AIR LIQUIDE

Fitness for Purpose Report for the Mt Gambier (Caroline One) Carbon Dioxide Gas Plant, South Australia

May 2007

Report Prepared by:

Air Liquide Australia Limited

Revision	Date	Prepared by	Reviewed by
0	24 May 07	M Bennett	R Kumar, R Andrew, B Vocale, C Vivian

AIR LIQUIDE

CONTENTS

AIR LIQUIDE

INTRODUCTION

In accordance with Regulation 30 of the Petroleum Regulations 2000, Air Liquide Australia Limited (AL) has conducted a fitness-for-purpose assessment of its facilities near Mount Gambier in South Australia. The purpose of this report is to summarise the findings of this assessment.

The objectives of the Fitness For Purpose Assessments, as described in Regulation 30(2) are;

1) To assess the risks imposed by facilities operated under licences granted under the Petroleum Act 2000 on:

   a) public health and safety; and

   b) the environment, in the natural, social and economic context; and

   c) where relevant, the security of natural gas production or supply.

2) To review the physical condition and the management systems of the facilities in so far as their adequacy in managing the risks to an acceptable level.

Scope of Assessment

The assessment which this report covers was undertaken in May 2007 and addresses the fitness for purpose of the equipment which makes up the Mt Gambier Carbon Dioxide facility ('the Plant') from the Well (known as Caroline One), up to and including the truck loading station. More specifically, this includes:

- Caroline 1 down hole assembly;
- Flow line / Pipework;
- Pressure vessels / Process piping;
- Oxygen Storage System;
- Catalytic Oxidation;
- Compression;
- Electrical;
- Utilities;
- Waster Handling (effluent);
- Waster Handling (gas);

- Total Site;
- Transportation;
- Dangerous Goods;
- Refrigeration.

Methodology of Assessment
The assessment study was undertaken by key personnel familiar with the plant and after reviewing available consultants reports, internal audits and reports, review of existing procedures.

The assessment methodology employed was in accordance with the Air Liquide Risk Management Procedure, PMR-G.03 (0).

The risk assessment was conducted on 15th May 2007 at the Melbourne Head Office of Air Liquide. The workshop participants were; Mark Bennett (Primary Production Manager - Southern Region), Ben Vocale (Manager On Site) and Elita Lopatinskaia (Group Expert – Technical Operations Plant and Pipelines). Details of the assessors credentials are available.

AIR LIQUIDE OPERATIONS

A brief description of the facility is given below.

Location and Land Tenure

The Carbon Dioxide Purification Plant is located on Carba Road, approximately 12 kilometres southeast of Mt. Gambier, and occupies an area of almost 2 hectares. All access to the site is via Carba Road, which is an all-weather public road maintained by the District Council of Grant. The Plant is situated within Petroleum Production Licence 21, which overlies the Caroline Forest Reserve, managed by Forestry SA.

Carbon Dioxide Purification Process

Raw carbon dioxide (CO2) is supplied from a single well to the purification plant via a 70 metre flowline. The plant runs continuously to process the raw CO2 into pure liquid CO2. The impurities removed from the raw CO2 include sulphur compounds, nitrogen, hydrocarbons and water. The process steps to purify the raw material are described in the following sections.

Carbon Dioxide Vaporisation

Initially, water (sourced from a licensed bore located on site) is used to heat the raw CO2 and convert it to a gas in the vapouriser. This water is dosed with inhibitor and sulphuric acid to prevent corrosion, control calcium build-up and maintain the pH. When the CO2 vapour exits the vaporiser, some hydrocarbon and some waste-water is separated out and disposed of. The waste hydrocarbon and water is stored

in a bunded tank. Waste water is later removed from this tank and pumped to the effluent storage tank.

Main Purification Train

The main purification process step involves passing the gas through adsorption media. The first absorption step removes sulphur compounds and hydrocarbons. The remaining moisture is then removed, again using an adsorption process.

Liquefaction

After drying, the CO2 flows through a dust filter and then is liquefied via mechanical refrigeration.

Catalytic Oxidation

After initial purification the liquid product is further purified by a catalytic oxidation process to remove remaining hydrocarbons. This process involves vaporisation of the liquid and heating via exchangers to ambient temperatures, compression via a single stage, single piston reciprocating compressor, hydrocarbon removal via oxidation across a platinum catalyst. The catalytic process requires the addition of oxygen which is stored on site in a vacuum insulated liquid storage vessel. The catalytic reactor runs with a slight excess of oxygen.

After hydrocarbon removal in this way, residual moisture is removed through set of drier vessel using activated alumina as the drying media.

