Amadeus Gas Pipeline

Asset Management Plan FY 2016-2020

(AMP)

Version	Date	Changes Made	Author	Reviewer	Approved
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1 EXECUTIVE SUMMARY

This Asset Management Plan (AMP) outlines the direction for the technical management of the Amadeus Gas Pipeline (AGP) and associated infrastructure to ensure that it continues to meet regulatory, safety, environmental and performance requirements over the next five years. The AMP is a locally developed document that is reviewed annually and covers the planning period from 1 July 2015 to 30 June 2020. The five year consideration of the asset integrity is necessary to ensure that it remains fit-for-purpose and to allow for longer term key strategic planning activities.

This AMP highlights proposed expenditure resulting from necessary upgrades or improvements to the AGP assets, with discussion on the merit of each. This document is a 'Technical Asset Management Plan' and generally does not address commercial or administrative issues involved with the operation of the AGP. The AMP is written on the basis of the best known information at the time of writing.

The AGP is reaching mid-life (approximately twenty seven years) where the updating and replacement of some components is necessary. There are a several significant items which the AMP has considered:

- Corrosion Under Sleeves

  The pipeline has suffered corrosion under the joint coatings applied during construction. If left unchecked the defects will ultimately threaten pipeline integrity. The damage is extensive and it is necessary to increase integrity measures with targeted inspection, excavation and repair.

- Unpiggable Darwin City Gate to Channel Island Spurline

  The Channel Island Spurline is currently unpiggable due to a step change in diameter of the pipeline at the Channel Island Bridge from 300 mm to 200 mm. As the majority of power generated in Darwin requires this asset and there is limited ability to meet power demands without it, it is imperative to ensure that this spurline is piggable to manage its ongoing integrity.

- Coating Refurbishment of Below Ground Station Pipework

  The original below ground station coating consists predominantly of coal tar enamel (CTE) and some tape wrap. The condition of the CTE coating is generally poor and a project has commenced to progressively replace the CTE with high build epoxy (HBE). To date the below ground station pipework at five stations and four MLV's have been completely recoated with HBE. The remainder of the stations and MLV's are to be refurbished as part of the Below Ground Station Recoating Project – Phase II.

The AMP provides further details of Non-Routine and Capital Expenditure items.

1.1 DEFINITIONS AND ABBREVIATIONS

AC	Alternating Current
AGP	Amadeus Gas Pipeline
AMP	Asset Management Plan (this plan)
AS	Australian Standard
BBS	Ban Ban Springs
BGP	Bonaparte Gas Pipeline
CAPEX	Capital Expenditure
CIP	Capital Improvement Plan
CIMS	Channel Island Meter Station
CP	Cathodic Protection
CTE	Coal Tar Enamel
CPU	Cathodic Protection Unit
DCG	Darwin City Gate
DCVG	Direct Current Voltage Gradient
EMP	Environmental Management Plan
FEED	Front End Engineering Design
FMECA	Failure Modes Effects and Criticality Analysis
FY	Financial Year
GC	Gas Chromatograph
GE	General Electric
HAZOP	Hazard and Operability Study
HDD	Horizontal Directional Drill
HBE	High Build Epoxy
ILI	In Line Inspection
KP	Kilometre Point
LAPA	Length Adaptive Pressure Analysis
LRUT	Long Range Ultrasonic Testing
MAOP	Maximum Allowable Operating Pressure
MEJ	
MLV	Mainline Valve
OPEX	Operational Expenditure
PIMP	Pipeline Integrity Management Plan
PMP	Pipeline Management Plan
PWC	Power and Water Corporation
RTU	Remote Telemetry Unit
SCADA	Supervisory Control and Data Acquisition
SIB	Stay in Business
SRB	Sulphur Reducing Bacteria
WPP	Wickham Point Pipeline

2 INTRODUCTION

2.1 Scope

The Asset Management Plan (AMP) is a strategic document which covers the planning period from 1 July 2015 to 30 June 2020. The AMP is a locally developed document and is reviewed annually to ensure that the content is current.

The AMP will form the basis for non-routine additions to the annual work program incorporating projects regarding longer term integrity management. The AMP will be revised annually and provides for pipeline assets and non-pipeline assets such as buildings, vehicles, small plant and equipment. Some non-pipeline assets are shared with pipeline assets other than the AGP. This plan does not include routine operations detail or costs estimates associated with these tasks.

2.2 Asset Management Methodology

The pipeline assets are operated and maintained to ensure an appropriate balance between the cost for asset maintenance, reliability and replacement against the risk and consequences of asset failure.

Engineering assessments are regularly conducted to review and revise the asset functionality and performance requirements to reflect changing operational requirements.

APA Group's Technical Policy relating to Asset Management holds further information relating to the overall Asset Management Philosophy. This information is stored on the HUB.

2.3 Asset Management Process

The Pipeline Licences, AS 2885 and other mandatory or statutory standards and regulations form the basis of the compliance requirements.

Other tasks are determined by operator experience, industry best practice, integrity considerations and risk assessment.

2.4 Assumptions and Limitations

The AMP is written on the basis of the best known information at the time of writing and changes to the content will inevitably occur during the life of the AMP. The AMP will be modified if issues that may impact the validity of the AMP are identified.

2.5 Relationship With Other Planning Documents

APA has developed a Pipeline Management System (PMS) as required by AS 2885.3 -2012. The PMS provides guidance to the organisation regarding high pressure gas pipeline management and operation techniques. It provides the framework for a consistent and appropriate process throughout the business for all pipelines operating under AS 2885. The PMS also specifies subservient documents including the Pipeline Integrity Management Plan (PIMP). The PIMP is a local document which is specific to particular assets or groups of assets. The PIMP carries relevant details of the assets and a detailed summary of the integrity challenges and mitigation. The mitigation identified in the PIMP drives the majority of funding provisions detailed within the AMP.

3 ASSET OVERVIEW

3.1 Stakeholders

The AGP is 100% owned, operated and maintained by APA Group. There are four producers:

- ENI - Blacktip (via the BGP)
- Darwin LNG – Wickham Point (via the WPP)
- Santos – Mereenie
- Central Petroleum – Palm Valley

The major shipper on the AGP is Power and Water Corporation (PWC) who use gas predominantly for power generation.

3.2 Asset Condition and Age

The AGP is now reaching mid-life where the updating and replacement of some components is necessary. The AGP, which was commissioned in 1986, is generally in good condition but has extensive problems developing with its coating system that will require continued attention for the rest of its useful life.

4 COMPLIANCE

4.1 Legislation and Regulations

The AGP is operated in accordance with the Energy Pipelines Act (NT) and Energy Pipelines Regulations.

The AGP is a covered pipeline with economic regulation governed by the Australian Energy Regulator (AER) under the National Gas Law and National Gas Rules.

4.1.1 Standards

The AGP is operated in compliance with AS 2885, Pipelines – Gas and Liquid Petroleum, and other standards as applicable.

5 LICENCES

Pipeline licences are granted under the Energy Pipelines Act (NT).

Pipeline Name	Pipeline Licence	Expiry
Amadeus Gas Pipeline Mereenie Field to Tylers Pass Spurline Laterals • Tennant Creek • Katherine • Pine Creek • Channel Island • Palm Valley Interconnect	04	2032
Elliott Pipeline	10	2032
Manton Pipeline	11	2034

5.1.1 Reporting

The National Greenhouse and Energy Reporting Act 2007 requires that organisations triggering thresholds report energy and emissions data. Thresholds relate to emissions of CO_2 equivalent, total amount of energy produced and total amount of energy consumed.

The National Pollution Inventory (NPI) requires pipeline operators to report emissions and waste transfers. The NPI database is designed to provide publicly available information on the types, and amounts of certain substances, being emitted to the air, land, and water. The legislative framework underpinning the NPI is the National Environment Protection (National Pollutant Inventory) Measure (NPI NEPM). The NPI NEPM program is implemented in the Northern Territory through an Environmental Protection Order (EPO) established under the Waste Management and Pollution Control Act 2003.

A six monthly reporting frequency has been agreed with the Executive Director and is documented in the Pipeline Management Plan (PMP) as submitted to the Northern Territory Department of Mines and Energy.

5.1.2 Changes to Regulatory Compliance Framework

On-line access is available for current standards and codes and a system of automated notification when key standards change is activated.

5.2 Pipeline Management Plan

A Pipeline Management Plan (PMP) has been prepared in accordance with the requirements of the NT Energy Pipeline Regulations and incorporates the following:

- Regulation 27 - description of safety policy;
- Regulation 28 - description of the pipelines;
- Regulation 29 - description of the pipeline management system;
- Regulation 30 - description of standards;
- Regulation 31 - arrangements for documents; and
- Regulation 32 - arrangements for reporting.

The PMP should be referred to for key asset information.

5.3 Emergency Plan

An Emergency Plan is implemented and maintained. It ensures that the incident response is correctly coordinated by focussing upon the response structure and field control to:

- Ensure a consistent and coordinated approach by emergency response personnel to any emergency;
- Control and limit any effect that the emergency may have on people, property and environment;
- Ensure priority communication of critical emergency information to affected stakeholders;
- Provide a sound basis for the training and assessment of emergency response personnel; and
- Provide a means for reviewing and improving the response techniques.

Emergency response plans are state specific and define the minimum response required for an emergency arising on all pipelines and associated pipeline facilities. The emergency response plan is tested and updated annually.

6 DEMAND AND SUPPLY INTEGRITY

6.1 Transportation Demand

The AGP has off-takes feeding laterals at Tennant Creek, Elliott, Daly Waters, Mataranka, Katherine, Mt Todd, Pine Creek, Noonamah and Darwin City Gate (DCG). The AGP currently has sufficient capacity to meet all anticipated loads.

Gas is received into the AGP at Mereenie and Palm Valley, at Ban Ban Springs, via the BGP, and at DCG, via the Wickham Point Pipeline (WPP).

The introduction of gas from the BGP has made a significant change to the operating flows in the AGP resulting in gas flowing north and south from the Ban Ban Springs connection point. Supply from Mereenie and Palm Valley is currently intermittent and the gas supply at DCG via the WPP is an emergency supply, intended to provide redundancy for the major gas supply from Eni via the BGP.. Some outlets have been modified in recent years due to increased gas demand for electricity generation. In 2012 an additional outlet was added to the Channel Island Meter Station. In 2013 a new outlet was added at the Katherine Meter Station. For both of these outlets the gas conditioning facilities are located on the adjacent PWC site. In 2014 an outlet was added at Noonamah to supply a nearby meat processing facility.

6.2 Growth Forecast

The are no likely developments in the next five years that will utilise existing capacity on AGP, with the exception of the North East Gas Interconnector (NEGI). There is insufficient detail on the proposed NEGI and its potential impact on the AGP, to include in the AMP at this time.

6.3 Operating Constraints

The AGP is capable of operating at is full Maximum Allowable Operating Pressure (MAOP) and has adequate capacity to meet all delivery requirements.

6.4 Maintenance Constraints

Post the commencement of supply from the BGP, the net southbound flow in the AGP at full operating pressure is expected to be insufficient to support normal pigging. Pigging may be facilitated by lowering the pipeline pressure in front of the launch station and carefully applying flow control behind.

6.5 Supply Integrity Risk

Unplanned maintenance or corrective maintenance is managed with on a case by case basis to minimise any supply disruptions. To facilitate this process, APA has 24/7 standby crews strategically located at Palmerston, Katherine, Tennant Creek and Alice Springs.

6.6 Project Governance and Delivery Management

Projects are delivered in two separate management frameworks dependant on their size and complexity.

Generally the projects are divided as such:

	Risk	Cost	Complexity
Major Project	Moderate or greater	$1m or greater	High
Minor Project	Low	Less than $1m	Low to Moderate

A project may be allocated to the Minor category despite meeting one of the prerequisites for Major. Usually this is due to a special process, high cost or a highly engineered item skewing the project unnecessarily.

Major Projects are delivered using the project management framework, Project Portfolio Management (PPM) tool. The PPM tool is Microsoft Project Server 2010™ and provides all project managers a uniform structure and platform for project scheduling, documentation, reporting and monitoring for every stage of the life of a project.

Major projects are delivered in a manner which is defined by APA's Project Management Policy and Project Delivery Procedure. These documents cover all aspects of project management including but not limited to; project structure, reporting, cost control, procurement and stakeholder engagement.

Generally most Minor projects for the AGP consist of SIB CAPEX and MEJ OPEX and are predominantly managed using NT APA personnel. Generally most Major Projects for the AGP consists of growth CAPEX are managed by a dedicated project team within Infrastructure Development, with local NT input where required.

7 KEY PERFORMANCE MEASURES

7.1 Supply Performance Criteria

Supply performance is based upon the following key pipeline operating criteria –

- Delivery at appropriate pressure and quality; and
- Operating below MAOP at all times.

During the Early Gas period (from late 2008 to early 2009), whilst the BGP delivered off-specification gas into the AGP an Early Off-Specification Gas Specification was agreed in accordance with the Early Gas Transportation Deed. Subsequent investigations revealed that the pipeline integrity was not compromised through the transportation of off-specification gas.

