Business Case – Capital Expenditure

WCS A Process Safety

Business Case Number 203

1 Project Approvals

TABLE 1: BUSINESS CASE – PROJECT APPROVALS

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Approved By	Craig Bonar, *Manager East Coast Grid Engineering, APA Group*

2 Project Overview

TABLE 2: BUSINESS CASE – PROJECT OVERVIEW

Description of Issue/Project	Demand on Wollert Compressor Station A has increased, which has forced the following upgrades to equipment • Unit Isolation valves from Fail Last to Fail Safe • Check valve installation to prevent reverse flow and compressor failure • Conversion from instrument gas to instrument air
Options Considered	The following options have been considered: 1. Option 1: Do Nothing Option 2. Option 2: Replace all three units balance of plant 3. Option 3: Replace and upgrade necessary equipment for process safety concerns
Estimated Cost	$1,045,506
Consistency with the National Gas Rules (NGR)	The replacement of these assets complies with the new capital expenditure criteria in Rule 79 of the NGR because: • it is necessary to maintain and improve the safety of services and maintain the integrity of services (Rules 79(2)(c)(i) and (ii)); and • it is such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services (Rule 79(1)(a)).
Stakeholder Engagement	Stakeholders affected by this project are: • Australian Energy Market Operator • Energy Safe Victoria

3 Background

The Wollert Compressor Station A (WCS A) was constructed over 35 years ago and has had no significant upgrades to compressor package process safety since then. The business case #217 will complete all necessary Type B compliance requirements for the station, this business case completes all other safety related upgrades. A station safety instrumented system was installed in 2007 which focused on achieving fail-safe station isolation in the event of fire or gas in the compressor hall. Work in progress at WCS A will improved fuel gas isolation in the event of fire and gas detection. The unit process isolation and vent valves are controlled by the relay-based compressor package controls and are fail-last.

The original intent of WCS A was to compress gas into the T74 pipeline system. That system supplies gas to almost all of northern Victoria and totals over 300km of pipeline. The offtake at Wandong also supplies the Bendigo and Ballarat regions reducing the workload on Brooklyn compressors. In 2006 two new compressors were installed at Wollert, known as station B and became the duty station. Station A was then used as a standby station. The new looping of the T74, called the Victorian Northern Interconnect Expansion (VNIE) will operate at 10,200 kPa and will be supplied by Station B at 10,200 kPa. The T74 pipeline between Wollert and Euroa is limited to 7,400 – 8,800 kPa and therefore will rely on Station A in the future. The expectation is that Wollert Station A will increase in utilisation compared to recent years as Station B will be committed to the VNIE supply.

3.1 Check Valves

Unit check valves: On other compressor stations within the Victorian Transmission System (VTS) there are axial type check valves downstream of the compressor to prevent reverse flow. A check valve failure resulting in reverse flow condition has the potential to severely damage compressor bearings and seals. This has occurred when wafer-style check valves have failed at Brooklyn such as the 2006 incident on BCS 10 and the 1992 incident on BCS 8.

Station check valve: Unlike other typical compressor stations with station recycle valve, the WCS A station does not have a station discharge check valve. The WCS A capacity valve has failed on three separate occasions in the last 10 years resulting in loss of pressure in T74 pipeline.

3.2 Isolation Valves

The design of the station incorporated valves and actuator on the inlet and outlet pipework to each compressor with "Fail-Last" positioning. This allows for long running machines to maintain their output regardless of a failure of the actuation system. It does though leave the equipment exposed to unsafe operating conditions in the event of actuator failure. There is no protection for the compressor which would be unable to shut itself down should there be a fire in the unit housing that affects other systems.

The valves and actuators have reached the end of their useful life and not able to be rehabilitated.

ISO 21789 5.20 Control and Automatic Protection Systems, Clause 5.20.4 Failure states: "When the control signal is removed from a valve or control device that is essential for shut-down or continued operation with tolerable risk, the valve or device shall automatically move to its fail-safe position. Where indicated by risk assessment, component redundancy or the fail-safe principle for electric circuits shall be used to perform a safety function and provide the necessary SIL…" Isolation of gas into the common turbine building is a safety function with SIL rating.

Clause 5.20.8 Gas turbine emergency shut-down system states: "The control system shall be designed so that the emergency shut-down system including the emergency stop buttons, trip not only the gas turbine by acting on the fuel gas shut-off valves to immediately cut off the fuel supply but also all associated equipment upstream and/or downstream if its continued operation can produce a hazard".

The WCS A is the last compressor station in the VTS to operate units with Fail Last positioning, all others have been upgraded.

3.3 Instrument Air

The use of instrument air is most desirable when upgrading to Fail Safe valves. WCS Station B has instrument air available; the cost to deliver instrument air to WCS A is small. The associated benefits of converting to instrument air is the elimination of direct greenhouse gas emissions, a reduction in the hazardous area for gas equipment (particularly in the area of building and machine intakes) and a qualitative increase in safety and availability.