Distillation and Storage

The final stage involves liquefaction and final distillation (to remove oxygen and nitrogen) before being piped to storage in 2 x 100t insulated storage vessels.

Loading and Transport

Road tankers load liquid CO2 on-site and transport it to customers in South Australia and Victoria.

Waste Management

All general waste (including solid waste, paper and domestic scraps) is collected in a hopper for later removal to a licensed disposal facility.

All sewage is stored in a concrete effluent pit near the western boundary of the site. A licensed waste disposal contractor pumps out the pits periodically and transports the waste to a licensed sewage treatment plant.

Chemical waste, including spent adsorbing media is collected by a licensed waste disposal contractor for disposal off-site. Empty chemical drums are returned to the bunded workshop storage area for subsequent collection and off-site disposal.

CO2 gas is vented during the distillation process.

All rainwater runoff in the immediate vicinity of the plant is collected in concrete drainage channels and temporarily stored in a settling pit before being pumped to the effluent storage tank.

Produced formation water is also stored in the storage tank. After a settling period all water from the effluent tank is pumped to an adjacent tank and aerated before being disposed of through irrigation of grassed areas within the plant boundaries. Irrigation takes place via a single sprinkler that is moved throughout the site. There are no natural drainage lines located either within the site or in the immediate surrounding environment.

Background

The source of the CO2 (and produced formation water) is the Caroline-1 well, which was spudded in September 1966 and reached a total depth of approx. 3300m. The well was completed in February 1967 and began producing CO2. The deepest formation penetrated is the Eumeralla Formation of the Otway Group. Apart from intermittent production during 1968, the well has produced CO2 almost continuously to the present.

PHYSICAL CONDITION OF FACILITIES

Summarised below are the relevant conclusions drawn from consultants' reports that refer to the physical condition of the Caroline well and CO2 plant.

1) Jones Tonkin Consulting Engineers conducted a soil sampling programme (2000) to determine the effect of past and present wastewater disposal activities on site. The report concludes, "petroleum type hydrocarbons are not an issue in the site soils associated with the former soakage pits. Furthermore, the hydrocarbons do not represent a human health or environmental risk in this area on the Air Liquide site, and it is highly unlikely due to the sampling regime undertaken that any underlying soils or groundwater would be impacted."

2) AL has logs of data, which date back to 1967 when the well originally started production. The data collected includes CO2 and water production rates, pressures and production losses. This data is analysed monthly and provides an extensive history of operation on which to monitor trends. Air Liquide uses the services of Questa Australia who are consultants with expertise in the petroleum industry to analyse this data. This history, combined with regular analysis, demonstrates the suitability of the maintenance and operating procedures at the facility.

3) Air Liquide has conducted down hole wireline testing which has confirmed the integrity of the Caroline 1 well bore. The most recent survey was conducted in May 2000. Data from the testing was analysed by Air Liquide with the assistance of Questa. The analysis concluded that no obstructions were present and there were no substantial deviations form previous surveys demonstrating that the well condition is sound and repair or other works are not required to address scale or corrosion issues.

4) Schlumberger Oilfield Australia Pty. Ltd. produced an Investigative Logging, Diagnosis and Recommendation report following a site investigation in March 2001. This work included measurements of the well casing and its surrounding cement bond. The conclusion of the report was that the casing cement bond is in sound condition and repair or replacement was not recommended.

EFFECTIVENESS OF MANAGEMENT SYSTEMS

AL has control systems in place to ensure the safe and reliable operation of the plant. The following is a summary:

1. Monthly safety meetings and plant safety inspections, are documented, published and sent to the Safety Department in Melbourne. This system allows for routine hazard identification and tracking of corrective actions.

2. The facility is subject to routine internal safety and environment audits by senior management. Reports are generated detailing corrective actions and completion is tracked through the site safety management system. In addition, the company has a program of management system audits that are conducted by a Chief Industrial Auditor. Reports are generated and actions identified and tracked. The above-mentioned audits combine to enhance safe and reliable operation of the facility.

3. Written Plant operating procedures, specific technical and safety manuals in line with Australian Standards and other state legislative requirements are in place to ensure the plant is operated safely and efficiently. The procedures are in accordance with the requirements of Air Liquide's Corporate management system requirements (IMS) and ISO 9002. The site has an ISO 9000 certification and was subjected to a triennial audit from external auditors SAI Global in December 2006.

4. An Environmental Impact Report and a Statement of Environmental Objectives have been prepared for the Caroline 1 Well and plant. The purpose of these reports is to outline the environmental objectives that the facility must meet in order to satisfy the requirements of Section 6 of the Petroleum Act 2000. The objectives have been set using measurable criteria.

