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## **NOISE IMPACT STATEMENT**

### **FLUIDISED CATALYTIC CRACKING UNIT UPGRADE**

#### **SHELL CLYDE REFINERY**

**REPORT J0029-43-R2**

**25th OCTOBER 2006**

Prepared for:  
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## **1. INTRODUCTION**

Shell Refining (Australia) Pty Ltd (Shell) has proposed an upgrade to the Fluidised Catalytic Cracking Unit (FCCU) within the Clyde Refinery at Rosehill which was originally commissioned in 1962. The FCCU's function is to convert heavy hydrocarbon molecules into lighter molecules that can be blended into petrol products and Liquefied Petroleum Gas (LPG).

The main reactor and stripper vessels are approaching the end of their useful life. The project includes replacement of both reactor and stripper with a single combined unit and replacement of the internal regenerator cyclones. The capacity of the entire FCCU is not proposed to change as a result of this project.

The entire refinery site is located in the Rosehill industrial area a few kilometres east of Parramatta. It is generally bounded by other industries and Grand Avenue to the north, Duck River to the south and east and other industries and Durham Street to the west. A plan of the refinery site is included in Appendix A.

This assessment was commissioned by CH2M HILL Australia Pty Ltd on behalf of Shell to support a Development Application for the project.

## **2. RECEIVER AREAS**

### **2.1. Industrial Receivers**

Nearest industrial receivers not associated with the refinery are approximately 150m north west of the FCCU on the opposite side of Durham Street, with others located along Durham Street and Grand Avenue. Industrial properties near the refinery include a plasterboard manufacturing plant, shipping container handling depot, plastic pipe manufacturing plant and a concrete recycling plant. The entire refinery site is almost completely surrounded by industrial properties to a distance of over 700m from the FCCU.

### **2.2. Residential Receivers**

Closest Silverwater residences are located approximately 720m to the south east while the main Silverwater residential area is approximately 920m from the site. The Rydalmere residential area is approximately 1250m to the north east, while closest Harris Park residences are over 1500m to the west.

Rydalmere residents currently receive industrial noise from the refinery and other industries in the Rosehill and Rydalmere industrial areas and road traffic noise from Silverwater Road and Victoria Road. Silverwater residents currently receive noise from the refinery, local industries and traffic on the M4 Motorway and Silverwater Road. Harris Park residents primarily receive noise from James Ruse Drive and local roads.

### **2.3. Other Receivers**

Properties best described as 'commercial' are scattered throughout the Silverwater and Auburn industrial estates, generally east to south of the refinery at least 600m from the site. Active recreation areas exist west of the site, particularly the Rosehill Gardens Racecourse and Granville

Showground, while passive recreation areas include Silverwater Park off Clyde Street Silverwater approximately 1000m east of the site.

The closest school is located approximately 1500m to the north between Victoria Road and South Street in Rydalmere while the closest church is approximately 1800m north on Victoria Road near Rydalmere Park. Rydalmere Hospital is located on the corner of James Ruse Drive and Victoria Road over 700m north west of the site.

Apart from industrial properties that are not particularly sensitive to noise, this discussion indicates all other receivers are at least 700m and usually over 1000m from the FCCU.

### **3. EXISTING ACOUSTIC ENVIRONMENT**

Refinery personnel and independent consultants have regularly surveyed the acoustic environment surrounding the refinery site for the last 30 years. The most recent survey was completed by Bridges Acoustics in July, October and November 2004 in response to Pollution Reduction Program E4 agreed between the Environment Protection Authority (EPA) and Shell. Survey results were described in Report J0063-09-R1 “Environmental Noise Assessment – Shell Clyde Refinery” dated 29th November 2004.

The survey consisted of measurements over at least 7 days using noise loggers at each of the following locations:

- Location 1. South eastern corner of Asquith Street and Skarratt Street, Silverwater,
- Location 2. South eastern corner of John Street and Nowill Street, Rydalmere,
- Location 3. On the western side of Arthur Street opposite Hope Street, Harris Park,
- Location 4. At the western end of Carnarvon Street, Silverwater,
- Location 5. At the western end of Holker Street, Silverwater,
- Location 6. At the intersection of Durham Street and Grand Avenue, Camellia.

Attended noise measurements over 15 minute periods were taken close to each logger location described above, in order to accurately quantify the refinery’s noise contribution. Additional attended noise measurements were also taken at the following locations:

- Location 7. On the corner of Durham Street and Devon Street Camellia, on the boundary of the adjacent industrial premises,
- Location 8. On the south eastern corner of Stubbs Street and Carnarvon Street Silverwater, in front of residential properties.
- Location 9. Off Millennium Circuit Silverwater, approximately 200m north of Derby Street and directly opposite the refinery’s cooling towers.
- Location 10. North western corner of Picken Street and Clyde Street in Silverwater Park, north east of the refinery and directly opposite the Basell plant.
- Location 11. In front of residential units at 16 Sylvia Street Rydalmere, well shielded from refinery noise.

