 20% redundancy;
- run gas boilers on either natural gas or bio-gas from the anaerobic digesters. As a result, the bio-gas can be diverted to the gas boilers in the event that the bio-filters are shut down. Electricity production will either reduce or cease temporarily while biofilters are being maintained or repaired; and
- transfer odour streams between biofilters. Biofilter fans will be provided in duty standby mode.

Power outage is not expected to lead to an increase in odorous emissions, as the thermal drying plants will be shut down.

Assessment

The EPA's environmental objectives for this factor are to ensure that:

- ground level concentrations of pollutants both individually and cumulatively meet appropriate health criteria;
- all reasonable and practicable measures are taken to minimise the discharge of gaseous emissions; and
- odours emanating from the proposed development do not adversely affect the welfare and amenity of other land users.

Air Quality

The EPA is aware that during assessment of the proposal the proponent made changes to the bio-refinery's footprint and layout. A number of process improvements were also incorporated into the plant design to achieve significant reductions in gaseous emissions and improvements in plant performance. The EPA considers the proposed gaseous emissions from the bio-refinery to be relatively low.

The EPA notes that modelling predicts that the GLC's of gaseous emissions from the bio-refinery in isolation and cumulatively will meet the NEPM guidelines and other relevant health criteria at sensitive receivers. The EPA, on advice of the DEC, is satisfied that modelling is conservative and that predicted impacts on health will be acceptable. The EPA recommends that a condition (Condition 5) be set that requires the bio-refinery to be designed to not exceed the proposed maximum NO_x emission rate of 3.6g/s to ensure that cumulative impacts will be acceptable.

The EPA notes that the proposed bio-refinery would be the first plant of its kind to be constructed and operated within Australia. Although the four main plant components (processing units) are used in a number of other existing ethanol and fertiliser plants worldwide, the proponent advised the EPA that the proposed interlinking of processing units is new. The EPA therefore considers that the proponent should be required to undertake an independent review of the proposed plant technology by an approved engineering consultancy (Condition 7) prior to submitting a works approval application. The review will best ensure that the proposed plant technology is best practice and that gaseous and odorous emissions will meet the performance levels specified in Umwelt (2007).

The EPA notes that NO_x emissions may exceed WHO vegetation standards in the recreational area to the west of the plant. The EPA notes that Primary Energy has committed to monitoring NO_x GLC's and vegetation condition within the recreation reserve and to undertake further NO_x reduction measures if required. The EPA recommends that this commitment be formalised through a Ministerial Condition (Condition 5) to ensure that NO_x emissions do not adversely effect vegetation within the reserve.

Odour

The proponent has undertaken modelling to demonstrate that odour will not impact on the amenity of nearby residences and other areas including the adjacent recreation reserve. The EPA notes that the two-part green-light odour criterion as detailed in the EPA draft Guidance No. 47 'Interim Guidance on Odour as a Relevant Environmental Factor' has been readily met in the screening assessment.

The EPA is satisfied that the predicted odour impacts will be acceptable based on the performance data provided for the biofilters. However, the EPA is aware of other facilities in

Perth that have experienced problems with biofilter technology, including failure under certain conditions. The EPA considers that effective odour control will be largely dependent on efficient plant operation and maintenance and prompt implementation of contingency measures should periods of plant upset occur. The EPA considers that the monitoring, control and notification system (degree of automation) for parameters such as temperature, humidity, pressure flow rate and pH, will be critical to correct operation.

The EPA notes that the proponent has committed to incorporating a number of redundancies and contingency measures into the design of the biofilters.

The EPA recommends that the proponent be required to prepare and implement an Odour Management Plan (Condition 6) to ensure that odour does not adversely affect the welfare and amenity of nearby land uses. The plan should include monitoring of odorous emissions and biofilter parameters, a complaints management procedure for nearby land users and residents, and management strategies to address issues including shut-down of operations if odorous emissions are considered to be unacceptable. The EPA also recommends that the performance of the biofilters be monitored closely by the DEC during the commissioning phase of the facility.

