Engineering Design Practice

Process

Process Input into Pipeline Isolation Plans

Owner	GM Infrastructure Engineering		Next Review Date	Aug-28	
Document No	ATP-EDP-Q-0004		Classification	Public	
Rev	**Date**	**Status**	**Originated**	**Checked**	**Approved**
1	3-Aug-23	IFU	Christine Nicholson Digitally signed by Christine Nicholson Date: 2023.08.03 17:16:59 +10'00'	Snell, Matthew 2023.08.04 09:49:08+10'00'	Button, Caroline Digitally signed by Button, Caroline DN: E=Caroline.Button@apa.com.au, CN="Button, Caroline" Date: 2023.08.04 12:16:24+10'00'

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1. INTRODUCTION

The APA Technical Practice (ATP) aim to achieve sound engineering and design practice through standardisation. We endeavour to make ATP sufficiently flexible to allow engineers to adapt the information in the ATP to project, asset, or customer conditions and requirements. This is of particular importance where the standard may not cover all situations or needs of use.

APA staff and its Contractors shall be solely responsible for applying ATP in the context of legal, statutory and approvals requirements to achieve the required engineering design and quality of work. For those requirements not specifically covered, the designer shall use a recognised engineering practice or standard to accomplish as a minimum the same level of integrity as reflected in the ATP. If in doubt, the Contractor shall, without detracting from their responsibility, consult APA.

Refer to APA's Engineering Glossary [Ref.1] for any terms and abbreviations not listed in the appendices.

1.1 Conflicts and Waivers

Conflicts between this standard and other applicable ATP or international, national standards, codes and industry practices shall be resolved in writing by the APA Standards and Assurance team.

Requests for waivers from this standard shall follow the Engineering Standards Waiver procedure in [Ref.2].

1.2 Order of Precedence

Refer to the order of precedence of standards in the Engineering Standards documentation [Ref.3].

2. PURPOSE AND SCOPE

This document is applicable to the process engineering input into pipeline isolation plans for all new and existing APA pipelines. Existing pipelines should be brought in line with the requirements of this Design Practice if modification to parts of the pipeline or associated equipment are required.

The document has been prepared to ensure APA Isolation Plans are prepared with adequate safety, rigour and consistency for APA pipelines. It defines the minimum documentation required for development of site-specific isolation plans for a given pipeline or pipeline section. It also aims to provide guidance on the development of the documentation to provide consistent and safe designs.

This document provides requirements for the preparation of process calculations in accordance with Australian and International Standards and APA Engineering Management Framework.

APA Climate Transition Plan outlines the company's commitment to achieving net-zero greenhouse gas emissions by 2050. The plan includes a range of strategies to reduce emissions, including increasing the use of renewable energy sources, transitioning to lower-emission fuels, and improving energy efficiency. APA aims to reduce its methane emissions, through the implementation of the Methane Guiding Principles and is committed to ensuring that all opportunities to reduce emissions are in line with the relevant Australian Federal, State, and Territory legislation.

For all greenfield and brownfield projects, the Net Zero requirements shall be considered to eliminate or reduce any risk of harm from Scope 1 and 2 GHG emissions i.e., avoid or minimise Scope 1 and Scope 2 emissions or where and so far as is reasonably practicable. The designer(s) shall apply to the commercial decision-making processes in APA's Internal Carbon Pricing Procedure, [Ref.18], to determine the best options to avoid or abate emissions. See also the Climate Change Standard [Ref.15] and The Methane Guiding Principles [Ref.25].

3. BACKGROUND INFORMATION - ISOLATION PLAN PROCEDURES

The following is provided as background information in reference to the process inputs to the Pipeline Isolation Plan. These plans are multidisciplinary and primarily driven by the pipeline engineers.

Pipelines shall be isolated in accordance with the Process Isolation [Ref.7]. The requirements for pipeline isolation are defined in AS 2885.1 [Ref.19]. Each isolatable section shall be identified in the Isolation Plan along with details of the design isolation and venting sequence in all anticipated scenarios.

Standards Australia defines the minimum requirements for a pipeline isolation plan as well as for isolation plan reviews in AS 2885.1 [Ref.19].

