Engineering Justification Paper: EJP13

Pipeline Isolation Valves

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1 Summary Table

Name of Project	**Pipeline Isolation Valve Interventions**
Scheme Reference	*EJP13*
Primary Investment Driver	*Asset Health, Health and Safety and Security of Supply*
Project Initiation Year	***Start date for proposed RIIO-3 work plan:*** 2027
Project Close Out Year	***Completion date for proposed RIIO-3 work plan***: 2032
Total Installed Cost Estimate (£)	[redacted]
Cost Estimate Accuracy (%)	+/- 5%
Project Spend to Date.	***Spend to date for RIIO-2 work plan:*** [redacted]
Current Project Stage Gate	*On going programme of works*
Reporting Table Ref	*5.01 – valves operating at above 7 bar* *5.06 – valves operating at 7 bar and below*
Outputs Included in RIIO-2 Business Plan	Yes
Spend apportionment (for RIIO-3 Plan)	*Not* applicable
Proposed Regulatory treatment for RIIO-3 workplan	*Included in Base-expenditure*

Table 1: Investment Summary Table

This investment case does not satisfy the criteria for late competition or early competition and pursuing these activities would not be in the interests of the customer. We recognise the benefits that competition can bring to customers through efficiency and innovation. We continue to challenge ourselves as a business to ensure that we are harnessing competitive forces where they can provide these benefits. For specific detail on how we have assessed competition, please see Chapter 6 of the Workforce and Supply Chain Strategy (Appendix 17).

All costs presented in this paper are pre-efficiency and are in 23/24 price base, unless otherwise stated.

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2 Executive Summary

Pipeline Isolation Valves are used to permit rapid isolation of network sections and plant in the event of damage, incident, or gas supply emergency; and to enable maintenance. In scope of this paper are Pipeline Isolation Valves operating above 75mbar.

The strategy for Pipeline Isolation Valves aligns with the overarching RIIO-3 Network Asset Management Strategy (NAMS), which focuses on maintaining a secure and resilient gas supply while progressing toward a proactive asset management model. This approach supports compliance with the Pipeline Safety Regulations 1996 (PSR) and enables optimal timing for asset interventions in line with our strategic pillars for asset stewardship.

Our proposed strategy has changed since RIIO-2. Whilst we will continue to invest in our assets based upon observed condition on all above 7 bar valves and 7 bar and below class M1 valves (strategic network isolation valves), we are now also including investment in 7 bar and below class M3 valves (local isolation valves), which were previously managed on a fix on failure basis when the valve was leaking or required as part of maintenance activities. We are also including a forecast for Emergency Control Valves (ECVs) installed at large Industrial and Commercial sites.

As agreed with the Ofgem engineering team at our engagement sessions throughout the year, we have not evaluated multiple options for valve interventions, nor have we undertaken Cost Benefit Analysis. This is because the workload is mandated against PSR and in line with our asset strategy we are investing to maintain asset health and safety risk stable.

The change follows extensive work to improve the granularity and quality of condition data of below 7 bar valves during RIIO-1 and RIIO-2, which allows us to forecast this workload with greater confidence. Our proposed investment forecast for RIIO-3 is as follows:

[redacted]
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Table 2: Forecast spend across RIIO-2 to RIIO-4 period

3 Introduction

This document covers the engineering justification for investment in Pipeline Isolation Valves and Industrial and Commercial Emergency Control Valves (hereafter referred to as “valves”).

Valves are part of the safety system installed on pipelines in our networks. Under the Pipeline Safety Regulations 1996 (PSR) (Regulations 6 (Safety Systems), Regulation 7 (Access for examination and maintenance), Regulation 12 (Arrangement for incidents and emergencies), Regulation 13 (Maintenance)) we are mandated to maintain these valves in serviceable condition to ensure that networks and plant can be isolated in emergency situations or to facilitate essential maintenance. This is further reinforced by the Gas Safety (Management) Regulations 1996 (GSMR) (Regulation 7 (emergency preparedness)) and the Gas Safety (Installation and Use) Regulations 1998 (GSI&UR) (Regulation 9 (emergency isolation)).

