



**Report for
APA Group**

Pipeline Safety Management Study Review - Victorian Transmission Pipelines

**Revision A
22 August 2011**

PETER TUFT & ASSOCIATES
Pipeline Engineering Consultant

6 The Comenarra Parkway
West Pymble NSW 2073
02 9983 1511 0414 297 487
Email: peter@tuft.id.au

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TABLE OF CONTENTS

1. SUMMARY	4
2. INTRODUCTION	4
3. SCOPE AND PROCESS	4
4. GENERIC THREATS	5
5. LOCATION CLASSIFICATION REVIEW	5
6. RISK EVALUATIONS	6
7. ALARP	6
8. ACTIONS	7
9. CONCLUSIONS	7
APPENDIX 1 Pipelines	
APPENDIX 2 Workshop details	
APPENDIX 3 All generic threats	
APPENDIX 4 External interference protection (generic threats)	
APPENDIX 5 Design or procedural protection (generic threats)	
APPENDIX 6 Risk evaluation (generic threats)	
APPENDIX 7 Location classification (pipeline sections)	
APPENDIX 8 Risk evaluation (location-specific threats)	
APPENDIX 9 ALARP analysis	
APPENDIX 10 Recommended actions	

1 SUMMARY

This report presents the results of a 5-year review of the safety management study for the Victorian transmission pipeline network. The previous study had been comprehensive and this review mainly looked for changes to land use that might have invalidated findings from the earlier work. Few such changes were found and none were substantial.

The opportunity was taken to review and revalidate assessment of generic threats to the pipelines, and to reassess previous risk evaluations. No material changes were necessary as a result of these reviews.

The review confirmed compliance of the Victorian transmission pipeline network with the safety requirements of AS 2885.

2 INTRODUCTION

The objective of this study was to review and update the safety management study (SMS) for the Victorian transmission pipeline network operated by APA. The previous SMS was done in mid 2007. AS 2885.3-2001 requires that each SMS be reviewed at intervals of not more than 5 years, and the current review fulfils that requirement. The SMS was conducted in compliance with the process specified in AS 2885.1-2007.

Because this study is a review, and there is no evidence that the previous SMS was seriously deficient, the approach adopted was that the findings of the previous study would generally be accepted (without detailed re-examination or amendment) provided that there had been no change in the pipeline surroundings. Hence the main focus of the current study was to reassess the land use around each pipeline. More attention was given to the few cases where there had been a change since 2007.

Items from the previous SMS that had actions or were subject to risk evaluation were reviewed in more detail than others. Generally those with actions required no further attention since APA have closed out all actions from the previous SMS (except those relating to cased crossings which recur in this SMS anyway). Those with risk evaluations were reviewed in detail.

This report assumes that readers are familiar with the AS 2885 process.

3 SCOPE AND PROCESS

This study covers all transmission pipelines operated by APA in Victoria (including the line from Barnawartha that extends into NSW as far as Culcairn). Appendix 1 contains a database report listing all pipelines (with some technical parameters), sorted by TP number.

Prior to reviewing the route of each pipeline a workshop examined all the generic threats from the previous SMS, plus a few new items that were identified in the course of discussion. Generic threats included both those that are repetitive (eg. typical road crossing) and those that are non-location-specific (eg. most corrosion issues). Generic threats and their mitigation are documented in the database.

This study has not included pipeline facilities as they will be the topic of a separate SMS and report.

The SMS review took place through a series of workshops held in the APA Dandenong offices between late May and early August 2011. Workshop participants are listed in Appendix 2.

The previous SMS was largely recorded in a GIS-linked database, at least for all location-specific items. However APA found that database difficult to use. This SMS has used a simpler database that is not GIS-linked but is more usable. Data was transferred from the old to the new database and retained all significant information (data on feature locations and descriptions, threat mitigation data, risk evaluation data).

The old data contained various minor errors and inconsistencies (eg. KPs, feature names, feature descriptions, spelling errors, etc), some of which have been removed but many may remain. In particular the KPs of pipeline features are often only a general indication of location rather than a precise definition. The legacy errors and inconsistencies are not material to the conclusions of this study.

The database contains over 3100 records and this report makes no attempt to present all of that detail. The database is provided to APA and should be interrogated directly if detailed data is required.

(A portion of the T74 pipeline between Wollert and Euroa was not reviewed through the workshops for this study because it had only recently been reviewed in detail as part of the MAOP upgrade study for that pipeline. However the location classification and the few location-specific threats from that local study have been added to the database.)

4 GENERIC THREATS

Generic threats were reviewed in detail, unlike location-specific issues, because they are the foundation of the SMS. The previous SMS had recorded the generic threats in a spreadsheet but for this study they were entered into the database. There are 44 repetitive threats and 26 that are non-location-specific.

For eight of the generic threats the workshop was not confident that they are fully controlled by the mitigation measures so these were carried forward to risk evaluation; most were for general metropolitan installation where the potential consequences of a failure are higher than for rural pipelines. Three of these threats were found to have a risk rank of Intermediate (but ALARP) and the remainder were Low or Negligible. (There is further discussion of risk evaluation in Section 6 below.)

Of the risks ranked Intermediate, two involved corrosion and the other related to auger damage to pipe in the metropolitan area (expected to be a growing threat as use of mini-HDD rigs increases for utility installation and particularly for the forthcoming National Broadband Network). In all three cases the worst case failure is a small-medium leak with limited consequences. The workshop judged that none of the evaluated generic threats would lead to a full bore rupture.

No generic threats presented an intolerable risk.

Details of the workshop deliberations on generic threats are contained in appendices:

- Appendix 3 All generic threats
- Appendix 4 External interference protection (generic threats)
- Appendix 5 Design or procedural measures (generic threats)
- Appendix 6 Risk evaluation (generic threats)

5 LOCATION CLASSIFICATION REVIEW

Land use around each pipeline was reviewed in detail with the aid of aerial imagery from the GIS and other sources (Google Earth, NearMap) and with the input of the pipeline operator responsible for the area. The GIS showed not only the pipeline centreline but also the extent of the "measurement length" defined by AS 2885.1-2007 (the 4.7 kW/m² radiation contour within which unprotected people are at risk of serious injury from an ignited full bore rupture). The focus of the workshop was on land use within this measurement length.

In making the assessment of current location classification no reference was made to previous assessments; this was a fresh and independent review. Nevertheless because a major objective of this SMS was to identify changes in location class some attention was subsequently given to the previous location classification in places where land use had changed.

The pipeline operators are intimately familiar with their areas and were able to advise where a change in land use had occurred in the last few years. Evidence of change was also available from aerial photography taken at different times. Changes were rare and generally limited to areas where urban growth is occurring on the outskirts of Melbourne and larger towns. In a few places additional isolated houses had been built but rarely if ever in sufficient number to alter the location classification.

Where changes were identified the pipeline protection measures in the area were briefly reviewed. This review led to only a very small number of minor recommendations such as increased patrol frequency in a couple of locations. Recommended actions are discussed further in Section 7 below. There was no suggestion from the workshops that any additional physical protection should be considered at any location.

Location classes were assigned solely on the basis of existing land use, or in rare instances an imminent future land use such as urban development that is currently in progress. However potential future uses, such as may be permitted by an existing planning scheme, were ignored for the purpose of this SMS. If those future uses occur they can be assessed at the time the development is proposed and appropriate adjustments can be made to the SMS on the basis of the information then available; to address them now would only be speculative.

The classification tended to be conservative. Demarcations between classes R1-R2, R2-T1 and T2-T1 are often not clear since house and building density is spread on a continuous spectrum. There may be minor inconsistencies across this SMS because it took place over a period of many weeks and involved different participants in the workshops. But because classes were always assigned quite conservatively any minor discrepancies are not material.

Each pipeline section of a single location class was recorded in the Sections part of the database. The data recorded includes the start and end KPs (and length), the primary and secondary location classes and a brief description of the land use. Appendix 7 presents the same information. (The data is also provided as an Excel spreadsheet for more convenient manipulation if required.)

The location classification in the SMS database should be regarded as the definitive record of the pipeline location classes as at the time of this SMS. The current classification is likely to differ from that shown on the route plans or other pipeline records for various reasons, including the fact that location classification for pipeline design purposes must include potential future land uses while the classification arising from these workshops reflects only the current land use as noted previously.

6 RISK EVALUATIONS

A total of 28 threats were judged to require risk evaluation. Eight of these were generic threats as discussed earlier in Section 4. Of the remainder, fifteen were "All Controls Fail" scenarios at specific locations, three concerned corrosion in cased crossings at specific locations and two addressed aircraft impact adjacent to a landing ground (in fact only a single threat but it spanned two pipeline sections so needed two entries).

Details of all risk evaluations are in Appendix 8.

Some evaluations were done for the first time as part of this SMS, others were originally from the 2007 SMS but were reviewed in the recent workshops. As noted elsewhere, there may be some minor inconsistencies between evaluations done by different groups at different times but that is inherent in the AS 2885 SMS process; all assessments appear conservative and the overall outcomes remain valid.

Of the twenty location-specific risk evaluations, three resulted in risk ranks of Intermediate (but ALARP), thirteen Low and four Negligible.

The Intermediate risks comprised two "All Controls Fail" cases involving pipe puncture by large excavators in highly populated areas and one case of corrosion in a cased crossing supplying Newport power station (hence substantial supply consequences). All three were shown to be ALARP and hence tolerable.

Given the extent of the Victorian transmission pipeline network, including large sections of high population density, the low number of risk evaluations and the resulting generally low risk ranks demonstrate a level of pipeline safety that is well within the required standard.

7 ALARP

Risks that are ranked Intermediate must be shown to be As Low As Reasonably Practicable (ALARP) in order to be accepted at tolerable. ALARP should be demonstrated through a cost benefit analysis, but inverting that process to calculate a maximum justifiable spend (MJS) is an equally valid but simpler approach. Mitigation measures that cost more than the MJS do not need to be considered, and if there are no mitigation measures less than MJS then ALARP has been demonstrated. MJS is given by (cost of failure) x (probability of failure) x (proportionality factor), the latter representing the "grossly disproportionate" term in the AS 2885 definition of ALARP.

For the six Intermediate risks in this study an MJS was calculated for three; for the other three it was unnecessary because there is simply no further mitigation available with current

technology, short of abandoning or rebuilding the affected pipelines (clearly unjustifiably costly).

ALARP details from the database (including MJS) are presented in Appendix 9.

8 ACTIONS

Most safety management studies generate moderately long lists of actions. Because this SMS is a review of an existing SMS the number of actions generated was very small - only five. They are presented in Appendix 10.

The 2007 SMS had a much longer list of actions. APA advised that all previous actions had been closed and they were not reviewed further in this SMS.

9 CONCLUSIONS

Review of the safety management study for the Victorian transmission pipeline network has confirmed that it meets the safety requirements of AS 2885.

APPENDIX 1

PIPELINES

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

PIPELINES

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

ID	Pipeline	Size	Length	MAOP	WT	Steel Grade	Toughness	Critical Defect	Excavator to penetrate B = 0.75	B = 1.3
42	Generic pipeline for repetitive and NLS threats									T
	DN	km	MPa		mm		J	mm	t	t
	Radiation distance for	12.6 kW/m ² :	m							
		4.7 kW/m ² :	m							
1	Morwell to Dandenong									T 1
	DN 450	127 km	2.76 MPa		7.9 mm	A	J	270 mm	28 t	10 t
					9.9	A		400	-	12
	Radiation distance for	12.6 kW/m ² :	150 m							
		4.7 kW/m ² :	240 m							
2	Princes Hwy to Regent St									T 15
	DN 200	0.82 km	2.76 MPa		6.4 mm	A	J	na mm	18 t	8 t
	Radiation distance for	12.6 kW/m ² :	56 m							
		4.7 kW/m ² :	108 m							
3	Dandenong to West Melbourne									T 16
	DN 750	36.2 km	2.76 MPa		9.5 mm	X42	J	350 mm	- t	16 t
	Radiation distance for	12.6 kW/m ² :	290 m							
		4.7 kW/m ² :	450 m							
4	Keon Park East to Keon Park West									T 18
	DN 450	0.6 km	2.76 MPa		7.9 mm	A	J	266 mm	28 t	10 t
	Radiation distance for	12.6 kW/m ² :	152 m							
		4.7 kW/m ² :	243 m							
5	Brooklyn to Corio									T 24
	DN 350	50.7 km	7.39 MPa		5.6 mm	B	J	100 mm	20 t	10 t
					6.4	B		130	28	10
	Radiation distance for	12.6 kW/m ² :	180 m							
		4.7 kW/m ² :	300 m							
6	Pound Rd to Tuckers Rd									T 32
	DN 100	2 km	2.76 MPa		6.0 mm	B	J	- mm	18 t	8 t
	Radiation distance for	12.6 kW/m ² :	20 m							
		4.7 kW/m ² :	33 m							

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5 Year Review safety mgt. study

ID	Pipeline									
	Size	Length	MAOP	WT	Steel Grade	Toughness	Critical Defect	Excavator to penetrate B = 0.75	B = 1.3	
7	South Melbourne to Brooklyn									T 33
	DN 750	12.8 km	2.76 MPa	9.5 mm	X42	J	350 mm	- t	16 t	
	Radiation distance for 12.6 kW/m ² : 290 m 4.7 kW/m ² : 450 m									
8	Supply to APM Maryvale									T 37
	DN 150	5.4 km	6.89 MPa	6.35 mm	B	J	140 mm	22 t	10 t	
	Radiation distance for 12.6 kW/m ² : 70 m 4.7 kW/m ² : 110 m									
9	Healesville to Koo-Wee-Rup Road									T 38
	DN 150	1.2 km	2.76 MPa	7.1 mm	X42	J	mm	28 t	10 t	
	Radiation distance for 12.6 kW/m ² : 47 m 4.7 kW/m ² : 77 m									
	This is a loop line. Also original DN 80 line parallel.									
10	Supply to Anderson St, Warragul									T 44
	DN 100	4.8 km	2.76 MPa	6.0 mm	B	J	- mm	18 t	8 t	
	Radiation distance for 12.6 kW/m ² : 20 m 4.7 kW/m ² : 33 m									
11	Brooklyn to Ballan									T 56
	DN 200	66.6 km	7.39 MPa	6.35 mm	B	J	105 mm	22 t	10 t	
				7.04	B		125	28	10	
	Radiation distance for 12.6 kW/m ² : 100 m 4.7 kW/m ² : 160 m									
12	Ballan to Ballarat (including loop line)									T 57
	DN 300	22.8 km	7.39 MPa	6.35 mm	X46	J	100 mm	22 t	10 t	
				7.6	X46		140	45	12	
	Radiation distance for 12.6 kW/m ² : 160 m 4.7 kW/m ² : 260 m									
				4.8	B		80	12	6	
				6.35	B		130	22	10	
	Above parameters are for loop line. Also original line DN 150, 4.8 and 6.4 mm Grade B.									
13	Euroa to Shepparton									T 59
	DN 200	34.5 km	7.4 MPa	5.6 mm	X42	J	100 mm	16 t	6 t	
	Radiation distance for 12.6 kW/m ² : 100 m 4.7 kW/m ² : 160 m									

