SHELL CLYDE REFINERY.

"FCCU Reactor & Regenerator Rejuvenation Project".

1. Summary.

Shell Refining (Australia) Pty Ltd at Clyde Refinery operates a Fluidised Catalytic Cracking Unit (FCCU), which is a unit predominantly responsible for petrol (Motor Gasoline, or Mogas) production from site. This unit has been in operation since 1963. The heart of the FCCU process is the Reactor and Regeneration (R&R) section, where the conversion from heavy fuel oil to Mogas takes place. Critical components of the R&R section are approaching end of life and hence this project seeks to replace these key critical components.

Costing some A$45 million, this investment seeks predominantly to restore the integrity of the unit by replacement of critical components rather than current practise of expensive and extensive repairs at planned maintenance intervals. Given the importance of this unit in producing Mogas for Sydney Market, this project will therefore ensure on going viability for the site and its ~350 employees.

The throughput and operation of the existing FCCU remains essentially unchanged as the proposed replacement is essentially like for like replacement for these key components. The use of modern equipment design allows significant reduction is energy consumption as well as hydrocarbon inventory within the system, i.e. reduction in hazards as well as improved unit efficiency.

Clyde Refinery is managed in accordance with the local legal requirements, Shell global standards as well as the Refinery's HSEQ Management System, which is certified to ISO9001, ISO14001 and AS4801.

2. Background.

2.1 FCCU Complex.

The FCCU complex, commissioned in 1962, is one of the main conversion units on site, responsible for converting heavy oil (fuel oil) from the crude oil into predominately Mogas and Liquefied Petroleum Gas (LPG). Mogas produced from the FCCU represents ~50% of the Mogas produced on site and therefore a major contributor to the Mogas production within NSW. In summary, conversion is achieved via contacting heavy oil feed with catalyst in a reactor, with the spent catalyst from the reactor directed to a stripper/regenerator for reactivation (combustion of the carbon generated in the process, referred to as "Coke"), and the product directed to the Work-Up section for treating and purification.

Given the age of the unit, critical components of the FCCU complex are approaching end of life, in which the repair costs and time to undertake repairs during planned maintenance periods is increasing and hence replacement is deemed economically viable. In particular, the critical components requiring replacement include:

1. Reactor Vessel
2. Stripper Vessel
3. Cyclonic separators located inside the Regenerator vessel
4. Miscellaneous large bore piping and control valves

3. Project Scope.

The project scope for the Regenerator cyclones and miscellaneous piping/control valve replacement is essentially like for like, given the current good performance achieved from these pieces of equipment. For the reactor/stripper replacement, considerable amount of work has been undertaken with Shell technical specialists in order to arrive at the proposed replacement option. This is because the existing reactor/stripper was designed in 1962, with the old design being less energy efficient, requiring larger hydrocarbon inventories as well as poorer availability. Consequently, an improved/modern design has been chosen, which though still essentially like for like with respect to operation/design intent, will offer the following advantages:

- Significantly reduced Reactor/stripper sizing and hence hydrocarbon inventory
- More reliable design that prevent internal coke formation, which reduces unplanned downtime/upsets and therefore reduced air emissions.
- Significant reduction in utility (steam) consumption for this unit, as well as downstream units, which process the sour water produced from this process.

It is noted that the unit intake and operating conditions are unchanged as a consequence of these above changes, and therefore all downstream equipment, utilities, and tankage are unchanged/not impacted by this project. Modern design standards will be applied in implementation of the project.

As part of this project, the refinery is also seeking to increase the coke burning capacity of the regenerator, which currently restricts intake below design capacity during summer months, as well as limits conversion to more valuable Mogas components. This will be achieved by modifying equipment in the regenerator overhead system to accommodate the increased flue gas produced from the additional coke burning. These modifications are targeted at ensuring all air pollutants including particulate emissions (PM50, PM10 and PM2.5) from the unit remain at the currently low levels and therefore meet current and future EPA licence requirements/conditions and envisaged specifications.

Figure 1 indicates the proposed site location for the envisaged modifications. Figure 2 overlays the existing (dotted line) and new reactor/stripper combination (full line).