As a consequence, our investments are driven by safety and compliance purposes and not to change our service levels. For this reason, cost benefit analysis is not appropriate and would not have any influence over the scale or assets we need to invest in.

In RIIO-1 and RIIO-2 we proactively invested to maintain the condition of our valve population, specifically in the intermediate pressure (IP) and medium pressure (MP) networks where previous interventions had been largely managed on a fix on failure basis. We also continued a steady state intervention in the High Pressure (HP) valve population. There is still a need to intervene due to deterioration in the overall asset base. However, as a consequence of our previous investments we are now observing a steady failure rate in the HP and critical IP and MP valve populations (see section 4.1 for details on IP and MP valve classes).

In the below 7 bar space [commercially sensitive data]. This is normally non-invasive (e.g. removing pits and chambers during other road works) but may also be up to and including third party damage. We have also continued work to manage third-party interference on our pipeline and associated assets, notably through industry campaigns (Line Search: Dial Before You Dig) and through Plant Protection inspections, surveys, and engagement with construction organisations.

At the same time, we extensively revised our engineering framework regarding valves, in line with recognised industry standards to align with the key principles of the Pipeline Safety Regulations. As a consequence, we have improved maintenance procedures, data capture tools, and have a more robust methodology for classification of below 7 bar valves. In the latter stages of RIIO-2, we plan to extend the approach to data capture through to our HP valve population.

The learning from the continuous improvement activities has led to a greater quality and confidence in the asset classification and the condition data of each valve, which allows us to forecast volumes of expected interventions more accurately than before for valves operating at 7 bar and below. This includes an ability to forecast down to specific intervention activities required per valve. We are planning to apply this learning to our above 7 bar valves assets over the remaining years in RIIO-2 so that we assess and forecast required interventions.

Additionally, following improvements to our engineering management systems, we are continuously re-validating the classification of 7 bar and below strategic valves as conditions on the network change. Consequently, the current population is subject to change.

In RIIO-3 we will continue to invest in HP, IP, and MP valves but we are proposing to include Class M3 local isolation valves and Industrial and Commercial Emergency Control Valves. This workload comprises a variety of intervention types, from minor remediation and refurbishments through to full valve replacements.

4 Equipment Summary

This section sets out the summary of the valve types deployed within our network, including number of each type of valve by region.

4.1 Overview of the assets

Summary information	
Global equipment count.	[commercially sensitive information]
`Breakdown of manufacturers / models	Bryan Donkin represent the majority of VALVEs (circa 80%). Remaining population are manufactured by assorted manufacturers, including IMI, Cameron, Audco, Nefit, Elliott Garrood, Westwood and Wright, and Cort
Location on the network	Valves are installed at the following locations across our four distribution networks (see figure 1): • On pipelines • Block valve installations • Pig Trap sites (normally associated with a Pressure regulating installation) • Emergency Control Valves installed inlet to Industrial and Commercial properties
Normal operating modes	Valves can be normally open or closed depending on network configuration. They can be operated to isolate or integrate network sections to address emergency conditions or to facilitate maintenance. Aside from Remote Operable Valves, all valves are manually operated (either directly or electrically / gas / hydraulically powered)
Pressure ratings	• HP Valve – 7 bar and above • IP Valve – above 2 bar and up to 7 bar • MP Valve – above 75mbar and up to 2bar • LP Valve – up to 75mbar
Redundancy architecture	Valves do not normally have redundancy. Networks are designed with multiple valves to enable isolation in event of a failure
Single feed indication	N/A – multiple locations across all networks.
Planned Intervention	Multiple interventions based upon condition, including: • Remediation of marker posts • Remediation of pits and chambers • Remediation of pressure posts and rider posts • Refurbishment of valves (actuators) • Replacement of valves
Health Score at end of price control	• At the start of the period, we will trigger intervention where health score is 4 and 5 from inspection results • At end of period these valves will be remediated to a health score of 3 or better, depending upon intervention mode
Confirmation of investment	RIIO-2 investment forecast for [cost data] to deliver 1,613 interventions on HP, IP, and MP class M1 valves, and Industrial and Commercial ECVs