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ID	Pipeline	Size	Length	MAOP	WT	Steel Grade	Toughness	Critical Defect	Excavator to penetrate B = 0.75	B = 1.3
14	Longford to Dandenong, including loop lines									T 60
	DN 750	174.2 km	6.89 MPa	10.3 mm	X60	J	180 mm	- t	22 t	
				12.7	X60		260	-	50	
	Radiation distance for 12.6 kW/m ² : 430 m 4.7 kW/m ² : 700 m									
15	Packenham to Wollert									T 61
	DN 750	93.1 km	6.89 MPa	10.6 mm	X60	J	190 mm	- t	22 t	
				12.7	X60		270	-	50	
	Radiation distance for 12.6 kW/m ² : 430 m 4.7 kW/m ² : 700 m									
16	Derrimut to Sunbury									T 62
	DN 150	24 km	7.39 MPa	6.35 mm	B	J	130 mm	22 t	10 t	
	Radiation distance for 12.6 kW/m ² : 72 m 4.7 kW/m ² : 113 m									
17	Tyers to Morwell looping									T 63
	DN 500	15.7 km	7.07 MPa	8.7 mm	X60	J	180 mm	- t	16 t	
				10.6	X60		255	-	22	
	Radiation distance for 12.6 kW/m ² : 265 m 4.7 kW/m ² : 450 m									
18	Supply to Newport Power Station									T 64
	DN 450	1 km	2.76 MPa	7.9 mm	X42	J	- mm	45 t	12 t	
				9.7	X42			-	16	
	Radiation distance for 12.6 kW/m ² : 150 m 4.7 kW/m ² : 245 m									
19	Dandenong to Princes Highway & Henty Street									T 65
	DN 750	5 km	2.76 MPa	9.5 mm	X42	J	350 mm	- t	16 t	
	Radiation distance for 12.6 kW/m ² : 290 m 4.7 kW/m ² : 440 m									
	Includes 200 m of DN 500, 7.9 mm Gr B from Princes Hwy and Henty St									
20	Mt Franklin to Kyneton									T 66
	DN 300	24.5 km	7.39 MPa	6.45 mm	X46	J	100 mm	22 t	10 t	
				7.55	X46		140	45	12	
	Radiation distance for 12.6 kW/m ² : 160 m 4.7 kW/m ² : 260 m									

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ID	Pipeline	Size	Length	MAOP	WT	Steel Grade	Toughness	Critical Defect	Excavator to penetrate B = 0.75	B = 1.3
21	<i>Guildford to Maryborough</i>									T 67
	DN 150	31.4 km	7.39 MPa		6.35 mm	B	J	130 mm	22 t	10 t
	Radiation distance for 12.6 kW/m ² : 75 m 4.7 kW/m ² : 115 m									
22	<i>Ballan to Bendigo (incl. looping)</i>									T 70
	DN 300	90.8 km	7.39 MPa		6.35 mm	X46	J	100 mm	22 t	10 t
					7.55	X46		140	45	10
	Radiation distance for 12.6 kW/m ² : 160 m 4.7 kW/m ² : 260 m									
					4.8	B		80	12	6
					6.35	B		130	22	10
DN 300 line is loop line, only from Mt Franklin to Bendigo, 50.8 km. Original line is DN 150, 4.8 & 6.35 mm Gr B.										
23	<i>Shepparton to Tatura to Kyabram</i>									T 71
	DN 200	16.2 km	7.39 MPa		6.35 mm	B	J	105 mm	22 t	10 t
					7.0	B		125	28	10
	Radiation distance for 12.6 kW/m ² : 100 m 4.7 kW/m ² : 160 m									
24	<i>Keon Park to Wollert</i>									T 74.1
	DN 600	14.1 km	2.76 MPa		7.92 mm	X42	J	300 mm	45 t	12 t
	Radiation distance for 12.6 kW/m ² : 230 m 4.7 kW/m ² : 370 m									
25	<i>Wollert to Wodonga</i>									T 74.2
	DN 300	270 km	7.4 MPa		6.35 mm	X46	J	100 mm	22 t	10 t
					7.55	X46		140	45	12
	Radiation distance for 12.6 kW/m ² : 160 m 4.7 kW/m ² : 260 m									
26	<i>Wandong to Kyneton</i>									T 75
	DN 300	59.5 km	7.39 MPa		6.45 mm	X46	J	100 mm	22 t	10 t
					7.6	X46		140	45	12
	Radiation distance for 12.6 kW/m ² : 160 m 4.7 kW/m ² : 260 m									
27	<i>Paaratte to Allansford</i>									T 81
	DN 150	33.3 km	9.89 MPa		6.35 mm	B	J	90 mm	22 t	10 t
	Radiation distance for 12.6 kW/m ² : 85 m 4.7 kW/m ² : 130 m									

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

PIPELINES

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

ID	Pipeline	Size	Length	MAOP	WT	Steel Grade	Toughness	Critical Defect	Excavator to penetrate B = 0.75	B = 1.3
28	<i>Kyabram to Echuca</i>									T 85
	DN 150	30.7 km	7.39 MPa	4.8 mm	B	J	80 mm	12 t	6 t	
				6.35	B		130	22	10	
	Radiation distance for 12.6 kW/m ² : 75 m 4.7 kW/m ² : 115 m									
43	<i>Allansford to Portland</i>									T 86
	DN 150	100.4 km	9.89 MPa	4.8 mm	X42	J	65 mm	12 t	6 t	
				6.35			105	22	10	
	Radiation distance for 12.6 kW/m ² : 85 m 4.7 kW/m ² : 130 m									
29	<i>Laverton to BHP</i>									T 88
	DN 150	1.6 km	2.76 MPa	6.35 mm	X42	J	- mm	22 t	10 t	
	Radiation distance for 12.6 kW/m ² : 47 m 4.7 kW/m ² : 77 m									
30	<i>Supply to Unichema, Bay St</i>									T 89
	DN 150	0.4 km	2.76 MPa	6.35 mm	X42	J	- mm	22 t	10 t	
	Radiation distance for 12.6 kW/m ² : 47 m 4.7 kW/m ² : 77 m									
31	<i>Curdievale to Cobden</i>									T 91
	DN 150	27.7 km	9.89 MPa	4.8 mm	X42	J	65 mm	12 t	6 t	
				6.35	X42		105	22	10	
	Radiation distance for 12.6 kW/m ² : 85 m 4.7 kW/m ² : 135 m									
32	<i>Iona to Lara</i>									T 92
	DN 500	143.9 km	10.2 MPa	9 mm	X60	J	115 mm	- t	18 t	
				12.7	X60		220	-	50	
	Radiation distance for 12.6 kW/m ² : 320 m 4.7 kW/m ² : 550 m									
33	<i>Codrington to Hamilton</i>									T 93
	DN 150	54.6 km	9.89 MPa	4.8 mm	X42	J	65 mm	12 t	6 t	
				6.35	X42		105	22	10	
	Radiation distance for 12.6 kW/m ² : 85 m 4.7 kW/m ² : 135 m									

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

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5 Year Review safety mgt. study

ID	Pipeline	Size	Length	MAOP	WT	Steel Grade	Toughness	Critical Defect	Excavator to penetrate B = 0.75	B = 1.3
34	Chiltern Valley to Rutherglen									T 96
	DN 200	14.7 km	7.4 MPa		4 mm	X60	J	80 mm	12 t	6 t
					4.8			110	16	6
	Radiation distance for 12.6 kW/m ² : 100 m 4.7 kW/m ² : 160 m									
35	Rutherglen to Koonoomoo									T 98
	DN 200	88.8 km	7.4 MPa		4.3 mm	X52	J	80 mm	12 t	6 t
					5.2	X52		110	16	6
	Radiation distance for 12.6 kW/m ² : 100 m 4.7 kW/m ² : 160 m									
36	Culcairn to Barnawartha									T 99
	DN 450	62.5 km	10.2 MPa		6.8 mm	X70	J	90 mm	50 t	12 t
					9.7	X70		175	-	22
	Radiation distance for 12.6 kW/m ² : 280 m 4.7 kW/m ² : 460 m									
37	Iona to Paaratte									T 100
	DN 150	7.8 km	7.4 MPa		7.1 mm	X52	J	- mm	32 t	10 t
	Radiation distance for 12.6 kW/m ² : 75 m 4.7 kW/m ² : 115 m									
38	Somerton Pipeline									T 102
	DN 250	3.4 km	2.76 MPa		6.4 mm	X42	J	- mm	22 t	10 t
	Radiation distance for 12.6 kW/m ² : 75 m 4.7 kW/m ² : 135 m									
39	Supply to Iluka, Hamilton									T 109
	DN 100	1.1 km	9.89 MPa		6 mm	B	J	125 mm	18 t	8 t
					8.6	B		220	-	12
	Radiation distance for 12.6 kW/m ² : 60 m 4.7 kW/m ² : 100 m									
40	Supply to Snowy Hydro, Laverton North									T 110
	DN 350	1.6 km	10.2 MPa		9.5 mm	X56	J	140 mm	- t	18 t
	Radiation distance for 12.6 kW/m ² : 210 m 4.7 kW/m ² : 350 m									

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

PIPELINES

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

ID	Pipeline		MAOP	WT	Steel Grade	Toughness	Critical Defect	Excavator to penetrate	
	Size	Length						B = 0.75	B = 1.3
41	Brooklyn to Lara								T 112
	DN 500	58 km	10.2 MPa	7.9 mm	X70	J	90 mm	- t	16 t
				12.7	X70		180	-	-
Radiation distance for 12.6 kW/m ² : 300 m									
4.7 kW/m ² : 500 m									

APPENDIX 2

WORKSHOP DETAILS

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

WORKSHOP DETAILS

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Workshop No 1 30 May - 31 May
APA offices, Dandenong

Purpose Review APA Vic SMS, covering GENERIC THREATS and NORTHERN region

Comments Not all attendees were present at all times

Attendees	<u>Name</u>	<u>Affiliation</u>	<u>Role</u>
	Craig Bonar	APA	Manager, AM&E
	Peter Dawson	APA	Operations Support Officer
	Alan Bryson	APA	Corrosion Manager
	Ian Johnson	APA	Eastern Manager
	Shane Matthews	APA	Western Manager
	Rob Dickie	APA	Pipeline Engineer
	Raymond Tan	APA	Operations Support Manager
	Ian Boyd	APA	Pipeline Operator
	Michael Knobloch	APA	Pipeline Operator
	Michael Harries	APA	Senior Draftsperson/GIS
	Peter Tuft	PT&A	Pipeline Engineer; Facilitator

Workshop No 2 14 Jun 2011 - 15 Jun 2011
APA offices, Dandenong

Purpose Review APA Vic SMS, covering EASTERN region

Comments Not all attendees were present at all times

Attendees	<u>Name</u>	<u>Affiliation</u>	<u>Role</u>
	Craig Bonar	APA	Manager, AM&E
	Peter Dawson	APA	Operations Support Officer
	Michael Harries	APA	Senior Draftsperson/GIS
	Ian Johnson	APA	Eastern Manager
	Robert Mielice	APA	Senior Technical Officer
	Nick van der Zweep	APA	Senior Technical Officer
	Rob Dickie	APA	Pipeline Engineer
	Don Allen	APA	Pipeline Operator
	Peter Tuft	PT&A	Pipeline Engineer; Facilitator

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

WORKSHOP DETAILS

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Workshop No 3 20 Jun 2011 -
APA offices, Dandenong

Purpose Review APA Vic SMS, covering CENTRAL region

Comments Not all attendees were present at all times

Attendees	<u>Name</u>	<u>Affiliation</u>	<u>Role</u>
	Craig Bonar	APA	Manager, AM&E
	Peter Dawson	APA	Operations Support Officer
	Michael Harries	APA	Senior Draftsperson/GIS
	Chris Knobloch	APA	Pipeline Operator
	Terry Hourigan	APA	Pipeline Operator
	Robert Fuller	APA	Pipeline Operator
	John Rodrigues	APA	Engineer, Operations
	Rob Dickie	APA	Pipeline Engineer
	Peter Tuft	PT&A	Pipeline Engineer; Facilitator

Workshop No 4 4 Aug 2011 -
APA offices, Dandenong

Purpose Review APA Vic SMS, covering WESTERN region

Comments Not all attendees were present at all times

Attendees	<u>Name</u>	<u>Affiliation</u>	<u>Role</u>
	Craig Bonar	APA	Manager, AM&E
	Peter Dawson	APA	Operations Support Officer
	Michael Harries	APA	Senior Draftsperson/GIS
	Jamie Storer	APA	Pipeline Operator
	Colin Hewlett	APA	Pipeline Operator
	Peter Tuft	PT&A	Pipeline Engineer; Facilitator

APPENDIX 3

ALL GENERIC THREATS

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

THREATS

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 42 **Generic pipeline for repetitive and NLS threats**

Section: 1 **Repetitive threats**

ID	3087	Cathodic protection shielding within casing due to annular void	KP
Location	Cased crossing		Corrosion
ID	3054	Excessive stress due to vehicle or machinery loads, on or off pavement	KP
Location	Road crossing		Design defect
ID	3060	Excessive stress due to vehicle or machinery loads, on or off tracks	KP
Location	Rail crossing		Design defect
ID	3038	Heavy vehicle over pipe other than at road crossings	KP
Location	General rural installation		External interference
ID	3039	Heavy vehicle bogged in trench	KP
Location	General rural installation		External interference
ID	3040	Fence post installation (stock fencing etc)	KP
Location	General rural installation		External interference
ID	3041	Vineyard trellis post installation (up to 900 mm deep for end posts)	KP
Location	General rural installation		External interference
ID	3042	Ploughing, up to 500 mm depth	KP
Location	General rural installation		External interference
ID	3043	Deep ripping, agricultural, up to 1000 mm depth	KP
Location	General rural installation		External interference
ID	3044	Cable plough, 1200 mm or perhaps deeper	KP
Location	General rural installation		External interference
ID	3045	Forestry, tree harvesting or planting adjacent to easement	KP
Location	General rural installation		External interference
ID	3046	Dam construction	KP
Location	General rural installation		External interference
ID	3047	Dam maintenance or re-contouring	KP
Location	General rural installation		External interference
ID	3048	Levee or contour bank construction or maintenance; expect ≤600 mm depth	KP
Location	General rural installation		External interference
ID	3049	Water bore installation	KP
Location	General rural installation		External interference