Pipeline branches shall be separately isolatable from the main pipeline. This is to allow the main pipeline to continue to operate in the event of damage to a branch.

3.1 Risk Identification and Management

A safety management study shall be conducted in accordance with AS 2885.1 [Ref.19]. This study is broken up into smaller study phases consistent with the level of project definition.

During the pipeline development, required isolation and blowdown points shall be identified at the pipeline boundaries and along the length. Wherever the pipeline is connected to a source of pressure that could exceed the MAOP, automatic isolation or other suitable equipment shall be provided to protect the pipeline.

The first response when a pipeline has been damaged and is leaking is to isolate the damaged section at the nearest isolation point either side of the leak. The expected response times to each isolatable section shall be defined. Where acceptable response times for manual valves cannot be achieved, remotely activated automatic isolation valves shall be provided.

Energy release rate and radiation contours at 4.7 and 12.6 kW/m^2 in the event of a full-bore rupture shall be defined consistent with AS 2885.1 [Ref.19] and the Plume Dispersion and Radiation Analysis [Ref.5] for all points along the pipeline. This shall be performed as early as possible as it has the potential to alter the acceptable pipeline routes and / or require additional rupture controls adding to the overall pipeline cost. See Section 5.3.3.

In the event of a major rupture, the local area of the leak shall also be evacuated beyond the 4.7 kW/m^2 radiation contour to prevent personnel injury. For minor leaks direct access to the pipeline shall be limited proportionate to the size of the leak.

The risks of future changes such as the continuous improvement of GHG emission targets, land development in the vicinity of the pipeline, etc., over the life of the asset may also affect the placement of isolation and venting facilities, pipeline route selection and wall thickness.

3.2 Isolation Procedure

Spacing of isolation valves shall be in accordance with the below table reproduced from AS 2885.1 [Ref.19, Table 4.6.4].

Table 1 Spacing of isolation valves

GUIDE FOR THE SPACING OF MAINLINE VALVES		
Location class	Recommended maximum spacing of valves, km	
	Gas and HVPL	Liquid petroleum
R1	As required	As required
R2	30	As required
T1 and T2	15	15
NOTE: A short length of higher location class in a pipeline that is of a lower location class does not necessarily require compliance with the recommendations of Clause 4.6.4		

Note that the above valve spacing are maximums. Closer valve spacing may be appropriate based on the fluid being transported and the potential impacts on the surrounding environment, in particular GHG emissions. An example template table for line valve spacing is shown in Appendix B.

The determination of isolation requirements needs to be performed early on as they affect the line valve spacing. The Pipeline Safety Management Study should determine the requirements for valve actuation and / or special tools required for manual isolation as this is dependent on the overall risk, emissions and response times required. This is usually performed in cooperation primarily between the pipeline engineers and the operations group.

3.3 Blowdown / Venting Procedure

Each isolatable section is required to define its de-pressuring facility and procedure. These de-pressuring facilities shall be designed based on the pipeline at its MAOP. To ensure that the venting can proceed safely and with minimal emissions, simulations of the blowdown shall be produced per Section 5.1 and they should be documented in the Pipeline Isolation Plan and consistent with the example template table shown in Appendix B. In designing the venting system, the following priorities shall be balanced to achieve an acceptable solution.

- Emergency situations where rapid depressuring is required (to make a damaged pipeline safe). All blowdowns to atmosphere should be minimised as far as practicable and emergency response in Pipeline Isolation Plan should consider options such as use of production facilities to reduce pressure e.g. use a compressor/PRS to quickly draw down a pipeline at least to a certain minimum practical pressure before blowing down to atmosphere.
- Noise and potential radiation from the vent stack
- Minimum design temperature limits
- Design to the Venting and Flaring practice [Ref.4]
- Reducing GHG emissions / availability for gas recovery and/or flaring (See Methane Guiding Principles, Best Practice Guides – Venting, [Ref.26].) This includes consideration of gas recovery systems such as "Zevac" gas recovery compression system or flaring for non-emergency depressuring which is not as time critical.

Appropriate vents shall be installed and remotely operated outside of the calculated 4.7 kW/m^2 radiation zone.

Where blowdown calculations show that hydrates, condensation or minimum design temperature excursions are possible, special attention shall be paid to the vent. If icing or vent instability is noted, then venting should be stopped to allow the pipeline to warm up before resuming venting. Temporary strap-on temperature monitoring may be considered.