8 LIFECYCLE PLAN

8.1 Pipeline

8.1.1 Condition and Integrity

The pipelines operate across remote areas of desert through to the coastal area near Darwin traversing many different terrains. Further details regarding integrity management on the AGP can be found in the Pipeline Integrity Management Plan (PIMP).

The primary methods of protection involve a depth of cover of at least 0.75 m and signage.

Pipeline Name	MAOP (kPa)	Grade	Length (km)	Diameter (mm)	Status
PL 04 – Amadeus Gas Pipeline	9,650	API 5L-X60			Operational
Palm Valley to Mataranka		API 5L-X60	1110.4	355.6	Operational
Mataranka to Darwin City Gate		API 5L-X60	390.8	323.9	Operational
Mereenie Spur		API 5L-X60	116.0	273.1	Operational
Tennant Creek Lateral		API 5L-GR-B	23.6	114.3	Operational
Katherine Lateral		API 5L-GR-B	5.4	114.3	Operational
Pine Creek Off Take		NA	NA	NA	Operational
Darwin City Gate to Channel Island MS	9,650	API 5L-X60	11.5	323.9/ 219.1	Operational
PL 010 – Elliott Pipeline	9,650	API 5L-X60	3.8	60.3	Operational
PL 011 – Manton Pipeline	9,650	API 5L-X42	0.4	60.3	Abandoned

8.1.1.1 *Coating*

The pipeline is coated with “yellow jacket” polyethylene which has proven to be a suitable coating for the conditions. However, MLV’s and scraper stations are suffering coating degradation and despite applied Cathodic Protection (CP) there is still a risk of corrosion. The original coating material was in many cases coal tar enamel (CTE) which has the potential to shield the CP current providing an unprotected environment where metal loss and stress corrosion cracking (SCC) may be active. For the scraper stations the main pipe material is believed to be in a satisfactory condition (being yellow jacket), but the tees, kicker lines and vent lines require recoating.

There are significant problems with corrosion under failed heat shrink sleeves used for field applied joint coatings during construction. This has led to extensive metal loss across the many field joint coatings. A program is in place to inspect and repair critical metal loss defects associated with heat shrink sleeves.

8.1.1.2 *In Line Inspections*

The Intelligent Pigging schedule for the AGP is recommended at ten year intervals to adequately monitor and manage the corrosion under the heat shrink sleeves, with the exception of the Mataranka to Helling section which has an interval of seven years due to the higher corrosion growth rates at heat shrink sleeves. The failure mode for these defects could be a rupture, albeit very much less likely than a leak due to the restricted critical defect length which is somewhat limited by axial length of the sleeves.

The Tennant Creek area is earthquake prone and gauge pigs are run in the event of a significant tremor. Experience has shown that it would be extremely unlikely that an immediate failure would occur as a result of minor ground movement, however, significant damage could lead to the development of a rupture failure at a later date.

The 12 kilometre long DN300 DCG to CIMS section is currently not piggable due to –

- no scraper station facilities;
- a section of DN200 pipe across the road bridge; and
- tight radius bends on the bridge approach.

A FEED study has been performed to examine the possible options to address integrity management of this spurline and a recommendation has been provided to PWC. The preferred option is a HDD under the bridge. The other options include replacing the DN200 section under the bridge with DN300 pipe or having a midway scraper station that can receive DN300 pigs and launch DN200 pigs.

8.1.1.3 *Direct Current Voltage Gradient*

Coating defects can be identified proactively by Direct Current Voltage Gradient (DCVG) which utilises the potential at the surface created by the coating defect. Alternatively, coating defects can be identified by intelligent pigging at corrosion sites.

For unpiggable pipelines the DCVG process is necessary to ensure that coating defects can be identified and repaired prior to corrosion of the underlying steel, creating a failure. As metal loss can't be detected this method is critical if pipeline failure is to be avoided.

Previously, DCVG surveys were performed on a five yearly cycle. Due to the high density of coating defects on the majority of the AGP, the survey data provides little use from an integrity management perspective as:

- targeted repair programs do not improve CP levels; and
- there is no correlation between DCVG defect size and actual metal loss.

Resources allocated to DCVG surveys are better diverted to intelligent pigging and CP upgrades.

The DCG to CIMS section will continue to be surveyed by DCVG every year due as it is unpiggable. Once the Channel Island Spurline is made piggable, DCVG surveys on the spurline will discontinue also.

8.1.1.4 *Corrosion*

In general the AGP is sufficiently protected by a combination of yellow jacket pipeline coating and CP. A large number of shrink sleeves have failed resulting in shielding, particularly in the northern sections of the AGP. Refer to section 7.1.3.1 for additional information.

8.1.2 Cathodic Protection

In 2004, a review of the CP system led to a two stage improvement process being implemented. Stage 1 works were completed in 2009 and Stage 2 works were completed in 2013. These works significantly improved the CP levels along the majority of the AGP. In 2014, a new impressed current site was installed near Lake Woods (KP823) and the ground bed at Fergusson was refurbished. Due to continual degradation of the yellow jacket coating, continual upgrades to the CP system will be required.

Stage 2 works included an AC mitigation study of the AGP. This study indicated that AC mitigation is required from Townend Road to CIMS and also the length of the Katherine Lateral. The modelling of the effects of these power lines on the AGP is currently underway and required mitigation works are planned for FY16 (pending approval from PWC).

The CP is marginal in the vicinity of KP870 and a new impressed current CP site is planned here in FY16.

A number of cathodic protection issues have been identified between Hayfield (KP912) and Mataranka (KP1108) with regions of marginal protection. A number of investigations have been instigated to investigate possible faults at Daly Waters Scraper station (KP980) along with identifying future possible sites for impressed current installations.

The time taken to acquire land for CP sites is typically 12 to 24 months in the NT due to sublease negotiations, native title notification process and obtaining cultural clearance certificates. Where possible, land for future CP sites will be identified early and the land acquisition process initiated so that significant construction delays do not occur if CP levels become marginal.

8.1.3 Specific Major Integrity Issues

8.1.3.1 *Corrosion Under Heat Shrink Sleeves*

The AGP is protected by SHAW yellow jacket coating and CANUSA heat shrink sleeves across all girth welds. Protection is also provided by numerous impressed current cathodic protection units. Results of intelligent pigging indicate that the majority of corrosion detected on the pipeline exists beneath failed girth weld sleeves. When these sleeves fail, moisture is able to penetrate the coating, but impressed current from cathodic protection is not able to provide protection. This also means that faulty sleeves cannot be detected through DCVG surveys. Therefore corrosion occurs regardless of the cathodic protection level of the pipeline. The result is corrosion in the vicinity of the weld joints in a circumferential pattern. Additional information regarding extent of this issue can be found in the PIMP.

Corrosion under heat shrink sleeves is detected by intelligent pigging and repairs are prioritised based on integrity assessments where the detected corrosion defects are grown based on estimated corrosion growth rates.

For the DN350 pipeline sections IONIK Consulting were contracted to provide recommendations for an ongoing repair program. The majority of the priority repairs on these sections have been performed.

For the recent intelligent pigging inspections of DN300 sections, the GE Length Adaptive Pressure Analysis (LAPA) method was used to perform integrity assessments based on the intelligent pigging data. Repairs were prioritised based on an estimated corrosion rate. Strain analysis of calliper data was performed where the pipeline could not be readily excavated for assessment.

Future inline inspections are expected to be assessed with the Integrity Data Management Tool (Uptime). Specific corrosion growth rates will be determined either through this project or in the APA Group ILI Policy.

8.1.3.2 *Darwin City Gate to Channel Island Pipeline Integrity*

The 12 kilometre spurline runs from DCG to the CIMS with approximately 600 metres of DN200 pipe installed on the bridge crossing towards the end of the section. The pipeline is critical to Darwin as it feeds major power generation facilities.

The DN200 pipeline across the bridge is currently unpiggable. This section of pipeline is well coated, but unequipped for pigging due to its reduced diameter, tight bends and lack of pig traps. As the pipeline cannot currently be intelligently pigged, the levels of corrosion are difficult to quantify. Sections of the spurline lie within the road reserve and cannot be easily excavated. This spurline is subject to the following integrity threats:

- External corrosion. The cathodic protection criteria is more stringent for this spurline at -950 mV to $Cu/CuSO_4$ (compared to standard value of -850 mV) due to the possible presence of sulphur reducing bacteria (SRB) in the coastal soils. Intelligent pigging would allow the extent of corrosion, especially at disbonded heat shrink sleeves, to be quantified.
- AC corrosion due the vicinity of nearby high voltage power lines (refer also to AC Mitigation works referenced in Section 7.1.2). Intelligent pigging would most likely detect AC corrosion if it is present.
- Lightning damage. Significant lightning damage has been found on this spurline and lightning strikes on thinner walled sections have resulted in a loss of containment. Intelligent pigging successfully detects lightning strike defects on pipelines.
- Third party damage. The spurline is generally location class R2 with heavy wall pipe (7.92 mm WT) making rupture from third party damage more difficult. Intelligent pigging would allow damage from third parties such as gouges and dents to be detected and repaired prior to possible failure.

Due to the possible integrity threats the current situation is unacceptable for a critical high pressure gas pipeline. There are four options for the spurline going forward:

1. Continue to rely on DCVG, CP surveys and physical inspection of the exposed pipe;

2. Install a midway scraper station that can receive DN300 pigs and launch DN200 pigs, along with modifying the last DN300 section of pipeline before CIMS to DN200;
3. Replace the DN200 section with DN300 pipe across the bridge and include pig launching and receiving stations at DCG and CIMS to allow for internal inspection; or
4. Replace the whole bridge crossing with a directionally drilled DN300 pipe and include pig launching and receiving stations at DCG and CIMS to allow for internal inspection.

A FEED study has been submitted to PWC to address the above issues along with legacy issues at the CIMS including leaking valves and the pressure rating of filtration equipment. APA's preferred option is a DN300 HDD under the Channel Island Bridge (Option 4). PWC will fund the Channel Island Spur Line Works and therefore are involved in the selection of the option chosen to improve the integrity management of this spurline.

8.1.3.3 *In Line Inspection of the DN350 Amadeus Gas Pipeline*

The change in duty for the AGP between Palm Valley and Mataranka will see a southbound flow to Alice Springs. A DN350 tool needs around 200 kPa differential pressure to get the pig moving and then 100 kPa differential pressure to keep it moving, providing the pipeline has a reasonable level of pre-cleaning. The pipeline pressure needs to be maintained at a pressure above the lowest off-take requirement at all times, but in general should be kept as low as possible in front of the pig in order to maximise the gas velocity and reduce pigging run times.

Unless demand is significantly increased at the Palm Valley Interconnect outlet, pigging south of Daly Waters will require a reduction in the line pack downstream of the launch station and the controlled use of the pressure upstream to push the pig. The swept volume of gas from pigging must be accommodated in the downstream pipeline without allowing the differential pressure across the pig to reduce below approximately 200 kPa. The sensitivity of this calculation is critical as any snagging on weld root beads might require an additional differential pressure to free it. Also, changes in pipeline wall thickness and pipeline fittings (such as tees and valves) might cause the pig to hang up.

A temporary pressure reduction skid has been built which can be fitted across a scraper station in order to reduce the line pack in the downstream section. Pigging in a southern direction is only feasible when the producers at Mereenie and Palm Valley are not supplying gas to the pipeline system.

8.1.4 Forecast Major Expenditure

Routine pipeline inspections by ILI, DCVG and CP survey have identified a decline in the condition of the asset and its protective systems, which needs to be rectified. The yellow jacket coating is generally performing well, however a combination of shielded defects at the weld joints and cracking of the yellow jacket particularly in areas of high soil stress or rocky ground, will continue to require significant repairs.

8.1.5 Integrity Related Projects

A list of major projects with forecast expenditure for the next five years is provided in Appendix B.

8.2 Stations

The type and number of stations on the AGP are summarised below –

Pipeline	Scraper Stations	Mainline Valves Site	Offtake	Odorant Plant	Metering Station	Compressor Station	Pressure Reduction Stations
PL 04 – Amadeus Basin to Darwin Pipeline	12	12	13		6	1	4
PL 010 – Elliott Pipeline	2				1		1
Total Assets per Type	14	12	12	1	7	1	5

8.2.1 Electrical and Instrumentation

The sites are generally in good order, however they are not fully compliant with the latest hazardous area legislation. Hazardous area compliance requires having equipment suitably designed and traceable with hazardous area dossiers at each site listing the specific equipment details and maintenance history.

A hazardous area survey has been completed identifying opportunities for improvement. A risk based equipment upgrade approach will be adopted across all sites. Consideration will be given to reducing future OPEX spend through equipment selection to minimise training requirements and simplify dossier development.

Lightning strikes on the assets particularly in the northern area are often the cause of equipment damage. RTU and communications equipment are held as spares/inventory. A lightning and earthing study will be performed to identify areas for improvement. Upgrades will be performed at stations in order to reduce the extent of equipment damage from lightning events.

An allowance for site batteries and chargers has been made to enable replacement as they fail due to age. An allowance has been made for the replacement of RTU's due to technology upgrades and/or failure due to age. An allowance has been made to replace aged cathodic protection units (CPU).

