Business Case – Capital Expenditure

WCS A Decommissioning

Business Case Number BC203 AA23-27

TABLE 1: BUSINESS CASE – PROJECT APPROVALS

Updated By	Adam Newbury Adam Clegg	Asset Lifecycle Specialist, Asset Management Rotating Engineer, Engineering & Planning
Cost Updated By	Prasoon Premachandran	Victorian Team Lead Project Delivery, Engineering & Planning
Reviewed By	Adam Clegg	Rotating Engineer, Engineering & Planning
Approved By	Kirrily Hawker	Victorian Asset Manager, Asset Management

TABLE 2: BUSINESS CASE – PROJECT OVERVIEW

Description of Issue/Project	Wollert Compressor Station A utilisation and criticality have reduced in recent years which makes it increasingly difficult to justify the ongoing upgrades required to keep the station safe and reliable. A decision needs to be made to either commit to decommissioning the equipment or upgrading to maintain safe and reliable operations. The aim of this project is to address the safety and reliability concerns for Wollert Compressor Station A (WCS A) by addressing the following process safety issues: • Unit isolation valves are fail-last rather than fail-safe configuration • Check valves are required to prevent reverse flow and compressor reversal related failures • Hazardous area and Type B are both currently non-compliant The successful solution will address the above risks.
Options Considered	The following options have been considered: Option 1: Do-Nothing - continue to operate without addressing risks Option 2: Replace compressor packages and associated balance of plant Option 3: Replace and upgrade necessary equipment for process safety concerns Option 4: Develop end-of-life plan then decommission (Preferred option)
Estimated Cost	$750,000 (Est.)
Relevant Standards	The proposed option aligns with Australian Standards and ISO 21789.5.20 Control and Automatic Protection Systems and with the As Low As Reasonably Practical principle by either removing the risk via decommissioning the asset or addressing risk through compliant upgrades.

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)).
	Once confirming the assets are no longer required for system operations via a formal end-of-life plan, APA recommend removing these assets from service is prudent for the following reasons:
	• AEMO do not support the required process safety and compliance upgrades as post WORM AEMO modelling indicates WCS A won't be required.
	• If AEMO advice is that WCS A won't be required post WORM,
	  ○ it would be inefficient to keep the station in service and
	  ○ without the process safety and compliance upgrades it would also be a safety risk continuing to operate current condition.

Stakeholder Engagement	Stakeholders affected by this project are: • Australian Energy Market Operator • Energy Safe Victoria
Benefits to customers and consumers	APA believe that Option 4 is the most prudent and efficient option and offers the greatest benefit to customers and consumers by retiring a redundant asset from service rather than investing in upgrades.

1 Background

This business case was raised specifically to address process safety related issues, note in addition to this scope Type B compliance (assessments and upgrades) are covered in BC271 AA23-27 Type B as part of a larger VTS Type B compliance program.

The original purpose for Wollert Compressor Station A (WCS A) was to compress gas into the T74 pipeline system which supplies gas to most of northern Victoria. The offtake at Wandong also supplies the Bendigo and Ballarat regions which supported Brooklyn compressors to meet demand.

However, in 2006 two new compressors were installed at Wollert Station B which then became the duty station. WCS A was then retained as a standby station (contingency asset).

Then in 2007, an overarching Wollert station safety instrumented system (SIL) was installed which focused on achieving fail-safe station isolation in the event of fire or gas in the compressor hall, this work excluded WCS A which retained the original fail-last isolation philosophy.

WCS A briefly became more critical after completion of the (T74) looping (also known as Victorian Northern Interconnect Expansion [VNIE]). The reason for this increase in WCS A demand is that Station B has been configured to maintain the VNIE at 10,200kPa while WCS A maintained the T74 pipeline between Wollert and Euroa to 7,400 – 8,800 kPa.

More recently APA have announced the WORM pipeline (Western Outer Ring Main) will be built by winter 2023, this project includes the installation of a third Solar Centaur 50 (Unit 6) in Wollert Compressor Station B. Initial AEMO capacity modelling indicates the WORM will reduce the need for the WCS A and address current contingency concerns making it difficult to justify upgrading WCS A.