The EPA considers that the requirement for the proponent to undertake an independent review of the proposed plant technology by an approved engineering consultancy (Condition 7) as described in the air quality assessment section of this bulletin will ensure that implementation of the proposed bio-refinery will meet odour performance levels specified in the EPS (Umwelt, 2007).

Summary

Having particular regard to the:

- proposed emission rates of gaseous pollutants;
- predicted GLC's of gaseous emissions at sensitive receivers; and
- recommended conditions (Condition 5 and 6),

it is the EPA's opinion that the proposal can be managed to meet the EPA's environmental objectives for this factor.

4.2 Noise

Description

The proposed bio-refinery will generate noise emissions from a number of sources including the hammer mills, generators, fans and pumps. Noise will also be generated from road transport to and from the bio-refinery.

Industrial facilities are required to comply with the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations) which specify levels to be met for various types of premises, the most stringent of which is the night time Assigned Level for residential premises. However, since noise levels in the Kwinana-Rockingham area currently exceed noise regulations, proposals must demonstrate that they will not be 'significantly contributing' to noise levels at sensitive receiver locations by being 5dB below the Assigned Level.

The nearest sensitive receivers are in North Rockingham, with the closest residential area and the caravan park being located approximately 800m and 650m respectively southwest of the site.

Fixed Plant Noise

Primary Energy engaged Heggies (2006b) to model noise emissions from the fixed plant. The total unmitigated sound power output from the plant and other associated activities was estimated to be 131dB(A). However, Primary Energy is proposing a number of noise reduction measures including:

- construction of a 5m high acoustic barrier along the southern boundary of CBH, which will adjoin and increase the height of the existing rail wall;
- construction of two 2m high barriers adjacent to the air coolers;
- lining of the generator building and hammer mill buildings with suitable acoustic rated insulation to reduce noise reverberation in the building;
- enclosing agitators on the digestion tanks; and
- construction of three-sided enclosures around all pumps in the digester tank area.

The attenuated sound power outputs are detailed for each source in Appendix 5 of the EPS (Umwelt, 2007).

The Environmental Noise Model was used to predict worst case scenario noise levels at the nearest noise-sensitive premises from the bio-refinery in isolation and cumulatively with other noise sources. Modelling was undertaken in accordance with EPA draft Guidance No. 8 ‘Environmental Noise’ using defined default meteorological conditions.

Modelling predicts that the proposal will not significantly contribute to noise levels at the Caravan Park or North Rockingham, apart from Weld Street and Governor Street as shown in Table 7.

Table 7. Predicted noise levels under worst case conditions at night

Location	Non-contributing Assigned Level (dBA)	Predicted noise level (dBA)
Caravan Park	35	27
Governor St	34	35
Weld St	31	33

Primary Energy has committed to remodelling individual and cumulative noise emissions based on final plant layout and equipment selection prior to commissioning of the plant. Should modelling indicate that the bio-refinery will not comply with Noise Regulations, modifications will be made to the plant to further reduce noise levels.

If required, Primary Energy can reduce its contribution to noise impacts at Weld Street and Governor Street, by approximately 1 dB(A) by locating the acoustic barrier adjacent to the bio-refinery instead of along the southern boundary of the CBH facility. However, this is not the preferred option, as the CBH boundary acoustic wall is expected to also reduce noise impacts from the CBH facility and rail traffic, achieving a significant reduction in cumulative noise impacts. The model predicted that cumulative noise levels would decrease by 6 dB(A) at the caravan park and 2 dB(A) at Weld Street, with no change at Governor Street due to a combination of effective barrier height and distance from noise sources.

Heggies (2006b) conducted an analysis of meteorological data from Woodman Point, proposing that the worst case default meteorological conditions as defined in EPA Guidance 8 are unlikely to occur at the bio-refinery site. Analysis of this data indicated that during the worst month (June 2003 and 2004) the default worst case meteorological conditions did not occur at all at night.

Construction Noise

Construction activity for the bio-refinery will occur within the hours of 7am to 7pm, Monday to Saturday, and will be regulated under Regulation 13 of the noise regulations.