Some stations have obsolete single loop controllers for pressure, flow or temperature control. A program is in place to replace these with more suitable units.

8.2.2 Mechanical

Mechanically the sites are sound; however the Limitorque actuators on the MLV's are obsolete. A phased replacement program is scheduled. The MLV actuator at Tennant Creek is obsolete and will be replaced.

The mainline valves have met testing requirements but circumstances haven't allowed testing against a full differential pressure. No replacement of these critical assets has been built into the program, however, it is an aspect that should be checked when circumstances exist which provide the full line pressure against one side of the valve only.

Slops tanks are installed at Darwin City Gate, Pine Creek, Katherine and Tennant Creek to capture hydrocarbon liquids from the filter-separators. These slops tanks have some compliance issues that require rectification. An upgrade of the Darwin City Gate slops was performed in FY15.

Water bath heaters were installed at numerous outlets for dewpoint proving. Allowances have been made for future major water bath heater overhaul.

Tennant Creek Meter Station does not have backup pneumatic control and the installation of a Wizard controller is planned. Aging Wizard controllers require replacement at Pine Creek and Darwin City Gate.

Recent safety audits have revealed non-compliant ladders and access platforms at numerous sites. Rectification works are required in order to achieve compliance.

Recent technical investigations (preliminary FMECA) of the Pine Creek station have revealed a number of design deficiencies relating to pressure regulation, over pressure protection, water bath heaters, instrument gas supply and pressure vessels. A full FMECA and HAZOP will be performed to identify possible deficiencies that require rectification.

8.2.3 Scraper Stations

In 2013, the Bi-directional Pigging Project was completed allowing the pig traps in the scraper stations to both launch and receive pigs. Offtake valves were included in the design to allow the connection of a pressure reduction skid in order to reduce downstream pipeline pressures, if required. The pig traps are now in sound operational order and the pressure reduction skid was used on recent intelligent pigging of the Tanami Road to Palm Valley Section (2014).

The original below ground station coating at scraper stations and MLV's consists predominantly of coal tar enamel (CTE) and some tape wrap. The condition of the CTE coating is generally poor and a project has commenced to progressively replace the CTE with high build epoxy (HBE). To date the below ground station pipework at five stations and four MLV's have been completely recoated with HBE. The remaining 25 stations and MLV's are to be refurbished as part of the Below Ground Station Recoating Project – Phase II.

The above ground coating at scraper stations and MLV's requires periodic recoating due to harsh environmental conditions.

8.2.4 Metering and Quality

There are no current metering issues that are causing billing issues. A number of outlets use orifice meters utilising NX19 calculations which is not considered best practice. However, as PWC is the only major customer transporting gas in the pipeline this is not an issue. Should another large customer commence transporting gas in the AGP the metering type at all outlets would need to be reviewed and upgrades may be required.

In 2012, the C6 GC at DCG was upgraded to a C9 and the moisture analyser was also replaced. Allowances have been made in future years for replacement of GC's and moisture analysers.

8.2.5 Odorant

There is an existing odorant installation at Tylers Pass. This installation is currently required where there is significant quantities of flow from Mereenie or Palm Valley. Odorisation of the flows from the BGP is currently achieved by a facility located at the Ban Ban Springs Metering Station on the BGP.

8.2.6 Site Buildings

The site buildings are deteriorating with age. A program is in place to construct shelters over the existing demountable buildings, however, to enable them to provide for potentially an additional forty years life, expenditure for replacement / refurbishment / upgrade has been provided.

8.2.7 Asset Security Guidelines

The AGP is located in reasonably remote areas of Australia and is unlikely to be a target for terrorism. The assets are all fenced and locked with SCADA alarms on telemetered sites. The pipeline control can be operated by authorised computer equipment from any location that has adequate internet connection.

The current levels of AGP security are considered appropriate.

8.2.8 Station Related Projects

A list of major projects with forecast expenditure for the next five years is provided in Appendix B.

8.3 Rotating Equipment

8.3.1 Turbine

With the introduction of the Blacktip field the Solar turbine compressor at Warrego is currently not required. It has been mothballed for potential future operation or relocation.

8.4 Plant

8.4.1 Building

The AGP is supported by four major maintenance bases at Palmerston, Katherine, Tennant Creek and Alice Springs along with a corporate head office at Palmerston. An unmanned workshop with accommodation is located at Daly Waters.

The maintenance base at Palmerston supports the northern region of the AGP and incorporates a workshop, storage sheds and office facilities. These facilities are rented so no works are anticipated.

The maintenance base at Katherine supports the central region of the AGP and incorporates a workshop, storage sheds and office facilities. The base is well maintained and serviced and capital programs are conducted on an as needed basis. Major office upgrades were completed in 2011 and no major upcoming modifications are anticipated.

The maintenance base at Tennant Creek supports the southern region of the AGP and incorporates a workshop, storage sheds and office facilities. The base is well maintained and serviced and capital programs are conducted on an as needed basis. No major upcoming modifications are anticipated.

The maintenance base at Alice Springs supports the southern region of the AGP and incorporates a workshop, storage sheds and office facilities. The base is well maintained and serviced and capital programs are conducted on an as needed basis. No major upcoming modifications are anticipated.

The head office located at Palmerston accommodates the majority of local corporate staff including engineering, commercial, finance and administration. The office provides seating for approximately 30 personnel, along with a storeroom. A major renovation is planned at the Palmerston head office including:

- Security upgrades;
- Expansion to allow personnel and equipment from the Northern Operations Base to be collocated;
- Creation of additional desk space by converting to open plan office; and
- Upgrade of kitchen and bathroom facilities.

8.4.2 Vehicles

The vehicle fleet in the NT consists of approximately 20 4WD vehicles and two 4WD trucks. The vehicle fleet is well maintained, regularly serviced and reflects a program of staggered renewal based on age and/or kilometres travelled. Vehicles may also be purchased on an as required basis.

8.4.3 Tools

A large and varied collection of tools and equipment is utilised in the maintenance and up keep of the pipeline systems. Tools and equipment are purchased and replaced on an as needed basis.

8.4.4 Heavy Plant

In general heavy plant is supplied by contractors.

8.4.5 SCADA and Communications

It is anticipated that a combination of software upgrades and a two yearly hardware replacement will maintain the SCADA system fully operational. The current Honeywell Experion SCADA system will be replaced with Clear SCADA.

The Telstra Bigpond satellite service was upgraded to the URSYS iDirect service in 2014. During this project the IP addressing configuration was?? also modified to allow integration into the APA Group system.

8.4.6 Office Equipment

A varied array of office equipment is utilised including computers, copiers and program software. To date every office facility has been properly equipped based on the needs of that specific location. Office equipment is purchased and replaced on an as required basis.

8.4.7 Plant Projects

A list of major projects with forecast expenditure for the next five years is provided in Appendix B.

8.5 Easement

8.5.1 Land

The pipeline easements are generally maintained by APA personnel with assistance from specialised contractors. The main maintenance activities are:

- Vegetation control;
- Land erosion control;
- Fence maintenance; and
- Signage management.

The pipeline operates through remote areas which have heavy seasonal rain periods in the northern areas and long dry periods in the southern areas. There are no specific issues with the easement and normal maintenance practices maintain appropriate levels of access.

Washaways are likely during the wet season, however no specific allowance has been included for these with this work expected to be covered by the OPEX budget.

8.5.2 Third Party

The assets are located inside a registered easement and due to the remote locations, generally outside the location that third parties operate. APA Group maintains Dial Before You Dig membership and regular liaison with property owners. There are no extraordinary risks that require additional attention.

8.5.3 Environment

The APA Operations Environmental Management Plan covers routine work undertaken on the AGP. There are no extraordinary measures required.

8.5.4 Aviation

The pipelines are all observed by aerial surveillance. Any defects or threats are notified and relevant aspects photographed with GPS coordinated embedded. There are no additional activities proposed.

9 REVIEW OF PREVIOUS YEARS AMP

A review of the previous year's AMP for the period 2014 to 2019 is shown in Appendix A.

10 ALLOWANCES FOR FUTURE YEARS

Looking forward further than five years requires consideration of what could realistically be considered likely to fail and to make suitable ongoing allowances. All electrical equipment would require replacement at some stage, however, the bulk of the mechanical equipment should continue to perform. There is potential for future obsolescence which is difficult to predict.

Provision has been included for repair or replacement of mechanical items, based on expected wear, and for replacement of minor plant. For major items, such as water bath heaters and field huts, deterioration with age and use will necessitate replacement.

For the AGP, the ongoing planned integrity management should ensure that the pipeline steel will remain in its current condition except where the coating and CP system has failed to provide adequate protection. Continued ageing of the coating will therefore require additional CP and the ongoing sleeve repair program will be necessary. The expected level of repairs has been allowed for in the estimate, however, the extent of the sleeve disbondment and metal loss could be significantly more than expected and therefore the costs could increase substantially.

Appendix B shows a summary of the forecast major expenditure for future years. Details of each item in the forecast can be found in Appendix C.

APPENDIX A –2015-2019 AMP BUDGET REVIEW

Item Ref.	Description	Category	Status	FY15 Budget	Forecast FY15 Spend
1	Below ground station pipe work recoating - phase 2	Growth CAPEX	Project commenced but completion delayed to FY17	$8,000,000	$492,000
2	Above ground station pipe work recoating	MEJ OPEX	FY15 scope increased	$50,000	$229,000
3	Heat shrink sleeve replacement program	SIB CAPEX	Scope increased to achieve efficiencies with contractor. FY15 program complete	$500,000	$725,000
4	Intelligent pigging + verification dig-ups	SIB CAPEX	FY15 program complete	$515,000	$366,000
5	Site battery replacements	SIB CAPEX	Expected to be completed FY15		$16,000
6	240 V battery charger replacements	SIB CAPEX	Project delayed to FY16		$0
7	Single loop controller replacements	SIB CAPEX	Project commenced but completion delayed to FY17	$90,000	$19,000
8	Hazardous areas equipment upgrades	SIB CAPEX	Project delayed to FY16	$600,000	$0
9	Earthing and lightning upgrades	SIB CAPEX	Project commenced but completion delayed to FY16	$250,000	$18,000
10	Transfer satellite providers and update IP configuration	SIB CAPEX	FY15 program complete	$400,000	$107,000
11	Clear SCADA upgrade	SIB CAPEX	Project commenced but completion delayed to FY16	$300,000	$69,000
12	Cathodic protection unit replacement	SIB CAPEX	Project delayed to FY16		0
13	New cathodic protection sites	SIB CAPEX	Portion of FY15 allowance deferred to FY16	$440,000	$321,000
14	AC mitigation	Growth CAPEX	Project delayed but due to commence FY15	$319,000	$33,000
15	Channel Island bridge upgrade (including FEED)	Growth CAPEX	Project delayed to FY16	$8,000,000	$222,000
16	PVIC temporary filtration	Recoverable CAPEX	Complete	$480,000	$246,000
17	Mainline valve actuators replacement	SIB CAPEX	Project delayed to FY16	$60,000	$0
18	Tennant Creek mainline valve actuator replacement	SIB CAPEX	Project delayed to FY16	$30,000	$0
19	Wizard controller replacement	SIB CAPEX	Expected to be completed FY15		$5,000
20	Water bath heater study	MEJ OPEX	Cancelled	$10,000	$0
21	Slops tanks upgrade	SIB CAPEX	Expected to be completed FY15	$10,000	$22,000
22	Ladder access	SIB CAPEX	Expected to be completed FY15	$30,000	$5,000
23	Replace solar panels	SIB CAPEX	Expected to be completed in FY15		$32,000