3.4 Seal oil and engine starter gas motors

The existing compressor packages utilize gas motors for the engine start system seal oil system. This gas is sourced from the fuel gas system. In the event of gas leakage within the compressor hall, potentially from the power gas system (lubricators and hoses etc), the gas source cannot be isolated until the package has been stopped and confirmed no pressure in the compressor case. This creates a potential for accumulation of gas and subsequent

explosion in the compressor hall. The most significant benefit is the ability to convert the onskid motors from power-gas to electric motor. This would allow immediate isolation of all sources of gas into the compressor hall in the event of gas leak detection..

4 Risk Assessment

The primary risks associated with reverse spin are the destruction of a compressor. Whilst the personnel safety considerations are difficult to quantify the cost of compressor replacement would be at least $1m and would affect the gas market for approximately 12 months.

TABLE 3: RISK RATING

Risk Area	Risk Level
Health and Safety	**Low**
Environment	**Negligible**
Operational	**Moderate**
Customers	**Moderate**
Reputation	**Moderate**
Compliance	**Moderate**
Financial	**Low**
Final Untreated Risk Rating	**Moderate**

5 Options Considered

5.1 Option 1 – Do Nothing

The Do Nothing option is to persist with a valve arrangement that does not comply with Australian or International Standards for turbomachinery. In addition, the surge protection system has not been upgraded for decades and is significantly inferior to current performance levels. The existing protection for reverse flow has failed at least three occasions in the last 10 years and does not provide equivalent process safety performance as a check valve.

5.1.1 Cost/Benefit Analysis

WCS A has remained a backup station for many years. The new VNIE pipeline has restored WCS A to its original function prior to WCS B. That is, to compress into the DN300 pipeline at 7,400 kPa during peak winter.

The benefits of the Do Nothing option are delayed capital expenditure. The costs of the Do Nothing option are the risks highlighted leading to a possible process safety event.

5.2 Option 2 – Replace compressor packages and associated balance of plant

This option is to replace all three compressor units including unit isolation and vent valves. The benefit of this option is that all Type B, hazardous area, process safety, reliability, availability issues will be resolved.

5.2.1 Cost/Benefit Analysis

The cost of this option is significant, an early estimate is $15m. This reflects the costs of recent projects at Winchelsea and Brooklyn. For this reason, this option is not considered prudent.

5.3 Summary of Cost/Benefit Analysis

TABLE 4: SUMMARY OF COST/BENEFIT ANALYSIS

Option	Benefits (Risk Reduction)	Costs
Option 1	Do Nothing	
Option 2	Replace compressor packages and associated balance of plant	$15m
Option 3	Process Safety Upgrades	$1.1m

5.4 Proposed Solution – PSV, IA, Fail Safe valves

5.4.1 What is the Proposed Solution?

The proposed solution consists of;

- Replace unit isolation valves with Fail Safe positioning
- Convert Instrument Gas to Instrument Air
- Unit check valve upgrade
- Electric seal-oil and engine starter motor upgrade

5.4.2 Why are we proposing this solution?

The station will be operated at a much higher utilisation rate from 2017 onwards.

- The Fail Last positioning of a unit isolation valve is out dated design. This practise was performed by the Gas and Fuel Corporation and was considered satisfactory at the time. The current design philosophy is to install Fail Safe positioning of isolation valves associated with turbo machinery. This prevents consequence escalation.
- The unit check valve upgrade will prevent reverse flow and subsequent damage. This occurred in WCS A unit 3 in April 2002 and on other compressor units within the VTS.
- Instrument Gas is undesirable in most circumstances. IG systems vent hazardous gases, greenhouse gases and require additional safety controls compared to IA systems.

5.4.3 Consistency with the National Gas Rules

Consistent with the requirements of Rule 79 of the National Gas Rules, APA considers that the capital expenditure is:

- Prudent – The expenditure is necessary in order to maintain and improve the safety of services and maintain the integrity of services to customers and personnel and is of a nature that a prudent service provider would incur.
- Efficient – The field work will be carried out by the external contractor that has been used to date, who has demonstrated specific expertise in the installation of the pressure piping facilities in a safe and cost effective manner. The work will be undertaken consistent with the APA procurement policy. The expenditure can therefore be considered consistent with the expenditure that a prudent service provider acting efficiently would incur

- Consistent with accepted and good industry practice – Addressing the risks associated with compressor surge, fail last actuators, compressor reverse flow and replacing assets that have reached the end of their useful life is accepted as good industry practice. In addition, the reduction of risk to as low as reasonably practicable in a manner that balances cost and risk is consistent with Australian Standard AS2885.
- To achieve the lowest sustainable cost of delivering pipeline services – The sustainable delivery of services includes reducing risks to as low as reasonably practicable and maintaining reliability of supply.

5.4.4 Forecast Cost Breakdown

TABLE 5: PROJECT COST ESTIMATE,

	Total
Internal Labour	$247,410
Materials	$479,700
Contracted Labour	$318,396
Other Costs	$0
Total	**$1,045,506**