4. Project Timing.

The above scope will be executed during a Q1 2008 maintenance shutdown, in which the existing aged equipment will be removed and thereafter replaced with the new equipment.

Due to the magnitude of the cost involved, Clyde is currently working through the various stages of approval. Key milestones includes:

- Approval for order of Reactor/Stripper Vessel in March 06, to ensure sufficient time to procure/manufacturer given current materials/labour shortages within Australia.
- Scope finalisation, completion of Engineering and HAZOPs by June 2006 to allow full financial support to be obtained in July 2006.
- Implementation during FCCU planned shutdown scheduled for Q1 2008.
- Start-up in Q2 2008.

Figure 1: Site Map showing Location of Proposed Modifications

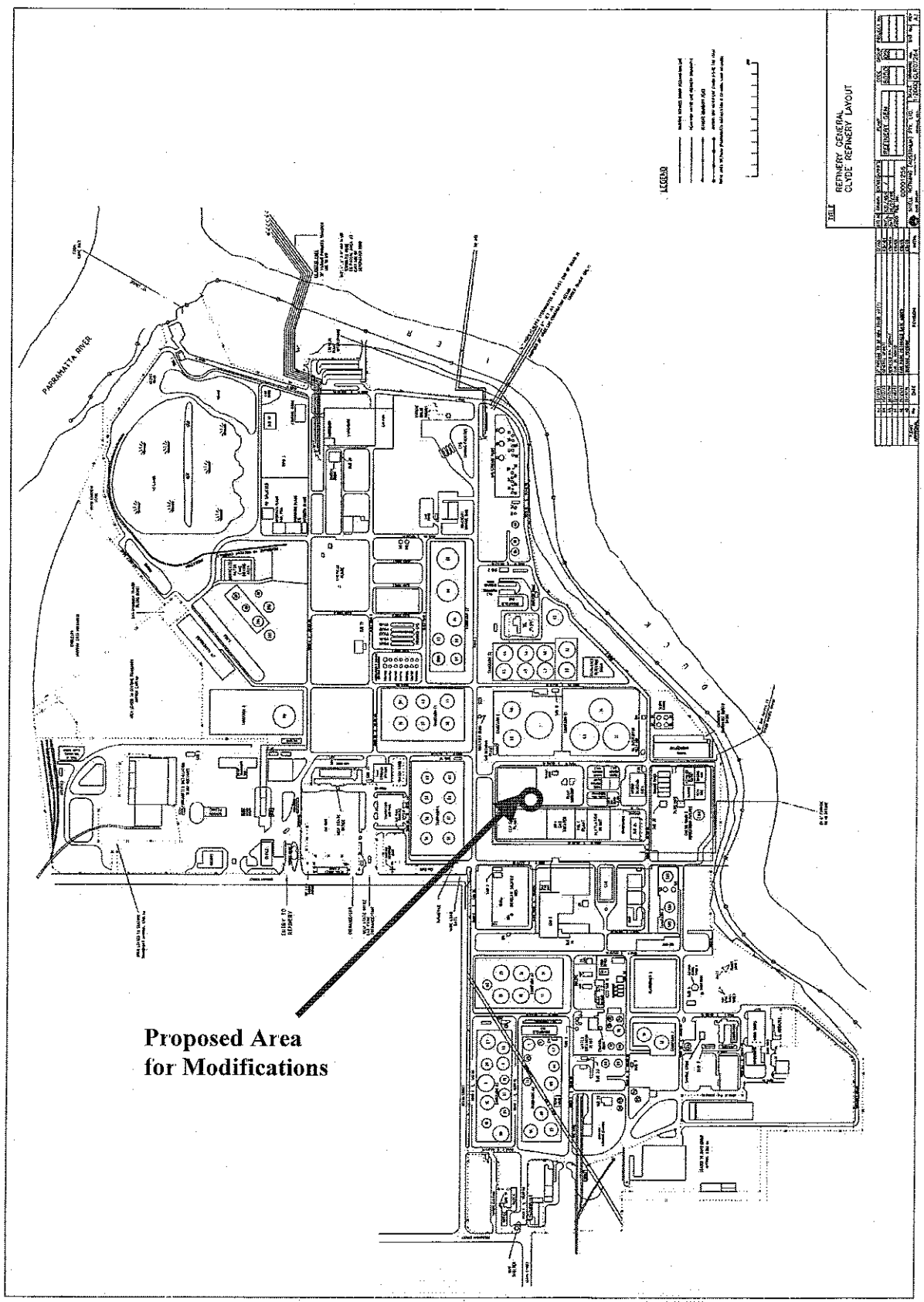
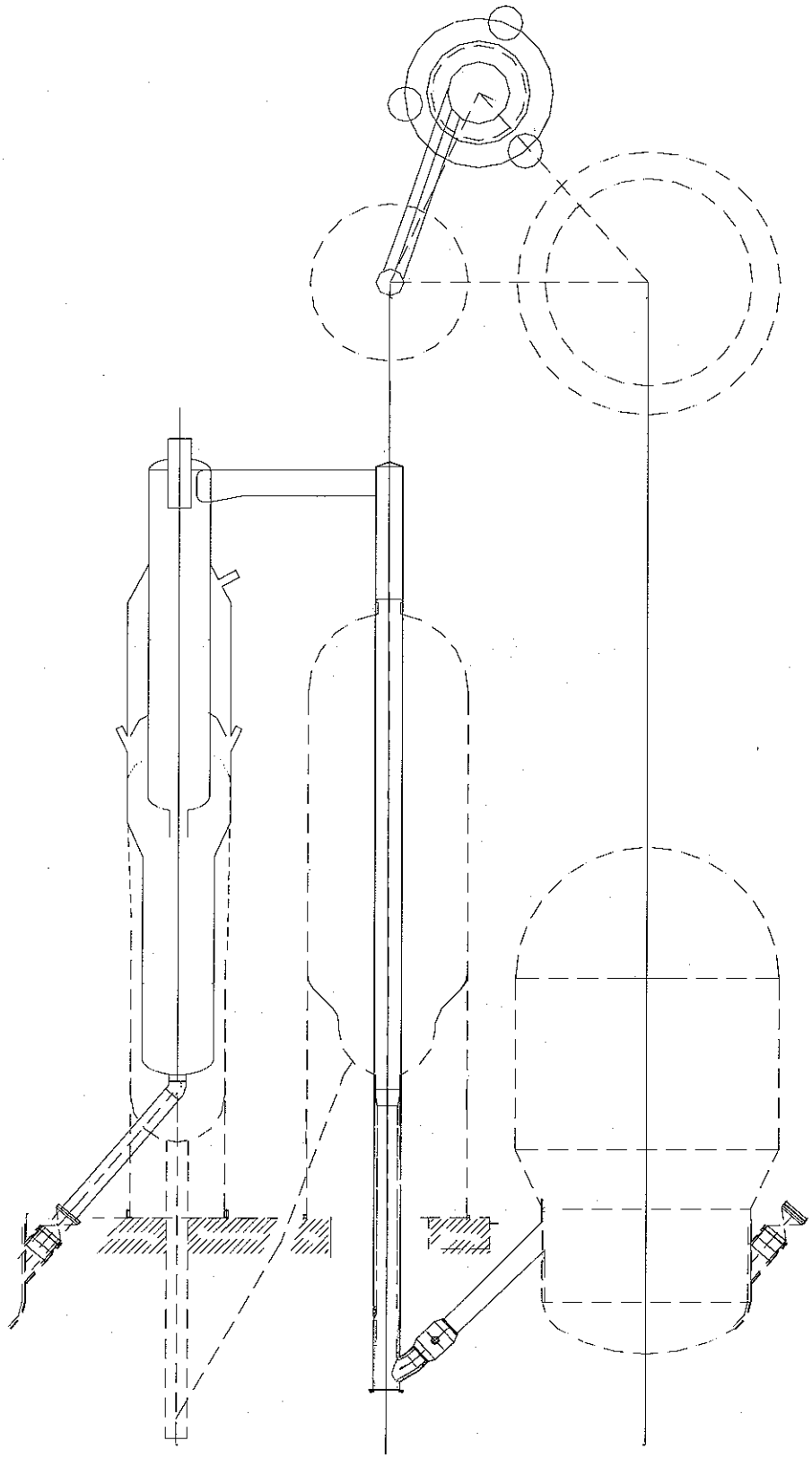