APPENDIX B – 2016-2020 AMP SUMMARY

Note: all allowances are in 2015 dollars

Item Ref.	Description	Category	New / Existing	FY16	FY17	FY18	FY19	FY20
1	Below ground station pipe work recoating - phase 2	CAPEX	Existing	$8,810,000	$3,374,800			
2	Above ground station pipe work recoating	MEJ OPEX	Existing			$123,000	$160,000	$160,000
3	Heat shrink sleeve replacement program	SIB CAPEX	Existing		$50,000	$250,000	$250,000	$250,000
4	Intelligent pigging + verification dig-ups	SIB CAPEX	Existing		$350,000	$1,200,000	$2,000,000	
5	Site battery replacements	SIB CAPEX	Existing	$46,000	$80,500	$105,250	$12,000	$35,000
6	240 V battery charger replacements	SIB CAPEX	Existing	$50,000	$27,000	$23,000	$24,500	
7	Single loop controller replacements	SIB CAPEX	Existing	$171,739	$40,000		$10,000	$10,000
8	Hazardous areas equipment upgrades	SIB CAPEX	Existing	$200,000	$250,000	$150,000		
9	Earthing and lightning upgrades	SIB CAPEX	Existing	$134,149				
11	Clear SCADA upgrade	SIB CAPEX	Existing	$740,832				
12	Cathodic protection unit replacement	SIB CAPEX	Existing	$28,000	$28,000	$28,000	$28,000	$28,000
13	New cathodic protection sites	SIB CAPEX	Existing	$453,978	$350,000	$350,000		$350,000
14	AC mitigation	CAPEX	Existing	$200,000				
15	Channel Island bridge upgrade	CAPEX	Existing	$233,371	$10,450,000			
17	Mainline valve actuators replacement	SIB CAPEX	Existing	$95,000	$89,200		$89,200	
18	Tennant Creek mainline valve actuator replacement	SIB CAPEX	Existing	$47,000				
19	Wizard controller replacement	SIB CAPEX	Existing	$9,000	$30,000		$15,000	
24	AGP general	SIB CAPEX	Existing	$244,000	$250,100	$256,353	$262,761	$269,330
25	AGP motor vehicles	SIB CAPEX	Existing	$300,000	$576,000	$216,000	$360,000	$432,000
26	Building modifications	SIB CAPEX	Existing		$3,000,000			
27	Gas chromatograph upgrades	SIB CAPEX	New		$200,000	$200,000		
28	Moisture analyser upgrades	SIB CAPEX	New				$100,000	$100,000
29	Pine Creek station upgrades	SIB CAPEX	New	$60,000				
30	Replace CP Ground Beds	SIB CAPEX	New			$70,000		$70,000
31	CUG radio upgrade	SIB CAPEX	New	$100,000				
32	RTU replacement	SIB CAPEX	New	$38,000	$36,000	$38,000	$41,000	$38,000
33	Site hut upgrades	SIB CAPEX	New	$38,000	$19,000	$38,000	$37,000	$39,000
34	Solar panel replacement	SIB CAPEX	New	$36,000	$25,300	$36,300	$26,300	$20,000
35	Water bath heater upgrades	SIB CAPEX	New				$300,000	
-	AGP Access Arrangement 2016	SIB CAPEX (non AMP)	New	$100,000				

APPENDIX C – 2016-2020 AMP PROJECT DETAILS

Note: all allowances are in 2015 dollars

Item 1 – Below ground station pipe work recoating - phase 2

Issue / Opportunity Description

During construction of the AGP the below ground valves, fittings and complex joints were coated with coal tar enamel (CTE). The majority of stations on the pipeline have detectable coating defects identified during DCVG surveys, CP surveys and physical assessment. During the Check Valve Disablement project, spot sampling of the coating within the scraper stations confirmed a high density of coating defects in the CTE sections and poor condition of heat shrink sleeves and tape applied coatings.

Where corrosion defects exist within CTE, heat shrink sleeves and tape wrap, there is high potential for the development of shielding of the pipe steel from the CP system resulting in corrosion defects.

Phase 1 of this project was completed by Special Projects in June 2013, comprising five stations and four MLV's. Long range ultrasonic testing (LRUT) was used to inspect the valve support blocks and anchor blocks and no significant metal loss was detected. The coating at all scraper stations was found to be in poor condition and some coating disbondment with shielding was detected. Heat shrink sleeves and tape wrap were also removed at some stations, revealing disbondment with shielding. In general, where shielding was not encountered the CP prevented significant metal loss and no mechanical repairs were required. It was found that DCVG surveys conducted prior to excavation did not locate all significant coating defects.

Objectives / Outcomes

The objective of this project is to remove the CTE, tape wrap and heat shrink sleeves which were used on the buried pipe work. This involves excavating, stripping the coating, abrasive blasting, recoating, backfilling and reinstatement. If significant corrosion is evident at the metal / concrete interface on valve support blocks and anchor blocks, then the concrete will have to be removed. Following recoating, the blocks will have to be reinstated.

The scope of phase 2 of the project includes the recoating of all underground pipe work at a total of 25 stations.

Options

None of this pipe work is able to be inspected through metal-loss pigging, and it is therefore necessary to excavate, inspect and repair the coating where required.

It is a pipeline licence requirement to perform operations and maintenance in accordance with "good pipeline practice". The monitoring and maintenance of coating systems is also an AS 2885.3 requirement. The direct assessment of unpiggable pipework and remedial repairs is standard industry practice.

Stage 1 of the project revealed shielded coating defects where the risk of metal loss is not mitigated through the application of cathodic protection. Therefore it is possible that these

corrosion defects could grow over time resulting in a leak, or in the worst case a rupture of the pipe work.

Delivery Concept

Phase 1 was delivered using in house APA Group project management and a pipeline contractor (AJ Lucas).

In order to ensure pipeline integrity, gas supply integrity and fitness for purpose of the repairs, Phase 2 of the project will be managed in house by APA Group utilising specialist contractors and consultants as required.

Given the extent of works, a pipeline contractor will need to be utilised. The pipeline contractor will be selected through an invitation to tender which will ensure the project is delivered cost effectively.

Estimate and Timeframe

It is estimated that the works will commence in late FY2015 and continue on a rolling basis until complete in FY17. Works will need to be carefully programmed in the northern part of the AGP to take into account the high seasonal rainfall during the wet season.

Budget

FY16	FY17	FY18	FY19	FY20
$8810000	$3374800			

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	High	Negligible
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	Moderate	Negligible
Financial	Moderate	Negligible

Supporting Documentation

The following reports provide a detailed analysis of the results found from Phase 1:

• BGS-RP-A-0001 “Darwin City Gate, Coating Assessment Report”, Stephen Dykes, APA Group, Rev 0, 20 November 2012.

• BGS-RP-A-0002 “Newcastle Waters Scraper Station, Coating Assessment Report”, Stephen Dykes, APA Group, Rev 0, 5 March 2013.

• BGS-RP-A-0005 “Tindal MLV, Coating Assessment Report”, Stephen Dykes, APA Group, Rev 0, 19 April 2013.

• BGS-RP-A-0006 “Morphett Creek MLV, Coating Assessment Report”, Stephen Dykes, APA Group, Rev 0, 19 April 2013.

• BGS-RP-A-0009 “Warrego Scraper Station, Coating Assessment Report”, Stephen Dykes, APA Group, Rev 0, 10 July 2013.

• BGS-RP-A-0010 “Wauchope Scraper Station, Coating Assessment Report”, Stephen Dykes, APA Group, Rev 0, 3 July 2013.

• BGS-RP-A-0010 “Tanami Road Scraper Station, Coating Assessment Report”, Stephen Dykes, APA Group, Rev 0, 10 July 2013.

• BGS-RP-A-0012 “Kelly Well MLV, Coating Assessment Report”, Stephen Dykes, APA Group, Rev 0, 14 July 2013.

• BGS-RP-A-0013 “Aileron MLV, Coating Assessment Report”, Stephen Dykes, APA Group, Rev 0, 15 July 2013.

Recommendation

Given the extent of works required to prevent metal loss due to corrosion of the below ground station coating, the works should commence as soon as practicable. The works should be project managed in-house and utilise a pipeline contractor to complete the site works.

Item 2 – Above ground station pipe work recoating

Issue / Opportunity Description

The coating applied to above ground pipe work is exposed to the extremes of conditions and requires recoating at approximately 10-15 year intervals. Coating condition is particularly critical under supports, ground entry points or where pipe surface temperatures are lower downstream of a pressure cut. The recoating interval is influenced by environmental factors (temperature, humidity, airborne contamination) and soil conditions.

Objectives / Outcomes

It is planned to repair up to two scraper stations and two mainline valves during each coating repair campaign.

Options

Failed coating could result in significant metal loss requiring expensive rectification. If corrosion went unchecked it could result in a leak or possibly a rupture.

It is a pipeline licence requirement to perform operations and maintenance in accordance with "good pipeline practice" and therefore the pipework needs to be recoated to prevent significant metal loss due to corrosion. It is a requirement of AS 2885.3 to monitor and repair as required above ground station coatings.

It is imperative to proactively repair the coating to prevent more expensive reactive maintenance.

Delivery Concept

The pipework preparation (minor excavation and blasting) and coating will be performed by a specialist coating applicator contractor. Permitting would be performed by Field Services or an APA approved contractor.

The cost effectiveness would be influenced by the site location. In addition to integrity considerations, sites will be selected to optimise contractor mobilisation time where possible.

Estimate and Timeframe

Additional OPEX was available in FY15, which brought forward the works planned in FY16 and FY17.

The repair schedule is based on repairing two to three MLV's or scraper stations per year, so that on a 10 to 15 year cycle all stations are recoated.

Budget

FY16	FY17	FY18	FY19	FY20
		$123000	$160000	$160000

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Moderate	Negligible
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Low	Negligible
Reputational	Low	Negligible
Compliance	Moderate	Negligible
Financial	Negligible	Negligible

Supporting Documentation

Nil

Recommendation

It is critical that this preventative maintenance task is performed when required to ensure that expensive reactive maintenance is not needed in order to maintain pipeline integrity. Therefore, the funding allocation, works program and coating assessments should be reviewed on an annual basis to ensure the adequacy of the program.

Item 3 – Heat shrink sleeve replacement program

Issue / Opportunity Description

In 2008, Rosen performed an inline inspection of seven 14" pipeline sections on the Amadeus Gas Pipeline. The inspection found numerous corrosion features, mainly adjacent to girth welds beneath heat shrink sleeves. IONIK Consulting performed analysis on this data and prioritised these sleeves for repair based on estimated corrosion growth rates. The initial sleeve repair rate was approximately 100 per year.

In 2013, an inline inspection was performed on two 12" pipeline sections on the Amadeus Gas Pipeline. Results showed a high number of failed heat shrink sleeves on the Mataranka to Helling Section. GE performed a LAPA (length adaptive pressure assessment) incorporating defect growth rates. This method was less conservative that the B31G method used previously, although a significant number of repairs were required.

In 2014 the Tanami Road to Palm Valley section was inspected but did not show a high number of failed heat shrink sleeves.

A reinspection of the 14" pipeline will be performed around FY18. An inspection of the Channel Island Spurline is planned for FY18.

Comparisons of inline inspections over the life of the AGP indicate that the quantity and severity of corrosion beneath heat shrink sleeves is increasing.

Cathodic protection is not effective in protecting pipework beneath failed heat shrink sleeves due to shielding. Direct assessment of the pipework and recoating is the only way to prevent corrosion from getting worse in these areas.

Objectives / Outcomes

The objectives are to inspect the metal loss on specific pipeline locations, as indicated by intelligent pigging reports. This will be performed by excavating the pipe, removing the coating, blasting, inspecting, recoating and backfilling. If the corrosion is significant, mechanical repairs such as composite wraps will need to be applied.

Options

Given the extent of failed heat shrink sleeves in combination with high soil stress from expansive soils in some regions, metal loss would continue uncontrolled resulting in a leak or possibly a rupture.

It is a pipeline licence requirement to perform operations and maintenance in accordance with "good pipeline practice". It would be considered good practice to repair corrosion due to failed heat shrink sleeves before the defects become of critical size. It is a requirement of AS 2885.3 to monitor and repair as necessary failed below ground coatings such as heat shrink sleeves.

The proactive repair of defects that would fail in future years based on predicted corrosion growth prevents the possibility of a leak or rupture on the pipeline.

Delivery Concept

The heat shrink sleeve replacement program can either be performed by a contractor or by APA Field Services. The majority of repairs until now have been performed by a contractor, allowing Field Services to focus on routine operations and maintenance.

Estimate and Timeframe

In order to obtain synergies with available contractors and to minimise mobilisation costs, the repairs originally scheduled in FY16 and FY17 were brought forward to FY15.

The allowance in FY17 is for possible repairs on the Channel Island Spurline identified through DCVG surveys.

The estimates for future years is based on historical repair rates and assumes the repair program can be levelled based on FY18 DN350 pigging results.

Budget

FY16	FY17	FY18	FY19	FY20
	$50000	$250000	$250000	$250000

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Moderate	Negligible
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	Moderate	Negligible
Financial	Moderate	Negligible

Supporting Documentation

• IONIK Fitness for Purpose Report based on 2008 14” Rosen ILI

• Pipeline Integrity Management Plan

Recommendation

Future heat shrink sleeve repairs should be based on the GE LAPA analysis incorporating growth rate.Due to high mobilisation costs and limited resource availability, consideration should be given to combining programs over concurrent years in order to realise synergies.

Item 4 – Intelligent pigging + verification dig-ups

Issue / Opportunity Description

Intelligent pigging will be performed on all AGP pipeline sections at ten year intervals, with the exception of Mataranka to Helling (seven years). The AGP has known problems with failed heat shrink sleeves. The purpose of these inspections is to determine the location of metal loss features, which is a driver for the heat shrink sleeve replacement project. Intelligent pigging will also detect other significant features, including lightning strikes and dents, which may need to be repaired to maintain pipeline integrity.

The next major inspections include:

• Channel Island Spurline in FY18

• DN350 sections (excluding Tanami Road to Palm Valley) in FY18 and FY19

Objectives / Outcomes

The objectives are to perform intelligent pigging on all AGP pipeline sections at ten or seven year or intervals. Each program will consist of running gauge pigs, cleaning pigs and a Magnetic Flux Leakage (MFL) tool.

At the completion of each inspection, five verification dig ups will be performed in each section. The purpose of these inspections is to confirm that the sizing and location of features provided by the pigging vendor is acceptable.

Options

Intelligent pigging is a requirement of the pipeline licence and AS 2885.3.