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

THREATS

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

ID	3050	Unplanned or uncontrolled minor construction (tracks, sheds, etc); expect ≤600 m depth	KP
Location	General rural installation		External interference
ID	3051	Minor buried service maintenance; expect ≤600 mm depth	KP
Location	General rural installation		External interference
ID	3052	Minor buried service installation; expect ≤600 mm depth	KP
Location	General rural installation		External interference
ID	3056	Traffic accident, vehicle ploughs into ground over pipe	KP
Location	Road crossing		External interference
ID	3057	Table drain maintenance	KP
Location	Road crossing		External interference
ID	3058	Buried service construction or maintenance	KP
Location	Road crossing		External interference
ID	3059	Table drain maintenance	KP
Location	Rail crossing		External interference
ID	3061	Rail accident, excessive stress on pipe, or coating or pipe damage	KP
Location	Rail crossing		External interference
ID	3062	Trackside services maintenance or construction	KP
Location	Rail crossing		External interference
ID	3063	Trackside fence maintenance or construction	KP
Location	Rail crossing		External interference
ID	3064	Roadside fence maintenance or construction	KP
Location	Road crossing		External interference
ID	3068	Drain maintenance	KP
Location	Drain crossing (manmade)		External interference
ID	3069	Power pole installation or replacement in road reserve	KP
Location	Road crossing		External interference
ID	3070	Power pole installation or replacement	KP
Location	Powerline crossing		External interference
ID	3071	Landscaping & tree planting	KP
Location	Isolated house		External interference
ID	3072	Construction of buried services to house	KP
Location	Isolated house		External interference
ID	3073	Power pole installation or replacement	KP
Location	Isolated house		External interference

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

THREATS

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

ID	3074	Well sinking (bore)	KP
Location	Isolated house		External interference
ID	3075	Sewage system construction, including septic tank	KP
Location	Isolated house		External interference
ID	3077	Swimming pool construction	KP
Location	Isolated house		External interference
ID	3104	Buried service construction (open cut)	KP
Location	General metro installation		External interference
ID	3105	Power pole installation or replacement	KP
Location	General metro installation		External interference
ID	3106	HDD for buried service installation	KP
Location	General metro installation		External interference
ID	3107	Road reconstruction or major maintenance	KP
Location	General metro installation		External interference
ID	3108	Core drilling for geotech investigation	KP
Location	General metro installation		External interference
ID	3111	Buried service maintenance	KP
Location	General metro installation		External interference
ID	3065	Erosion or loss of cover, leading to flotation	KP
Location	Watercourse crossing		Natural events
ID	3066	Erosion and exposure of pipe, possible damage from waterborne debris	KP
Location	Watercourse crossing		Natural events
ID	3067	Erosion and exposure of pipe, possible damage from waterborne debris	KP
Location	Drain crossing (manmade)		Natural events

Section: 2 Non-location-specific

ID	3078	Undetected or unreported construction defect	KP
Location	Non-location-specific		Construction defect
ID	3079	Stress corrosion cracking	KP
Location	Non-location-specific		Corrosion
ID	3080	Internal corrosion	KP
Location	Non-location-specific		Corrosion
ID	3081	Loss of cathodic protection due to failure of a CPU or loss of electrical isolation	KP
Location	Non-location-specific		Corrosion

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

THREATS

Pipeline Licensee: APA GasNet

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ID	3082	CP testing performed incorrectly	KP
Location	Non-location-specific		Corrosion
ID	3083	Stray current corrosion	KP
Location	Non-location-specific		Corrosion
ID	3084	Interference from other authority structure or CP unit	KP
Location	Non-location-specific		Corrosion
ID	3085	Telluric effects	KP
Location	Non-location-specific		Corrosion
ID	3086	Cathodic protection shielding (disbonded coating)	KP
Location	Non-location-specific		Corrosion
ID	3088	Microbiological corrosion or aggressive soils	KP
Location	Non-location-specific		Corrosion
ID	3089	Unidentified or unreported design shortcoming	KP
Location	Non-location-specific		Design defect
ID	3110	Fracture control plan inadequate	KP
Location	Non-location-specific		Design defect
ID	3090	Sabotage or unauthorised operation	KP
Location	Non-location-specific		Intentional damage
ID	3091	Undetected or unreported material defect	KP
Location	Non-location-specific		Material defect
ID	3092	Earthquake	KP
Location	Non-location-specific		Natural events
ID	3053	Incident due to inaccurate or misinterpreted pipeline location information	KP
Location	Non-location-specific		Operation & maintenance
ID	3093	Loss of supply due to pigging operations	KP
Location	Non-location-specific		Operation & maintenance
ID	3094	Maintenance procedures inadequate or incomplete	KP
Location	Non-location-specific		Operation & maintenance
ID	3095	Maintenance contrary to procedures	KP
Location	Non-location-specific		Operation & maintenance
ID	3096	Project records, as-built records and material records lost, ignored or not maintained	KP
Location	Non-location-specific		Operation & maintenance
ID	3097	Changes to assets not managed, implemented or recorded properly	KP
Location	Non-location-specific		Operation & maintenance

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

THREATS

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

ID	3098	Operators not adequately trained or lacking specific competence	KP
Location	Non-location-specific		Operation & maintenance
ID	3100	Escalation of incident due to inadequate or ineffective emergency management	KP
Location	Non-location-specific		Operation & maintenance
ID	3101	In-service welding	KP
Location	Non-location-specific		Operation & maintenance
ID	3102	High voltages induced from parallel powerlines	KP
Location	Non-location-specific		Other
ID	3103	Earth potential rise due to earthing fault or lightning strike on powerline	KP
Location	Non-location-specific		Other

APPENDIX 4

EXTERNAL INTERFERENCE PROTECTION (Generic Threats)

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

EXTERNAL INTERFERENCE PROTECTION

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 42 **Generic pipeline for repetitive and NLS threats**

Section: 1 **Repetitive threats**

THREAT DETAILS

ID **3038** **Heavy vehicle over pipe other than at road crossings** KP
Location General rural installation External interference
INITIAL EIP **Physical protection:** Burial **Procedural protection:** Landowner liaison
Wall thickness Third party liaison
Warning signs
Phys notes: Calculations under AP-RP 1102 demonstrate loading acceptable.
Cover at most locations is greater than 750 mm, and 1200 mm Patrolling
One-call system
Proc notes:
Cover: 750 mm **Wall thickness:** mm **Sign spacing:** m
Initial EIP acceptable? ☒ Yes ☐ No Amended EIP acceptable? ☐ Yes ☒ No

AMENDED EIP (corrective actions)

ID Action Contin-
uing

THREAT DETAILS

ID **3039** **Heavy vehicle bogged in trench** KP
Location General rural installation External interference
INITIAL EIP **Physical protection:** Burial **Procedural protection:**
Wall thickness
Phys notes: Weight distribution of vehicle spreading load. Cover at most
locations is greater than 750 mm, and 1200 mm on older
Proc notes: Patrols note wheel ruts and manage appropriately
Cover: 750 mm **Wall thickness:** mm **Sign spacing:** m
Initial EIP acceptable? ☒ Yes ☐ No Amended EIP acceptable? ☐ Yes ☒ No

AMENDED EIP (corrective actions)

ID Action Contin-
uing

THREAT DETAILS

ID **3040** **Fence post installation (stock fencing etc)** KP
Location General rural installation External interference
INITIAL EIP **Physical protection:** Burial **Procedural protection:** Landowner liaison
Wall thickness Warning signs
Patrolling
Phys notes: Cover at most locations is greater than 750 mm, and 1200 mm Third party liaison
on older pipelines. One-call system
Marker tape
Proc notes: Patrols review signage and fence line changes.
Cover: 750 mm **Wall thickness:** mm **Sign spacing:** m
Initial EIP acceptable? ☒ Yes ☐ No Amended EIP acceptable? ☐ Yes ☒ No

AMENDED EIP (corrective actions)

ID Action Contin-
uing

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

EXTERNAL INTERFERENCE PROTECTION

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID	3041	<i>Vineyard trellis post installation (up to 900 mm deep for end posts)</i>	KP
Location	General rural installation		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness	Procedural protection: Landowner liaison Warning signs Patrolling One-call system Third party liaison Marker tape
	Phys notes: Cover at most locations is greater than 750 mm, and 1200 mm on older pipelines.		
	Proc notes:		
	Cover:	750 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3042	<i>Ploughing, up to 500 mm depth</i>	KP
Location	General rural installation		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness	Procedural protection: Landowner liaison Warning signs Patrolling One-call system Third party liaison Marker tape
	Phys notes: Cover at most locations is greater than 750 mm, and 1200 mm on older pipelines.		
	Proc notes:		
	Cover:	750 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3043	<i>Deep ripping, agricultural, up to 1000 mm depth</i>	KP
Location	General rural installation		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness	Procedural protection: Landowner liaison Warning signs Patrolling Third party liaison One-call system Marker tape
	Phys notes: Cover at most locations is greater than 750 mm, and 1200 mm on older pipelines.		
	Proc notes:		
	Cover:	750 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

EXTERNAL INTERFERENCE PROTECTION

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID	3044	Cable plough, 1200 mm or perhaps deeper	KP
Location	General rural installation		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness	Procedural protection: Landowner liaison Warning signs Patrolling
	Phys notes:	Cover at most locations is greater than 750 mm, and 1200 mm on older pipelines.	Third party liaison One-call system
	Proc notes:		
	Cover:	750 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3045	Forestry, tree harvesting or planting adjacent to easement	KP
Location	General rural installation		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness	Procedural protection: Landowner liaison Warning signs Patrolling
	Phys notes:	Cover at most locations is greater than 750 mm, and 1200 mm on older pipelines.	Third party liaison One-call system Marker tape
	Proc notes:		
	Cover:	750 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3046	Dam construction	KP
Location	General rural installation		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness	Procedural protection: Landowner liaison Warning signs Patrolling
	Phys notes:	Cover at most locations is greater than 750 mm, and 1200 mm on older pipelines. However cover may not be adequate	Third party liaison One-call system Marker tape
	Proc notes:		
	Cover:	750 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No

AMENDED EIP (corrective actions)

ID	Action	Continuing
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Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

EXTERNAL INTERFERENCE PROTECTION

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID	3047	<i>Dam maintenance or re-contouring</i>	KP
Location	General rural installation		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness	Procedural protection: Landowner liaison Warning signs Patrolling Third party liaison One-call system Marker tape
	Phys notes: Cover at most locations is greater than 750 mm, and 1200 mm on older pipelines. However cover may not be adequate		
	Proc notes:		
	Cover:	750 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3048	<i>Levee or contour bank construction or maintenance; expect ≤600 mm depth</i>	KP
Location	General rural installation		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness	Procedural protection: Landowner liaison Warning signs Patrolling One-call system Third party liaison Marker tape
	Phys notes: Cover at most locations is greater than 750 mm, and 1200 mm on older pipelines.		
	Proc notes:		
	Cover:	750 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3049	<i>Water bore installation</i>	KP
Location	General rural installation		External interference
<u>INITIAL EIP</u>	Physical protection:	Wall thickness	Procedural protection: Landowner liaison Warning signs Patrolling One-call system Third party liaison Marker tape
	Phys notes:		
	Proc notes:		
	Cover:	mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No

AMENDED EIP (corrective actions)

ID	Action	Continuing
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Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

EXTERNAL INTERFERENCE PROTECTION

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID	3050	Unplanned or uncontrolled minor construction (tracks, sheds, etc); expect ≤600 m depth	KP
Location	General rural installation		External interference
INITIAL EIP	Physical protection:	Burial Wall thickness	Procedural protection: Landowner liaison Warning signs Patrolling One-call system Third party liaison Marker tape
	Phys notes:	Cover at most locations is greater than 750 mm, and 1200 mm on older pipelines.	
	Proc notes:		
	Cover:	750 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3051	Minor buried service maintenance; expect ≤600 mm depth	KP
Location	General rural installation		External interference
INITIAL EIP	Physical protection:	Burial Wall thickness	Procedural protection: Landowner liaison Warning signs Patrolling One-call system Third party liaison Marker tape
	Phys notes:	Cover at most locations is greater than 750 mm, and 1200 mm on older pipelines.	
	Proc notes:		
	Cover:	750 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3052	Minor buried service installation; expect ≤600 mm depth	KP
Location	General rural installation		External interference
INITIAL EIP	Physical protection:	Burial Wall thickness	Procedural protection: Landowner liaison Warning signs Patrolling One-call system Third party liaison Marker tape
	Phys notes:		
	Proc notes:		
	Cover:	900 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

EXTERNAL INTERFERENCE PROTECTION

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID	3056	Traffic accident, vehicle ploughs into ground over pipe	KP
Location	Road crossing		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness	Procedural protection:
Phys notes:			
Proc notes: Procedural measure not applicable to accidental events.			
Cover: 1200 mm		Wall thickness: mm	Sign spacing: m
Initial EIP acceptable? <input checked="" type="radio"/> Yes <input type="radio"/> No		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	
<u>AMENDED EIP (corrective actions)</u>			Contin-
ID	Action		uing

THREAT DETAILS

ID	3057	Table drain maintenance	KP
Location	Road crossing		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness Penetration barrier	Procedural protection: Third party liaison Warning signs Landowner liaison One-call system Marker tape Patrolling
Phys notes: Concrete slabs at road crossings (except bored portion)			
Proc notes:			
Cover: 1200 mm		Wall thickness: mm	Sign spacing: m
Initial EIP acceptable? <input checked="" type="radio"/> Yes <input type="radio"/> No		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	
<u>AMENDED EIP (corrective actions)</u>			Contin-
ID	Action		uing

THREAT DETAILS

ID	3058	Buried service construction or maintenance	KP
Location	Road crossing		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness Penetration barrier	Procedural protection: Landowner liaison Third party liaison Warning signs Marker tape One-call system Patrolling
Phys notes: Concrete slabs at road crossings (except bored portion)			
Proc notes:			
Cover: 1200 mm		Wall thickness: mm	Sign spacing: m
Initial EIP acceptable? <input checked="" type="radio"/> Yes <input type="radio"/> No		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	
<u>AMENDED EIP (corrective actions)</u>			Contin-
ID	Action		uing