3.4 Emergency Response

Appropriate emergency response measures shall be in place for all anticipated emergency scenarios as identified in the Safety Management Study and Isolation Plan. The anticipated response times shall be documented in the Pipeline Isolation Plan (an example template table is shown in Appendix B). Requirements for non-APA emergency services shall also be identified and coordinated throughout the design and operation phase.

3.5 Required Drawings / Documents List

- Pipeline key plan
- Process and Instrumentation Diagrams (P&IDs)
- Blowdown study results (process input)
- Isolation and Venting assembly details
- Isolation, Blowdown and Re-Pressurisation procedures
- Valve and Actuator Datasheets
- Emission Measuring and Monitoring plan

4. ISOLATION PLAN VENT ARRANGEMENT

4.1 Standard Permanent Vent Installation

Permanent vents may be installed at compressor, scraper, and pressure reduction stations for de-pressuring as part of operation and maintenance. They are not typically designed to perform a full pipeline blowdown on their own as this is typically achieved in concert with temporary vents installed on the MLV bypass risers. Permanent vents shall be designed consistent with the design in the Flares and Vents [Ref.4]. Permanent vents are typically designed for around 40 t/h to limit radiation sterile area. These vents can be used to perform full pipeline blowdown.

If GHG needs to be released from the system – prioritise recycling or flaring over venting, as per the Flares and Vents, [Ref.4].

4.1.1 Pipeline Permanent Vents

Permanent pipeline vents are occasionally used in exceptional circumstances along a pipeline route. They would be used in particularly sensitive areas (e.g., local to public buildings, hospitals, schools etc.). The design of these vents is covered by the Flares and Vents [Ref.4] like all venting/de-pressuring systems. Sonic exit velocities are permitted provided the piping is designed to withstand the extra vibration/stress.

They are often a simple vent stack, which may include piping away from the isolation valves to a safe location for venting. They may be silenced if the local area is particularly sensitive to noise. A maximum rate of 40 t/h is typically used which limits the extent of the sterile area to approximately 50 m (radiation < 4.7 kW/m²).

Their use is often in conjunction with a temporary pipeline vent at a remote location which can tolerate higher venting rates and achieve an overall faster blowdown.

4.2 Standard Temporary Vent Installation

4.2.1 Gascovent

The Gascovent is a silenced temporary vent designed for blowdown of smaller inventories of gas such as filter vessels. The Gascovent may also be used for pipelines, typically in excess of the maximum flow rates where the silencer is effective. It is limited to a maximum pressure of 6800 kPag. More details of this vent are available in the Flares and Vents [Ref.4].

4.2.2 High-Rate Temporary Vent

The High-Rate Temporary Vent is designed to be installed on an MLV bypass assembly to enable venting at high rates to atmosphere via an RO and short vent tailpipe. The manual vent valve is operated by attaching an actuator to the plug valve which is remotely operated using a compressed air supply on long tubing which extends out to the 4.7 kW/m² radiation contour.

Each vent assembly shall be engineered for the specific conditions at the MLV considering maximum allowable noise, emissions, dispersion and radiation limits based on the maximum Linepack pipeline conditions. Calculations shall be as per Section 5.1.

There are several existing RO sizes available to be changed out as required, which achieve the following rates:

Table 2 Standard RO Sizes

Flow @ 10.2 MPa t/h	Orifice Size mm	Distance @ 4.7 kW/m² m	Noise @ 4.7 kW/m² dBA
40	27.0	47	117
100	42.7	74	117
150	52.2	90	117
250	67.2	117	117
400	84.3	148	117

Interface to the emergency port shall be engineered by appropriate selection of the plug valve or adapter kit and shall be verified by demonstrating operation during pipeline construction.

If GHG needs to be released from the system – prioritise recycling or flaring over venting, as per the Flares and Vents, [Ref.4].

5. ISOLATION PLAN CALCULATIONS

The calculations shall include all foreseeable risks using methods as prescribed in this guide or as approved by the Lead Process Engineer. The calculations below shall be included in the Appendices of the Isolation Plan.