Figure 1 shows noise monitoring locations compared to the refinery site, taken from Appendix A of the November 2004 report.

Figure 1: Area Plan Showing Noise Monitoring Locations.



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Black markers and attached numbers show monitoring locations referred to in this report.

Attended noise measurements were taken during the day, evening and night at locations 1 to 7, although the majority of measurements were taken during the late evening and night as the refinery is generally more audible during these periods. Noise measurements at locations 8 to 11 inclusive were only taken during the evening and night.

Noise level data obtained during the survey were processed to determine background noise levels, in the absence of the refinery, as reported to the EPA and reproduced in Table 1.

**Table 1: INP Background Noise Levels Excluding Refinery Contribution, dB(A).**

Receiver Type	Location	Background Level, LA90,15min		
		Day	Evening	Night
Residential	Silverwater	48	47	43
	Rydalmere (John Street)	45	45	46
	Harris Park	48	47	40
Commercial, Industrial	Silverwater (Carnarvon Street)	47	46	42
	Silverwater (Holker Street)	45	45	46
	Camellia (Grand Avenue)	55	55	55
	Camellia (Devon Street)	66	66	66

## 4. NOISE CRITERIA

### 4.1. Construction Noise

Criteria applied to the construction period are sourced from Chapter 171 of the EPA's Environmental Noise Control Manual (ENCM), as follows:

- For construction periods up to 4 weeks – 20 dBA above the background noise level
- For periods between 4 and 26 weeks – 10 dBA above the background noise level

Construction work associated with this project is expected to take approximately 8 weeks, excluding minor work before and after the major shutdown, so noise criteria 10 decibels above the background level are adopted for this assessment. Construction work meeting operational noise criteria can occur at any time of the day or night, although work during normal daytime working hours would be preferred to minimise audibility at residences.

Table 2 shows construction noise criteria for normal construction hours, along with normal operational noise criteria for any out of hours work that may be required, based on the background noise levels reported in Table 1 above and noise criteria for the existing refinery as reported to the EPA in 2004. As the FCCU would be shut down during this period, the noise criteria in Table 1 have been based on background noise levels that would be measured in the absence of the FCCU.

**Table 2: Construction Noise Criteria, dB(A)**

Receiver Type	Location	Construction Noise Criteria, LA10,15min		
		Day	Evening	Night
Residential	Silverwater	58	52	48
	Rydalmere (John Street)	55	50	47
	Harris Park	58	50	45
Commercial, Industrial	Silverwater (Carnarvon Street)	70	70	70
	Silverwater (Holker Street)	70	70	70
	Camellia (Grand Avenue)	70	70	70
	Camellia (Devon Street)	67	67	67

## 4.2. Operational Noise

Operational noise criteria have been determined according to procedures recommended in the INP, based on background noise levels that would be measured in the absence of the refinery, as shown in Table 3.

**Table 3: INP Noise Criteria, New or Upgraded Equipment, dB(A)**

Receiver	Residential			Industrial			
	Silver-water Asquith St	Rydalmere John St	Harris Park Arthur St	Silver-water Carnarvon	Silver-water Holker St	Camellia Grand Av	Camellia Devon St
Time Period	Day Evening Night	Day Evening Night	Day Evening Night	Day Evening Night	Day Evening Night	Day Evening Night	Day Evening Night
Background excl. refinery LA90,15min	48 47 43	45 45 46	48 47 40	47 46 42	45 45 46	55 55 55	66 66 66
<b>Intrusive Criteria, LAeq,15min</b>	53 52 48	50 50 51	53 52 45	Intrusive noise criteria do not apply to industrial receivers.			
<b>Sleep Disturb. Criteria, LA1,1min</b>	- - 58	- - 61	- - 55	Sleep disturbance criteria do not apply to industrial receivers.			
Amenity Limit, LAeq,period	60 50 45	60 50 45	60 50 45	70 70 70	70 70 70	70 70 70	70 70 70
Exist. excluding refinery, LAeq,period	47 < 35 < 35	52 49 47	<41 <42 <35	<50 <50 <40	46 46 47	56 56 56	67 67 67
<b>Amenity Criteria, LAeq,period</b>	60 50 45	60 44 35	60 50 45	70 70 70	70 70 70	70 70 70	67 67 67
<b>Upgrade Criteria, LAeq,15min</b>	53 52 45	50 44 35	53 50 45	70 70 70	70 70 70	70 70 70	67 67 67
Exist. Refinery Contribution, LAeq,period	41 46 48	45 47 48	<41 <42 <35	52 53 52	46 46 47	65 50 63	67 67 67
<b>Additional Sources, * LAeq,period</b>	53 51 35	48 35 35	53 50 45	70 70 70	70 70 70	68 70 70	57 57 57

\* Noise criteria applied to any additional noise from new plant and equipment installed within the refinery, in order to meet noise criteria for upgrade projects when existing refinery noise levels are considered.