Without intelligent pigging results, it is not possible to determine which heat shrink sleeves to target for repair. Active corrosion associated with sleeve failures could result in a leak or rupture on the pipeline. Intelligent pigging is also the only way to locate critical sized metal loss defects on the pipeline, such as lightning strikes, dents, gouges and general corrosion.

Delivery Concept

GE are currently APA Group's preferred contractor to perform the intelligent pigging. Field labour is provided by Field Services. Cleaning and gauge tools are purchased by APA Group from a variety of vendors. Field Services will perform all verification dig ups.

Estimate and Timeframe

The estimate is based on historical intelligent pigging costs.

Low flows on the DN350 sections may result in significant price increases as the low gas speed will increase the time the pig is in the pipeline and the associated cost.

Budget

FY16	FY17	FY18	FY19	FY20
	$350000	$1200000	$2000000	

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Moderate	Negligible
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	Moderate	Negligible
Financial	Moderate	Negligible

Supporting Documentation

• APA ILI Policy

• Pipeline Integrity Management Plan

Recommendation

The requirements for intelligent pigging should continue to be reviewed via the Pipeline Integrity Management Plan (PIMP).

Item 5 – Site battery replacements

Issue / Opportunity Description

Solar powered sites have a battery system to store energy. This power is used for communications, station monitoring and control and cathodic protection.

Mains powered sites have an uninterruptible power supply (UPS) to maintain station control and monitoring in the event that the site power fails. If the UPS system cannot supply the required power, the site will automatically shut in as a safety precaution. Therefore, it is important that the UPS system is reliable so that a fail to supply or fail to take does not occur.

The life of the batteries is heavily influenced by temperature exposure.

The older generation of wet cell lead acid batteries used on solar powered sites had a life of between 10 to 15 years. These batteries have numerous safety related issues and have generally been superseded by gel cell lead acid batteries which have an estimated maximum life in hot conditions of between 7 to 10 years. The NiCd batteries used in the UPS systems are original equipment and have exceeded their design life of 25 years.

Objectives / Outcomes

To ensure that battery powered systems are available as required

Options

If the battery power system is not critical to supply, safety or pipeline integrity, the batteries can be replaced on a reactive basis, provided they can be sourced and installed in a timely manner.

Where the battery power system is critical to supply, safety or pipeline integrity a programmed replacement program will be used based on expected mean time to failure and battery monitoring results.

The reliable supply of power via batteries is essential at some critical sites. Without power these sites cannot be monitored or controlled remotely via SCADA. The ability to perform remote monitoring is a requirement of the pipeline licence and AS 2885.

Delivery Concept

Batteries will be purchased and replaced by Field Services as required. Consideration will be given to replacing batteries at multiple sites in order to achieve synergies. The battery enclosures may also need to be replaced in some instances, depending on their condition and the physical dimensions of the replacement batteries.

An economic and technical assessment will be made to determine if a different type of battery should be used, for example, gel cell in place of NiCd.

Estimate and Timeframe

An annual allowance has been provided based on the age and expected life of the batteries that are in service. The condition of batteries is checked periodically and the replacement priority will be adjusted accordingly.

Budget

FY16	FY17	FY18	FY19	FY20
$46000	$80500	$105250	$12000	$35000

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Not Applicable	Not Applicable
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	High	Negligible
Reputational	Moderate	Negligible
Compliance	Low	Negligible
Financial	Low	Negligible

Supporting Documentation

Nil

Recommendation

Batteries should be replaced based on criticality and current performance. Consideration should be given to alternative battery technologies based on a technical and economic analysis.

Item 6 – 240 V battery charger replacements

Issue / Opportunity Description

All meter stations have 240 V battery chargers that are required for the uninterruptible power supply (UPS). The UPS provides power to maintain station control and monitoring in the event that the site power fails. If the UPS system cannot supply the required power, the site will automatically shut in as a safety precaution. Therefore it is important that the UPS system is reliable so that a fail to supply or fail to take does not occur.

The 240 V chargers have historically undergone extensive refurbishments as components fail and they are now obsolete. Due to the large physical size of the charger, some rearrangement of existing equipment may be required.

Objectives / Outcomes

Replace battery chargers prior to complete failure.

Options

Due to the criticality of this equipment and long lead times for some types of battery chargers, they need to be replaced prior to complete failure.

An economic and technical assessment will be performed to determine the most appropriate type of replacement charger.

The capacity of the system will be reviewed as the station load and criticality may have changed since construction. An upgrade in the UPS capacity will be doubly beneficial as it will provide redundancy to the system.

Reliable charging of the UPS system is essential at some critical sites. Without backup power these sites cannot be monitored or controlled remotely via SCADA in. The ability to perform remote monitoring is a requirement of the pipeline licence and AS 2885.

Delivery Concept

The replacement battery chargers will be specified by Engineering and purchased and installed by Field Services. The replacement program will be based on equipment condition and service criticality.

Estimate and Timeframe

The replacement program is prioritised on current equipment condition and criticality and is phased over four years.

Budget

FY16	FY17	FY18	FY19	FY20
$50000	$27000	$23000	$24500	

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Not Applicable	Not Applicable
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	High	Negligible
Reputational	Moderate	Negligible
Compliance	Low	Negligible
Financial	Low	Negligible

Supporting Documentation

Nil

Recommendation

The 240 V chargers should be replaced based on equipment condition and criticality in order to ensure the reliability of gas supply.

Item 7 – Single loop controller replacements

Issue / Opportunity Description

Pressure and flow control stations in the Northern Territory currently utilises Eurotherm T640 or Toshiba TOSDIC single loop controllers (SLC) for flow, pressure and/or temperature control of gas. These SLC's are used at Darwin City Gate, Pine Creek, Katherine and Tennant Creek.

Serviceability has been very poor for these units with complex supply chains and long lead times. Due to the key role of the controllers in station control, failure of equipment has the potential to cause a fail to supply.

Additionally the controllers have proven difficult to program and there is no support within the Northern Territory and only limited and expensive support within Australia. Neither the TOSDIC or Eurotherm controller are manufactured anymore and replacement units are not available.

The controllers have also failed to perform as designed at two stations which have more complex control requirements.

Objectives / Outcomes

The objective of this project is to replace these SLC's with a simpler controller that:

• Can be serviced and repaired domestically

• Can be programmed within APA Group

• Has a shorter lead time for new units and parts

• Is capable of controlling as per design requirements

• Will be available for purchase for several years going forward

Options

Due to the current SLC's being obsolete, they must be replaced in the near future to ensure that a fail to supply does not occur.

Although most stations have a single backup pneumatic control system, this cannot be relied upon as the primary means of station control for extended periods.

It is a pipeline licence requirement to perform operations and maintenance in accordance with "good pipeline practice". It would be considered good practice to ensure that the SLC's are reliable so that the station functions as per the intended design and can securely deliver gas.

Delivery Concept

A study has been completed to discern the most appropriate replacement for the existing SLC's

The Yokogawa YS1700 is by far the best replacement option technically. Yokogawa also have local support for both programming and repair. The YS1700 is designed to be easily programmed and is distributed with several pre-set programs which will eliminate a large amount of the programming time.

Pine Creek will be the first station to receive the new controllers as Field Services are having issues with the existing TOSDIC controllers here. A control philosophy has been developed for the station and this will be the basis for the programming. The controllers will be trialled here before being implemented at the other stations.

The SLC design will be performed by Engineering and implemented by Field Services

Estimate and Timeframe

The SLC replacement will be prioritised based on criticality. Most of the development time will be used at the first site (Darwin City Gate) with the replacement of the remainder SLC's over a period of two years.

The allowance in future years is for the replacement of other SLC's with minor station control functions.

Budget

FY16	FY17	FY18	FY19	FY20
$171739	$40000		$10000	$10000

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Not Applicable	Not Applicable
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	Low	Negligible
Financial	Low	Negligible

Supporting Documentation

Nil

Recommendation

Replace the obsolete Toshiba TOSDIC and Eurotherm T640 SLC's with the Yokogawa YS1700 to ensure station reliability and control.

Item 8 – Hazardous areas equipment upgrades

Issue / Opportunity Description

In accordance with Northern Territory Legislation and Australian Standards (in particular AS3000, AS 60079), there is a requirement to ensure all electrical equipment meets Hazardous Area compliance. Hazardous Areas are places where an explosive atmosphere may exist. An explosive atmosphere coupled with an ignition source will result in ignition and/or explosion. Electrical equipment in the hazardous area is a potential ignition source.

The standards require that only equipment rated for specific hazardous area zones are allowed to be installed. There is a duty of care to ensure that all electrical equipment at all sites are sufficiently rated and maintained for the environment in which it is used.

Hazardous area inspections have been performed at all stations and dossiers have been complied. Instrument / Electrical Technicians have received training in hazardous areas inspections.

Objectives / Outcomes

Create and implement a change out program for equipment that is not compliant with the Hazardous Area assessment. The hazardous areas dossiers will be updated to reflect these upgrades.

Repair and rectify equipment that is suitably rated but incorrectly installed or requires maintenance.

Options

AS 2885.1 requires that all new pipeline facilities must be designed to the relevant standards (AS 3000 / AS 60079). AS 2885 and the pipeline licence requires that any modifications are done in accordance with the latest relevant standards.

Due to the relatively short life of electrical equipment compared to the pipeline, any upgrades of electrical equipment must meet the current relevant standards.

The same risks to personnel and assets exist at older sites that were not compliant at construction or whose compliance has lapsed.

Therefore upgrades are required at stations where hazardous areas non-compliances exist.

Delivery Concept

A risk based replacement program will be developed for all sites. The equipment selected will be assessed based on total lifecycle cost. The use of wireless technology will be investigated as one option to reduce ongoing maintenance and training costs.

Field Services personnel have been trained in hazardous areas equipment installation and inspection and will perform the site works. The replacement program may be supplemented by contractors where required.

The design will be performed by Engineering and implemented by Field Services.

Estimate and Timeframe

The estimate to complete the works is based on similar works on other sites and by the consultant used to produce the hazardous areas dossier.

Budget

FY16	FY17	FY18	FY19	FY20
$200000	$250000	$150000		

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Moderate	Negligible
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	Moderate	Negligible
Financial	Low	Negligible

Supporting Documentation

• AGP Hazardous Areas Dossier and associated reports

Recommendation

A risk based replacement program will be implemented to improve compliance to hazardous areas equipment requirements

Item 9 – Earthing and lightning upgrades

Issue / Opportunity Description

The Northern Territory has one of the highest lightning strike densities in the world. Historically there has been significant asset damage to both the pipeline and above ground equipment. Pipeline damage includes coating defects and significant loss of pipe wall and in some instances through wall defects resulting in loss of containment. Damage to above ground assets typically consists of damaged electrical equipment.

Transient voltages on the pipeline due to lightning strikes or power line faults also present a risk of harm to personnel. These voltages can travel considerable distances on well coated pipelines. AS 4853 requires that an Electrical Hazard Management Plan is developed to ensure the integrity of earthing and lightning protection systems in order to minimise damage to assets and harm to personnel. Adherence to AS 4853 is a requirement of AS 2885 parts 1 and 3. A preliminary audit of AGP stations against AS 1768 has shown that a number of stations do not have compliant earthing or lightning systems.

The AGP earthing and lightning system design is considerably less substantial than more modern pipelines that have been constructed in the Northern Territory such as the BGP and WPP.

Objectives / Outcomes

The aim of the earthing and lightning system upgrades is to ensure that AGP assets are appropriately designed so that excessive asset damage does not occur and risk to personnel is reduced to an acceptable level.

Options

Equipment failures will continue to occur at AGP stations until the earthing and lightning systems are upgraded.

It is a requirement of AS 2885.3 to monitor and mitigate the effects of lightning strikes on pipeline facilities.

Equipment failure can result in a loss of station control both locally and via SCADA if communications are lost. It is a requirement of AS 2885 to be able to monitor and control the pipeline remotely via SCADA.

Delivery Concept

The earthing and lightning design for the AGP is poorly documented. A study is required in order to assess the current design and identify possible improvements. The study will be performed largely using internal resources for data collection and analysis. A provision has been made in the estimate for a consultant to review the internal analysis and provide detailed upgrade designs if required.

Based on asset criticality and current asset condition, an upgrade program will be developed to improve earthing and lightning protection across AGP assets. This may require extensive modifications at some critical sites.

Estimate and Timeframe

The expenditure in FY16 is for the rectification of lightning protection and earthing at critical sites. Future funding will most likely be required, but this is difficult to ascertain until the completion of the study.

Budget

FY16	FY17	FY18	FY19	FY20
$134149				

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Moderate	Low
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	Low	Negligible
Financial	Low	Negligible

Supporting Documentation

Nil

Recommendation

The rectification of earthing and lightning systems at critical sites should be prioritised.

Item 11 – Clear SCADA upgrade

Issue / Opportunity Description

Supervisory control and data acquisition (SCADA) is critical to ensure the reliable control and monitoring of pipeline assets. The SCADA system also forms part of the billing system allowing commercial transactions to occur on the pipeline.