Rail Noise

The bio-refinery is not expected result in an increase in rail noise. Co-operative Bulk Handling advised that they do not anticipate any material changes to the existing operating limits of the grain terminal. This is because grain destined for the bio-refinery will be drawn from stock that would otherwise be destined for export. However, as part of community consultation the proponent commissioned Heggies (2006b) to include a rail noise assessment in their noise report.

Currently, there is an existing acoustic wall of 4m height and 300m in length along the southern end of the rail loop to reduce noise emissions from the railway to residents at North Rockingham. Primary Energy has proposed to extend the length of the existing wall along the southern boundary of CBH and increase the height to 5m.

Assessment

The area considered for assessment is the North Rockingham residential area. The EPA notes that the reasons the assessment is limited to North Rockingham are that the:

- noise received at adjacent industrial premises is predicted to comply with the noise regulations; and
- noise levels predicted at other residential locations were well within the Noise Regulations.

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

- noise emanating from the new plant and associated rail activities will comply with statutory requirements and acceptable standards; and
- noise impacts on North Rockingham are as low as practicable.

The EPA, on advice of the DEC, is satisfied that the noise modelling by Heggies (2006b) has been undertaken in accordance with EPA draft Guidance No. 8 'Environmental Noise'.

The EPA notes that noise levels currently exceed the Noise Regulations within North Rockingham. The EPA also notes that the proposed bio-refinery may significantly contribute to noise levels at Weld Street and Governor Street under worst case meteorological conditions at night. The EPA is also aware that an analysis of Woodman Point meteorological data undertaken by Heggies (2006b), indicates that the predicted 2dB(A) exceedence is unlikely to occur more than 2% of the time at Weld Street. However, the EPA considers, on advice of the DEC, that the above analysis may not represent a conservative approach, and that for the Kwinana area, the default worst case meteorological values should be adopted to provide a consistent approach to noise assessments. Previous noise assessments for the Kwinana Industrial Area have been based on the Hope Valley meteorological data, which indicates that the default worst case meteorological conditions should be used.

The EPA notes that Primary Energy has committed to undertake ongoing noise analysis during final design and that noise emissions will be remodelled prior to being commissioned to ensure compliance with the Noise Regulations. The EPA considers that it is not unreasonable to expect further reductions in noise emissions through careful selection of key items of plant equipment, and a review of plant layout and proposed noise attenuation measures.

The EPA recommends that a Ministerial Condition (Condition 8) be imposed requiring the proponent to prepare a Noise Management Plan so that appropriate actions are undertaken during plant design to ensure compliance with the Noise Regulations will be achieved. It is also recommended that the proponent submit a Noise Monitoring Report following commissioning of the bio-refinery to demonstrate that the Noise Regulations are being met.

The EPA supports the proposed location of a barrier wall to the south of the CBH facility given that it is expected to reduce cumulative noise by 6dB(A) at the Caravan Park and 2dB(A) Weld Street. The EPA recommends that the noise barrier be constructed of concrete to ensure that noise levels at North Rockingham meet assigned noise levels under the Noise Regulations.

The EPA notes that the bio-refinery is not expected to increase rail noise, as operating limits of the CBH facility will remain consistent with current operations.

Summary

Having particular regard to the:

- noise modelling predictions;
- recommended Condition 8, requiring the development of a Noise Management Plan to ensure compliance with the Noise Regulations will be achieved; and
- construction of a acoustic barrier wall, which is expected to significantly reduce cumulative noise impacts at the nearest sensitive receivers,

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

4.3 Vegetation

Description

The bio-refinery will occupy a 19ha site that is partially vegetated. The proponent commissioned Umwelt (2006) to review a flora and vegetation survey of the East Rockingham Industrial Park (IP14) by ATA Environmental, and conduct a reconnaissance survey of the bio-refinery site.

Historically, the bio-refinery site was covered by vegetation of the Quindalup Vegetation Complex. In 1998/99 it was estimated that approximately 47.1% of the pre-clearing extent of this vegetation complex remained. Currently, 14.5% of the original extent of this vegetation complex is protected in the Perth Metropolitan Region (ATA, 2002, cited in Umwelt, 2006).