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

EXTERNAL INTERFERENCE PROTECTION

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID	3059	Table drain maintenance	KP
Location	Rail crossing		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness Penetration barrier	Procedural protection: Landowner liaison Third party liaison Warning signs Patrolling One-call system Marker tape
	Phys notes:	Casing (steel) and concrete slabs outside bored portion	
	Proc notes:		
	Cover:	mm	Wall thickness: mm Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3061	Rail accident, excessive stress on pipe, or coating or pipe damage	KP
Location	Rail crossing		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness Penetration barrier	Procedural protection:
	Phys notes:	Casing (steel)	
	Proc notes:	Procedural measure not applicable to accidental events.	
	Cover:	1200 mm	Wall thickness: mm Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3062	Trackside services maintenance or construction	KP
Location	Rail crossing		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness Penetration barrier	Procedural protection: Landowner liaison Third party liaison Warning signs Patrolling One-call system Marker tape
	Phys notes:	Casing (steel)	
	Proc notes:		
	Cover:	1200 mm	Wall thickness: mm Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

EXTERNAL INTERFERENCE PROTECTION

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID	3063	Trackside fence maintenance or construction	KP
Location	Rail crossing		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness Penetration barrier	Procedural protection: Landowner liaison Third party liaison Warning signs Patrolling One-call system Marker tape
	Phys notes:	Casing (steel)	
	Proc notes:		
	Cover:	1200 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3064	Roadside fence maintenance or construction	KP
Location	Road crossing		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness Penetration barrier	Procedural protection: Third party liaison Warning signs Landowner liaison One-call system Marker tape Patrolling
	Phys notes:	Concrete slabs at road crossings (except bored portion)	
	Proc notes:		
	Cover:	1200 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3068	Drain maintenance	KP
Location	Drain crossing (manmade)		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness	Procedural protection: One-call system Landowner liaison Third party liaison Warning signs Marker tape Patrolling
	Phys notes:	Cover of 2000 mm or more at major drains and irrigation channels	
	Proc notes:		
	Cover:	1200 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No

AMENDED EIP (corrective actions)

ID	Action	Continuing
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Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

EXTERNAL INTERFERENCE PROTECTION

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID	3069	Power pole installation or replacement in road reserve	KP
Location	Road crossing		External interference
<u>INITIAL EIP</u>	Physical protection:	Wall thickness Penetration barrier	Procedural protection: Landowner liaison Third party liaison One-call system Warning signs Marker tape Patrolling
	Phys notes:	Concrete slabs at road crossings (except bored portion)	
	Proc notes:	Special signs on existing poles within 4 m of pipeline. Power company control rooms aware of pipeline location near poles.	
	Cover:	mm	Wall thickness: mm Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3070	Power pole installation or replacement	KP
Location	Powerline crossing		External interference
<u>INITIAL EIP</u>	Physical protection:	Wall thickness	Procedural protection: Landowner liaison Third party liaison One-call system Warning signs Marker tape Patrolling
	Phys notes:		
	Proc notes:		
	Cover:	mm	Wall thickness: mm Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3071	Landscaping & tree planting	KP
Location	Isolated house		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness	Procedural protection: Landowner liaison One-call system Warning signs Third party liaison Marker tape Patrolling
	Phys notes:	Cover at most locations is greater than 750 mm, and 1200 mm on older pipelines.	
	Proc notes:		
	Cover:	750 mm	Wall thickness: mm Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

EXTERNAL INTERFERENCE PROTECTION

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID	3072	Construction of buried services to house	KP
Location	Isolated house		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness	Procedural protection: Landowner liaison Warning signs Patrolling One-call system Third party liaison Marker tape
	Phys notes:	Cover at most locations is greater than 750 mm, and 1200 mm on older pipelines.	
	Proc notes:		
	Cover:	750 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3073	Power pole installation or replacement	KP
Location	Isolated house		External interference
<u>INITIAL EIP</u>	Physical protection:	Wall thickness	Procedural protection: Landowner liaison One-call system Warning signs Third party liaison Marker tape Patrolling
	Phys notes:		
	Proc notes:		
	Cover:	mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3074	Well sinking (bore)	KP
Location	Isolated house		External interference
<u>INITIAL EIP</u>	Physical protection:	Wall thickness	Procedural protection: Landowner liaison One-call system Warning signs Third party liaison Marker tape Patrolling
	Phys notes:		
	Proc notes:		
	Cover:	mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

EXTERNAL INTERFERENCE PROTECTION

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID	3075	Sewage system construction, including septic tank	KP
Location	Isolated house		External interference
INITIAL EIP	Physical protection:	Wall thickness	Procedural protection:
	Phys notes:		Landowner liaison
	Proc notes:		One-call system
			Warning signs
			Third party liaison
			Marker tape
			Patrolling
	Cover:	mm	Wall thickness:
			mm
			Sign spacing:
			m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	Amended EIP acceptable?
			<input type="radio"/> Yes <input checked="" type="radio"/> No

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3077	Swimming pool construction	KP
Location	Isolated house		External interference
INITIAL EIP	Physical protection:	Wall thickness	Procedural protection:
	Phys notes:		Landowner liaison
	Proc notes:		One-call system
			Warning signs
			Third party liaison
			Marker tape
			Patrolling
	Cover:	mm	Wall thickness:
			mm
			Sign spacing:
			m
Initial EIP acceptable?		<input checked="" type="radio"/> Yes <input type="radio"/> No	Amended EIP acceptable?
			<input type="radio"/> Yes <input checked="" type="radio"/> No

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3104	Buried service construction (open cut)	KP
Location	General metro installation		External interference
INITIAL EIP	Physical protection:	Burial Wall thickness	Procedural protection:
	Phys notes:		Landowner liaison
	Proc notes:		Third party liaison
			One-call system
			Warning signs
			Marker tape
			Patrolling
	Cover:	1200 mm	Wall thickness:
			mm
			Sign spacing:
			m
Initial EIP acceptable?		<input type="radio"/> Yes <input checked="" type="radio"/> No	Amended EIP acceptable?
			<input type="radio"/> Yes <input checked="" type="radio"/> No

AMENDED EIP (corrective actions)

ID	Action	Continuing
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Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

EXTERNAL INTERFERENCE PROTECTION

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID	3105	Power pole installation or replacement	KP
Location	General metro installation		External interference
<u>INITIAL EIP</u>	Physical protection:	Wall thickness	Procedural protection: Landowner liaison Third party liaison One-call system Warning signs Marker tape Patrolling
	Phys notes:		
	Proc notes:	Special signs on existing poles within 4 m of pipeline. Power company control rooms aware of pipeline location near poles.	
	Cover:	mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input type="radio"/> Yes <input checked="" type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3106	HDD for buried service installation	KP
Location	General metro installation		External interference
<u>INITIAL EIP</u>	Physical protection:	Wall thickness	Procedural protection: Landowner liaison Third party liaison One-call system Warning signs Patrolling
	Phys notes:		
	Proc notes:		
	Cover:	mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input type="radio"/> Yes <input checked="" type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3107	Road reconstruction or major maintenance	KP
Location	General metro installation		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness	Procedural protection: Landowner liaison Third party liaison One-call system Warning signs Marker tape Patrolling
	Phys notes:		
	Proc notes:		
	Cover:	1200 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		<input type="radio"/> Yes <input checked="" type="radio"/> No	
		Amended EIP acceptable? <input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

EXTERNAL INTERFERENCE PROTECTION

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID	3108	Core drilling for geotech investigation	KP
Location	General metro installation		External interference
<u>INITIAL EIP</u>	Physical protection:	Wall thickness	Procedural protection: Landowner liaison Third party liaison One-call system Warning signs Marker tape Patrolling
	Phys notes:		
	Proc notes:		
	Cover:	mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		Amended EIP acceptable?	
<input type="radio"/> Yes <input checked="" type="radio"/> No		<input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3111	Buried service maintenance	KP
Location	General metro installation		External interference
<u>INITIAL EIP</u>	Physical protection:	Burial Wall thickness	Procedural protection: Landowner liaison Third party liaison One-call system Warning signs Marker tape Patrolling
	Phys notes:		
	Proc notes:		
	Cover:	1200 mm	Wall thickness: mm
			Sign spacing: m
Initial EIP acceptable?		Amended EIP acceptable?	
<input type="radio"/> Yes <input checked="" type="radio"/> No		<input type="radio"/> Yes <input checked="" type="radio"/> No	

AMENDED EIP (corrective actions)

ID	Action	Continuing
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APPENDIX 5

DESIGN OR PROCEDURAL PROTECTION (Generic Threats)

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

PROTECTION BY DESIGN OR PROCEDURES

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 42 **Generic pipeline for repetitive and NLS threats**

Section: 1 **Repetitive threats**

THREAT DETAILS

ID **3087** **Cathodic protection shielding within casing due to annular void** KP
Location Cased crossing Corrosion

INITIAL DESIGN

Linepipe coating; in-line inspection; check for electrical isolation between pipe and casing (6 monthly)

Initial design acceptable? ☐ Yes ☒ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID Action Contin-
uing

THREAT DETAILS

ID **3054** **Excessive stress due to vehicle or machinery loads, on or off pavement** KP
Location Road crossing Design defect

INITIAL DESIGN

Ample cover and wall thickness. Concrete slabs at road crossings (except bored portion).

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID Action Contin-
uing

THREAT DETAILS

ID **3060** **Excessive stress due to vehicle or machinery loads, on or off tracks** KP
Location Rail crossing Design defect

INITIAL DESIGN

Ample cover and wall thickness. Casing pipe (steel).

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID Action Contin-
uing

THREAT DETAILS

ID **3065** **Erosion or loss of cover, leading to flotation** KP
Location Watercourse crossing Natural events

INITIAL DESIGN

1200 mm depth of cover, regular patrol to detect erosion. Major river crossings have ample cover. NO history of erosion at river crossing. Occasional washouts at minor gullies, identified through patrol and rectified. Patrol to inspect for erosion after major flood events.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID Action Contin-
uing

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

PROTECTION BY DESIGN OR PROCEDURES

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID	3066	<i>Erosion and exposure of pipe, possible damage from waterborne debris</i>	KP
Location	Watercourse crossing		Natural events

INITIAL DESIGN

1200 mm depth of cover, regular patrol to detect erosion. Major river crossings have ample cover. NO history of erosion at river crossing. Occasional washouts at minor gullies, identified through patrol and rectified. Patrol to inspect for erosion after major flood events.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID	Action	Continuing
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THREAT DETAILS

ID	3067	<i>Erosion and exposure of pipe, possible damage from waterborne debris</i>	KP
Location	Drain crossing (manmade)		Natural events

INITIAL DESIGN

1200 mm depth of cover, regular patrol to detect erosion. Drains not wide enough, or of strong enough current, to cause flotation or overstressing of exposed pipe.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID	Action	Continuing
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Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

PROTECTION BY DESIGN OR PROCEDURES

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Section: **2** **Non-location-specific**

-

-

THREAT DETAILS

ID **3078** **Undetected or unreported construction defect**

KP

Location Non-location-specific

Construction defect

INITIAL DESIGN

Pipelines operating successfully for many years, all hydrotested except Lurgi line which has now had MFL ILI.

Initial design acceptable? ☐ Yes ☒ No

Amended design acceptable? ☒ Yes ☐ No

AMENDED DESIGN (corrective actions)

ID **Action**

Contin-
uing

2 Lurgi line - consider reviewing the possibility of latent construction defects, given the year in which it was built and the lack of hydrotest ☐ Yes

THREAT DETAILS

ID **3079** **Stress corrosion cracking**

KP

Location Non-location-specific

Corrosion

INITIAL DESIGN

Assessment of SCC likelihood done on all pipelines, based on PRCI criteria, and shows results of low or low-moderate likelihood. Blast cleaned surface preparation. CP will take pipe potential more negative than SCC range. All coating factory applied (except at weld margins). Each direct assessment includes magnetic particle inspection to check for cracking.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID **Action**

Contin-
uing

THREAT DETAILS

ID **3080** **Internal corrosion**

KP

Location Non-location-specific

Corrosion

INITIAL DESIGN

In-line Inspection. Dry gas. Gas constituents non corrosive. Dewatering and drying procedures following hydrostatic testing. No prolonged retention of hydrostatic test water. Additional wall thickness to that required for pressure containment.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID **Action**

Contin-
uing

THREAT DETAILS

ID **3081** **Loss of cathodic protection due to failure of a CPU or loss of electrical isolation**

KP

Location Non-location-specific

Corrosion

INITIAL DESIGN

In-line Inspection. CPU monthly check. 6 monthly potential surveys. 6 monthly surge protection checks. Additional wall thickness to that required for pressure containment.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID **Action**

Contin-
uing

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

PROTECTION BY DESIGN OR PROCEDURES

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID **3082** **CP testing performed incorrectly**

KP

Location Non-location-specific

Corrosion

INITIAL DESIGN

In-line Inspection. Logging of representative sample of TPs. Staff competency assessments. Review of field results by supervisor. Additional wall thickness to that required for pressure containment. NATA certified annual calibration checks of all test equipment.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

Contin-
uing

ID **Action**

THREAT DETAILS

ID **3083** **Stray current corrosion**

KP

Location Non-location-specific

Corrosion

INITIAL DESIGN

In-line Inspection. Stray current drainage bonds 6 monthly potential surveys. Regular inspection and testing of drainage equipment by Victorian Electrolysis Committee (VEC) Operations Group - 10 times per year. 5 yearly combined authority area test on stray current mitigation. (Most pipelines also have auto controlled CP units and these units are checked monthly.)

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

Contin-
uing

ID **Action**

THREAT DETAILS

ID **3084** **Interference from other authority structure or CP unit**

KP

Location Non-location-specific

Corrosion

INITIAL DESIGN

In-line Inspection. Legislated requirement for approval of new CPUs. Review of CP permit applications by Technical Sub- committee (TSC) of VEC representative. Checks during area testing by VEC in metro area. 6 month potential surveys.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

Contin-
uing

ID **Action**

THREAT DETAILS

ID **3085** **Telluric effects**

KP

Location Non-location-specific

Corrosion

INITIAL DESIGN

In-line Inspection. CPU monthly check 6 monthly potential surveys. Coating defect surveys (Most pipelines also have auto controlled CP units and these units are checked monthly.)