APA is treating the AEMO feedback as justification to change to develop an end-of-life plan that looks holistically at Wollert Compressor Station A to achieve the following:

1. assess the likely post WORM capacity/redundancy contributions for WCS A
2. use point 1. findings to define the anticipated remaining commercial life for WCS A
3. use point 2. findings to recommend decommissioning/upgrade/replacement each for WCS A
4. identify equipment impacted by point 3. and cost the modifications to mitigate the impacts

5. using outputs from points 1-4. create a strategy, a schedule and a budget for the recommended scope (WCS A end-of-life plan)
6. consult with stakeholders and seek endorsement to proceed with the WCS A end-of-life plan
7. deliver agreed CY23-27 scope then request remainder for CY28-32

1.1 Issues

After Station B was commissioned there has been a reduction in demand for WCS A which will be exacerbated by the WORM pipeline which includes additional compression in WCS B (Unit 6 Solar Centaur 50), this has made it difficult to justify upgrades for WCS A which has had no significant reliability or process safety upgrades applied since Station B was commissioned. The unit process isolation and vent valves on WCS A are controlled by (obsolete) relay-based compressor package controls and have a fail-last control philosophy (common on older equipment). During a control system failure, a fail-last valve will remain in the last position commanded by the control system, i.e. the valve is likely to fail open when closed is required to ensure process safety. Current compressor station design philosophy is to install Fail Safe positioning of safety critical isolation valves. The improvements that are described in sections 3.3 to 3.7 have been recommended to improve the process safety and reliability of WCS A. If WCS A remains in service the recommended improvements include upgrading check valves, isolation valves, instrument air and seal oil and gas starter gas motor.

In addition, a Hazardous Area study conducted during the SIL* indicated substantial upgrade is now required to meet Hazardous Area compliance requirements.

**Safety Integrity Level rating is used to assess process control systems to define their ability to fail safe, i.e. the response to a failure does not escalate the consequences*

1.2 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, reverse flow is of concern as it can cause substantial damage rotating assets which would occur if the unit suction and discharge valves fail last in the open position.

The proposal is to replace unit isolation valves with Fail Safe valves. 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.

1.3 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 however 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 recommended for overhaul, so the proposal is to replace them with a modern fire rated fail-safe equivalent aligned with ISO 21789.5.20 Control and Automatic Protection Systems.

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 [Safety Integrity Level]…" 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.

1.4 Instrument Air

The use of instrument air is most desirable when upgrading to fail-safe valves. WCS Station B has instrument air available so the intent is that instrument air will be piped to WCS A. 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. It is assumed that station B air compressors can provide adequate instrument air volumes to provide for WCS A. Instrument gas is undesirable in most circumstances as instrument gas systems vent hazardous, greenhouse gases and require additional safety controls compared to instrument air systems.

1.5 Seal oil and engine starter gas motors

The existing compressor packages utilise 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 on-skid 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.

1.6 Control System

If remaining in service, the unit control systems in WCS A are obsolete and would also require replacement in the current access arrangement period with estimated cost of $2.5m per compressor.

1.7 Hazardous Area

This business case was raised specifically to address process safety related issues, note in addition to this scope Type B compliance (assessments and upgrades) are covered in BC271 AA23-27 Type B as part of a larger VTS Type B compliance program.

2 Risk Assessment

The primary risks associated with reverse spin are the catastrophic failure of a compressor resulting in low probability of injury to personnel in close proximity to the compressor with disruption to WCS A availability. Without the fail-safe philosophy in place there is also potential for gas to spill back from T74 which could impact T74 gas supply until field personnel attend to manually isolate the station valves. Whilst the personnel safety considerations are difficult to quantify the cost of a single compressor replacement would be $2-4m and would take approximately 6 months to restore to operation.

TABLE 3: RISK RATING

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

3 Identification and Assessment of Options

3.1 Options Considered

The options considered are:

Option 1: Do-Nothing - continue to operate without addressing risks

Option 2. Replace compressor packages and associated balance of plant

Option 3. Replace and upgrade necessary equipment for process safety concerns.