The current condition of the remnant vegetation on the bio-refinery site is either degraded or completely degraded (Umwelt, 2006), using the Bush Forever Condition Scale. Potential occurrences of Priority (P4) species *Jacksonia sericea* and *Lepidium puberulum* were

identified through searches of relevant databases; however, these species were not located in the reconnaissance survey. A threatened ecological community (TEC), *Sedgeland in Holocene dune swales of the southern Swan Coastal Plain*, occurs to the east and up-gradient of the bio-refinery site. However, the survey did not locate the TEC or any of the characteristic species on the site.

Vegetation of local or regional significance on the bio-refinery site includes a stand of Tuarts (*Eucalyptus gomphocephala*) in the north western area of the site. A maximum of 10 Tuarts will be cleared for the proposed bio-refinery. The area of Tuarts on the bio-refinery site may not be a priority for conservation based on the following considerations:

- nearby areas of Tuarts exist which are of healthier condition. This includes a large area of Tuart woodland immediately west of the subject site, adjacent to Rockingham Beach Road;
- an estimated 2408ha of Tuart woodland occurs within the Kwinana and Rockingham local government areas (Tuart Response Group, 2002, cited in Umwelt, 2006); and
- the bio-refinery site does not contain any nesting habitat for hollow-dependent species.

Primary Energy has committed to rehabilitate the recreational reserve immediately west of the bio-refinery site. This commitment includes planting of approximately 20 Tuarts to replace those that will be removed to build the bio-refinery.

Assessment

The EPA's environmental objective for this factor is to protect the environmental values of areas identified as having significant environmental attributes, such as Tuart ecosystems.

The EPA notes that vegetation to be cleared for the development will be of degraded or completely degraded condition. The EPA also notes the survey undertaken by Umwelt (2006) which indicates that no TEC's, Priority Flora or DRF will be cleared for construction of the bio-refinery. The EPA is also aware that during assessment of this proposal, the size of the site footprint has been reduced, which will minimise the amount of clearing required for the development.

The clearing of Quindalup Vegetation Complex remnants on the site will not reduce the complex to below the 'threshold level' of 30% of the pre-clearing extent of the complex. The EPA therefore considers impacts to this vegetation complex to be acceptable.

With regards to the removal of Tuarts, the EPA notes that the proponent has undertaken a search of hollows in the Tuarts, as part of a fauna habitat study. No hollows were observed in Tuart trees to be cleared, and therefore clearing is unlikely to affect nesting habitat for hollow-dependant species.

The proponent has committed to restore an area of Tuarts within the recreational reserve vested in the City of Rockingham adjacent to the bio-refinery. However, the EPA considers that minimum detail has been provided for the restoration program.

The EPA supports a restoration program that will create a Tuart ecosystem with greater values than the current overstorey vegetation. The restoration program should aim to include mid-storey and understorey species native to this area. The EPA considers that a higher ratio than 2:1 for the replacement of Tuarts would be more appropriate to ensure the survival of an

equivalent number of Tuart trees. The EPA recommends that the proponent consult with DEC and the City of Rockingham regarding appropriate restoration of this area.

Summary

Having particular regard to the:

- studies undertaken by the proponent;
- DEC's advice; and
- proponent's commitment to restore an area of Tuart bushland within the recreational reserve adjacent to the bio-refinery;

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

5. Conditions

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.

5.1 Recommended conditions

Having considered the proponent's commitments and the information provided in this report, the EPA has developed a set of conditions that the EPA recommends be imposed if the proposal by Primary Energy to construct and operate a bio-refinery is approved for implementation. These conditions are presented in Appendix 3.

6. Conclusions

The EPA has considered the proposal by Primary Energy to construct and operate a bio-refinery.

Air Quality and Odour

The EPA is satisfied that the air dispersion modelling is conservative, and that the NEPM guidelines and other relevant health criteria can be readily met at all sensitive receivers. The EPA recommends that a condition (Condition 5) be set that requires the bio-refinery to be designed to not exceed the proposed maximum NO_x emission rate of 3.6g/s to ensure cumulative impacts will be acceptable.