5.1 Linepack

Linepack calculation for isolation planning shall be done by the IOC / Process optimisation team and be based on the contents of the pipeline at MAOP and average winter / minimum ground temperature. The results shall be provided in mass units (tonnes) and standard volume units (kSm³). The use of the Line Pack Calculation [Ref.13] or an appropriate simulation software (e.g., HYSYS) are the preferred tools for Linepack calculation.

Note: The System Modelling team calculate Linepack using Gregg or SynerGI software.

5.2 Vent flowrate

The release rate shall be calculated with regards to the geometry of the release, the release velocity, ρv^2, concentration and temperature. Vent stacks should discharge vertically upwards wherever practicable and be at least 3 m above the adjacent working area level, consistent with the Piping Design Criteria [Ref.8]. Vent calculations shall be made as per APA's procedures for Plume Dispersion - Natural Gas [Ref.6] and Flares and Vents [Ref.4].

New temporary vent designs should be compatible with the High-Rate Temporary Vent (Section 4.2.2) Attention should be paid to the existing valve actuation equipment used by operators to ensure that the selected valve is compatible. The use of the Gascovent or permanent vent designs is also acceptable.

If GHG needs to be released from the system – prioritise recycling or flaring over venting, as per the Flares and Vents, [Ref.4].

5.2.1 Blowdown Criteria

The typical blowdown criteria are to achieve 690 kPag within 8 hours. Where this is not achievable, consideration shall be given to installing mid-line valve isolation.

Incorporate a blowdown recovery system, to capture and recompress the released gas. See Climate Transition Plan, [Ref.16].

For directly connected short vent stacks mounted on the MLV assembly, vent flowrate shall be calculated using one of the following methods, depending on the restrictive component:

5.2.1.1 Plug or Ball valve

HYSYS or the standard line sizing spreadsheet should be used if full bore ball valves are used and the primary restriction in the flow path is the vent piping. Initial venting rates are restricted by sonic velocity in the vent assembly.

IGE/SR/23 [Ref.24] gives guidance on predicting the choked flow through reduced port valves on pipeline vents. In general, a discharge coefficient CD = 1 will be conservatively used as the data is not available from the valve vendors. This can be compared with the American Petroleum Institute's (API) prediction for choked flow through relief valves in API 520 [Ref.21] which shows similar results. In each case, the effective diameter is based on the area of the vent valve throat. In each case, it should be confirmed that backpressure in the tailpipe assembly (esp. due to sonic velocity in the vent assembly) is not high enough to prevent critical flow across the valve.

If flow is too high as revealed by the predicted radiation, emissions, temperatures or noise, an orifice will be required to further restrict the flow.

5.2.1.2 Restriction Orifice

The standard Critical flow Through a Square-Edged Orifice calculation template [Ref.10] is preferred.

5.2.1.3 Control valve or Regulator Sizing

The standard Control Valve Sizing Template Output calculation template [Ref.11] is preferred.

5.3 Dispersion and Radiation

Where dispersion modelling software is required, such as PHAST or other methods approved by APA, the modelling inputs shall account for unfavourable weather conditions as well as GHG emissions. API's method provided in the AS 2885 [Ref.19/20] and API 521 [Ref.22] is generally more conservative than results from PHAST for far-field events such as rupture.

The results shall be documented in tabular and graphical form (side view of dispersion in low and high wind) to establish the maximum safe radius and height for potential ignition sources, including aircraft.

5.3.1 Radiation Contours – Permanent and Temporary Vents

Vent calculations should be performed per the Plume Dispersion and Radiation Analysis [Ref.5] for a 4.7 kW/m² radiation contour. They should consider the maximum venting rate assuming instantaneous ignition even when there is no obvious ignition source.

5.3.2 Late Ignition (Flash fire, Explosion)

Where the threat of late ignition is identified as a credible threat and the potential exists for gas to enter congested areas or buildings, PHAST may be used to establish control measures to quantify the damage and establish the overpressure contours. Where pipeline venting can be avoided, or be performed at another location without this risk, it shall be preferred.

Flash fire contour is based on the 50% LFL dispersion contour.