Summary information	
Monetised Risk	N/A – not currently assessed via monetised risk

Table 3: Overview of the assets

An example of a typical valve configuration is shown in Figure 1.

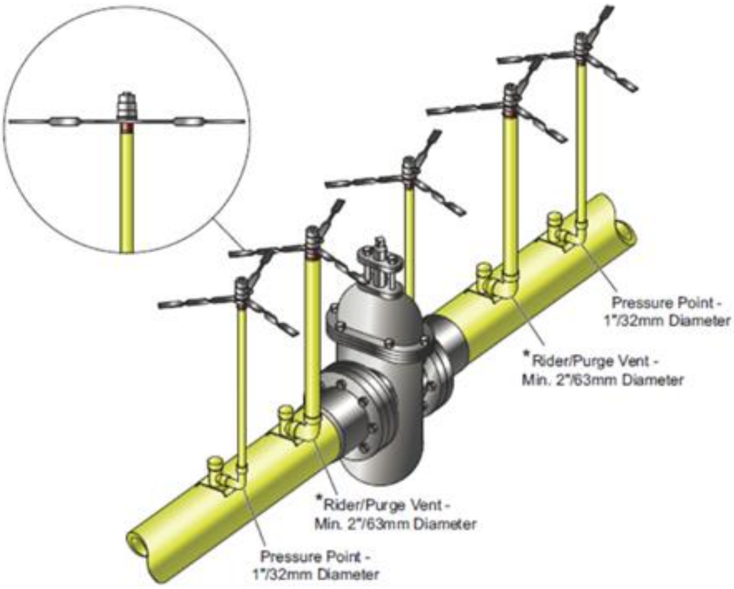

Figure 1: example of a Pipeline Isolation Valve

Most valves were installed when the pipelines were originally constructed and have been subjected to routine maintenance regimes with limited remediation since. Our maintenance programmes are now recording indications of deterioration, including issues around the operability and accessibility of valves. In response, we have undertaken an increasing number of interventions.

We have continued work from RIIO-1 to improve the quality and granularity of the asset attribute and condition data for all valves, particularly in the 7 bar and below space. This has supported an ongoing review of valve classification and is improving our understanding of defects and required interventions, specifically on 7 bar and below class M1 and M3 valves.

The following section sets out the different types and locations that valves are used.

4.1.1 Above 7 Bar Valves

High Pressure (HP) pipeline valves are those that are sited on the above 7 bar network. The 3 main types of valves on the HP network are.

- Block Valves – Normally consist of a line valve and bridle arrangement, sometimes used at spurs to different pipelines or offtakes. (see Figure 2)
- Line Valves – Normally single valves located on the pipeline. (see Figure 3)
- Pipeline Inspection Guage (PIG) trap isolation valves. - Valves that are for the purpose of isolating and managing in-line inspections (ILI) operations, these can be on stand-alone sites or part of an above ground installation (AGI). (see
- Figure 4)

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Figure 2: Typical block valve site configuration

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Figure 3: Pipeline data book, showing line valves at [sensitive information]

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Figure 4: Typical PIG facility layout

HP valves are categorised as either critical, non-critical or redundant. The designation of critical and non-critical valves is defined in our internal pipeline maintenance procedure that ensures compliance with our key legislation (PSR / PSSR / GSMR). Following this guidance, the majority of line and block valves will be considered critical and PIG trap valves will generally be classified as a non-critical.