The EPA notes that NO_x emissions may exceed WHO vegetation standards in the recreational area to the west of the plant. The EPA notes that Primary Energy has committed to monitoring NO_x GLC's and vegetation condition within the recreation reserve, and if required, further reduce NO_x emissions. The EPA recommends that this commitment be

formalised through a Ministerial Condition (Condition 5) to ensure that NO_x emissions do not adversely effect vegetation within the reserve.

The EPA notes that odour modelling indicates that the two-part green-light odour criterion, as detailed in EPA draft Guidance No. 47 'Interim Guidance on Odour as a Relevant Environmental Factor' can be readily met.

The EPA is satisfied that impacts from odour will be acceptable under normal operation based on the performance data provided for the biofilters. However, the EPA notes that effective odour control will be largely dependant on efficient plant operation and maintenance and prompt implementation of contingency measures, should periods of plant upset occur.

The EPA recommends that the proponent be required to prepare and implement an Odour Management Plan (Condition 6) to ensure that odour does not adversely affect the welfare and amenity of nearby land users. The plan should include monitoring of odorous emissions and bio-filter parameters, a complaints management procedure for nearby land users and residents, and management strategies to address issues including shut-down of operations if odorous emissions are unacceptable.

The EPA notes that the proposed bio-refinery would be the first plant of its kind to be constructed and operated within Australia. The EPA considers that the proponent should be required to undertake an independent review of the proposed plant technology by an approved engineering consultancy (Condition 7) prior to submitting a works approval application. The review will best ensure that the proposed plant technology is best practice and that gaseous and odorous emissions will meet the performance levels specified in Umwelt (2007).

Noise

The EPA notes that noise levels currently exceed the Noise Regulations within North Rockingham. The EPA also notes that the proposed bio-refinery may significantly contribute to noise levels at Weld Street and Governor Street under worst case meteorological conditions at night.

The EPA notes that Primary Energy has committed to undertake ongoing noise analysis during final design and that noise emissions will be remodelled prior to being commissioned to ensure compliance with the Noise Regulations. The EPA considers that it is not unreasonable to expect further reductions in noise emissions through careful selection of key items of plant equipment, and a review of plant layout and proposed noise attenuation measures.

The EPA recommends that a Ministerial Condition (Condition 8) be imposed requiring the proponent to prepare a Noise Management Plan so that appropriate actions are undertaken during plant design to ensure compliance with the Noise Regulations is achieved. It is also recommended that the proponent submit a Noise Monitoring Report following commissioning of the bio-refinery to demonstrate that the Noise Regulations are being met.

Modelling undertaken by Heggies (2006b) indicates that the construction of an acoustic wall at south of CBH facility will reduce cumulative noise by 6dB(A) at the Caravan Park and 2dB(A) Weld Street. The EPA supports the proposed location of the acoustic wall, provided that the bio-refinery can achieve compliance with the Noise Regulations at North Rockingham.

The bio-refinery is not expected to increase rail noise, as operating limits of the CBH facility will remain consistent with current operations.

Vegetation

The vegetation to be cleared for the development will be of degraded or completely degraded condition. The survey undertaken by Umwelt (2006) indicates that no TEC's, Priority Flora or DRF will be cleared for construction of the bio-refinery.

The clearing of Quindalup Vegetation Complex remnants on the site will not reduce the complex to below the 'threshold level' of 30% of the pre-clearing extent of the complex. The EPA therefore considers impacts to this vegetation complex to be acceptable.

No hollows were observed in Tuart trees to be cleared, and therefore clearing is unlikely to affect nesting habitat for hollow-dependant species.

The proponent has committed to restore an area of Tuarts within the recreational reserve adjacent to the bio-refinery. However, the EPA considers that minimum detail has been provided for the restoration program. The EPA supports a restoration program that will create a Tuart ecosystem with greater values than the current overstorey vegetation. The restoration program should aim to include mid-storey and understorey species native to this area. The EPA considers that a higher ratio than 2:1 for the replacement of Tuarts would be more appropriate to ensure the survival of an equivalent number of Tuart trees. The EPA recommends that the proponent consult with DEC and the City of Rockingham regarding appropriate restoration of this area.