The current NT SCADA system is a Honeywell Experion. The software license for this system will expire shortly. APA Group has a project to standardise SCADA systems to the Schneider ClearSCADA system. This brings numerous benefits to APA Group including consistency, in-sourcing and cost savings and enables the Integrated Operations Centre (IOC) to operate on a single SCADA platform.

The implementation of ClearSCADA within APA Group is prioritised based on resource availability along with technical and commercial drivers.

Objectives / Outcomes

To upgrade the current Honeywell SCADA system to Schneider ClearSCADA.

Options

Pipelines cannot operate safely and efficiently without a SCADA system. SCADA software requires updating on a continual basis to ensure appropriate functionality and security. If the NT were to remain using Honeywell Experion then the benefits associated with standardisation including cost efficiencies could not be achieved.

It is a requirement of AS 2885 to have reliable SCADA monitoring of the pipeline.

Delivery Concept

The upgrade will be delivered using internal resources and specialised vendors where required.

Estimate and Timeframe

The project is due to commence in FY15 and be completed in FY16. The timing to date has been influenced by national priorities and the availability of resources.

Budget

FY16	FY17	FY18	FY19	FY20
$740832				

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Not Applicable	Not Applicable
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	Moderate	Negligible
Financial	Low	Negligible

Supporting Documentation

Nil

Recommendation

The current SCADA system should be updated prior to expiry of the current Honeywell Experion license. The timing will be based on national priorities, including the establishment of the IOC.

Item 12 – Cathodic protection unit replacement

Issue / Opportunity Description

A number of the existing cathodic protection units (CPU's) are old and spare parts are difficult or impossible to obtain. The CPU's typically contain a number of proprietary printed circuit boards containing discrete components. Failures can occur through prolonged service and sometimes due to transient voltages on the pipeline. When a CPU fails, the faulty circuit board is often sent away for service, resulting in reduced or no cathodic protection being applied for a period of time. There are numerous models of CPU in use on the AGP making parts interchangeability difficult.

Numerous CPU's with reliability issues were replaced as part of the CP Upgrade Stage 2 project. However, there was not sufficient evidence at the time to justify replacement of all aging CPU's. Therefore, old CPU's need to be continually upgraded based on condition.

Objectives / Outcomes

To ensure that cathodic protection of the pipeline is not compromised by failed CPU's.

Options

If cathodic protection is not available for prolonged periods then metal loss corrosion can occur on the pipeline.

Unreliable CPU's incur high servicing costs which eventually makes them uneconomical. The sparing of existing CPU's would not be economical due to range of models and age of the units.

Unreliable units will be replaced progressively to ensure that cathodic protection is available on the pipeline. This will also lead to standardisation of equipment on the pipeline.

It is a requirement of AS 2885 and the pipeline licence to have reliable cathodic protection applied to the pipeline in order to prevent corrosion.

Delivery Concept

The lead time for a new CPU is approximately four months. Therefore, two CPU's will be purchased for installation in the event of a failure, or imminent failure. The number of CPU's to be held as spares will be reviewed on an annual basis. The CPU's will be replaced by Field Services.

Estimate and Timeframe

The estimate is based on replacing two CPU's per year using internal resources.

Budget

FY16	FY17	FY18	FY19	FY20
$28000	$28000	$28000	$28000	$28000

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Not Applicable	Not Applicable
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	Moderate	Negligible
Financial	Low	Negligible

Supporting Documentation

Nil

Recommendation

The number of CPU's to be held as spares and the units requiring replacement should be reviewed on an annual basis.

Item 13 – New cathodic protection sites

Issue / Opportunity Description

The primary method of corrosion prevention on the AGP is an extruded HDPE coating, otherwise known as “yellow jacket”. Coating defects cannot be prevented entirely, so corrosion of the pipeline steel is prevented by the application of cathodic protection (CP). CP slows the corrosion process down to negligible rates as long as certain protection criteria can be met. CP is generally not effective at preventing corrosion at heat shrink sleeves. This type of corrosion is best detected by intelligent pigging and then excavated for repair.

Coating defects typically result from the growth of construction coating damage, in-service failures from interaction with the pipeline backfill (soil stress / rock damage) or transient voltages (from lightning strikes or power line faults). The continual degradation of the pipeline coating requires the application of more CP current in order to mitigate corrosion. There is a limit to the amount of CP current that can be injected at a point on the pipeline, so it is usual to install CP sites at intervals determined by a CP system design.

CP can be applied using sacrificial anodes or by impressed current. Generally impressed current systems must be used on the AGP because of the current levels required. These sites can be powered mains power (where available) or by solar systems elsewhere.

The application of CP is a requirement of AS 2885 / AS 2832.1 and the AGP pipeline license. The pipeline is surveyed annually to determine if the CP protection criteria have been met.

Objectives / Outcomes

To ensure that CP levels can be maintained as required by AS 2885.1 / AS2832 and the AGP pipeline license, new impressed current CP sites will be installed on the AGP as identified from the annual CP survey.

The next impressed current site will be installed at KP869. Other sites identified for impressed current systems include KP420, KP952 and KP1023.

Protection levels north and south of Daly Waters are also marginal, although it is suspected that this is due to a fault at Daly Waters. Investigations are currently underway to investigate this.

Options

CP is essential to ensure that metal loss due to corrosion does not occur which could result in a leak or rupture.

Due to the continual degradation of the yellow jacket coating on the AGP, continual augmentation of the CP system is required.

It is a requirement of AS 2885 and the pipeline licence to have reliable cathodic protection applied to the pipeline in order to prevent corrosion.

Delivery Concept

New sites will be based on previous designs incorporating identified improvements. A ground bed survey has already been performed to identify possible sites.

The sites will be constructed using a combination of internal resources and contractors / consultants, based on resource availability and cost.

Estimate and Timeframe

One new solar powered impressed current CP site is planned in the vicinity of KP869 in FY16. The estimate is based on costs for the FY2014 CP site at Lake Woods. Additional allowances have been made in FY16 for the long lead land acquisition process at KP420, KP952 and KP1023.

The estimated spend for future years will be based on the results from annual CP surveys.

Budget

FY16	FY17	FY18	FY19	FY20
$453978	$350000	$350000		$350000

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Not Applicable	Not Applicable
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	High	Negligible
Financial	Moderate	Negligible

Supporting Documentation

• Annual AGP CP regulator reports

Recommendation

A new solar powered impressed current CP site should be installed in the vicinity of KP869 in order to mitigate pipeline corrosion. The cause of marginal protection levels in the vicinity of Daly Waters should be determined prior to considering future CP site locations at KP952 and KP1023.

Item 14 – AC mitigation

Issue / Opportunity Description

The Channel Island Spurline and Katherine Lateral both parallel high voltage power lines. This may result in low frequency induction (LFI), earth potential rise (EPR), capacitive coupling and AC corrosion. Due to the installation of new high voltage power lines and increased loads on existing high voltage power lines, the possible harm to people and assets needs to be mitigated. The requirement to review the AC mitigation strategy was identified in the 2011 SMS (item 1032 and 1098). AC mitigation is a requirement of AS 2885 parts 1 and 3.

As part of the CP Upgrade Stage 2 project, a consultancy was performed by Geoff Cope and Associates in accord with AS 4853 “Electrical hazards on metallic pipelines” in order to determine what mitigation is required. This study also considered if the existing CP infrastructure is adequate to maintain protection levels in accordance with AS 2832.1.

Objectives / Outcomes

The consultancy was completed by Geoff Cope and Associates in August 2013. As estimate was prepared to perform the mitigation works and submitted to PWC in September 2013 to be funded under the transitional tariff arrangement. Subsequent to this report, PWC engaged Evans and Peck to perform an independent review. Evans and Peck made a number of recommendations which Geoff Cope and Associates are in the process of reviewing.

A summary of the proposed scope of works includes:

• Installation of equipotential grading ring and AC mitigation test point at four locations on the Katherine Lateral.

• Installation of equipotential grading ring and AC mitigation test point at 33 locations on the AGP between KP 1476 and KP 1510.

• Decommissioning of the ground beds (two off) at KP 1506 on the Channel Island Spurline.

Options

Given the threat to asset integrity and public safety, compliance to AS 4853 needs to be achieved in order to successfully mitigate all risks. AS 4853 allows a quantitative risk based approach which aims to develop mitigation which is commensurate with the risk. This approach is accepted by the pipeline and energy utility industries.

Delivery Concept

The AC mitigation works are planned to be installed by a pipeline contractor in FY16. This pipeline contractor will provide all resources necessary to complete the project (including PIO’s), minimising the impact to Field Services resources. However, depending on contractor availability, some Field Services personnel may be required to assist with the delivery of the project.

Estimate and Timeframe

The timing of the project is dependent on finalisation of the modelling by Geoff Cope and Associates. The modelling requires that data is obtained from the power line operator (PWC) which may delay process.

Budget

FY16	FY17	FY18	FY19	FY20
$200000				

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	High	Negligible
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	Moderate	Negligible
Financial	Low	Negligible

Supporting Documentation

• “Katherine – Darwin City Gate – Channel Island, Investigation of Induced Voltage Mitigation Requirements” Geoff Cope, Geoff Cope and Associates, Rev 0, 28 August 2013.

• "APA Gas Pipeline LFI Mitigation Review", Evans and Peck, March 2014, revision D.

Recommendation

The proposed mitigation should be installed by during the 2015 dry season (FY2016) to ensure that AC induced voltages are appropriately mitigated on the AGP.

Item 15 – Channel Island bridge upgrade

Issue / Opportunity Description

Particular integrity threats on the Channel Island Spurline (Darwin City Gate to Channel Island Meter Station) include coating and metal loss due to transient voltages (lightning and power line faults), AC corrosion, corrosion due to sulphate reducing bacteria, corrosion due to shielding (typically at heat shrink sleeves), and damage due to third party interference. The most useful method for detecting these integrity threats is by intelligent pigging.

The Channel Island Spurline cannot currently be intelligently pigged, and is the only mainline section of the AGP that has not been pigged since construction. This makes integrity management of this spurline difficult and relies on increased levels of coating inspection and direct assessments by excavating and inspecting all coating defects. Lightning strikes and corrosion have already been found on this pipeline through DCVG surveys, however these surveys cannot be relied upon to find all metal loss features.

Intelligent pigging could be performed on the Channel Island Spurline when the following modifications are performed:

• Replacement or modification of the 8” section that currently crosses the Channel Island Bridge.

• Removal of tight radius bends on the bridge approaches and at the pig trap risers.

• Installation of pig traps at Darwin City Gate and Channel Island Meter Station.

• Installation of appropriately sized and pressure rated filtration at Channel Island Meter Station.

• Replacement of the mainline valve at Channel Island Meter Station which cannot provide a positive isolation.

• Increase the size of the mainline valve bypass to allow full flow without causing an unacceptable pressure drop or high gas velocity.

• Tie into the existing Units 8 & 9 offtake.

Objectives / Outcomes

Perform the required modifications to the Channel Island Spurline, Darwin City Gate and Channel Island Meter Station to allow intelligent pigs to be run in the pipeline. These modifications must be performing whilst not causing a supply interruption to Channel Island Power Station.

Options

The methods used to manage unpiggable pipelines, such as direct assessments, are not as reliable as intelligent pigging. Therefore, there is a risk that integrity threats can go undetected. The Channel Island Spurline supplies the Channel Island Power Station and the

majority of Darwin with electricity. A threat to gas supply on this spurline would therefore have significant economic consequences. PWC have indicated they do want to accept the risk of a supply on this spurline and would like to mitigate integrity risks by making it piggable.

Three options exist to make the DN200 section of the spurline piggable:

• Replacement of the DN200 section of pipe could be achieved using pull through of a DN300 pipe onto new hangers on the bridge.

• Performing a horizontal directional drill (HDD) under the bridge and tying into the Channel Island Meter Station.

• Installing a mid-way scraper station on the eastern side of the bridge that can receive DN300 pigs and launch DN200 pigs.

All modifications will need to be performed whilst maintaining gas supply to the Channel Island Power Station.

Delivery Concept

A front end engineering design (FEED) study has been performed by APA Group using internal resources and specialist contractors where required.

The detailed job design will be undertaken using a combination of internal resources and consultants / contractors.

The pipeline modifications will be project managed using internal resources with the work performed by contractors. Permitting could be performed by internal resources, depending on resource availability, or could use contractors if required.

Estimate and Timeframe

The estimate provided is for the complete project, including the FEED study. The project timing is dependent on approval from the project sponsor, PWC. The project cost estimate will be refined upon completion of the FEED study.

Budget

FY16	FY17	FY18	FY19	FY20
$233371	$10450000			

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Moderate	Negligible
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	Moderate	Negligible
Financial	Moderate	Negligible

Supporting Documentation

Channel Island Bridge FEED study

Recommendation

To ensure that pipeline integrity can be appropriately managed on this spurline given the numerous credible threats, it should be made piggable as soon as practicable.

Item 17 – Mainline valve actuators replacement

Issue / Opportunity Description

The Limitorque actuators on the 12" and 14" mainline valves are original equipment and are now obsolete as spare parts cannot be readily obtained.