4.1.2 Below 7 bar Valves

Below 7 bar valves are installed on the below 7 bar network. The types of valve are:

- Line valves (including block valve sites and remotely operable valves) operating at pressures up to and including 7 Bar
- Emergency Control Valves (ECVs) at large industrial and commercial sites operating at pressures up to and including 7 Bar

Figure 5 below shows the typical locations of below 7 bar line valves.

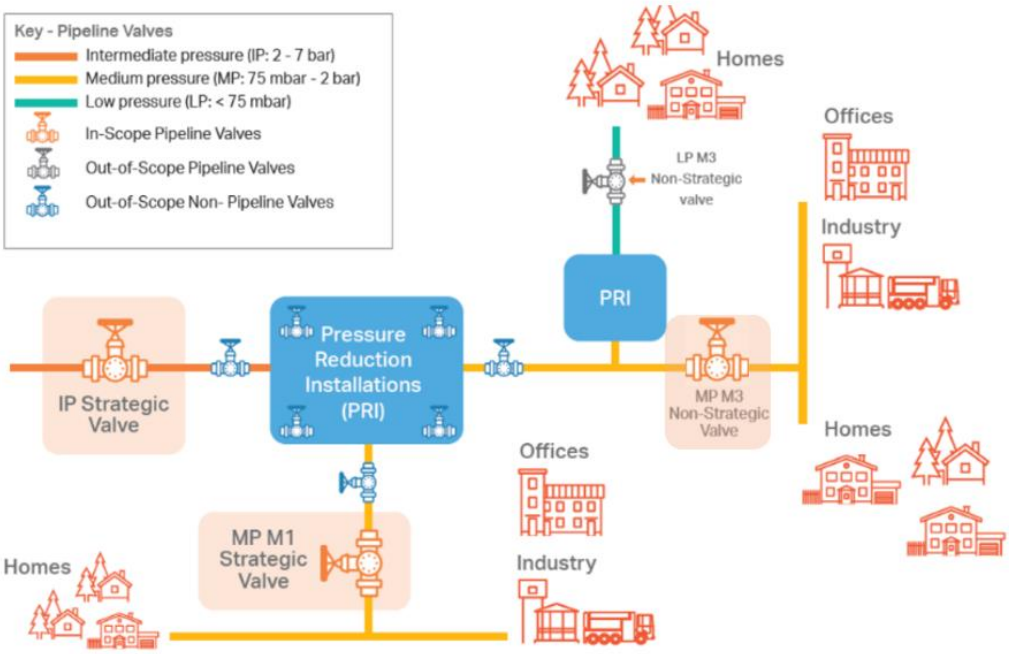

Figure 5: Network diagram showing valves in and out of scope

Valves are classified in accordance with our internal procedure for the management of valves in Pipelines Operating at Pressures up to and Including 7 Bar, which has been substantially revised in RIIO-2 for greater clarity on valve classifications, condition inspection requirements, and remediation requirements. The classifications are summarised below:

- Class M1 for strategic network isolation valves: typically installed on IP networks, MP networks with flows above 7500 standard cubic metres per hour (scmh), remotely operable valves, and valves installed either side of subways and tunnels. These are of strategic importance to isolate large sections of networks in emergency situations
- Class M3 for local isolation valves: typically installed on MP with flows up to 7500 scmh, valves either side of underwater or special crossings, and any valve providing the only flow stop solution to a local network section. These valves are typically used for isolation purposes in emergency conditions or to facilitate maintenance
- Class M2 for Pressure Regulating Installation Isolation Valves
- Unclassified for all valves not classed as M1, M2 or M3

Class M2 and Unclassified valves are out of scope of this investment paper, which are part of EJP04– Governor Interventions.

At large Industrial and Commercial sites there is an Emergency Control Valves which are classified as the end of the distribution network in accordance with Gas Safety (Installation and Use) Regulations 1998. These valves are used to isolate Industrial and Commercial sites for maintenance on in emergency conditions. These valves are normally associated with a metering or pressure regulating installation into the Industrial and Commercial customer.