The EPA has therefore concluded that the proposal can be managed to meet the EPA's environmental objectives, provided there is satisfactory implementation by the proponent of their commitments and the recommended conditions set out in Appendix 3.

7. Recommendations

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

1. That the Minister notes that the proposal being assessed is for construction and operation of a bio-refinery at East Rockingham Industrial Park by Primary Energy;
2. That the Minister considers the report on the key environmental factors as set out in Section 4;
3. That the Minister notes that the EPA has concluded that the proposal can be managed to meet the EPA's environmental objectives, provided there is satisfactory implementation by the proponent of the recommended conditions set out in Appendix 3, including the proponent's commitments; and
4. That the Minister imposes the conditions and procedures recommended in Appendix 3 of this report.

Appendix 1

References

Environmental Protection Authority (2006). *Draft Guidance Statement 8: Environmental Noise*. (Unpubl.) Perth, WA.

Environmental Protection Authority (2006). *Interim Guidance on odour as a relevant environmental factor*. (Unpubl.) Perth, WA.

Heggies (2006a). *Kwinana Bio-Refinery. Air Quality Impact Assessment*. (Unpubl.) December, 2006, Sydney, NSW.

Heggies (2006b). *Kwinana Ethanol Plant – Revised Noise Impact Assessment*. (Unpubl.) January 2007. Sydney, NSW.

Umwelt (2006). *Flora and Fauna Assessment of Proposed Kwinana Ethanol Bio-Refinery*. (Unpubl.) September 2006, Sydney, NSW.

Umwelt (2007). *Proposed Kwinana Ethanol Bio-Refinery. Primary Energy*. (Unpubl.) February 2007, Sydney, NSW.

Appendix 2

Proponents Management Actions

Table 1. Proponents Environmental Management Actions

Item No.	Topic	Actions	Advice
1	Air Quality	<p>Ground level NO_x concentrations and the health of the vegetation within the recreation reserve immediately to the west of the proposed bio-refinery will be monitored to determine if NO_x emissions from the operation of the bio-refinery are having an adverse impact on native vegetation in the area.</p> <p>If adverse impacts on the vegetation are being observed or elevated NO_x concentrations are being recorded, a range of contingency measures will be reviewed and implemented.</p> <p>As a guide to the potential for impacts on native vegetation, ground level NO_x concentrations will be compared with suggested World Health Organisation 2000 levels of 30 µg/m³ annual average and 75 µg/m³ 24 hour average unless more relevant guidelines specific to Australian native plants can be identified.</p>	DEC
2	Vegetation	<p>Primary Energy will work with local environmental and community groups to remove weeds, rubbish and debris from the recreation reserve area immediately to the west of the proposed bio-refinery site. Primary Energy will rehabilitate this reserve with native species including planting approximately 20 Tuarts to replace the 5 to 10 that will be removed to facilitate the development of the proposed bio-refinery.</p>	DEC

Appendix 3

Recommended Environmental Conditions

RECOMMENDED ENVIRONMENTAL CONDITIONS

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

KWINANA ETHANOL BIO-REFINERY KWINANA INDUSTRIAL AREA

Proposal: The construction and operation of a bio-refinery on a 19 hectare site in the Kwinana Industrial Area. The proposal is documented in schedule 1 of this statement.

Proponent: Primary Energy Pty Limited

Proponent Address: PO Box 1734 TAMWORTH NSW 2340

Assessment Number: 1668

Report of the Environmental Protection Authority: Bulletin 1248

The proposal referred to in the above report of the Environmental Protection Authority may be implemented. The implementation of that proposal is subject to the following conditions and procedures:

1 Proposal Implementation

1-1 The proponent shall implement the proposal as documented and described in schedule 1 of this statement subject to the conditions and procedures of this statement.

2 Proponent Nomination and Contact Details

2-1 The proponent for the time being nominated by the Minister for the Environment under sections 38(6) or 38(7) of the *Environmental Protection Act 1986* is responsible for the implementation of the proposal.

2-2 The proponent shall notify the Chief Executive Officer of the Department of Environment and Conservation (CEO) of any change of the name and address of the proponent for the serving of a notice or other correspondence within 30 days of such change.