Option 4: Develop end-of-life plan then decommission (Preferred option)

Option 1: Do-Nothing - continue to operate without addressing risks

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.

Option 2 – Replace compressor packages and associated balance of plant

This option is to replace all three WCS A compressor units including unit isolation and vent valves. The benefit of this option is that all hazardous area, process safety, reliability, availability issues will be resolved. The cost of this option is estimated to exceed $15 million. This option is not feasible as there is no foreseeable demand for WCS A.

Option 3: Replace and upgrade necessary equipment for process safety concerns

Option 3 involves replacing and upgrading necessary equipment for process safety concerns including:

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

When considering the starter and seal oil pneumatic to electric conversions this work may trigger the need for the control system to be upgraded/supplemented to ensure the electric start and seal oil pump motor can be adequately controlled by the unit to ensure correct ignition sequence and that the wet seal system is adequately sealing the process gas on the compressor. Option 3 is considered the most practical if decommissioning is not approved but given the limited demand anticipated this is unlikely.

note:

This business case was raised specifically to address process safety related issues, note in addition to this scope Type B compliance (assessments and upgrades) are covered in BC271 AA23-27 Type B as part of a larger VTS Type B compliance program.

Approximately $7.5m would be required to complete all upgrades including unit relay logic control system replacement.

Option 4: Develop end-of-life plan then decommission (Preferred option)

This option is to develop an end-of-life plan followed by the decommissioning of the Wollert A compressor station to remove the process safety risks but also increase VTS efficiency by retiring assets that are not being utilised (i.e. stranded assets).

The anticipated phases of this process are as follows;

Part A. Post-WORM System utilisation study ($150k),

Part B. Assess & scope impacts of study ($150k)

Part C. Execute scopes ($450k)

The benefits of this option are:

- After the decommissioning there will be a reduction in operating costs as the routine maintenance being conducted currently to keep the compressors available will no longer be required.
- A reduction in energy consumption, e.g. control systems, climate control, lighting and other utilities.
- Operations field staff will be able to direct their efforts into assets that are contributing to VTS capacity rather than responding to failed test starts on less critical equipment.
- Expensive upgrades required to keep the station operational and compliant will not be required. Anticipated that it would approximately $7.5m to address all obsolescence, compliance and safety issues – including the unit control upgrades.
- Retiring unused assets also improves overall VTS asset efficiency.

The disadvantages of this option are:

- A minor reduction in contingency, however the capacity of this asset and opportunity for operation are extremely low. (e.g. WCS A ran 19 hours in 2021). WCS B capacity will also increase by 50% by winter 2023 with the addition of Unit 6 Solar Centaur 50 as part of the WORM project and is anticipated to address capacity/contingency concerns.
- Decommissioning will cost approximately $250,000 per compressor ($750,000) and will consist of the following scope: (not comprehensive)
    - Develop an end-of-life plan to identify consequences of decommissioning and seek stakeholder approval of the plan in terms of scope of decommissioning and timing.
    - Positively isolate the WCS A from the VTS.
    - Isolate all other energy and control systems
    - Drain lubrication system and dispose of oil.
    - Crane out and transport the compressor packages for disposal/recycling
    - Remove all redundant WCS A compressor unit and compressor station related control and monitoring equipment.
- Additional scope risk.
  The end-of-life plan will consider demand scenarios to identify capacity or contingency risks resulting from WCS A decommissioning.

- An example contingency risk is the Wollert T119 PRS (a single run pressure regulating meter station) that maintains T74 gas pressure. AEMO tend to rely on WCS A whenever the PRS is unavailable so the stakeholder risk assessment may reveal that a second regulating run is required before decommissioning can occur.