5.3.3 Radiation Contours – Pipeline Rupture

In accordance with AS 2885.1 [Ref.19] the radiation contour shall be calculated using the method described in API 521 [Ref.22] for an energy contour of 12.6 kW/m² and 4.7 kW/m². The additional energy contour for 2.1 kW/m² shall also be calculated. The results shall also be presented in both tabular and graphical form.

For full-bore pipeline rupture, see the Rupture Radiation Calculation Output [Ref.12] which is based on AS 2885.1 [Ref.19] may be used for pipelines up to 15.3 MPag, 750 mm diameter and gases < 0.65 SG. If these conditions are not met, HYSYS Dynamics or other dynamic model should be used to determine the flowrate and PHAST or AS 2885.1 [Ref.19] used to determine the radiation contours. Note that in this case, the radiation should be assessed based on the flow anticipated 30s after the initial release.

Holes significantly smaller than full-bore (<25%) should be assessed using the Critical flow Through a Square-Edged Orifice [Ref.10]. AS 2885.1 [Ref.19] provides excavator tooth dimensions which may be used as the basis for defining the size of the hole. For holes larger than 25% of pipeline bore, the radiation should be assessed based on the flow anticipated 30s after the initial release per AS 2885.1 [Ref.19].

5.4 Noise

Noise from unsilenced sonic vents shall be calculated using the method described in API 521 [Ref.22] for the 2.1 and 4.7 kW/m² contours (these being the contours at which an operator may be required to operate the vent valve or observe the venting activity). The results shall be presented in both tabular and graphical form.

Typical noise levels are such that there is a risk of hearing damage to operators due to the high noise level and duration of the venting activity meaning that they are required by law to be assessed. In accordance with Work and Safety Regulations in each State and Territory (85 dBA for 8-hours), the risk to personnel should be mitigated so far as is reasonably practicable by:

- Elimination
- Design (using a silencer or reducing the vent rate where practicable,)
- Administrative controls (by placing personnel further away from the noise source or reducing personnel time exposure, see Flares and Vents [Ref.4])
- Hearing protection (Class 5 ear plugs and/or Class 5 earmuffs)

Noise pollution to the surrounding area and environment should also be considered and, if practicable, minimised.

In an emergency condition as is typical for a pipeline blowdown, noise is a secondary concern and is not considered mandatory to mitigate. Currently, silencers are not used for pipeline vents as the flowrates are too high for most vents and it would necessitate an unreasonably large silencer to be installed. The Gascovent includes a silencer but is only suitable for flows up to 4400 Sm³/h in silenced mode (Section 4.1.1). At much higher rates it is anticipated that the sound damping material will be damaged and may require replacement to achieve the originally designed level of noise reduction.

Work is currently being performed by the EPCRC to design a “noise mitigation bowl” which redirects the noise from the pipeline vent vertically and can assist with meeting noise restrictions, however these devices are not yet commercially available, see EPCRC Industry Guideline on managing noise [Ref.23].

As pipeline venting is considered an infrequent activity, double hearing protection (earplugs and earmuffs) shall be worn as protection measures for operators.

5.5 Minimum Pipeline Temperature

Minimum anticipated pipeline temperature during pipeline venting shall also be confirmed as acceptable using Aspen HYSYS or another approved software package. APA has developed and validated a HYSYS dynamics simulation against real pipeline blowdown data. This is available as the HYSYS Template – Pipeline Blowdown [Ref.14] and its associated explanatory technical note [Ref.9]. This template should be used as the basis for blowdown simulations unless approval has been given to use another method.

The peak vent rate shall be selected such that the pipeline wall temperature does not fall below the pipeline design minimum operating temperature while the hoop stress is above 85 MPa and shall be approved by Pipeline Engineering. Consideration may be given to providing a section of pipeline near the vent with reduced minimum design temperature as this location will get the coldest having the highest velocity gas at the lowest pressure and temperature flowing through it.

The pipeline vent piping should be designed for the worst-case pressures and temperatures possible. A situation may exist where the vent valve fails to open fully and exposes the vent pipe to very low temperatures. If the vent valve is then fully opened it will be exposed to high pressure while still being very cold, potentially in the brittle fracture region of certain pipe grades.

6. RESULTS REQUIREMENTS

6.1 Identification of Risks

The risks to personnel and property shall be identified in the Isolation Plan and include as a minimum the threat of noise, flash fire, jet fire, and delayed ignition and explosion in the event of nearby buildings or congestion such as trees.