3 Time Limit of Authorisation

3-1 The authorisation to implement the proposal provided for in this statement shall lapse and be void within five years after the date of this statement if the proposal to which this statement relates is not substantially commenced.

- 3-2 The proponent shall provide the CEO with written evidence which demonstrates that the proposal has substantially commenced on or before the expiration of five years from the date of this statement.

4 Compliance Reporting

- 4-1 The proponent shall submit to the CEO environmental compliance reports annually reporting on the previous twelve-month period, unless required by the CEO to report more frequently.

- 4-2 The environmental compliance reports shall address each element of an audit program approved by the CEO and shall be prepared and submitted in a format acceptable to the CEO.

- 4-3 The environmental compliance reports shall:

1. be endorsed by signature of the proponent's Chief Executive Officer or a person, approved in writing by the CEO, delegated to sign on behalf of the proponent's Chief Executive Officer;
2. state whether the proponent has complied with each condition and procedure contained in this statement;
3. provide verifiable evidence of compliance with each condition and procedure contained in this statement;
4. state whether the proponent has complied with each key action contained in any environmental management plan or program required by this statement;
5. provide verifiable evidence of conformance with each key action contained in any environmental management plan or program required by this statement;
6. identify all non-compliances and non-conformances and describe the corrective and preventative actions taken in relation to each non-compliance or non-conformance;
7. provide an assessment of the effectiveness of all corrective and preventative actions taken; and
8. describe the state of implementation of the proposal.

- 4-4 The proponent shall make the environmental compliance reports required by condition 4-1 publicly available in a manner approved by the CEO.

5 Oxides of Nitrogen Emissions

- 5-1 The proponent shall design and construct the bio-refinery to meet a total plant NO_x emission rate not exceeding 3.6 grams per second through the utilisation of

low NO_x gas burner and engine technology and other NO_x emissions reduction technology.

- 5-2 Within 12 months following commencement of operation of the bio-refinery, the proponent shall submit a “Nitrous Oxides and Nitrogen Dioxide Concentration” report to the Department of Environment and Conservation to demonstrate that cumulative ground level concentrations of nitrogen dioxide at Wells Park meet the National Environmental Protection Measures or other relevant health criteria, and that cumulative ground level concentrations of nitrous oxides at the recreational Park meet the relevant World Health Organisation criteria for vegetation under worst-case emissions and meteorological conditions.

6 Odour

- 6-1 Prior to commencement of operation, the proponent shall prepare an Odour Management Plan to manage the impacts of odour on health and amenity, to the requirements of the Minister for the Environment on advice of the Environmental Protection Authority

This Plan shall address the following:

1. the biofilter commissioning period;
 2. the procedures for the replacement of the biofilter media;
 3. an initial dynamic olfactometry determination;
 4. regular checks of biofilter loading to ensure the biofilter is balanced and to identify any short circuits (eg surface flow rate measurements and smoke tests);
 5. regular qualitative determination of odour from the facility;
 6. contingency plans during upset or maintenance conditions; and
 7. complaint registration, investigation, response and reporting.
- 6-2 The proponent shall implement the Odour Management Plan, required by condition 6-1.
- 6-3 The proponent shall make the Odour Management Plan, required by condition 6-1 publicly available in a manner approved by the CEO.

7 Independent Design Review

- 7-1 Prior to submitting a Works Approval application meeting the requirements of the Department of Environment and Conservation, the proponent shall undertake an Independent Design Review (IDR) of the proposed plant technology, conducted by an approved engineering consultancy that specialises in design, construction, commissioning and monitoring of large industrial equipment. The proponent shall also seek specialist input from international experts where required.

The IDR shall assess the engineering design details for the bio-refinery prior to the Works Approval application to advise the Department of Environment and Conservation on whether the design meets international best practice in terms of plant technology, gaseous emissions and odour control and management. The review shall also confirm that the proposed technology can achieve the emissions performance levels specified in *Proposed Kwinana Ethanol Bio-Refinery – Primary Energy* (Umwelt, 2007) including Appendix 4 of that document.