The actuators are installed on all mainline valves located with scraper stations and at critical mid-section mainline valves.

Objectives / Outcomes

Replace the Limitorque actuators with suitable alternative prior to them becoming unserviceable.

Options

These actuators provide pipeline isolation and can be operated local or remotely via SCADA. Therefore they are relied upon for pipeline isolation in the event of an emergency. AS 2885.1 requires that procedures are in place to be able to effectively isolate the pipeline remotely using mainline valves in a timely manner.

The long lead time for the actuators means that they have to be replaced ahead of failure.

Delivery Concept

An assessment of the possible actuators has already been performed by Engineering, with Shafer actuators recommended.

Replacement actuators will be purchased and installed by Field Services based on a technical specification produced by Engineering.

Estimate and Timeframe

Two actuators have already been purchased for Helling and Batchelor. A phased replacement of the remaining 10 actuators is proposed to commence in 2015, at the rate of two every actuators every two years. The replacement cost per actuator is approximately $44,600 including materials and labour.

The lead time for the actuator is approximately eight months.

Budget

FY16	FY17	FY18	FY19	FY20
$95000	$89200		$89200	

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Not Applicable	Not Applicable
Environmental	Not Applicable	Not Applicable
Operational	Not Applicable	Not Applicable
Customers	Not Applicable	Negligible
Reputational	Moderate	Negligible
Compliance	Moderate	Negligible
Financial	Not Applicable	Not Applicable

Supporting Documentation

Nil

Recommendation

Replace Limitorque mainline valve actuators with Shafer actuators, prior to them becoming unserviceable.

Item 18 – Tennant Creek mainline valve actuator replacement

Issue / Opportunity Description

The mainline valve actuator at the Tennant Creek Meter Station is original equipment and is no longer serviceable due to spare parts not being available. Another known problem is that the manual hydraulic override pump system leaks air, making it difficult to reliably operate the valve locally in manual mode (in the event of an actuator failure). This actuator is the same type that was recently replaced at the Katherine Meter Station.

The actuator is a critical component of the station as it provides positive isolation from the upstream pipeline pressure and must operate reliably when required. This actuators can be operated locally or remotely via SCADA.

Objectives / Outcomes

Replace the existing actuator with a Shafer actuator (as installed at Katherine Meter Station).

Options

The actuator at Tennant Creek Meter Station is required for station isolation and is therefore critical for station control an operation. AS 2885.1 requires that procedures are in place to be able to effectively isolate the pipeline and stations remotely using mainline valves in a timely manner.

As the actuator is no longer serviceable, it should be replaced with a suitable alternative.

Delivery Concept

The replacement actuator will be purchased and installed by Field Services based on a technical specification produced by Engineering. A Shafer actuator will be purchased as these are the preferred type in the NT.

Estimate and Timeframe

The estimate is based on a recent price for the replacement actuator at Katherine Meter Station. The estimate is for materials and labour.

Budget

FY16	FY17	FY18	FY19	FY20
$47000				

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Not Applicable	Not Applicable
Environmental	Not Applicable	Not Applicable
Operational	Not Applicable	Not Applicable
Customers	Not Applicable	Negligible
Reputational	Moderate	Negligible
Compliance	Moderate	Negligible
Financial	Not Applicable	Not Applicable

Supporting Documentation

Nil

Recommendation

Replace the existing actuator at Katherine Meter Station with a Shafer actuator prior to it becoming unserviceable.

Item 19 – Wizard controller replacement

Issue / Opportunity Description

At stations where electronic valve control is used (temperature, flow or pressure control) backup control is often provided using a pneumatic controller. Should the electronic valve control fail, the pneumatic controller will take over control, therefore preventing a fail to supply event. The preferred type of pneumatic controller in the NT is a Wizard by Fisher.

The Tennant Creek Meter Station has electronic valve control but no back pneumatic controller.

At Darwin City Gate and Pine Creek the Wizard controllers are nearing the end of their useful life.

Objectives / Outcomes

Install a Wizard controller at Tennant Creek to provide pneumatic backup to the electronic control system.

Replace the Wizard controllers at Darwin City Gate and Pine Creek prior to failure.

Options

The wizard controller is a single non-redundant backup pneumatic control system. Therefore, this equipment needs to be reliable in order to maintain gas supply in the event that the electronic valve control system fails.

The cost of installing backup pneumatic control systems is significantly less than a fail to supply event.

Delivery Concept

The Wizard pneumatic controller will be installed at Tennant Creek Meter Station using the same approach as at Katherine Meter Station. The purchase and installation will be performed by Field Services. This work is planned for FY2015.

The replacement Wizard controllers for Darwin City Gate and Pine Creek will be purchased and installed by Field Services. This work is planned for subsequent years.

Estimate and Timeframe

The cost of the wizard controller and associated materials is estimated to be $15,000 per site including materials and labour.

Budget

FY16	FY17	FY18	FY19	FY20
$9000	$30000		$15000	

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Not Applicable	Low
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Not Applicable
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	Moderate	Negligible
Financial	Low	Negligible

Supporting Documentation

Nil

Recommendation

Install a Wizard pneumatic controller at Tennant Creek Meter Station to provide backup to the electronic control system.

Replace the aging Wizard pneumatic controllers at Darwin City Gate and Pine Creek.

Item 24 – AGP general

Issue / Opportunity Description

Stay in business operating capital items are purchased through the year and requested on an individual basis.

The type of equipment purchased includes minor plant and equipment and materials used on the pipeline.

Objectives / Outcomes

To ensure that Field Services have the necessary minor plant, equipment and materials to perform maintenance on the pipeline.

Options

The minor plant, equipment and materials are required to ensure that the pipeline can be operated and maintained in accordance with the pipeline licence and AS 2885.3.

Delivery Concept

Individual items are purchased using the operating capital request process to ensure that the item is justified and the best value is obtained.

Estimate and Timeframe

The annual allowance is based on historical levels of expenditure and the anticipated maintenance effort required to maintain the pipeline.

Budget

FY16	FY17	FY18	FY19	FY20
$244000	$250100	$256353	$262761	$269330

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Moderate	Negligible
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	Moderate	Negligible
Financial	Low	Negligible

Supporting Documentation

Nil

Recommendation

The annual allowance is required for purchasing plant, equipment and materials needed to maintain the AGP.

Item 25 – AGP motor vehicles

Issue / Opportunity Description

A fleet of vehicles are in service throughout the AGP system including light cars, utilities and 4WD trucks. The fleet is well maintained, regularly services and reflects a program of staggered renewal. Vehicles are purchased or replaced on an as required basis depending on personnel, project or operational requirements.

Objectives / Outcomes

To ensure that Field Services have the appropriate types of vehicles to perform operations, maintenance and project work on the pipeline and to ensure that these vehicles are adequately maintained and serviced.

Options

The vehicles required are matched to personnel or operational needs and are reviewed on an annual basis. Vehicles are purchased, replaced and maintained in accordance with the national APA Group policy.

The vehicles are required to ensure that the pipeline can be operated and maintained in accordance with the pipeline licence and AS 2885.3.

Delivery Concept

Vehicles are purchased or replaced based on the national APA Group policy by procurement.

Estimate and Timeframe

The estimate allows for expected levels of vehicle purchases or replacements based on projected pipeline operational needs.

Budget

FY16	FY17	FY18	FY19	FY20
$300000	$576000	$216000	$360000	$432000

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	High	Negligible
Environmental	Not Applicable	Not Applicable
Operational	Low	Negligible
Customers	Not Applicable	Not Applicable
Reputational	Low	Negligible
Compliance	Low	Negligible
Financial	Negligible	Negligible

Supporting Documentation

Nil

Recommendation

Vehicles should be purchased or replaced based on the national APA Policy and the operational requirements of the AGP.

Item 26 – Building modifications

Issue / Opportunity Description

Upgrades are needed to the 25 plus year old facility at 16 Georgina Crescent to accommodate the workforce, improve staff facilities, upgrade the building and ensure compliance with Australian Standards. In addition the need for additional warehouse/storage facilities and improved office space has been identified at the 27 Georgina Crescent facility.

The administrative office component is an APA Group owned building on Crown Land at 16 Georgina Crescent whilst the maintenance base currently occupies a leased facility at 27 Georgina Crescent Yarrawonga.

Objectives / Outcomes

The intent of this project is to identify a real estate solution that will provide sufficient space to accommodate all Darwin staff into a single facility, to improve site security, to increase seating capacity and better utilise the surplus land, to accommodate more shedding and plant and stores building on the current excess land.

Bringing together both facilities will improve the safety and cultural environment.

A large scale upgrade of the 16 Georgina Crescent facility will provide a reduction in annual rental expenditure, meet the terms of the gas transportation agreement and address the identified upgrades required for both facilities.

Options

This development may take one of the following options:

• The refurbishment of the existing administration office building, the finance office building and construction of a new workshop facility on site, including the relocation of Field Services (north) to 16 Georgina Crescent; or

• The refurbishment of the existing administration office building and the finance office building; or

• The refurbishment of the existing administration office building.

Delivery Concept

The project would be managed by APA Group but delivered using consultants and contractors.

The offices would need to remain functional during the modifications.

Estimate and Timeframe

The modifications are planned to commence in FY16. Preliminary plans have been developed by an architect and an estimate produced by a quantity surveyor.

The estimated amount is based on Option 1.

Budget

FY16	FY17	FY18	FY19	FY20
	$3000000			

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Moderate	Negligible
Environmental	Not Applicable	Not Applicable
Operational	Not Applicable	Not Applicable
Customers	Not Applicable	Not Applicable
Reputational	Negligible	Negligible
Compliance	Moderate	Negligible
Financial	Not Applicable	Not Applicable

Supporting Documentation

Nil

Recommendation

The buildings at 16 Georgina Crescent should be upgraded so that all personnel are on the one site and ensuring that the building meets the operational needs of the business.

Item 27 – Gas chromatograph upgrades

Issue / Opportunity Description

Gas chromatographs (GC) are used on pipeline systems to determine the chemical composition of the gas. This chemical composition is used for a number of purposes including:

• Calculation of the physical properties, for flow calculations and custody transfer for billing purposes.

• Determining the gas quality in accordance with gas transportation agreements and pipeline integrity requirements.

GC's become obsolescent due to technology updates of both hardware and software. Older units become unserviceable as they are no longer supported by the vendor.

Objectives / Outcomes

To replace GC's before they become unreliable or unserviceable.

Options

GC's are an integral part of an operating pipeline and must have high levels of availability and accuracy so that they can be relied upon for billing and gas quality determination.

It is a pipeline licence requirement and AS 2885.3 requirement to know the composition of the contents being conveyed in a pipeline.

Delivery Concept

GC's will be replaced prior to them becoming unserviceable or unreliable. This work will be performed by Field Services with assistance from specialised vendors where required.

Estimate and Timeframe

The estimate allows for CG's to be replaced including materials and labour.

The GC's requiring replacement in the current forecast period are located at Mereenie and Palm Valley.

Budget

FY16	FY17	FY18	FY19	FY20
	$200000	$200000		

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Not Applicable	Not Applicable
Environmental	Not Applicable	Not Applicable
Operational	Low	Negligible
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	Low	Negligible
Financial	Negligible	Negligible

Supporting Documentation

Nil

Recommendation

GC's should be replaced prior to them becoming unserviceable or unreliable as they are required for billing and gas quality purposes.

Item 28 – Moisture analyser upgrades

Issue / Opportunity Description

Moisture analysers are used on pipeline systems to accurately determine the amount of water present in the gas. The moisture content in the gas stream needs to be controlled for the following reasons:

• To prevent the formation of corrosive carbonic acid when water combines with carbon dioxide in the gas stream. This could result in internal corrosion of the pipeline.

• To meet end user requirements as specified in the gas transportation agreement.

Objectives / Outcomes

To replace moisture analysers before they become unreliable or unserviceable.

Options

Moisture analysers are an integral part of an operating pipeline and must have high levels of availability and accuracy so that they can be relied upon for determining the water content in pipelines.

It is a pipeline licence requirement and AS 2885.3 requirement to know the composition of the contents being conveyed in a pipeline.

Delivery Concept

Moisture analysers will be replaced prior to them becoming unserviceable or unreliable. This work will be performed by Field Services with assistance from specialised vendors where required.

Estimate and Timeframe

The estimate allows for moisture analysers to be replaced including materials and labour.

The moisture analysers requiring replacement in the current forecast period are located at Mereenie and Palm Valley.

Budget

FY16	FY17	FY18	FY19	FY20
			$100000	$100000

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Not Applicable	Not Applicable
Environmental	Not Applicable	Not Applicable
Operational	Low	Negligible
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	Moderate	Negligible
Financial	Low	Negligible

Supporting Documentation

Nil

Recommendation

Moisture analysers should be replaced prior to them becoming unserviceable or unreliable as they are required for determining the water content of the gas being conveyed in a pipeline.

Item 29 – Pine Creek station upgrades

Issue / Opportunity Description

The Pine Creek meter station supplies gas to the Energy Developments Limited (EDL) power station at Pine Creek. EDL currently have a contract to supply base load power to PWC.