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

Contin-
uing

ID **Action**

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

PROTECTION BY DESIGN OR PROCEDURES

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID **3086** ***Cathodic protection shielding (disbonded coating)*** KP
Location Non-location-specific Corrosion

INITIAL DESIGN

In-line inspection. Coating defect surveys are done but have limited effectiveness for shielded defects. Some disbondment known on PE coated lines, but no corrosion.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID **Action** Contin-
1 Unpiggable pipelines - review means of identifying corrosion defects, particularly due to shielding ☐ Yes
by either disbonded coating or casings

THREAT DETAILS

ID **3088** ***Microbiological corrosion or aggressive soils*** KP
Location Non-location-specific Corrosion

INITIAL DESIGN

In-line inspection. Coating. DCVG coating inspection. Cathodic protection usually renders pH too alkaline at coating defects for microbiological agents to be active.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID **Action** Contin-
uing

THREAT DETAILS

ID **3089** ***Unidentified or unreported design shortcoming*** KP
Location Non-location-specific Design defect

INITIAL DESIGN

Hydrostatic Testing (except Lurgi line). High design standards and supervision by GFC/APA. Most pipelines operating successfully for many years. Latent design defects would have appeared by now.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID **Action** Contin-
uing

THREAT DETAILS

ID **3110** ***Fracture control plan inadequate*** KP
Location Non-location-specific Design defect

INITIAL DESIGN

Many lines were built before fracture controls plans were required. Review in ~2000 showed worst case was arrest within three pipes (Longford to Dandenong). Outcome informed decisions on quantity of spare pipe.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID **Action** Contin-
uing

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

PROTECTION BY DESIGN OR PROCEDURES

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID **3090** ***Sabotage or unauthorised operation*** KP
Location Non-location-specific Intentional damage

INITIAL DESIGN

Maintain relationships with landowners, MFB, CFA, Police, community. Lockable enclosures, valves, etc. with key registration. Patrols. Emergency procedure/training.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID Action Contin-
uing

THREAT DETAILS

ID **3091** ***Undetected or unreported material defect*** KP
Location Non-location-specific Material defect

INITIAL DESIGN

Manufacturer's QA procedures. Receipt inspection procedures. Procedures for site testing and commissioning. Life-cycle management procedures. On-shelf service / testing of spares procedures. Manufacturers and Suppliers Q.A. Monitoring to be practiced. Hydrostatic Testing. Most pipelines operating successfully for many years. Latent defects would have appeared by now.

Initial design acceptable? ☐ Yes ☒ No

Amended design acceptable? ☒ Yes ☐ No

AMENDED DESIGN (corrective actions)

ID Action Contin-
uing
2 Lurgi line - consider reviewing the possibility of latent construction defects, given the year in which it was built and the lack of hydrotest ☐ Yes

THREAT DETAILS

ID **3092** ***Earthquake*** KP
Location Non-location-specific Natural events

INITIAL DESIGN

In the previous 100 years the maximum strength of earthquake measured in the vicinity of the pipeline was ML 5.3 on 20/6/1969 over 15 km away from the pipeline route. No damage to the pipeline was recorded.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID Action Contin-
uing

THREAT DETAILS

ID **3053** ***Incident due to inaccurate or misinterpreted pipeline location information*** KP
Location Non-location-specific Operation & maintenance

INITIAL DESIGN

Pipeline physically located by Pipeline Operator prior to works. Pipeline supervised during work in vicinity. As-built data updated and checked against physical locations - updated as required on an ongoing basis.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID Action Contin-
uing

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

PROTECTION BY DESIGN OR PROCEDURES

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID **3093** ***Loss of supply due to pigging operations***

KP

Location Non-location-specific

Operation & maintenance

INITIAL DESIGN

Pigging and facilities procedures.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID **Action**

Contin-
uing

THREAT DETAILS

ID **3094** ***Maintenance procedures inadequate or incomplete***

KP

Location Non-location-specific

Operation & maintenance

INITIAL DESIGN

Preventative maintenance based on APA programme. Procedures generated in-house by maintenance personnel - includes review process (defined authorisation and revision control). Completion of maintenance tasks monitored within Maintenance Connection. Formal document review and approval process throughout asset lifecycle. Service level agreements with AEMO. Operating and maintenance procedures.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID **Action**

Contin-
uing

THREAT DETAILS

ID **3095** ***Maintenance contrary to procedures***

KP

Location Non-location-specific

Operation & maintenance

INITIAL DESIGN

Competent and experienced personnel adequately trained. Comprehensive procedures in place prior to execution of works.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID **Action**

Contin-
uing

THREAT DETAILS

ID **3096** ***Project records, as-built records and material records lost, ignored or not maintained***

KP

Location Non-location-specific

Operation & maintenance

INITIAL DESIGN

Policy and procedures for accurate information management. Policy and procedures for pre-maintenance task analysis (e.g. JHA). Policy to maintain stability in specification for equipment installed.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID **Action**

Contin-
uing

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

PROTECTION BY DESIGN OR PROCEDURES

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID **3097** ***Changes to assets not managed, implemented or recorded properly*** KP
Location Non-location-specific Operation & maintenance

INITIAL DESIGN

Structured change management procedures. Collaboration of operations and engineering in all phases, especially commissioning and handover. Policy for pre-commissioning document requirements.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID **Action** Contin-
uing

THREAT DETAILS

ID **3098** ***Operators not adequately trained or lacking specific competence*** KP
Location Non-location-specific Operation & maintenance

INITIAL DESIGN

Established training/competency programme. Certification for task competencies. Specific work instructions. Task analysis/JHA. Work crew feedback & communications. Mentoring programmes. Selective job assignment by supervisors.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID **Action** Contin-
uing

THREAT DETAILS

ID **3100** ***Escalation of incident due to inadequate or ineffective emergency management*** KP
Location Non-location-specific Operation & maintenance

INITIAL DESIGN

Emergency procedures. Programme of training and exercises. Industry mutual aid agreements. Accurate and updated reference material. Isolation, curtailment, and/or load shedding. Liaison with AEMO/DB's/suppliers.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID **Action** Contin-
uing

THREAT DETAILS

ID **3101** ***In-service welding*** KP
Location Non-location-specific Operation & maintenance

INITIAL DESIGN

Use of Qualified Welders and Welding procedures. Use of Qualified Supervision and Checklists. NDT. Selection of Materials in compliance with accepted codes and standards.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID **Action** Contin-
uing

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

PROTECTION BY DESIGN OR PROCEDURES

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS

ID **3102** ***High voltages induced from parallel powerlines*** KP
Location Non-location-specific Other

INITIAL DESIGN

Induced voltage calculated for individual locations. Earthing beds. Surge protection equipment. Lockable test point heads and equipotential grids where required. Procedure discussed with Corrosion Manager and considered adequate. Procedures: CPS-2308. Compliance with AS 4853 Electrical Hazards on Metallic Pipelines.

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID Action Contin-
uing

THREAT DETAILS

ID **3103** ***Earth potential rise due to earthing fault or lightning strike on powerline*** KP
Location Non-location-specific Other

INITIAL DESIGN

Earth potential voltage calculated for individual locations. Earthing beds. Surge protection equipment. Lockable test point heads and equipotential grids where required. Procedure discussed with Corrosion Manager and considered adequate. Procedures: CPS-2308. Compliance with AS 4853 Electrical Hazards on Metallic Pipelines. (Note that for new utility installations the pipeline is kept clear by 3 m min.)

Initial design acceptable? ☒ Yes ☐ No

Amended design acceptable? ☐ Yes ☒ No

AMENDED DESIGN (corrective actions)

ID Action Contin-
uing

APPENDIX 6

RISK EVALUATION (Generic Threats)

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline:	42	Generic pipeline for repetitive and NLS threats
Section:	1	Repetitive threats

THREAT DETAILS (assuming no additional mitigation)

ID 3087 **Cathodic protection shielding within casing due to annular void** KP

Location Cased crossing Corrosion

Existing design Linepipe coating; in-line inspection; check for electrical isolation between pipe and casing (6 monthly)

CONSEQUENCES (assuming no additional mitigation)

Failure mode Worst case would be pitting corrosion, say 10 mm hole max

Effects Radiation distances are only a few metres, fatalities highly unlikely. Supply interruption or restriction (depending on location) for 2-4 weeks pending installation of stopples and bypass. (Interruption to towns with single supply, but back feed possible if the failure is in metro area.)

Severity notes Conservatively adopt Major for interruption of supply to a town; would be only Severe if location was metro

Freq. notes About 10 unpiggable casings out of about 150 total, no evidence of corrosion in casings that can be inspected. Estimate Remote, at upper end of range (ie. around 0.1% likelihood in pipeline life)

Frequency Remote	Severity Major	Rank INTERMEDIATE
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MITIGATION (and revised risk evaluation & ranking)

ID	Action	By	Due	Continuing
	New Frequency	New Severity	New Rank	

THREAT DETAILS (assuming no additional mitigation)

ID 3104 **Buried service construction (open cut)** KP

Location General metro installation External interference

Existing design

CONSEQUENCES (assuming no additional mitigation)

Failure mode Not evaluated in detail. Very similar to Threat ID 3111 "Buried service maintenance" but lower likelihood.

Effects

Severity notes

Freq. notes

Frequency Remote	Severity Severe	Rank Low
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MITIGATION (and revised risk evaluation & ranking)

ID	Action	By	Due	Continuing
	New Frequency	New Severity	New Rank	

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

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THREAT DETAILS *(assuming no additional mitigation)*

ID **3105** **Power pole installation or replacement**

KP

Location General metro installation

External interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

- Failure mode**
1. Coating and steel damage (dent and/or gouge)
 2. Penetration by pilot bit of auger, max hole say 50 mm

- Effects**
1. No safety or supply consequences, repair required
 2. Penetration, no fatality, supply interruption pending repair, 2 days max
 3. Fatality to rig operator

- Severity notes**
1. Trivial
 2. Severe, for short term interruption
 3. Major, for fatality

- Freq. notes**
1. Occasional, towards upper end of range (already a couple of incidents)
 2. Remote, upper end of range, given warning signs on poles near pipeline and low likelihood that pole will be relocated by more than a metre or so from existing position
 3. Hypothetical, given 2% ignition likelihood and low conditional probability of fatality

Frequency Remote

Severity Severe

Rank Low

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

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RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS *(assuming no additional mitigation)*

ID **3106** **HDD for buried service installation** KP
Location General metro installation External interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode 1. Coating damage and superficial steel damage, identified by patrol
 2. As above, unidentified
 3. Penetration, hole say 25 mm max (even if drill is larger drilling will stop when gas released)

Effects 1. No safety or supply consequences, repair required
 2. Potential for corrosion, expect control by CP; eventually found by ILI
 3. No fatality; supply interruption pending repair (2 days max)
 4. Fatality to rig operator

Severity notes 1. Trivial
 2. Trivial
 3. Severe, short term interruption
 4. Major, for fatality

Freq. notes 1 & 2. Occasional
 3. Expect penetration by small HDD rigs to be very unusual, say 1% of hits, Unlikely
 4. 2% ignition probability, not all ignitions will cause fatality, say bottom end of Remote

Frequency Remote **Severity** Major **Rank** **INTERMEDIATE**

MITIGATION *(and revised risk evaluation & ranking)*

ID	Action	By	Due	Continuing

New Frequency **New Severity** **New Rank**

THREAT DETAILS *(assuming no additional mitigation)*

ID **3107** **Road reconstruction or major maintenance** KP
Location General metro installation External interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode Not evaluated in detail. Similar in some ways to Threat ID 3111 "Buried service maintenance" but lower likelihood because of the planned nature of the work and hence close supervision.

Effects

Severity notes

Freq. notes

Frequency Hypothetical **Severity** Major **Rank** **Low**

MITIGATION *(and revised risk evaluation & ranking)*

ID	Action	By	Due	Continuing

New Frequency **New Severity** **New Rank**

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

THREAT DETAILS *(assuming no additional mitigation)*

ID **3108** **Core drilling for geotech investigation**

KP

Location General metro installation

External interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode Not evaluated in detail. Similar in some ways to Threat ID 3106 "HDD for buried service installation" but lower likelihood and lower consequences.

Effects

Severity notes

Freq. notes

Frequency Hypothetical

Severity Severe

Rank **Negligible**

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

THREAT DETAILS *(assuming no additional mitigation)*

ID **3111** **Buried service maintenance**

KP

Location General metro installation

External interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode 1. Coating and steel damage (dent and/or gouge)
2. Penetration by tiger tooth, max hole say 30 mm
(Expect generally "gentle" digging by a utility excavating to repair an existing service.)

Effects 1. No safety or supply consequences, repair required
2. Penetration, no fatality, supply interruption pending repair, 2 days max
3. Fatality to rig operator

Severity notes 1. Trivial
2. Severe, for short term interruption
3. Major, for fatality

Freq. notes 1. Occasional
2. Remote, upper end of range, given careful digging and absence of tiger teeth except in west
3. Hypothetical, given 2% ignition likelihood and low conditional probability of fatality

Frequency Remote

Severity Severe

Rank **Low**

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

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Section: 2 **Non-location-specific**

THREAT DETAILS *(assuming no additional mitigation)*

ID **3086** **Cathodic protection shielding (disbonded coating)** KP
Location Non-location-specific Corrosion
Existing design In-line inspection. Coating defect surveys are done but have limited effectiveness for shielded defects. Some disbondment known on PE coated lines, but no corrosion.

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode Pinhole leak, max size few mm
Effects Safety consequences highly unlikely. Short term interruption pending repair, a day or so.
Severity notes Severe, for short term interruption
Freq. notes For non-pigged lines: Occasional, at least 10% chance of leak somewhere in the system over next few decades. (Effectively eliminated from pigged lines by ILI.)