SECURITY OF GAS SUPPLY

The Caroline well produces carbon dioxide. The plant does not produce natural gas and accordingly the security of natural gas supply is not relevant.

AIR LIQUIDE

POTENTIAL FOR SERIOUS INCIDENTS

Some potential incidents were identified as being 'serious' under the definition in section 85 of the Petroleum Act 2000 when consider before control measures are in place. The subsequent risk, ie when assessed after existing control measures are considered was acceptable in all cases.

AREAS WITH LACK OF RELEVANT INFORMATION

With reference to Regulation 30(8)c, Air Liquide is unaware of any matter to which there is a significant lack of relevant information or a significant degree of uncertainty.

SUMMARY

On the basis of the risk assessment in Appendix 1, Air Liquide has concluded that the physical condition of the facilities and the management systems in place at the Mt Gambier Plant are fit for the purpose of managing the risks to public health and safety and the environment to an acceptable level. "Acceptable" is defined as the attainment of the objectives and assessment criteria outlined in the AL Statement of Environmental Objectives (ECOS, 2000).

As required by the Petroleum Regulations, this fitness for purpose assessment will repeated within 5 years of the date of this report.

REFERENCES

Air Liquide Risk Management Procedure, doc no. PMR-G.03 (0)

ECOS Consulting (Aust) Pty Ltd, *Air Liquide Australia Ltd, Caroline Carbon Dioxide Plant, Statement of Environmental Objectives*, June 2001

ECOS Consulting (Aust) Pty Ltd, *Air Liquide Australia Ltd, Caroline Carbon Dioxide Plant, Environmental Impact Report*, June 2001

Jones Tonkin Consulting Engineers, *Air Liquide Caroline Well Soil Investigation*, 29 March 2001

Schlumberger Oilfield Australia Pty. Ltd, *Report for Air Liquide on Caroline-1, Investigative Logging, Diagnosis and Recommendations*, April 2001.

AIR LIQUIDE

APPENDIX 1

Fitness for Purpose Risk Assessment Study

Summary of Threats, Consequences and Control Measures

Plant Section	Threat - Actual Potential	Consequences	Current Condition	SI	Control Measures	S	L	C
Down Hole assembly	Corrosion	Casing Failure Tubing Failure Diesel Loss Cross Flow Contamination	Extent of corrosion within acceptable limits, refer to Questa Australia reports.	Yes 24	Daily Logs of well pressure, flow and other parameters Standard Operating Procedures are used Previous Wireline Survey have established that flowing tube is in good condition. Regular monitoring of diesel level Specialist Consultant Reviews, operations and monitoring data	2s	2	22
Flowlines/Pipework	Corrosion, Erosion, Third party interference, Over Pressurisation	Pipework Failure, CO2 release Plant shutdown & loss of production/income	Extent of corrosion within acceptable limits – based on a sample piece of piping which indicates negligible internal corrosion	No 23	External corrosion protection for piping (denso tape) External Painting of above ground sections of piping Internal Inspection of piping at every maintenance interval Operating experience and the advice of experts (Questa) is that natural scaling preserves pipe integrity. The site is fenced, is in a relatively remote location has 24hr supervision & restricted 3rd party access Manual valves are available to isolate if	2s	2	22

Plant Section	Threat - Actual Potential	Consequences	Current Condition	SI	Control Measures	S	L	C
					required in an emergency Control measures to prevent over-pressurisation are described below; • Refer to 'pressure vessels' for controls on over pressurisation. • Current pressure conditions are well below original design.			
Pressure Vessels/Process Piping	Corrosion, embrittlement, Over pressurisation, over temperature, fire and explosion	Failure, CO2 release, Risk to Personnel, Plant shutdown & loss of production/income	All Vessels comply with the requirements of AS3768. Refer to pressure vessel inspection reports	Yes 33	Vessels are designed to AS1210 and operated in accordance with AS3768. Inspections are conducted as required by the standard. Pressure is controlled by automatic controllers and valves, Ultimate pressure protection is provided by Pressure Relief valves Pressure & temperature cycling loads of vessels are such that embrittlement is not a factor in the design or operation of the equipment, refer to vessel design approvals.	2s	2	22
Oxygen storage/systems	Loss of containment, embrittlement, over pressurisation, oxygen enrichment & fire	Oxygen release, injury, loss of production	Oxygen system installed in 2003 to industrial gas industry standards	Yes (33)	Vessel complies with AS1210 and has over pressure protection, piping made from resilient materials and protection against low temperatures installed to AL	3s	1	31