A guide to the significance of the radiation levels (kW/m²) and noise levels (dBA) shall be clearly included in the site plan maps of each vent location.

Details on emission volumes shall be identified, analysed and documented, along with plans for measuring and monitoring. This to identify and enable reduction of GHG emissions in accordance with APA's Climate Change Standard [Ref.15] and Climate Transition Plan [Ref.16].

6.2 Site Maps

The purpose of the site maps is to provide effective communication to the field personnel planning pipeline venting of the consequence areas in order that a JHA may be prepared in accordance with SafeGuard HSE GP 08.02, [Ref.17].

A site map shall be prepared for each vent location on the pipeline. The 2.1, 4.7 and 12.6 kW/m² contours shall be presented as a graphical overlay and distances tabulated together with the noise level and associated consequences stated in clear, unambiguous and easy to understand terms. Refer to Appendix A for example map.

7. REVISION CHANGE RECORD

Table 3 Revision Change Record

Rev	Description	Date	Author
1	Document content based on 530-EDP-Q-00004 Rev 3. Periodic review and updates has been made and Net Zero and other environmental considerations added..	03.08.2023	C. Nicholson

8. TERMS

ITEM	DEFINITION[1]
Greenhouse Gas	A Greenhouse Gas (GHG) is a gas that absorbs and emits radiant energy within the thermal infrared range, causing the greenhouse effect. The primary Greenhouse gases in Earth's atmosphere are water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3).
HYSYS	A chemical process simulator software, developed by AspenTech used to mathematically model chemical processes.
MAOP	The maximum pressure at which a pipeline or section of a pipeline may be operated consistently, following hydrostatic testing in accordance with Pipelines - Gas and liquid petroleum, Design and construction [Ref.19] or after an MAOP review performed in accordance with Pipelines - Gas and liquid petroleum, Operation and maintenance [Ref.20].
MLV	Isolation valve installed along the main length of the pipeline.
Net Zero	A target of completely negating the amount of greenhouse gases produced by human activity, to be achieved by reducing emissions and implementing methods of absorbing carbon dioxide from the atmosphere.
PHAST	A comprehensive consequence analysis tool examining the process of a potential incident from the initial release to far field dispersion, including modelling of pool vaporisation and evaporation as well as flammable and toxic effects.

[1] Definitions should be accompanied by a reference using the "Citations & Bibliography" APA style. Terms listed in the APA Engineering Glossary need not be repeated in this list.

9. [2]ABBREVIATIONS

ITEM	DEFINITION
dBA	Weighted decibels
DBB	Double Block & Bleed (Valves)
DIB	Double Isolation & Bleed (Valves)
EPCRC	Energy Pipelines Cooperative Research Centre
GHG	Greenhouse Gas
JHA	Job Hazard Analysis
kSm^3	Standard cubic metres
MAOP	Maximum Operational Pressure
MLV	Main Line Valve
OH&S	Occupational Health & Safety
PHAST	Process Hazard Analysis Software Tool
RO	Restriction Orifice
SWMS	Safe Work Method Statement

[2] Any abbreviation (acronym) used more than once in the body of the document shall be listed in this table. Abbreviation used once only must be written out in full in parentheses after the acronym, for example WIP (Work in Progress).

10. REFERENCES

All work performed in accordance with this document shall be in conformance with the current issue, including amendments, of those national and international standards, codes of practice, guidelines and APA document/s listed below.

APA STANDARDS

Ref. No.	DOC NO.	DESCRIPTION
1.	530-LI-QM-0001	APA Engineering Glossary
2.	530-PR-EM-0002	Engineering Standards Waivers
3.	530-PR-EM-0003	APA Engineering Standards
4.	ATP-EDP-Q-0003	Flares and Vents
5.	530-EDP-Q-0005	Plume Dispersion and Radiation Analysis
6.	530-GD-Q-0002	Plume Dispersion - Natural Gas
7.	530-GD-Q-0004	Process Isolation
8.	530-SP-P-0096	Piping Design Criteria
9.	530-TN-Q-0001	Test-Correlated Pipeline Blowdown using HYSYS Dynamics
10.	530-TP-Q-0009	Critical flow Through a Square-Edged Orifice
11.	530-TP-Q-0014	Control Valve Sizing Template Output
12.	530-TP-Q-0016	Rupture Radiation Calculation Output
13.	530-TP-Q-0017	Line Pack Calculation - Output
14.	530-TP-Q-0025	HYSYS Template – Pipeline Blowdown
15.	APA Group Standard	Climate Change Standard
16.	APA Group	Climate Transition Plan
17.	APA HSE GP 08.02	Job Risk Assessment
18.	APA Group Procedure	Internal Carbon Pricing