Frequency Occasional **Severity** Severe **Rank** **INTERMEDIATE**

MITIGATION *(and revised risk evaluation & ranking)*

ID	Action	By	Due	Continuing
1	Unpigging pipelines - review means of identifying corrosion defects, particularly due to shielding by either disbonded coating or casings	A. Bryson		<input type="radio"/> Yes

New Frequency

New Severity

New Rank

APPENDIX 7

LOCATION CLASSIFICATION (Pipeline Sections)

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK ASSESSMENT SECTIONS

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 42 **T Generic pipeline for repetitive and NLS threats**

Section:	1 Repetitive threats All land uses	Location classes	-	KP to	Length km
Section:	2 Non-location-specific All land uses	Location classes	-	KP to	Length km

Pipeline: 1 **T1 Morwell to Dandenong**

Section:	51 Dandenong - Cranbourne North Urban outskirts, extensive suburban and industrial areas with occasional rural land	Location classes	T1 -	KP to	0 13	Length 13 km
Section:	50 Cranbourne North - Officer Grazing and agriculture	Location classes	R1 -	KP to	13 16.5	Length 3.5 km
Section:	49 Hillcrest Christian College Isolated school	Location classes	R1 S	KP to	16.5 17.5	Length 1 km
Section:	48 Officer - Pakenham Grazing and agriculture	Location classes	R1 -	KP to	17.5 24.5	Length 7 km
Section:	47 Pakenham Town edge and light industrial; freeway	Location classes	T1 -	KP to	24.5 29.5	Length 5 km
Section:	42 Pakenham - Yarragon Grazing and agriculture	Location classes	R1 -	KP to	29.5 81	Length 51.5 km
Section:	41 Yarragon Town edge	Location classes	T1 -	KP to	81 82.7	Length 1.7 km
Section:	40 Yarragon - Trafalgar Grazing and agriculture	Location classes	R1 -	KP to	82.7 89.7	Length 7 km
Section:	39 Trafalgar Town edge	Location classes	T1 -	KP to	89.7 91.5	Length 1.8 km
Section:	38 Trafalgar - Trafalgar East Grazing and agriculture	Location classes	R1 -	KP to	91.5 94	Length 2.5 km
Section:	37 Trafalgar East Rural residential	Location classes	R2 -	KP to	94 95.8	Length 1.8 km
Section:	36 Trafalgar - Moe Forestry, some grazing	Location classes	R1 -	KP to	95.8 98.8	Length 3 km
Section:	35 Moe South Rural residential	Location classes	R2 -	KP to	98.8 107.2	Length 8.4 km
Section:	34 Moe South - Morwell Grazing and agriculture, some forestry	Location classes	R1 -	KP to	107.2 127	Length 19.8 km

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK ASSESSMENT SECTIONS

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Pipeline: **2 T15 Princes Hwy to Regent St**

Section: 65	Princes Hwy - Regent St Suburban	Location classes	T1 -	KP to	0 1.5	Length	1.5 km
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Pipeline: **3 T16 Dandenong to West Melbourne**

Section: 59	Dandenong South Suburban - industrial and residential	Location classes	T1 I	KP to	0 2	Length	2 km
Section: 60	Dandenong Major shopping centre and offices	Location classes	T2 -	KP to	2 4	Length	2 km
Section: 61	Dandenong - Clayton Suburban - industrial and residential	Location classes	T1 -	KP to	4 14.1	Length	10.1 km
Section: 66	Clayton North primary school Suburban, school immediately adjacent	Location classes	T1 S	KP to	14.1 15.3	Length	1.2 km
Section: 67	Clayton - Chadstone Suburban - industrial and residential	Location classes	T1 -	KP to	15.3 18.8	Length	3.5 km
Section: 62	Chadstone shopping centre Major shopping centre	Location classes	T2 -	KP to	18.8 20.2	Length	1.4 km
Section: 63	Chadstone - Caulfield Suburban	Location classes	T1 -	KP to	20.2 22.5	Length	2.3 km
Section: 64	Caulfield - Docklands Inner Melbourne, including dense housing, racetrack, Albert Park, CBD fringe, etc	Location classes	T2 -	KP to	22.5 35.65	Length	13.15 km

Pipeline: **4 T18 Keon Park East to Keon Park West**

Section: 93	Keon Park east to west Suburban	Location classes	T1 -	KP to	0 0.61	Length	0.61 km
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Pipeline: **5 T24 Brooklyn to Corio**

Section: 99	Brooklyn - Williams Landing Industrial	Location classes	R2 I	KP to	0 8.2	Length	8.2 km
Section: 100	Williams Landing - Hoppers Crossing Suburban, some light industrial;	Location classes	T1 -	KP to	8.2 14	Length	5.8 km
Section: 101	Hoppers Crossing - Werribee Agricultural	Location classes	R1 -	KP to	14 17	Length	3 km
Section: 102	Werribee Suburban	Location classes	T1 -	KP to	17 21	Length	4 km
Section: 103	Werribee - Pousties Road Grazing and agriculture	Location classes	R1 -	KP to	21 37.8	Length	16.8 km

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RISK ASSESSMENT SECTIONS

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Section: 114	Pousties Road Large roadhouse adjacent	Location classes	T1 -	KP to	37.8 38.6	Length 0.8 km
Section: 115	Pousties Road - Lara Grazing and agriculture	Location classes	R1 -	KP to	38.6 44.2	Length 5.6 km
Section: 104	Lara - Corio Rural residential	Location classes	R2 -	KP to	44.2 48.5	Length 4.3 km
Section: 105	Corio Grazing and agriculture	Location classes	R1 -	KP to	48.5 50	Length 1.5 km
Section: 106	Corio retail Large retail complex adjacent	Location classes	T1 -	KP to	50 50.65	Length 0.65 km

Pipeline: 6 **T32 Pound Rd to Tuckers Rd**

Section: 53	Pound Rd - Tuckers Rd Grazing and agriculture	Location classes	R1 -	KP to	0 2	Length 2 km
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Pipeline: 7 **T33 South Melbourne to Brooklyn**

Section: 97	Cecil St - Todd Rd Inner Melbourne, including dense housing and industrial uses	Location classes	T2 -	KP to	0 5	Length 5 km
Section: 98	Todd Rd - Brooklyn Mixed industrial and inner urban residential areas	Location classes	T1 I	KP to	5 12.8	Length 7.8 km

Pipeline: 8 **T37 Supply to APM Maryvale**

Section: 29	APM Maryvale Grazing and agriculture, major industry at southern end	Location classes	R1 HI	KP to	0 5.5	Length 5.5 km
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Pipeline: 9 **T38 Healesville to Koo-Wee-Rup Road**

Section: 52	Pakenham offtake Town edge and light industrial; freeway	Location classes	T1 -	KP to	0 1.2	Length 1.2 km
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Pipeline: 10 **T44 Supply to Anderson St, Warragul**

Section: 43	Warragul offtake - Wills St Grazing and agriculture	Location classes	R1 -	KP to	0 4.25	Length 4.25 km
Section: 44	Wills St - Anderson St Leisure centre, parkland, industrial	Location classes	T1 -	KP to	4.25 5	Length 0.75 km

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK ASSESSMENT SECTIONS

Pipeline Licensee: APA GasNet

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Pipeline: 11 **T56 Brooklyn to Ballan**

Section:	81	Brooklyn - Derrimut Industrial, including some grassland reserve and golf course, freeway adjacent	Location classes	R2 I	KP to	0 7.25	Length	7.25 km
Section:	82	Derrimut Residential to north, industrial development to south, freeway between	Location classes	T1 -	KP to	7.25 9.3	Length	2.05 km
Section:	83	Derrimut - Ballan Grazing and agriculture	Location classes	R1 -	KP to	9.3 66.7	Length	57.4 km

Pipeline: 12 **T57 Ballan to Ballarat (including loop line)**

Section:	84	Ballan - Gordon Grazing and agriculture	Location classes	R1 -	KP to	0 6	Length	6 km
Section:	85	Gordon Rural residential	Location classes	R2 -	KP to	6 8.8	Length	2.8 km
Section:	86	Gordon - Ballarat Grazing and agriculture	Location classes	R1 -	KP to	8.8 22.2	Length	13.4 km
Section:	87	Ballarat city gate vicinity Town edge and light industrial	Location classes	R2 -	KP to	22.2 22.75	Length	0.55 km

Pipeline: 13 **T59 Euroa to Shepparton**

Section:	9	Euroa to Shepparton Grazing and irrigated agriculture	Location classes	R1 -	KP to	0 34.6	Length	34.6 km
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Pipeline: 14 **T60 Longford to Dandenong, including loop lines**

Section:	21	Longford gas plant - Giffards Rd Market gardens, frequent large numbers of workers, several houses	Location classes	R2 -	KP to	0 6	Length	6 km
Section:	22	Giffards Road - Lime Quarry Road Forestry	Location classes	R1 -	KP to	6 31.5	Length	25.5 km
Section:	23	Lime Quarry Road - Tyers Grazing	Location classes	R1 -	KP to	31.5 58.5	Length	27 km
Section:	24	Tyers Scattered rural residential, with low-density suburban in Tyers	Location classes	T1 -	KP to	58.5 62	Length	3.5 km
Section:	25	Tyers - Drouin Grazing and agriculture, numerous widely scattered houses	Location classes	R1 -	KP to	62 115	Length	53 km
Section:	26	Drouin Low density residential	Location classes	T1 -	KP to	115 118.5	Length	3.5 km

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RISK ASSESSMENT SECTIONS

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Section:	27 Drouin - Longwarry Grazing and agriculture	Location classes	R1 -	KP to	118.5 121.5	Length 3 km
Section:	28 Longwarry, Bunyip, Tynong Several small towns (Bunyip etc) interspersed with rural land; two large roadhouses	Location classes	T1 -	KP to	121.5 137	Length 15.5 km
Section:	45 Tynong to Pakenham (LV9) Grazing and agriculture	Location classes	R1 -	KP to	137 145	Length 8 km
Section:	46 Pakenham (LV9) to Dandenong Urban outskirts, extensive suburban and industrial areas with occasional rural land	Location classes	T1 -	KP to	145 173	Length 28 km

Pipeline: 15 **T61 Pakenham to Wollert**

Section:	54 Pakenham Urban development adjacent to west, otherwise grazing	Location classes	T1 -	KP to	0 1.5	Length 1.5 km
Section:	55 Pakenham - Yellingbo Grazing and agriculture, numerous widely scattered houses	Location classes	R1 -	KP to	1.5 28	Length 26.5 km
Section:	56 Yellingbo Small township, intensive horticulture with large numbers of workers	Location classes	R2 -	KP to	28 32.5	Length 4.5 km
Section:	57 Yellingbo - St Andrews Grazing and agriculture, some forestry, some vineyards	Location classes	R1 -	KP to	32.5 66.5	Length 34 km
Section:	68 St Andrews - Lorimer Park Rural residential	Location classes	R2 -	KP to	66.5 79	Length 12.5 km
Section:	69 Lorimer Park Suburban	Location classes	T1 -	KP to	79 82.5	Length 3.5 km
Section:	70 Lorimer Park - Wollert Grazing and agriculture, a couple of locations with small groups of houses	Location classes	R1 -	KP to	82.5 93	Length 10.5 km

Pipeline: 16 **T62 Derrimut to Sunbury**

Section:	88 Derrimut - Sunbury Grazing and agriculture	Location classes	R1 -	KP to	0 22.5	Length 22.5 km
Section:	89 Sunbury Suburban	Location classes	T1 -	KP to	22.5 24.2	Length 1.7 km

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RISK ASSESSMENT SECTIONS

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Pipeline: 17 **T63 Tyers to Morwell looping**

Section:	30	Tyers - crematorium Grazing and agriculture	Location classes	R1 -	KP to	0 2.5	Length	2.5 km
Section:	31	Traralgon outskirts Rural residential, forestry	Location classes	R2 -	KP to	2.5 6.5	Length	4 km
Section:	32	Traralgon - Morwell Grazing and agriculture	Location classes	R1 -	KP to	6.5 11	Length	4.5 km
Section:	33	Morwell Scattered industrial uses and vacant land; abandoned Lurgi plant	Location classes	R1 I	KP to	11 15.7	Length	4.7 km

Pipeline: 18 **T64 Supply to Newport Power Station**

Section:	90	Supply to Newport Industrial	Location classes	T1 I	KP to	0 1.0	Length	1 km
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Pipeline: 19 **T65 Dandenong to Princes Highway & Henty Street**

Section:	58	Dandenong to Princes Hwy & Henty St Suburban Dandenong - industrial and residential	Location classes	T1 -	KP to	0 5.2	Length	5.2 km
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Pipeline: 20 **T66 Mt Franklin to Kyneton**

Section:	74	Mt Franklin - Kyneton Grazing and agriculture, numerous widely scattered houses	Location classes	R1 -	KP to	0 24.55	Length	24.55 km
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Pipeline: 21 **T67 Guildford to Maryborough**

Section:	75	Guildford - Maryborough Grazing and agriculture	Location classes	R1 -	KP to	0 31.5	Length	31.5 km
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Pipeline: 22 **T70 Ballan to Bendigo (incl. looping)**

Section:	76	Ballan - Castlemaine Grazing and agriculture, some forestry	Location classes	R1 -	KP to	0 62.3	Length	62.3 km
Section:	77	Castlemaine outskirts Rural residential	Location classes	R2 -	KP to	62.3 65.3	Length	3 km
Section:	78	Castlemaine - Belvoir Park Rd Grazing and agriculture, numerous widely scattered houses	Location classes	R1 -	KP to	65.3 87	Length	21.7 km
Section:	79	Belvoir Park Rd Rural residential	Location classes	R2 -	KP to	87 88	Length	1 km
Section:	80	Belvoir Park Rd - Bendigo Grazing and agriculture, some forestry	Location classes	R1 -	KP to	88 91	Length	3 km

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RISK ASSESSMENT SECTIONS

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Pipeline: 23 **T71 Shepparton to Tatura to Kyabram**

Section: 10	Shepparton South Grazing and irrigated agriculture	Location classes	R1 -	KP to	0 3.1	Length	3.1 km
Section: 11	Arcadia Downs Town outskirts	Location classes	T1 -	KP to	3.1 5.56	Length	2.46 km
Section: 12	Arcadia Downs to Kyabram Grazing and irrigated agriculture	Location classes	R1 -	KP to	5.56 37.5	Length	31.94 km

Pipeline: 24 **T74.1 Keon Park to Wollert**

Section: 94	Keon Park to O'Herns Rd Mixed use including suburban, industrial and grazing, with ongoing suburban development	Location classes	T1 I	KP to	0 7	Length	7 km
Section: 95	O'Herns Rd - Wollert Grazing	Location classes	R1 -	KP to	7 13.9	Length	6.9 km

Pipeline: 25 **T74.2 Wollert to Wodonga**

Section: 135	Wollert - Heathcote Junction Rural land uses, occasional isolated houses	Location classes	R1 -	KP to	0 22.5	Length	22.5 km
Section: 136	Heathcote Junction Low density residential	Location classes	T1 -	KP to	22.5 25.1	Length	2.6 km
Section: 137	Heathcote Junction - Seymour Rural land uses, occasional isolated houses	Location classes	R1 -	KP to	25.1 65.0	Length	39.9 km
Section: 138	Seymour outskirts Town outskirts with scattered houses, industry, recreation areas	Location classes	R2 -	KP to	65.0 71.4	Length	6.4 km
Section: 139	Seymour - Euroa Rural land uses, occasional isolated houses	Location classes	R1 -	KP to	71.4 124.1	Length	52.7 km
Section: 3	Euroa to Glenrowan Grazing and agriculture	Location classes	R1 -	KP to	124 193	Length	69 km
Section: 4	Glenrowan Grazing, town outskirts within measurement length	Location classes	R2 -	KP to	193 196.5	Length	3.5 km
Section: 5	Glenrowan to Barnawartha Grazing and agriculture	Location classes	R1 -	KP to	196.5 256.3	Length	59.8 km
Section: 6	Barnawartha Grazing, town outskirts within measurement length	Location classes	R2 -	KP to	256.3 260.3	Length	4 km
Section: 7	Barnawartha North Grazing, but with large distribution centre adjacent and possible further industrial development	Location classes	R1 I	KP to	260.3 263.2	Length	2.9 km

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK ASSESSMENT SECTIONS

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Section:	8	Barnawartha to Wodonga	Location classes	R1 -	KP to	263.2 269.12	Length	
		Grazing and agriculture					5.92	km