3.2 Assessment of options

TABLE 4: SUMMARY OF COST/BENEFIT ANALYSIS

#	Description	Cost Est.	Benefits/Disadvantages
Option 1	Do-Nothing	Indeterminate	Low cost/non-compliant, risk of asset damage and supply constraint
Option 2	Replace compressor packages and associated balance of plant	>$15m	Compliant and best solution in terms of remaining life / high cost for an asset that is essentially at end-of-life (and stranded)
Option 3	Replace and upgrade necessary equipment for process safety concerns	$1.3m	Compliant, modest cost / asset remaining life is low, additional investment needed to address WCS A obsolescence issues.
Option 4	Decommission station A (Preferred option)	$750k	Low cost, addresses the non-compliance and process safety risks / slight reduction in contingency

Option 1 is considered impracticable as it does not address current problems with a valve arrangement, does not comply with Australian or International Standards for turbomachinery and retains out-of-date protection systems. The Do-Nothing option could cause a process safety event but also continues the unacceptable situation where APA have non-compliant assets available for operation. Do-Nothing is therefore the least preferred option.

Option 2 is the highest cost option and not considered prudent as it is not proportionate to the need that needs to be addressed. The estimated cost of $15 million is based on costs of recent projects at Winchelsea and Brooklyn. Option 2 is not recommended as it is not considered efficient/prudent expenditure compared to Option 3 or 4.

Option 3 provides the most practical and lowest cost solution **if the asset cannot be decommissioned**. From 2017 onwards, the station had been operating at a much higher utilisation rate relative to previous years. 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 restored function of the WCS A has driven the need for the compressor to be upgraded to align with aligned with ISO 21789.5.20 Control and Automatic Protection Systems.

However, when the WORM pipeline is commissioned (forecasted for winter 2024) AEMO modelling suggests WCS A will no longer be required. It is this this change in operating context that makes this option less practical than option 4.

Option 4 is considered the most pragmatic solution as it aligns APA strategy with AEMO, addresses the process safety and compliance risks while reducing ongoing VTS operating, maintenance and capital expenditure. The primary benefit of decommissioning WCS A is obviously the associated operating risk reduction, but in doing so resources currently committed to keeping WCS A operational can also be redirected towards mission critical assets. The only disadvantage of this option is a reduction in contingency, however due to the modest demand and station capacity this is anticipated to have negligible consequences. In addition, Wollert Compressor Station B station capacity will increase 50% after WCS B Unit 6 is operational which is likely to address above-mentioned contingency concerns. Option 4 is considered the most prudent and efficient option.

3.2.1 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. The preferred option is necessary to meet requirements of the restored and enhanced function of the WCA compressor station.

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. The work will be subject to APA procurement policy to obtain good value.

3.2.2 Forecast Cost Breakdown

TABLE 5: PROJECT COST ESTIMATE

Category	Cost
Internal Labour	$100,000
Materials	$150,000
Contracted Labour	$350,000
Other Costs	$150,000
Total	**$750,000**

Note:

The estimates provided are intended to cover the isolation/removal/disposal costs of the compressors and ancillaries. However, the end-of-life plan may identify additional costs not considered in table 5 as these are yet to be defined in the end-of-life plan risk identification and assessment processes.

4 Acronyms

Acronym	Description
AEMO	Australian Energy Market Operator
AGA	Australian gas association – Type B compliance governing body
API	American Petroleum Institute – publisher of standards
CHAZOP	Control system HAZOP – study of the control system functions to identify logic vulnerabilities
ESD	Emergency shutdown – control system-initiated shutdown designed to prevent incident escalation if operating parameters are breached
ESV	Energy Safe Victoria
HAZOP	Hazard and operability study
HMI	Human machine interface
ILI	Inline inspection – pipeline internal inspection
OEM	Original Equipment Manufacturer
RA	Risk Assessment
RBI	Risk Based Inspection – a process used to prioritise maintenance or inspection activities based on risk of failure.
SIL	Safety integrity level rating is used to assess process control systems to define their ability to fail safe, i.e. the response to a failure does not escalate the consequences
SMS	Safety Management Study
VTS	Victorian Transmission System
WCS A	Wollert Compressor Station A
WORM	Western Outer Ring Main – new pipeline to remove existing VTS capacity constraint.