SUPERSEDED DOCUMENTS

Ref. No.	DOC NO.	DESCRIPTION
	530-EDP-Q-0004	Process Input into Pipeline Isolation Plans, Rev 3

AUSTRALIAN STANDARDS

Ref. No.	DOC NO.	DESCRIPTION
19.	AS/NZS 2885.1:2018	Pipelines - Gas and liquid petroleum, Design and construction
20.	AS 2885.3:2022	Pipelines - Gas and liquid petroleum, Operation and maintenance

INTERNATIONAL STANDARDS AND PUBLICATIONS

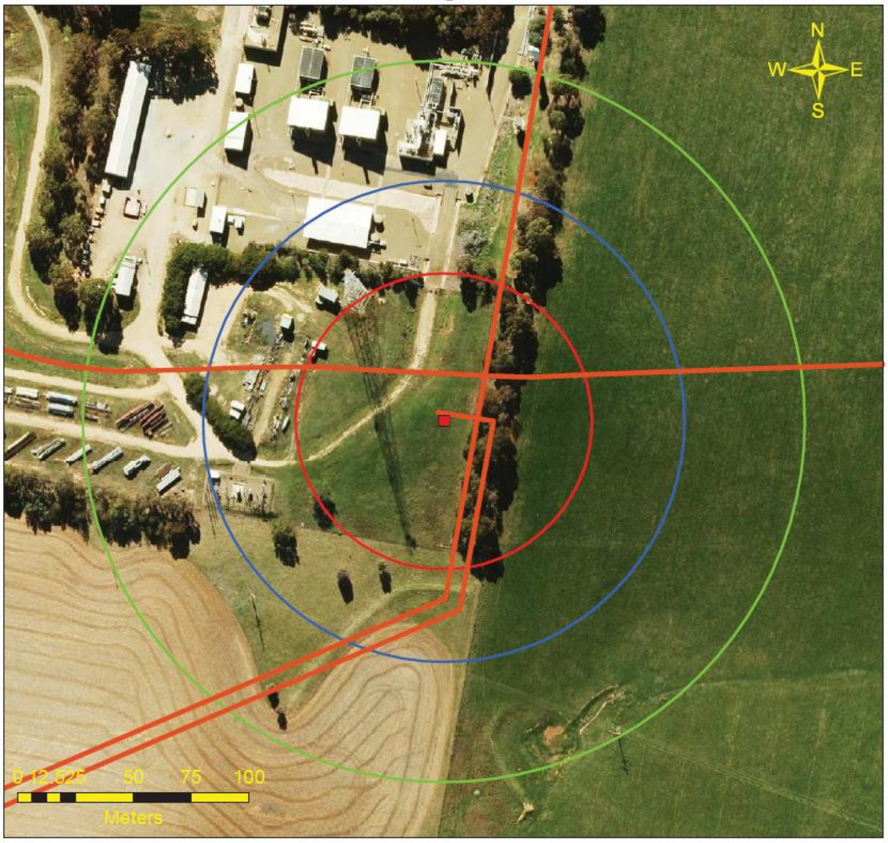
Ref. No.	DOC NO.	DESCRIPTION
21.	API 520 Part 1	Sizing, Selection and Installation of Pressure-relieving Devices
22.	API 521	Pressure-relieving and De-pressuring Systems
23.	EPCRC Industry Guideline	Managing Noise, Gas Dispersion and Ignition Hazards when Venting Natural Gas Transmission Pipelines
24.	IGE/SR/23	Venting of Natural Gas
25.	Methane Guiding Principles	The Methane Guiding Principles
26.	Methane Guiding Principles	Best Practice Guides – Venting