Pipeline: 26 **T75 Wandong to Kyneton**

Section:	71	Wandong - O'Gradys Rd	Location classes	R1 -	KP to	0 3.5	Length	
		Grazing and agriculture					3.5	km

Section:	72	O'Gradys Rd - Mathiesons Rd	Location classes	R2 -	KP to	3.5 5.8	Length	
		Rural residential					2.3	km

Section:	73	Mathiesons Rd - Kyneton	Location classes	R1 -	KP to	5.8 60	Length	
		Grazing and agriculture, numerous widely scattered houses					54.2	km

Pipeline: 27 **T81 Paaratte to Allansford**

Section:	129	Paaratte - Allansford	Location classes	R1 -	KP to	0 33.4	Length	
		Grazing and agriculture					33.4	km

Pipeline: 28 **T85 Kyabram to Echuca**

Section:	13	Kyabram to Echuca	Location classes	R1 -	KP to	0 30.65	Length	
		Grazing and irrigated agriculture					30.65	km

Pipeline: 43 **T86 Allansford to Portland**

Section:	130	Allansford - Portland	Location classes	R1 -	KP to	0 100.55	Length	
		Grazing and agriculture					?	km

Pipeline: 29 **T88 Laverton to BHP**

Section:	96	Laverton to Coogee	Location classes	R2 I	KP to	0 1.65	Length	
		Industrial					1.65	km

Pipeline: 30 **T89 Supply to Unichema, Bay St**

Section:	91	Supply to Unichema	Location classes	T1 I	KP to	0 0.45	Length	
		Industrial					0.45	km

Pipeline: 31 **T91 Curdievale to Cobden**

Section:	131	Curdievale - Cobden	Location classes	R1 -	KP to	0 27.7	Length	
		Grazing and agriculture					27.7	km

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK ASSESSMENT SECTIONS

Pipeline Licensee: APA GasNet

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Pipeline: 32 **T92 Iona to Lara**

Section: 116	Lara offtake - Lara Agricultural	Location classes	R1 -	KP to	0 3	Length 3 km
Section: 117	Lara New medium density suburb plus extensive low density residential	Location classes	T1 -	KP to	3 8	Length 5 km
Section: 118	Lara - Batesford Grazing and agriculture	Location classes	R1 -	KP to	8 18.2	Length 10.2 km
Section: 119	Batesford Low density residential	Location classes	T1 -	KP to	18.2 20.0	Length 1.8 km
Section: 120	Batesford - Ellimnyt Grazing and agriculture	Location classes	R1 -	KP to	20.0 86.5	Length 66.5 km
Section: 121	Ellimnyt Scattered rural residential	Location classes	R2 -	KP to	86.5 89.3	Length 2.8 km
Section: 122	Ellimnyt - Simpson Grazing and agriculture	Location classes	R1 -	KP to	89.3 125.4	Length 36.1 km
Section: 123	Simpson Scattered houses and dairy factory	Location classes	R2 -	KP to	125.4 126.5	Length 1.1 km
Section: 124	Simpson - Iona Grazing and agriculture	Location classes	R1 -	KP to	126.5 142.0	Length 15.5 km
Section: 125	Iona gas plant vicinity Several gas plants among grazing country	Location classes	R1 HI	KP to	142.0 143.95	Length 1.95 km

Pipeline: 33 **T93 Codrington to Hamilton**

Section: 132	Codrington - Hamilton Grazing and agriculture	Location classes	R1 -	KP to	0 54.6	Length 54.6 km
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Pipeline: 34 **T96 Chiltern Valley to Rutherglen**

Section: 14	Chiltern Valley to Rutherglen Grazing and agriculture	Location classes	R1 -	KP to	0 14.35	Length 14.35 km
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Pipeline: 35 **T98 Rutherglen to Koonoomoo**

Section: 15	Rutherglen to Murray Valley Hwy Grazing and irrigated agriculture	Location classes	R1 -	KP to	0 55.7	Length 55.7 km
Section: 16	Murray Valley Hwy parallel Within road reserve	Location classes	R1 CI	KP to	55.7 69.1	Length 13.4 km
Section: 17	Lonergans Road to Koonoomoo Grazing and irrigated agriculture	Location classes	R1 -	KP to	69.1 83.5	Length 14.4 km

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK ASSESSMENT SECTIONS

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Section: 18	Koonoomoo Town outskirts	Location classes	R2 -	KP to	83.5 85.2	Length 1.7 km
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Section: 19	Koonoomoo North Grazing and agriculture	Location classes	R1 -	KP to	85.2 89.2	Length 4 km
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Pipeline: 36 **T99 Culcairn to Barnawartha**

Section: 20	Culcairn to Barnawartha Grazing	Location classes	R1 -	KP to	218.9 282.1	Length 63.2 km
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Pipeline: 37 **T100 Iona to Paaratte**

Section: 126	Iona gas plant vicinity Several gas plants among grazing country	Location classes	R1 HI	KP to	0 0.5	Length 0.5 km
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Section: 127	Iona - Paaratte Grazing	Location classes	R1 -	KP to	0.5 7.2	Length 6.7 km
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Section: 128	Paaratte gas plant vicinity Several gas plants among grazing country	Location classes	R1 HI	KP to	7.2 7.9	Length 0.7 km
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Pipeline: 38 **T102 Somerton Pipeline**

Section: 92	Somerton pipeline Mainly grazing but with industrial uses at each end	Location classes	R1 I	KP to	0 3.5	Length 3.5 km
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Pipeline: 39 **T109 Supply to Iluka, Hamilton**

Section: 133	Hamilton - Iluka Grazing and agriculture	Location classes	R1 -	KP to	0 0.9	Length 0.9 km
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Section: 134	Iluka plant vicinity Periphery of mineral treatment plant	Location classes	R1 HI	KP to	0.9 1.1	Length 0.2 km
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Pipeline: 40 **T110 Supply to Snowy Hydro, Laverton North**

Section: 107	James St - Snowy Hydro Industrial, pipe under road pavement	Location classes	T1 I	KP to	0 1.55	Length 1.55 km
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Pipeline: 41 **T112 Brooklyn to Lara**

Section: 108	Brooklyn - Derrimut Industrial, including some grassland reserve and golf course, freeway adjacent	Location classes	T1 I	KP to	0 8.7	Length 8.7 km
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Section: 109	Prison (Melbourne Remand Centre) Prison adjacent	Location classes	T1 S	KP to	8.7 10	Length 1.3 km
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Section: 110	Derrimut - Pousties Rd Grazing and agriculture	Location classes	R1 -	KP to	10 48.7	Length 38.7 km
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Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK ASSESSMENT SECTIONS

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Section: 111 <i>Pousties Rd (freeway service centre)</i> Two large freeway service centres	Location classes	T1 -	KP to	48.7 49.8	Length 1.1 km
Section: 112 <i>Pousties Rd - Avalon</i> Grazing and agriculture	Location classes	R1 -	KP to	49.8 52.5	Length 2.7 km
Section: 113 <i>Avalon outskirts</i> Scattered rural residential, with some industry	Location classes	R2 I	KP to	52.5 58	Length 5.5 km

APPENDIX 8

RISK EVALUATION (Location-Specific Threats)

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 1 **Morwell to Dandenong**

Section: 49 **Hillcrest Christian College**

R1 S

THREAT DETAILS *(assuming no additional mitigation)*

ID 7 **All controls fail: 35T Excavator or Auger in vicinity of school.**

KP 16.87

Location Hillcrest Christian College

External Interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode Auger penetrates pipeline.

Effects 30mm hole. Possible fatality to machine operator and assistant.

Note: 4.7kW radiation contour from a 30mm hole is 25m from puncture.

Severity notes Few fatalities (rig operators). Because 4.7kW contour is 25m it is considered highly unlikely that students will be affected.

Freq. notes Procedural measures fail + auger direct hit + continues drilling to full penetration + ignition.

Frequency Hypothetical

Severity Major

Rank Low

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 2 **Princes Hwy to Regent St**

Section: 65 **Princes Hwy - Regent St**

T1 -

THREAT DETAILS *(assuming no additional mitigation)*

ID 187 **All controls fail during maintenance of services by light machinery (no major sewer or drain, no heavy excavation)** **KP** 0
Location Clyde St and Regent St **External Interference** .819

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode 20mm hole, radiation zone ~15 m

Effects 1. No ignition, supply interruption for a day or so pending repair
 2. Ignition, with fatality to rig operator (The 4.7kW radiation zone is only 15m, and residents in the vicinity will most likely be unaffected).

Severity notes 1. Severe, for supply interruption
 2. Major, for few fatalities

Freq. notes 1. Hypothetical for small excavator to penetrate this pipe (resistant to 8 t machine with B = 1.3); historically, no excavators exceeding 4T have been known to work in this area.
 2. Sub-hypothetical

Frequency Hypothetical

Severity Major

Rank Low

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 3 **Dandenong to West Melbourne**

Section: 66 **Clayton North primary school**

T1 S

THREAT DETAILS *(assuming no additional mitigation)*

ID 210 **All controls fail near school, auger penetrates pipe**

KP 14.74

Location Clayton North Primary School

Standard design

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode Pole or HDD auger penetrates pipeline, max hole ~30 mm

- Effects**
1. No ignition, short term supply interruption pending repair
 2. Ignition, no fatalities
 3. Ignition with fatalities to rig operator(s); school outside radiation zone of ~25 m

- Severity notes**
1. Severe, for short term interruption notwithstanding backfeed available to most delivery points
 2. Severe, as above and also possible injuries
 3. Major, for few fatalities

- Freq. notes**
1. Remote for direct hit AND operator perseveres long enough to penetrate
 2. Hypothetical; only 2% conditional probability of ignition
 3. Hypothetical at worst for fatalities

Frequency Hypothetical

Severity Major

Rank Low

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Section: 64 **Caulfield - Docklands**

T2 -

THREAT DETAILS *(assuming no additional mitigation)*

ID **223** **All controls fail: Puncture by 35T Excavator Resulting in 35mm hole - assumed future impact resulting from development works.** KP **35.65**
Location Collins St, Docklands External Interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode Leak leading to ignition and fire.

Effects Puncture by 35T Excavator Resulting in 35mm hole, gas leak, ignition. Assume 2 or 3 fatalities (machine operator & fellow workers). Note: 15m to 12.6kW/m2 and 25m to 4.7kW/m2. (Consideration given to possibility of tram passenger fatalities. However, not likely to be in area while heavy excavator works underway).

Severity notes Few fatalities.

Freq. notes All controls fail + 35T excavator hits + hard and direct enough to put a hole in it + escaping gas ignites + fellow workers in area + death results (i.e. fail to escape). (This evaluation originally done in 2007; in 2011 the area is almost fully developed, heavy construction now even less likely.)

Frequency Hypothetical

Severity Major

Rank Low

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline:	5	Brooklyn to Corio		
Section:	100	Williams Landing - Hoppers Crossing	T1	-

THREAT DETAILS *(assuming no additional mitigation)*

ID	402	All controls fail: Heavy Excavator punctures pipe during utilities maintenance	KP 9.957
Location	Swamp Hen Drive, Williams Landing		External Interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode	Puncture - large leak. No-rupture case for 30T excavator.		
Effects	A 110mm hole resulting from a 35T excavator with twin points tiger teeth impacting line leading to ignition. Discharge rate = 4.3 GJ/s. Hole Size is less than critical defect length (129mm) but does not meet full no-rupture criteria (which requires less than 2/3 critical defect length). 4.7 kW zone = 130m. 12.6 kW = 80m.		
Severity notes	Adjacent residents within 12.6kW area - approx 12 houses.		
Freq. notes	35T excavator with tiger teeth working in the area + hitting pipe + penetration with two points + ignition.		
Frequency	Hypothetical	Severity	Catastrophic
Rank	INTERMEDIATE		

MITIGATION *(and revised risk evaluation & ranking)*

ID	Action	By	Due	Continuing
New Frequency	New Severity	New Rank		

THREAT DETAILS *(assuming no additional mitigation)*

ID	352	All controls fail - major infrastructure work, large excavator punctures pipelines	KP 13.505
Location	Old Geelong Road - Utility Installation using excavator		External Interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode	Puncture - large leak. (Notes from 2007 SMS: No-rupture case for 30T excavator. Need to consider possible use of 30T excavator, or greater, impacting pipeline. 30T excavator would only be used for major new infrastructure.)		
Effects	A 110mm hole resulting from a 35T excavator with twin points tiger teeth impacting line leading to ignition. Discharge rate = 4.3 GJ/s. Hole Size is less than critical defect length (129mm) but does not meet full no-rupture criteria (which requires less than 2/3 critical defect length). 4.7 kW zone = 130m. 12.6 kW = 80m.		
Severity notes	Adjacent shopping centre car park within 12.6kW area.		
Freq. notes	35T excavator with tiger teeth working in the area + hitting pipe + penetration with two points + ignition.		
Frequency	Hypothetical	Severity	Catastrophic
Rank	INTERMEDIATE		

MITIGATION *(and revised risk evaluation & ranking)*

ID	Action	By	Due	Continuing
New Frequency	New Severity	New Rank		

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 7 **South Melbourne to Brooklyn**

Section: 97 **Cecil St - Todd Rd**

T2 -

THREAT DETAILS *(assuming no additional mitigation)*

ID 418 **Undetected corrosion in cased crossing**

KP .211
.25

Location City Road Crossing

Corrosion

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode Pin hole leak. *(Notes from 2007 SMS: Cased crossing - risk of corrosion + being missed from cased crossing review program. Not piggable. Possible corrosion not detected. Newport Power Station fed by line. Note: Reinforced concrete casing)*

Effects 1. Line shutdown and repair - .
2. Gas migrates into adjacent pit - ignites and burns worker.

Severity notes Significant restriction in supply to Newport Power Station.

Freq. notes Corrosion of this type found on other lines - no way of determining if corrosion is occurring at this point. Note: Northern end of casing is below sea level adjacent to river and silty soil.

Frequency Remote

Severity Major

Rank **INTERMEDIATE**

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**
1 Unpiggable pipelines - review means of identifying corrosion defects, particularly due to shielding by either disbonded coating or casings

By
A. Bryson

Due Contin-
uing
☐ Yes

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 11 **Brooklyn to Ballan**

Section: 83 **Derrimut - Ballan**

R1 -

THREAT DETAILS *(assuming no additional mitigation)*

ID 524 **Undetected corrosion in cased crossing**

KP 37.405

Location Bacchus Marsh - Geelong Road Cased Crossing

Corrosion

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode Pin hole leak

Effects No

Severity notes Worse case: Ingition of gas could result in personal injury.

Freq. notes Event not known to be recorded previously in Australia. In-line inspection greatly reduces the likelihood.