## 5. ASSESSMENT

### 5.1. Construction Sources

Construction work associated with the project would include removal of existing reactor, stripper and regenerator vessels using large cranes and hand tools, minor civil work to modify the existing foundations to suit the new equipment, installation of new equipment using large cranes and hand tools then installation of relatively minor items such as pipes and valves to reconnect the system. Quieter work would include electrical cabling, painting, testing and commissioning

In the absence of major civil work, which is typically the loudest construction phase, significant construction noise levels would be produced by the following assumed equipment fleet:

- Three trucks,
- Two small cranes,
- Two large cranes,
- One 80m crane which will require 4 other cranes to assemble it on site,
- Two impact wrenches,
- Two compressors, and
- Ten portable welders.

These construction sources produce a combined sound power of 115 dBA assuming they all operate simultaneously. Other likely construction scenarios result in a lower sound power and have not been specifically assessed.

### 5.2. Construction Noise Levels

The worst case construction sound power level of 115 dBA is likely to result in the received noise levels shown in Table 4 below under noise enhancing weather conditions where relevant.

**Table 4: Predicted Worst Case Civil Construction Noise Levels, LA10,15min.**

Receiver	Distance, metres	Received Level, LA10		Criteria, LA10		
		Day	Even, Night	Day	Even.	Night
<b>CLOSEST RESIDENTIAL AREAS</b>						
Silverwater (south east)	720	35	40	58	52	48
Rydalmere (north)	1250	33	38	55	50	47
Harris Park (west)	1500	28	33	58	50	45
<b>CLOSEST COMMERCIAL PROPERTY</b>						
Silverwater (east)	600	38	44	70	70	70
<b>CLOSEST INDUSTRIAL PROPERTY</b>						
Rosehill (west)	150	53	57	67	67	67

Table 4 shows predicted worst case construction noise levels meet appropriate criteria during all time periods. It should be noted that construction activities with cranes and other diesel powered machines working on the site would sound similar to existing truck movements within the refinery, and that regular truck movements currently occur at all hours to maintain and operate the refinery.

Typical construction noise is unlikely to be audible during the day, or would be barely and occasionally audible at worst, based on the results in Table 4. Some construction work is assumed to occur during the night to minimise the shutdown period and can occur if required without exceeding or even approaching conservative operational noise criteria at any receiver.

### 5.3. Operational Noise

The existing and replacement reactor, stripper and regenerator units are thick walled pressure vessels containing hydrocarbons at elevated temperature and pressure. These vessels and the large pipes that connect to them are not likely to produce significant noise due to their mass and wall stiffness. Rotating equipment such as fans and pumps are the major noise sources within the FCCU but most of these items are not proposed to be replaced or modified as part of this project.

Shell has advised the following noise generating equipment would be potentially affected by the project:

- The combustion air blowers, one electrically driven and one turbine driven, are proposed to be replaced. The replacement blowers would be acoustically insulated to produce less than 80 dBA at 1m from their exposed surfaces, implying a sound power level of less than 98 dBA from each new blower.
- Pump P321A would be refurbished and fitted with a new impellor to marginally increase its capacity. The refurbished pump will continue to produce less than 82 dBA at 1m from its surface, implying a sound power level of less than 96 dBA per pump.
- Relief valves on the No. 8 boiler may require replacement as part of the project. The valves operate, on average, once every 4 years during a plant shutdown. Any new relief valves installed to replace the existing units would be fitted with silencers, implying a sound power level of less than 93 dBA assuming a sound level of 85 dBA at 1m from the silencer outlets.

The worst case sound power level of 103 dBA from proposed new or refurbished equipment is expected to produce the received noise levels shown in Table 5. Received noise levels have been predicted during the day, under neutral weather conditions, and during the night under prevailing (noise enhancing) conditions including a temperature inversion.