8 Noise

- 8-1 Prior to construction, the proponent shall prepare and implement a Noise Management Plan (NMP) to demonstrate that noise emanating from the bio-refinery is as low as reasonably practicable and that compliance with the *Environmental Protection (Noise) Regulations 1997* (Noise Regulations) will be achieved at all noise-sensitive receptors under default worst-case meteorological conditions.

The NMP shall include:

- 1 Remodelling of plant noise emissions based on final plant layout and equipment selection;
- 2 Procedures for purchasing quiet equipment that includes noise limits for key items of equipment that will be reflected in supply contracts; and
- 3 If required, noise reduction measures to be implemented prior to plant operation to achieve compliance with the Noise Regulations.

Note: Default worst case meteorological conditions at night (ie. 3 metres per second wind speed, 2°C/100 metre temperature inversion lapse rate, 15°C temperature, 50% relative humidity), with a positive wind direction from source to receiver.

This plan shall be implemented at appropriate times, and be made publicly available in a manner approved by the CEO.

- 8-2 Within six months following commencement of operation of the bio-refinery, the proponent shall prepare a Noise Monitoring Report, demonstrating compliance with the Noise Regulations.
- 8-3 The proponent shall construct a concrete noise barrier to ensure that noise levels at North Rockingham meet the assigned noise levels under the Noise Regulations.
- 8-4 The proponent shall construct the concrete noise barrier at the southern boundary of the bio-refinery site in the event that the barrier cannot be constructed south of the Cooperative Bulk Handling facility as detailed in *Proposed Kwinana Ethanol Bio-Refinery – Primary Energy* (Umwelt, 2007).

Notes

1. Where a condition states "on advice of the Environmental Protection Authority", the Environmental Protection Authority will provide that advice to the Department of Environment and Conservation for the preparation of written notice to the proponent.
2. The Environmental Protection Authority may seek advice from other agencies or organisations, as required, in order to provide its advice to the Department of Environment and Conservation.
3. The Minister for the Environment will determine any dispute between the proponent and the Environmental Protection Authority or the Department of Environment and Conservation over the fulfilment of the requirements of the conditions.
4. 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 1986*.

The Proposal (Assessment No. 1668)

General Description

The proposal is to construct and operate an ethanol refinery (bio-refinery) on a 19 ha site in the IP14 East Rockingham Industrial Park which adjoins the southern boundary of the Kwinana Industrial Area (figures 1 and 2).

The bio-refinery will consist of a series of processes that convert wheat and grain into:

- bio-fuel, or fuel grade ethanol;
- bio-gas (predominantly methane), which will fuel generators to produce electricity;
- aqueous ammonia, a precursor of fertiliser; and
- fertiliser.

Summary Description

A summary of the key proposal characteristics is presented in Table 1.

Table 1: Summary of the Key Proposal Characteristics

Element	Description
Site location	45km south-west of Perth, within the IP14 East Rockingham Industrial Park and Kwinana Industrial Area
Site area	19 ha
Products generated	Fuel grade ethanol – 160 ML/a Fertiliser - 350,000 t/a Aqueous ammonia - 16,000 t/a
Inputs	Wheat or other grains, starch and wheat dust - 400,000 t/a Fertiliser input material (trace elements and granular phosphate)- 280,000 t/a
Hours of operation	Construction – 7am – 7pm, Monday to Saturday Operation – 24 hour day, 7 day week Transport of ethanol - Monday to Saturday Transport of aqueous ammonia and fertiliser - Monday to Friday
Power generation	23 MW
Net reduction of greenhouse gases	400,000 t/a of CO _{2-e}
Water requirements	50,000 kL/a, sourced from Sepia Depression Line or alternative source

Abbreviations:

- ha – hectare
- kL/a – kilolitres per annum
- ML/a – megalitres per annum
- MW – megawatts
- t/a – tonnes per annum
- e - equivalent

Figures (see main body of bulletin)

Figure 1 - Location of the Kwinana ethanol bio-refinery

Figure 2 - Locality plan of the Kwinana ethanol bio-refinery (Figure 3 above)