Frequency Hypothetical

Severity Severe

Rank **Negligible**

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 12 **Ballan to Ballarat (including loop line)**

Section: 85 **Gordon**

R2 -

THREAT DETAILS *(assuming no additional mitigation)*

ID 585 **All controls fail. Major road reconstruction, serious damage to DN 150 line within road reserve.**

KP 6.6
8.04

Location Construction in Nightingale Street affecting Adjacent

External Interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode DN 150 can be penetrated by both points of 35 t excavator, hole size 110 mm. CDL for 4.8 mm WT is 80 mm, so rupture is possible. Radiation distances 75 m and 115 m.

Effects Assume ignition. Few fatalities at worst, given low number of houses within radiation distance

Severity notes Major, for few fatalities

Freq. notes Require uncontrolled work over pipe AND 35 t excavator involved AND impact on pipe AND both points penetrate AND ignition

Frequency Hypothetical

Severity Major

Rank Low

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 15 **Packenham to Wollert**

Section: 69 **Lorimer Park**

T1 -

THREAT DETAILS (assuming no additional mitigation)

ID **1110** **All controls fail: 35 t Excavator Developing Drainage or Sewer**

KP **80.8**

Location Mernda, urban development

External Interference

Existing design

CONSEQUENCES (assuming no additional mitigation)

Failure mode Anticipate excavator to be using a rock breaker in this area rather than a toothed bucket. Dent and gouge - 12.7 mm X60, no penetration.

Effects Dent and gouge. No penetration considered possible. Restriction of supply to repair.

Severity notes Short term restriction only. External repair required.

Freq. notes Remote is a very conservative estimate in this case as all procedural controls need to have failed.

Frequency Remote

Severity Minor

Rank Negligible

MITIGATION (and revised risk evaluation & ranking)

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 17 **Tyers to Morwell looping**

Section: 31 **Traralgon outskirts**

R2 -

THREAT DETAILS *(assuming no additional mitigation)*

ID 1170 **Airstrip - aircraft impact**

KP 5.5

6.5

Location Aircraft Impact Threat

External interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode Coating damage and minor metal damage

Effects Pressure reduction pending repair. Interruption to interruptible costumers.
Note: Risk occurs during take off or landing - therefore, position = gliding angle.

Severity notes Short term inturruption.

Freq. notes Frequency of: Plane crashes + fully penetrates 1.2m soil + hits pipeline.

Frequency Hypothetical

Severity Severe

Rank **Negligible**

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Section: 32 **Traralgon - Morwell**

R1 -

THREAT DETAILS (assuming no additional mitigation)

ID **3131** **Airstrip - aircraft impact**

KP **6.5**
9

Location Aircraft Impact Threat

External interference

Existing design

CONSEQUENCES (assuming no additional mitigation)

Failure mode Coating damage and minor metal damage

Effects Pressure reduction pending repair. Interruption to interruptible costumers.
Note: Risk occurs during take off or landing - therefore, position = gliding angle.

Severity notes Short term inturruption.

Freq. notes Frequency of: Plane crashes + fully penetrates 1.2m soil + hits pipeline.

Frequency Hypothetical

Severity Severe

Rank Negligible

MITIGATION (and revised risk evaluation & ranking)

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 24 **Keon Park to Wollert**

Section: 94 **Keon Park to O'Herns Rd**

T1 I

THREAT DETAILS *(assuming no additional mitigation)*

ID **1474** **All controls fail: Installation of Utilities Across Main Road by HDD**

KP .003

Location Anstey Ave, Keon Park

External interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode Worst case = HDD resulting in a 30mm hole. No-rupture pipe. Gas leak leading to ignition.

Effects 30mm hole results in 0.12 GJ/s discharge . 4.7kW radius = 23m. 12.6kW = 14m.

Severity notes One house in 4.7kW radius and no houses within 12.6kW zone. At the most 2 fatalities = workers.

Freq. notes HDD operating in vicinity + hitting pipe + penetration of pipe + ignition.

Frequency Hypothetical

Severity Major

Rank Low

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 29 **Laverton to BHP**

Section: 96 **Laverton to Coogee**

R2

I

THREAT DETAILS *(assuming no additional mitigation)*

ID 2345 **All controls fail - HDD for installation of utilities across road**

KP 0

1.606

Location Fitzgerald Road

External Interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode Hole in pipe causing leak.

Effects 25mm hole. Ignition unlikely - leak only case considered.

Severity notes Short term interruption to supply.

Freq. notes Soil conditions make HDD a non-preferred option (ie. rock)

Frequency Remote

Severity Severe

Rank Low

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 30 **Supply to Unichema, Bay St**

Section: 91 **Supply to Unichema**

T1

I

THREAT DETAILS *(assuming no additional mitigation)*

ID 2358 **Undetected corrosion in cased crossing**

KP .314

Location Normanby Road - Cased Crossing, Non Piggable Section.

Corrosion

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode Pin Hole Leak

Effects Interruption to single customer. Short term public disruption - road closed during repair work.

Severity notes Interruption to single customer.

Freq. notes Crossing 1.5m below sea level therefore almost certainly filled with liquid maintaining CP.

Frequency Remote

Severity Severe

Rank Low

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 32 **Iona to Lara**

Section: 117 **Lara**

T1 -

THREAT DETAILS *(assuming no additional mitigation)*

ID 3155 **All controls fail - pipe penetrated by auger (pole or HDD)**

KP 4.8

Location Patullos Road

External interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode Worst case is hole, max equivalent diameter ~50 mm but probably smaller

- Effects**
1. No ignition, supply interruption for a few days pending repair, but shortfall met from other sources either side of failure
 2. Ignition, one or two fatalities to rig operator(s)

- Severity notes**
1. Minor, for minimal supply disruption
 2. Major, for fatalities

Freq. notes Hypothetical, for both cases, given 10.8 mm X70 pipe and nature of this location

Frequency Hypothetical

Severity Major

Rank Low

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Section: 119 **Batesford**

T1 -

THREAT DETAILS *(assuming no additional mitigation)*

ID **2426** **All controls fail: Puncture by 35T Excavator Resulting in 35mm hole - assumed future impact resulting from development works.** KP **19.1**

Location Bates Court, Batesford

External Interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode Leak

Effects Leak from 30mm hole with ignition. For 30mm hole at 10.2MPa, 4.7kW zone = 45m, 12.6kW zone = 25m.

Severity notes Assume machine operator killed but no other casualties. For a single puncture only one house will be affected (just within 4.7kW zone).

Freq. notes Frequency of 35T excavator working + hitting pipe + puncturing pipe upon impact + ignition + location within 45m of house with people present in the area.

Frequency Hypothetical

Severity Major

Rank Low

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 41 **Brooklyn to Lara**

Section: 109 **Prison (Melbourne Remand Centre)**

T1

S

THREAT DETAILS *(assuming no additional mitigation)*

ID 2931 **All controls fail - construction of freeway sound barriers, 40 t excavator for foundations**

KP 9.3

Location Adjacent to prison on other side of Middle Rd

External interference

Existing design

CONSEQUENCES *(assuming no additional mitigation)*

Failure mode Penetration of pipe highly unlikely with 40 t machine but is just possible. Resulting hole would not be large, say 40 mm. Radiation zone for 4.7 kW/m2 is 60 m. Prison wall is 180 m from pipeline.

Effects No consequences for occupants of prison. Possible fatality to machine operator.

Severity notes Fatality is always Major.

Freq. notes Likelihood of uncontrolled excavation over pipe AND machine large enough to penetrate AND achieving penetration AND ignition is Hypothetical

Frequency Hypothetical

Severity Major

Rank Low

MITIGATION *(and revised risk evaluation & ranking)*

ID **Action**

By

Due

Continuing

New Frequency

New Severity

New Rank

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

RISK EVALUATION & MANAGEMENT

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Section: 113 **Avalon outskirts**

R2 I

THREAT DETAILS (assuming no additional mitigation)

ID **3034** **All controls fail - assume HDD drill across freeway penetrates pipe**

KP **57.2**

Location Cozens Road

External interference

Existing design

CONSEQUENCES (assuming no additional mitigation)

Failure mode Assume hole for DN 500 pipe, heavy duty drill rig with tungsten carbide bit. Full size hole not credible, driller will stop as soon as pipe is penetrated and gas returns up borehole. Assume max 50 mm hole.

Effects Extreme worst case is ignition of gas release from 50 mm hole. (Ignition actually unlikely.) Radiation distances ~80 m for 4.7 kW/m², ~50 m for 12.6 kW/ms. Possibly a few fatalities among drill rig operators. No residents affected. If freeway is congested then possible multiple motorist deaths.

Severity notes 1. Few fatalities to rig operators - Major. 2. Multiple fatalities to motorists - Catastrophic (but frequency for this case is very much lower - adopt first case).

Freq. notes Any hole is Hypothetical. Further consequences (ignition and deaths) are even less likely.

Frequency Hypothetical

Severity Major

Rank Low

MITIGATION (and revised risk evaluation & ranking)

ID **Action**

By

Due

Contin-
uing

New Frequency

New Severity

New Rank

APPENDIX 9

ALARP ANALYSIS

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

ALARP ANALYSIS

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 5 **Brooklyn to Corio**

Section: ? **Williams Landing - Hoppers Crossing**

T1 -

THREAT DETAILS

ID **402** **All controls fail: Heavy Excavator punctures pipe during utilities maintenance** KP **9.957**

Location Swamp Hen Drive, Williams Landing

External Interference

ALARP ANALYSIS

ALARP confirmed? ☒ Yes ☐ No

Cost of failure \$30,000,000 Say 6 fatalities @ M\$4 = M\$24, plus property damage and other costs, say M\$30
Probability of failure 0.001% Top of Hypothetical range
Proportionality factor 10 Worst case, just to be conservative

Maximum justified spend to eliminate risk: \$3,000

Possible alternative mitigation

Slabbing

Reason not adopted

Highly expensive relative to benefit; likelihood of this threat already very low

No other mitigation possible for any reasonable cost

THREAT DETAILS

ID **352** **All controls fail - major infrastructure work, large excavator punctures pipelines**

KP **13.505**

Location Old Geelong Road - Utility Installation using excavator

External Interference

ALARP ANALYSIS

ALARP confirmed? ☒ Yes ☐ No

Cost of failure \$30,000,000 Say 6 fatalities @ M\$4 = M\$24, plus property damage and other costs, say M\$30
Probability of failure 0.001% Top of Hypothetical range
Proportionality factor 10 Worst case, just to be conservative

Maximum justified spend to eliminate risk: \$3,000

Possible alternative mitigation

Slabbing

Reason not adopted

Highly expensive relative to benefit; likelihood of this threat already very low

No other mitigation possible for any reasonable cost

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

ALARP ANALYSIS

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 7 **South Melbourne to Brooklyn**

Section: 97 **Cecil St - Todd Rd**

T2 -

THREAT DETAILS

ID 418 **Undetected corrosion in cased crossing**

KP .211
.25

Location City Road Crossing

Corrosion

ALARP ANALYSIS

ALARP confirmed? ☒ Yes ☐ No

Cost of failure
Probability of failure
Proportionality factor

Maximum justified spend to eliminate risk:

Possible alternative mitigation

Reason not adopted

No alternative mitigation available. Direct inspection not possible; no remote inspection technology available; awaiting technology developments (research in progress)

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

ALARP ANALYSIS

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Pipeline: 42 **Generic pipeline for repetitive and NLS threats**

Section: 1 **Repetitive threats**

THREAT DETAILS

ID **3087** **Cathodic protection shielding within casing due to annular void** KP
Location Cased crossing Corrosion

ALARP ANALYSIS

ALARP confirmed? ☒ Yes ☐ No

Cost of failure
Probability of failure
Proportionality factor

Maximum justified spend to eliminate risk:

Possible alternative mitigation

Reason not adopted

No alternative mitigation available. Direct inspection not possible; no remote inspection technology available; awaiting technology developments (research in progress)

THREAT DETAILS

ID **3106** **HDD for buried service installation** KP
Location General metro installation External interference

ALARP ANALYSIS

ALARP confirmed? ☒ Yes ☐ No

Cost of failure \$4,000,000 Assume one fatality, M\$4, plus repair and disruption costs - insignificant because backfeed possible
Probability of failure 0.01% Conservatively adopt middle of remote range
Proportionality factor 10 Worst case, just to be conservative

Maximum justified spend to eliminate risk: **\$4,000**

Possible alternative mitigation

Reason not adopted

No further mitigation available within max justified spend

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

ALARP ANALYSIS

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

Section: 2 **Non-location-specific**

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THREAT DETAILS

ID **3086** **Cathodic protection shielding (disbonded coating)**

KP

Location Non-location-specific

Corrosion

ALARP ANALYSIS

ALARP confirmed? ☒ Yes ☐ No

Cost of failure

Probability of failure

Proportionality factor

Maximum justified spend to eliminate risk:

Possible alternative mitigation

Reason not adopted

No further mitigation available

APPENDIX 10

RECOMMENDED ACTIONS

Pipeline Safety Management Study: **Victorian Transmission Pipeline Network**

ACTIONS

Pipeline Licensee: APA GasNet

5 Year Review safety mgt. study

ID	Action	By	Due
1	Unpiggable pipelines - review means of identifying corrosion defects, particularly due to shielding by either disbonded coating or casings	A. Bryson	

Associated Threats:

<u>ID</u>	<u>KPs</u>	<u>Location</u>	<u>Threat</u>
3086	-	Non-location-specific	Cathodic protection shielding (disbonded coating)
418	.211 - .25	City Road Crossing	Undetected corrosion in cased crossing

ID	Action	By	Due
2	Lurgi line - consider reviewing the possibility of latent construction defects, given the year in which it was built and the lack of hydrotest	C. Bonar	

Associated Threats:

<u>ID</u>	<u>KPs</u>	<u>Location</u>	<u>Threat</u>
3078	-	Non-location-specific	Undetected or unreported construction defect
3091	-	Non-location-specific	Undetected or unreported material defect

ID	Action	By	Due
3	Tyers - include in weekly patrol	P. Dawson	

Associated Threats:

<u>ID</u>	<u>KPs</u>	<u>Location</u>	<u>Threat</u>
776	60.5 -	Oval	General Installation

ID	Action	By	Due
4	Patrol frequency - review patrols for locations of increased population density	P. Dawson	

Associated Threats:

<u>ID</u>	<u>KPs</u>	<u>Location</u>	<u>Threat</u>
506	4.421 - 4.556	Leisure centre	General Installation
1109	79.82 - 82	Construction Activity at Proposed and Existing Mernda Development	General Installation

ID	Action	By	Due
5	ILI program - consider pigging pipelines DN 150 and larger that are less than 10 km (excluded from ILI to date)	C. Bonar	

Associated Threats:

<u>ID</u>	<u>KPs</u>	<u>Location</u>	<u>Threat</u>
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