Figure 2: Overlay of New and Old Reactor/Stripper Combination



Note:

1. Existing equipment shown in dotted lines, with new equipment over-layed in hard full line
2. Height of reactor/stripper ~40m above tabletop (50m above ground level)

5. Project Impact.

As indicated previously, as the project predominately concerned with the replacement of equipment, which is at end of life, the process/operation and design intent remains unchanged. The project should therefore be viewed like for like replacement with the exception that the opportunity is being taken to apply modern reactor/stripper technology, which is smaller in volume and requires less utilities.

Air Emissions

The 1st part of the scope (Reactor/Stripper replacement only) has no fired furnaces during normal operation (one start-up heater used once every 4 years for ~5 days) and uses less utilities (steam) as a consequence of the modern design. This will result in reduced steam demand/fuel gas consumption from the Refinery boilers, and hence lead to 3% reduction in air emissions (CO_2, NOx, SOx) from the boilers.

For the 2nd part of the project (increased coke burning capacity from regenerator), the flue gas quantity from the FCCU/Waste heat boiler will increase. The energy recovered from the flue gas in the associated waste heat boiler (No. 8 boiler) will further reduce fuel gas firing and associated emissions from the remaining boilers, and hence offset the increased emissions associated with the increased coke burning capacity. Further, the increased coke burning capacity allows increased efficiency, thus increased product yields for the same feed rate. The net effect is as follows:

- CO_2 emissions from site will increase by ~5%, but will remain constant/decrease slightly when expressed as tonne of CO_2 per tonne product produced due to increase unit efficiency. It is envisaged that this increase will be offset by the projects originating from the NSW and Federal Energy Savings Action Plan to be executed for the site in 2006. CO emissions are also expected to remain constant.
- NOx emissions from the site will remain effectively neutral (decrease when expressed as tonne NOx per tonne of product) as the steam generation (due to heat recovery from Regenerator flue gases) will be shifted from the fuel gas fired No. 7/9 boilers to the waste-heat fired No. 8 boiler, which is the lowest NOx producing boiler on site. It is noted for information that Clyde is currently undergoing discussions with the DEC with respect to a Pollution Reduction Programme (PRP) aimed at further NOx reduction from the site.
- SOx emissions from the site will increase by ~5% from the site, but will remain constant/decrease slightly when expressed as tonne of SOx per tonne product produced due to increase unit efficiency. Due to current sweet crude processing, SOx emissions are still, and will remain, well within historical SOx emissions.
- Particulate/PM10 emissions from the FCCU stack will increase slightly, though the concentration will continue to remain at very low levels, i.e. <100mg/Nm^3 which is already less than future envisaged specifications.
- VOC emissions will remain constant /decrease slightly due to reduce inventory within the reactor/stripper.

Water Emissions

Steam consumption will reduce and hence waste water production from the Reactor/stripper section will reduce. This decrease will be offset by increased process water injected into the overheads of the downstream equipment to neutralise/dilute the corrosive species present in the normal operating mode of the FCCU. These species are currently being neutralised/diluted by the extra steam injected into the stripper, which will cease with the new configuration. The amount of waste water and quality is expected to remain constant, though the source of this water will shift from being steam generated in a boiler to process water/condensate recovered from the site, thus reducing fuel consumption and CO_2 emissions.

Waste

Spent catalyst of the same quality will continue to be produced from the unit at the same rate because operation (design intake) remains unchanged and will be managed under our existing EPA licence number 570.

Use will be made of existing foundations to locate the new equipment and hence no civil excavation work/other resulting in solid waste will be produced.