11. LISTS

11.1 Tables

APPENDIX A EXAMPLE SITE MAP

Young Hub



Legend

- Valve
- APA Pipelines
- Heat Radiation in Radius (2.1 kW/m2)
- Heat Radiation in Radius (4.7 kW/m2)
- Heat Radiation in Radius (12.6 kW/m2)

Valve Number: UV-0310
MOP: 10.2MPag
Assumed Initial Mass Flowrate: 200 t/h
Restricted Orifice Size: 60.2mm
Heat Radiation in Radius (2.1 kW/m2): 156m
Heat Radiation in Radius (4.7 kW/m2): 104m
Heat Radiation in Radius (12.6 kW/m2): 64m

Consequences of Heat Radiation

Heat Radiation (kW/m^2)	Effect
2.1	• Minimum to cause pain after 1 minute.
4.7	• Will cause injury, at least second degree burns, after 30 seconds exposure. • Maximum radiant heat intensity in areas where emergency actions lasting 2 minutes to 3 minutes can be required by personnel without shielding but the appropriate clothing. • Appropriate clothing consists of hard hat, long-sleeved shirts with cuffs buttoned, work gloves, long-legged pants, and work shoes. Appropriate clothing minimizes direct skin exposure to thermal radiation.
12.6	• Represents the threshold of fatality, for normally clothed people, resulting in third degree burns after 30 seconds exposure.

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Consequences of Heat Radiation and Noise

Heat Radiation	Noise Level	Effect	Requirements
2.1 (kW/m^2)	113 (dBA)	• Minimum to cause pain after 1 minute. • Hearing damage.	• Trained operator with appropriate clothing may be allowed to work upto this contour. • Public personnel NOT to enter this contour at all time. • Appropriate clothing consists of hard hat, long-sleeved shirts with cuffs buttoned, work gloves, long-legged pants, and work shoes. Appropriate clothing minimizes direct skin exposure to thermal radiation. • Appropriate ear-plugs and hearing protector (Class 5) must be worn at all time
4.7 (kW/m^2)	117 (dBA)	• Will cause injury, at least second degree burns, after 30 seconds exposure.• Maximum radiant heat intensity in areas where emergency actions lasting 2 minutes to 3 minutes can be required by personnel without shielding but the appropriate clothing.• Hearing damage.	• Trained operator with appropriate clothing may be allowed to work upto this contour for a short duration.• Public personnel NOT to enter this contour at all time.• Appropriate clothing consists of hard hat, long-sleeved shirts with cuffs buttoned, work gloves, long-legged pants, and work shoes. Appropriate clothing minimizes direct skin exposure to thermal radiation.• Appropriate ear-plugs and hearing protector (Class 5) must be worn at all time
12.6 (kW/m^2)	n/a	• Represents the threshold of fatality, for normally clothed people, resulting in third degree burns after 30 seconds exposure.	• All personnel including operator NOT to enter inside 12.6 (kW/m^2) contour at all time

APPENDIX B EXAMPLE TEMPLATE TABLES

Line Valve Spacing and Location Classification

Location	**Line Valve / Isolation**	**Approx. Distance between Line Valve (km)**	**Location Class**	**Length (km)**	**Conclusion**
1					
			R1		
			R2		
			T1		
			T2		
			Sum		
2					
			R1		
			R2		
			T1		
			T2		
			Sum		

Pipeline Depressurisation with selected orifice sizes and blow down time:

Pipeline Segment No.	Start			Finish			Length (km)	MOP (MPag)	Volume of Gas (std m^3)	Blow Down Location	Blow Down Time (hrs)	Assumed Initial surface temp. (°C)	Calculated Min. Surface Temp. at pipeline outlet (°C)	Assumed initial mass flowrate (t/hr)	Density (kg/m^3)	Qm/L (t/km-h)	Orifice size (mm)	Safe Distance (4.7kW/m^2) (m)
	Location	KP	Valve no.	Location	KP	Valve no.												

Response Time to Attend Site for Venting

Section to be isolated	Site where venting to be performed	Estimated Response time for an operator to reach site (hrs)	Estimated Response time for a crew with equipment to reach site (hrs)	Remote actuation Available?	Special Tools Required?
1					
2					