Plant Section	Threat - Actual Potential	Consequences	Current Condition	SI	Control Measures	S	L	C
					standards. Operators have been trained in hazards of oxygen. Flammable materials not permitted in vicinity, works controlled by work permit procedures. Fire protection equipment in place.			
Catalytic oxidation	Over- pressurisation, high temperature	Vessel rupture with sudden release of gas, injury	Vessel installed in 2003, using special stainless steel materials. Piping designed to ANSI (and AS) standards.	No (23)	Materials resilient to operating temperatures, with over-temperature protection and control via excess oxygen analyser.	2s	2	22
Compression	Over pressure, over temperature, mechanical failure, rotating equipment	Equipment	Compressor installed in 2003 and has been maintained annually since, operates within design limits.	No (23)	Emergency stops, guarding, controls on over pressure and over temperature. Pressure relief valves installed, regular maintenance.	2s	2	22
Electrical	Fire, loss of power supply,	Injury, electrocution, loss of production,	Electrical switchboard is old but has been cleaned and inspected and redundant cabling removed.	No (23)	Fire extinguishers present and serviced at 6 monthly intervals. Emergency water pump is diesel powered. Switchboard is not serviced live.	2s	2	22
Utilities, (cooling water, instrument air, bore water)	Pressure release, flooding,	Asphyxiation, legionella, injury, equipment fouling due to calcium buildup.	Instrument air is supplied from an air compressor with CO2 as a backup, 3 cooling towers on site with dosing systems, bore with header tank supplies water for cooling and non-drinking	Yes (33)	Instrument air is only used in ventilated areas, except control room where a fixed monitor is present. Cooling water is treated and tested for bacteria at required intervals. Towers	3s	1	31

Plant Section	Threat - Actual Potential	Consequences	Current Condition	SI	Control Measures	S	L	C
			services.		cleaned at 6 monthly intervals.			
Waste Handling - effluent (concrete) tank, waste water (concrete) tank, wastewater sprinkler system, bunding and septic tank.	Excess effluent production, corrosion/erosion, utilities failure	Soil contamination Ground Water contamination	Concrete tanks and bunds have adequate integrity based on daily visual inspections	Yes 23	Service agreements are in place (Cleanaway) for solid and liquid waste removal. Daily monitoring of plant & equipment Pumps protected from elements by covers and shelters Refer Jones Tonkin consultants report on soil sampling March 29/01. Three monthly testing of waste water discharge to ANZEC specification	2e	2	22
Waste Handling - Gas and Fugitive Emissions	Pollution	Pollution Green House Gas Emissions	Current Emissions are approximately 21% of production Production rate is well below plant capacity and limited by well conditions.	No 14	Operation of plant to established procedures. CO2 losses program is in place.	0e	4	04
Total Site	Third Party interference Public road usage by Forestry vehicles (including logging trucks) equips. General public traffic Bush Fire Lightning	Vandalism - damage to Plant. Production loss. Operator injury.	No 3rd. Party issues have been experienced in the past or are anticipated. Road is unsealed but is maintained by the District Council, has relatively low usage and is considered to be in a serviceable condition Infrequent use by general public	No 23	Fenced Perimeter. Air Liquide personnel present 24hrs/day. Signage on main gate Controlled access to site via induction and sign in system. Internal audits conducted by AL to schedule Emergency Procedures via. SEO.	2s	2	22

Plant Section	Threat - Actual Potential	Consequences	Current Condition	SI	Control Measures	S	L	C
	Wildlife Flooding		Plant and surrounds clean and tidy		Emergency procedures include general emergencies eg Lightning and specific emergencies eg bushfires.			
Transportation	Vehicle Accident Failure of filling hoses. Failure of tanker vessel	Injury, Vehicle damage, Loss of Containment.	Nil incidence for ALA Mt. Gambier	Yes 33	Traffic controls in place, lighting adequate and low number of tanker and vehicle movements (only 1-2 tankers per day) Drivers are trained on CO2 and dangerous goods requirements. Operators trained in filling of tankers Brakes are interlocked at filling points while loading and unloading. Fill hoses are fitted with breakaway couplings, which automatically close if broken. Hoses tested annually. Tankers serviced to preventive maintenance plan.	3s	1	31
Dangerous goods, including works storage stored on site	3rd party interference Plant failure - dosing lines-acid or biocide	Personal injury Loss of containment Contamination of soil and ground water	CO2 storage total capacity 230t Storage of up to 4000 l of adsorption media, 200 l acid fro water treatment and miscellaneous cleaning and lubricating materials	Yes 33	Storage vessels design ed to AS1210, protected by safety valves which are tested and inspected regularly. M.S.D.S. Register on site. Bunding around hazardous substances stores. Daily monitoring and regular maintenance.	3s	1	31