Visual

The existing Reactor of the FCCU already stands ~40m above ground level and is therefore visible. The new reactor/stripper is expected to be ~10m taller, but will be vastly reduced in diameter/size thus offsetting the increase in height. This height is still lower than numerous columns and stacks on site and therefore visually there will be no change to the overall nature of the refinery. It is noted that due to application of modern lighting standards, the unit will be more visible at night, though no sleep or nuisance impact on adjacent properties is anticipated due to the distance from boundary and the low level (amenity) of lighting employed.

This development will not change the size, nature or visual amenity of the existing refinery complex as the area in question represents less than 0.1% of the refinery site. It will be centrally located and distant from the refinery boundaries.

Noise

The modifications proposed are for static equipment only and do not include any high noise emitting items such as rotating equipment, compressors or furnaces. New equipment will be procured to satisfy current Shell and industry standards for noise. Given that the equipment affected is predominantly static, the noise levels from the plant will be unchanged.

Impact During Construction

The Reactor/Stripper is sizeable equipment at ~40m in length. Whilst requiring specialised cartage, preliminary studies have been done to confirm no special provisions on transport such as road closures will be needed. Transport is expected to be via water, which is expected in October/November 2007 in preparation for the Q1 2008 shutdown. Upon arrival in late 2007 to early Q1 2008, an increased site activity will involve a peak of ~ 25 extra tradesmen associated with preparing the equipment for installation. During the Q1 2008 shutdown large sized cranes will be required on site associated with the removal of the existing reactor and installation of the new reactor. The number of tradesmen during this shutdown will also increase, but this resource level will be equivalent to a major Refinery Maintenance shutdown, which occurs every six years (most recently in February-April 2000). Consultation with the community will occur prior to these events.

6. Safety.

Clyde Refinery has undertaken over 2000-2001 and again in 2005 a Formal Safety Assessment including the use of Quantitative Risk Assessment technologies, via a recognised specialist firm, in accordance with the national 'Major Hazard Facility' code. This study included the FCCU complex and identified no intolerable risks.

The current suite of protective systems, including instrumented shutdown systems, relief valves, depressuring valves and on-line inspection technologies, including some improvements which will continued to be employed.

In summary, this project results in a net improvement in safety due to reduced inventories of hydrocarbon, process safety measures incorporated in the modern design, and improved reliability.

7. Licence Approvals.

The site EPA Licence No: 570 regulates all environmental aspects, including air, noise, odour, dust, waste, groundwater and water with air emission limits already identified for the FCCU stack associated with the FCCU regenerator flue gases. There are no changes to the location of discharge / monitoring points and no new sources of flue gas or waste-water from this plant. Though emissions are foreseen to be within existing license conditions, the new project could potentially impact the existing EPA Licence No: 570 conditions and as result Shell may be required to apply to vary EPA Licence conditions. EPA will request Shell to submit the environmental impact assessment and any positive or negative impact will require amending to our licence conditions (eg. New Pollution Reduction Programs (PRPs)).

8. Approval & SEE Considerations.

The purpose of this briefing note has been to inform Department of Planning of our plans for this project, and supports the Major Projects Application form.

We are aware that under Part 2 Schedule 3 of the *Environmental Planning and Assessment Regulation 2000* (the EP&A Regulation) "development involving alterations or additions to development (whether existing or approved) is not designated development if, in the opinion of the consent authority, the alterations or additions do not significantly increase the environmental impacts of the total development (that is the development together with the additions or alterations) compared with the existing or approved development". Our preliminary assessment concludes that the proposed modifications to the FCCU, given predominantly like for like is not considered to be designated development under the EP&A Act. Consequently a SEE will be prepared to support the application for the proposal to the consent authority. Parramatta City Council, Department of Environment and Conservation and NSW Fire Brigades will be consulted on the project.

9. Communication and Consultation.

The surrounding community would be kept informed of the project and their feedback would be encouraged.

10 Relevant Planning Controls are:

NSW *Environmental Planning and Assessment Act 1979*

State Environmental Planning Policies (SEPPs 33, 34, 55)
Sydney Regional Environmental Plan No. 28
Parramatta Local Environment Plan (LEP) 2000

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