A preliminary investigation of this station highlighted a number of potential issues including:

- Ladders and platforms that do not meet current design requirements and pose a health and safety risk
- The liquid knock out vessel (KO-2) is not pressure rated to have the operating pressure above the minimum delivery pressures as required in the gas transportation agreement
- The instrument gas supply system is not reliable as it is single run with no accumulator. A loss of instrument gas could result in a loss of station control.
- The primary over pressure protection on the final pressure cut has no redundancy. The pressure safety valve (PSV) cannot be functionally reset or checked without removing this piece of safety equipment. Also, due to the configuration of the over pressure protection system, the PSV is regularly set off when the power station shuts down without warning resulting in the prolonged uncontrolled venting of gas.

Objectives / Outcomes

To perform further engineering investigations including:

- Failure Mode and Effects Analysis (FMEA)
- Design reviews
- HAZOP study
- Risk assessments

in order to determine what immediate and long term upgrades are required at the station to ensure continuity of supply and personnel safety.

Options

The known deficiencies at this station need be addressed in order to ensure compliance with the pipeline licence and AS 2885.3.

The engineering investigations will determine what modifications are required to mitigate the supply and health and safety risks.

Delivery Concept

The engineering investigations will be performed using internal resources.

Depending on the extent of the modifications required, these will be performed either in-house using Field Services and/or with specialised contractors.

Estimate and Timeframe

The estimate provided is for the engineering investigations and rectifying known current known deficiencies.

If additional deficiencies are revealed in the engineering investigations these will be mitigated at additional cost.

Budget

FY16	FY17	FY18	FY19	FY20
$60000				

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Moderate	Negligible
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Moderate	Negligible
Reputational	Low	Negligible
Compliance	Low	Negligible
Financial	Low	Negligible

Supporting Documentation

Nil

Recommendation

Engineering investigations should be performed to reveal possible deficiencies with mechanical equipment at the Pine Creek meter station. These deficiencies should be mitigated by equipment upgrades as required based on risk analysis.

Item 30 – Replace CP Ground Beds

Issue / Opportunity Description

Cathodic protection ground beds form part of the cathodic protection system on a pipeline to prevent metal loss due to corrosion. The ground bed is a low resistance path to earth which is connected to the cathodic protection unit and allows current to be applied to the pipeline.

Current flowing onto the pipeline via the ground bed consumes the ground bed over time. Higher output currents required to protect increasing numbers of coating defects results in a decreased anode bed life. Anode beds can also fail due to excessive driving voltage caused by high resistance conditions, ground movement caused by expansive soils and cable / connection failure. The ground beds are buried at a depth of approximately 8 to 10 m so they cannot be readily refurbished.

Two ground beds were refurbished as part of the CP Upgrade Stage 2 project and a third was recently refurbished at Fergusson.

The performance of ground beds is monitored during annual cathodic protection surveys. Whilst some ground beds gradually decline in performance, others may fail over a shorter period of a few years.

Objectives / Outcomes

To replace ground beds to ensure that adequate levels of cathodic protection can be applied to protect the pipeline from metal loss corrosion.

Options

The replacement of ground beds can sometimes be delayed to an extent, but eventually replacement is the only option in order to ensure that the application of cathodic protection is successful.

CP is essential to ensure that metal loss due to corrosion does not occur which could result in a leak or rupture. The application of CP is a requirement of the pipeline licence and AS 2885.3.

Delivery Concept

The need for ground bed replacement is identified during annual cathodic protection surveys. The ground bed design is performed by specialised contractors and the ground bed replacement is delivered using a combination of specialised contractors and internal Field Services resources.

Estimate and Timeframe

The estimate is based on performing one ground be replacement approximately every two years. This rate of repair is based on historical replacement rates. An acceleration in coating

degradation or the premature failure of ground beds may require more frequent replacement. The estimate includes consultants, contractors, materials and labour.

Budget

FY16	FY17	FY18	FY19	FY20
		$70000		$70000

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Not Applicable	Not Applicable
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Moderate	Negligible
Reputational	Moderate	Negligible
Compliance	High	Negligible
Financial	Moderate	Negligible

Supporting Documentation

Annual AGP cathodic protection regulator reports

Recommendation

Ground beds should be replaced prior to complete failure to ensure the availability of the cathodic protection system which is required to prevent metal loss on the pipeline due to corrosion.

Item 31 – CUG radio upgrade

Issue / Opportunity Description

The closed user group (CUG) radio system is based on satellite communications and allows communications between the control room and field based personnel. The CUG also allows vehicle tracking for safety purposes in conjunction with GPS. Throughout the Northern Territory mobile phone coverage is limited and radio communications are not always reliable.

The CUG system has a number of advantages over portable satellite phones including:

- Personnel are always online and can transmit at any time without having to place a call
- High level of reliability
- Ability for all users in the group to hear conversations. This reduces the amount of call traffic, which is particularly advantageous in an emergency response.

The current CUG system is supplied by Optus but this service is due to expire due to outdated hardware.

A project is underway to define the requirement of a satellite CUG system nationally across APA Group.

Objectives / Outcomes

To find an alternative national solution to the current Northern Territory Optus satellite CUG system which has reached the end of its useful life.

Options

It is a requirement of the Work Health Safety Act and AS 2885.3 to be able to effectively monitor and communicate with remote workers.

An APA Group working party has been formed to examine the most appropriate technology to be implemented nationally.

Delivery Concept

A service provider will be engaged to provide a complete solution including hardware and software for a satellite CUG system.

Estimate and Timeframe

The estimate is based on the fleet replacement cost based on the current technology that is employed. Depending on the system selected, this estimate may change. The replacement is currently scheduled to occur in FY16 due to the age of the current system.

Budget

FY16	FY17	FY18	FY19	FY20
$100000				

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Moderate	Negligible
Environmental	Not Applicable	Not Applicable
Operational	Low	Negligible
Customers	Not Applicable	Not Applicable
Reputational	Low	Negligible
Compliance	Moderate	Negligible
Financial	Negligible	Negligible

Supporting Documentation

Nil

Recommendation

The current Optus satellite CUG should be replaced with an alternative system with the required functionality to meet pipeline operation requirements.

Item 32 – RTU replacement

Issue / Opportunity Description

Remote terminal units (RTU) are a microprocessor controlled device that interfaces field devices such as pressure transmitters, flow meter's and valve actuators with the supervisory control and data acquisition (SCADA) system. RTU's are therefore critical in the control and monitoring of gas pipeline facilities.

As RTU's are electronic equipment they have a finite life based on hardware and software requirements. With time, units may function adequately but are not well supported by the vendor. The typical design life for an RTU is approximately 10 to 15 years.

Objectives / Outcomes

To replace RTU's before they become unreliable or unserviceable.

It is a requirement of AS 2885 to have reliable SCADA monitoring of the pipeline.

Options

The RTU's are critical for station control and monitoring. The equipment needs to be replaced prior to failure to ensure that the pipeline can be effectively monitored and controlled.

Delivery Concept

Replacements will be performed on a staggered basis to reduce the number that need replacing in any one year. Replacements will be prioritised based on criticality and performance. The RTU's will be replaced using internal resources from Field Services. Specialised vendors will be engaged to perform configuration of the RTU's if required.

Estimate and Timeframe

The estimate is based on replacing approximately three to four RTU's per year on a rolling basis. The estimate includes materials, contractors and labour.

Budget

FY16	FY17	FY18	FY19	FY20
$38000	$36000	$38000	$41000	$38000

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Not Applicable	Not Applicable
Environmental	Not Applicable	Not Applicable
Operational	Low	Negligible
Customers	Low	Negligible
Reputational	Low	Negligible
Compliance	Low	Negligible
Financial	Negligible	Negligible

Supporting Documentation

Nil

Recommendation

RTU's should be replaced prior to failure to ensure that monitoring and control of the pipeline facilities can be achieved.

Item 33 – Site hut upgrades

Issue / Opportunity Description

The AGP has site huts at all meter stations and scraper stations. The site huts house electronic equipment that is used to monitor and control the pipeline such as remote terminal units (RTU), communications hardware and battery power systems.

The site huts on the AGP are original equipment and require significant maintenance in order to prolong their life.

Objectives / Outcomes

To upgrade the site huts on the AGP to ensure the integrity of the equipment contained inside is not compromised.

It is a requirement of the pipeline licence and AS 2885 to ensure that the pipeline can be appropriately monitored and controlled.

Options

The site huts must be either refurbished or replaced to ensure that the electronic equipment inside still functions correctly in order to perform station monitoring and control. The complete replacement of the site huts is cost prohibitive due to the extensive fit out required to relocate all of the electronic equipment. A refurbishment program is proposed to extend the life of the huts as fair as practicable including:

- Installation of a skillion roof
- Repainting
- Replacement failed building components such as doors, flashings, trims etc.

Delivery Concept

The upgrades will be performed using internal Field Services resources.

Estimate and Timeframe

The estimate is based on performing minor structural works using internal resources. Approximately two sites are budgeted for every year of the period. Site will be prioritised based on condition and criticality.

Budget

FY16	FY17	FY18	FY19	FY20
$38000	$19000	$38000	$37000	$39000

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Not Applicable	Not Applicable
Environmental	Not Applicable	Not Applicable
Operational	Low	Negligible
Customers	Low	Negligible
Reputational	Negligible	Negligible
Compliance	Negligible	Negligible
Financial	Negligible	Negligible

Supporting Documentation

Nil

Recommendation

Site huts on the AGP should be refurbished to extend their life rather than being completely replaced which is a more expensive and labour intensive option.

Item 34 – Solar panel replacement

Issue / Opportunity Description

Solar power systems are used at AGP stations where mains power is not available. The majority of solar panels on the AGP are original equipment (26 years old) and over time the efficiency, reliability and capacity of the panels deceases. This results in the solar panels not be able to supply enough power to run the site and charge the backup battery system.

Electrical power is critical to ensure the control and monitoring of the stations can be performed and to apply cathodic protection to the pipeline.

Some of the solar panels are mounted on the station hut roof or on elevated frames which presents working at heights issues.

Objectives / Outcomes

To replace the solar panels at AGP stations prior to complete failure.

The reliable supply solar power is essential at some critical sites. Without power these sites cannot be monitored or controlled remotely via SCADA. The ability to perform remote monitoring is a requirement of the pipeline licence and AS 2885.

Options

The solar panels form an integral part of the solar power system which supplies power to the station monitoring and control and CP equipment. Therefore, the panels need to be reliable and able to supply enough power, depending on the site requirements, in order to effectively operate the pipeline.

Delivery Concept

The replacement solar panels will be specified by Engineering and procured and installed by Field Services. Where possible, solar panels will be ground mounted to prevent future working at heights issues.

Estimate and Timeframe

The estimate is based on replacing solar panels at two sites per year. Sites will be prioritised based on condition and criticality. The estimate includes labour and materials.

Budget

FY16	FY17	FY18	FY19	FY20
$36000	$25300	$36300	$26300	$20000

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Moderate	Negligible
Environmental	Not Applicable	Not Applicable
Operational	Moderate	Negligible
Customers	Low	Negligible
Reputational	Low	Negligible
Compliance	Low	Negligible
Financial	Negligible	Negligible

Supporting Documentation

Nil

Recommendation

Replace the solar panels prior to complete failure so that adequate levels of electrical power are available for equipment used for monitoring or control of the pipeline or for cathodic protection.

Item 35 – Water bath heater upgrades

Issue / Opportunity Description

Water bath heaters are used to heat the gas at delivery stations to ensure that the delivery temperature is well above the dew point where liquids may form in the gas stream. It is a requirement of the gas transportation agreement not to deliver liquids, which can cause extensive damage to power generation equipment.

The water bath heaters are original equipment on the pipeline (26 years old), but have undergone a number of upgrades over the years. Upgrades can include:

- Burner control system
- Gas fuel system
- Process coils

Regular maintenance and inspections are performed in order to prolong the life of water bath heaters.

Objectives / Outcomes

To perform major maintenance as required to extend the life of the water bath heater as far as economically feasible.

Options

The water bath heaters are required to ensure that liquids are not delivered to customers.

The replacement of water bath heaters is not cost effective if major upgrades make the units serviceable for a prolonged period. Major upgrades have been successfully delivered in the past which have extended the useful life of the equipment.

The upgrades are required to ensure that the requirements of the gas transportation agreement can be met.

Delivery Concept

Major upgrades will be performed by specialist contractors with assistance from Field Services.

Estimate and Timeframe

The estimate is based on performing a major upgrades at Pine Creek in 2019. The estimate is based on costs to upgrade the Katherine meter station water bath heater. Major upgrades are planned at other stations in future years (beyond 2020).

Budget

FY16	FY17	FY18	FY19	FY20
			$300000	

Risk Analysis

	Untreated Risk	Treated Risk
Health and Safety	Not Applicable	Not Applicable
Environmental	Not Applicable	Not Applicable
Operational	Negligible	Negligible
Customers	Moderate	Negligible
Reputational	Low	Negligible
Compliance	Low	Negligible
Financial	Negligible	Negligible

Supporting Documentation

Nil

Recommendation

Perform a major upgrade of the Pine Creek water bath heater in order to extend its useful life.