Plant Section	Threat - Actual Potential	Consequences	Current Condition	SI	Control Measures	S	L	C
					Breathing apparatus on site and serviced Internal safety audits conducted. S.O.P, s in place for all dangerous goods handling and processing. Site access ie controlled, safety meetings			
Refrigeration	Mechanical Failure- cracks in pipework. Seal failures on ammonia refrigeration units eg crank case seals.	Loss of refrigerant containment. Plant shutdown. Production losses. Injury.	Ammonia and R22 refrigerants are in use. Combination of reciprocating and screw compressors.	No 23	Regular Maintenance program conducted by qualified refrigeration mechanic. Internal safety audits conducted to schedule. Daily inspection by Plant Operator. Ammonia equipment in a separate (ventilated) equipment room Breathing apparatus on site and serviced Emergency showers and eye wash stations on site. Pressure equipment protected by relief valves, moving parts guarded.	2s	2	22

Notes:

'SI' indicates whether or not an item is a 'Serious Incident' as assessed before the effect of the control measurers is considered. The number in the SI column refers to the initial Severity (first digit) and Likelihood (second digit) of the event. These have been assessed in accordance with the matrices given below.

A 'serious incident' is defined in section 85 of the Petroleum Act 2000 as:

"**serious incident**" means an incident arising from activities conducted under a licence in which;

*(a)*a person is seriously injured or killed; or,*(b)*an imminent risk to public health or safety arises; or,*(c)*serious environmental damage occurs or an imminent risk of serious environmental damage arises; or,*(d)*security of natural gas supply is prejudiced or an imminent risk of prejudice to security of natural gas supply arises.

'S' Severity, assessed after the effect of the control measures is considered. The suffix 's', 'e' or 'p' indicates which f safety, environment or production is the most significant.

'L' Likelihood, assessed after the effect of the control measures is considered.

'C' Criticality

This severity and likelihood columns of this assessment have been completed using the criticality matrix specified in the Air Liquide Risk Management Procedure, PMR-G.03 (0), a copy of which is provided below.

AIR LIQUIDE

APPENDIX 1

Fitness for Purpose Risk Assessment Study

SEVERITY	BODILY INJURY (SAFETY)	ENVIRONMENTAL DAMAGE (ENVIRONMENT)	DAMAGE TO PROPERTY OR PRODUCTION (PRODUCTION)
0	**No bodily injury**	**No damage** to the environment	**No damage** to property or production
1	**Minor injury** with no lasting effect	**Moderate damage with no long-term affects** (temporarily exceed regulatory limits or products spilled on site)	**Minor property or a brief loss of production** (several hours)
2	**Serious injury** (localized accident resulting in serious consequences for plant personnel)	**Serious damage but may be corrected** (a localized accident causing serious ecological damage to the environment, but which may be quickly treated and eliminated)	**Major property damage or loss of production** (several days)
3	**Potential fatality**	**Serious and long-term damage** (accident causing serious and long-term damage to the site and surrounding areas)	**Major property damage that results in an extended loss of production** (several weeks to months)
4	**Major accident with potential fatality**	**Ecological disaster**	**Massive destruction to property or facilities** or **total loss of production** (permanent shut-down)

AIR LIQUIDE

APPENDIX 1

Fitness for Purpose Risk Assessment Study

LIKELIHOOD	CLASS NAME	PROBABILITY OF OCCURRENCE / YEAR	OCCURRENCE OR FREQUENCY
0	**Improbable**	$P \leq 10^{-7}$	There are no known events of this kind.
1	**Very rare**	$10^{-7} < P \leq 10^{-5}$	Event requiring a combination of rare events
2	**Rare**	$10^{-5} < P \leq 10^{-3}$	Event that has occurred on redundant equipment
3	**Possible**	$10^{-3} < P \leq 10^{-1}$	Event occurring from once every 1000 years to once every 10 years (failure of equipment such as valves, etc.
4	**Frequent**	$P > 10^{-1}$	Event occurring more than once every 10 years

Severity / Occurrence	0	1	2	3	4
4	04	14	24	34	44
3	03	13	23	33	43
2	02	12	22	32	42
1	01	11	21	31	41
0	00	10	20	30	40

Low risk area

Area for which studies to minimize risk must be conducted

Unacceptable Risk Area