**Table 5: Predicted Received Noise Levels From New/Refurbished Equipment, LAeq,15min.**

Receiver	Distance, metres	Received Level, LA10		Criteria, LA10		
		Day	Even, Night	Day	Even.	Night
<b>CLOSEST RESIDENTIAL AREAS</b>						
Silverwater (south east)	720	28	33	53	51	35
Rydalmer (north)	1250	21	29	48	35	35
Harris Park (west)	1500	19	26	53	50	45
<b>CLOSEST COMMERCIAL PROPERTY</b>						
Silverwater (east)	600	30	35	70	70	70
<b>CLOSEST INDUSTRIAL PROPERTY</b>						
Camellia (west)	150	53	54	67	67	67

Table 5 shows noise levels from proposed new or refurbished equipment would comply with relevant INP criteria at all residential or other noise sensitive properties. Compliance with these criteria would ensure proposed equipment is inaudible compared to the remainder of the refinery

and other sources of background noise and, more importantly, would allow noise levels from the entire refinery to gradually reduce to meet the amenity criteria as various other components are upgraded or replaced.

Shell is currently negotiating a Pollution Reduction Program (PRP) with the Department of Environment & Conservation (DEC) to investigate and reduce overall noise emissions from the refinery site, mainly by targeting dominant sources of constant or intermittent noise. Noise sources such as control valves, relief valves and power recovery turbines have been replaced or enclosed in the last few years as part of an earlier PRP. As the PRP targets the loudest sources as viewed from receiver areas it potentially offers the greatest overall reductions in site noise, rather than applying noise treatment to components that are now, and will continue to be, barely audible or inaudible at receivers.

The following components of the FCCU have been or are being included in the current or future PRP:

- K301A, K301B power recovery turbines – acoustic enclosures have been fitted,
- 18PC537A MP-LP steam vent – acoustic controls have been fitted,
- K303B/C/D air blowers – acoustic enclosures to be fitted,
- 18PC537B LP steam vent – process changes proposed to remove the need for steam venting.

#### **5.4. Traffic Noise**

The project is expected to require up to four boat or barge movements on the Parramatta and Duck Rivers to deliver the reactor/stripper and regenerator, as these items are more easily transported by water given their size rather than via road. All other equipment such as pipes and valves would be transported by road. Noise from boat or barge movements is not considered in detail given the low number of noise ‘events’ produced by the project.

An estimated 30 trucks (60 movements) would be required to deliver new equipment, while another 30 heavy vehicles such as cranes and heavy floats would be required to deliver construction machines and equipment to site. Vehicle movements would occur before, during and after the shutdown period and may reach 10 movements per day during the shutdown.

Approximately 25 construction planning and preparation staff would be employed before and after the shutdown and approximately 500 people during the shutdown to replace outdated equipment and to complete minor repair and maintenance tasks within various parts of the refinery including the FCCU to take advantage of the shutdown period. With some car pooling, the construction workforce is expected to generate approximately 450 vehicle movements in an assumed one-hour period as people arrive for work or depart.

The car and truck access route to the site includes James Ruse Drive, Grand Avenue and Durham Street. Predicted worst case construction traffic is insignificant compared to existing traffic on James Ruse Drive, while Grand Avenue also carries heavy truck traffic generated by other industrial developments in the Rosehill area. With proposed traffic flows during the construction period being significantly less than existing traffic flows on roads approaching the site and with no sensitive residential developments along this route, no traffic noise impacts are expected to occur.

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## 6. CONCLUSION

This assessment shows received noise levels from construction activities associated with the proposed FCCU upgrade would be acceptable at all industrial, commercial and residential properties compared to daytime construction noise criteria and normal operational noise criteria for the refinery site at all hours. Construction noise would primarily be inaudible, or at worst would be barely audible, at all noise sensitive properties. Construction work could be carried out during the evening or night if required to meet project deadlines with little risk of exceeding appropriate operational noise criteria.

Road traffic associated with construction work would cause a slight increase in noise levels from Grand Avenue and the northern end of Durham Street. With no noise sensitive properties located near these roads and additional traffic only occurring during the construction period, no traffic noise mitigation measures are required or have been recommended.

No additional environmental noise would be generated during operation of the upgraded FCCU as noise levels produced by all new or refurbished noise generating equipment are within the conservative operational noise criterion of 35 LAeq,15min at all sensitive receivers including residences. It is noted that the refinery is subject to a Pollution Reduction Program (PRP) agreed with the DEC to target dominant sources of noise on the site and that noise reductions achieved by the PRP are in addition to and are not related to this project.

The results of this assessment show no need for noise control measures to be considered during the construction or operational phases of the project beyond those measures already proposed by Shell for new or refurbished equipment.

### APPENDIX A – SITE PLAN