4.2 Detailed equipment summary

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Table 4: Asset Stock (source: core system extract, May 2024) – Number of units by pressure and classification

Through RIIO-1 and RIIO-2 we have delivered a proactive programme of remediation over 10 years of all M1 valves, as recorded during routine valve maintenance. This included remediation of deteriorated valves, or where the valves were inaccessible or inoperable. For High Pressure valves this is a continuing volume of remediation responding to valve deterioration.

For IP and MP valves the volumes have been subject to improvements in valve asset data and our condition inspection approach, which have been systematically validating the condition and classification of valves, and therefore the inspection and interventions required on each asset. This has resulted in some change in volumes in the M1 and M3 classifications since RIIO-2, as shown in

Table 4.

For RIIO-3, we are including a forecast of class M3 valve remediation in the scope of the investment.

5 Problem/Opportunity Statement

Successful investment in RIIO-3 will focus on maintaining asset health across our pipeline isolation valves assets, with a commitment to achieving stable or improved asset conditions throughout the period. This will be realised without compliance failures, supply interruptions, or increased fault rates. Our asset data and projections allow us to forecast a fault rate that informs our proactive maintenance strategy.

Through this investment approach, we aim to sustain or enhance the health of our valve assets while upholding our safety and compliance record, ensuring that valve operations do not contribute to emissions. In line with regulatory requirements, we exclude 'do nothing' options or any alternatives that fail to meet statutory standards.

The need for regular and proactive maintenance of valves is consistent with our Network Asset Management Strategy, which emphasizes a shift from reactive to proactive management to ensure compliance, safety, and resilience across our gas network. This strategy is designed to meet Ofgem's regulatory expectations for asset health while optimising investments to balance service risk and cost effectiveness.

5.1 What happens if we do nothing

If we do not act on identified integrity risks (corrosion, third party interference, mechanical damage, access) to our valves, the consequence is a breach of legislative and licence obligations. By allowing a critical safety system to fail we risk safety and security of supply which has insupportable legal, reputational and financial impact. Hence, doing nothing to intervene is immediately discounted as a viable option.

Below summarises our obligations and commitments for which our investment must not allow contravention which would otherwise result in penalties, prosecution and enforcement action. For specific consequence of failure, please see Section 7.

Safety – Legislative Compliance: We invest to ensure continued compliance with the Pipeline Safety Regulations 1996 (PSR), the Gas Safety Management Regulations 1996 (GSMR) and other legislative requirements detailed in section 3. Failure to maintain valve systems in a serviceable is in itself a breach of the PSR regulation 13, but also prevents safe isolation of our network in emergency situations and to facilitate maintenance. This would represent further failure against PSR regulations 6 and 12.

Security of Supply – Regulatory compliance: We have a duty to comply with the terms of our gas transporter licence, specifically Condition 16 (Pipeline System Security Standards) to manage our network to meet the demand of connected customers by supplying to meet the peak aggregate daily demand. Any option that prohibits the meeting of this condition is not favourable. Loss of valves prevents rapid isolation of network sections in emergency conditions, which could have potentially significant impact upon security of supply to sections of the network.

Environmental: Any leaks due to asset deterioration will result in a gas-release to the atmosphere, with a resulting impact to carbon emissions. We have a target to reduce our network emissions in line with our Environmental Action Plan (EAP) therefore an option that undermines our environmental commitments is not favourable.

Providing Value for Money to Our Customers: it is imperative we provide the most efficient and cost-effective long-term solution to minimise customer bills. Reactive repairs have an impact on our customer's bills, due to additional call out costs and the need for temporary repairs. Gas-leaks also result in 'lost gas' which has a commercial impact. Customers have consistently highlighted security of supply as a key priority. Maintaining valve populations ensures we can quickly isolate network sections to allow for rapid response to emergency conditions and protect supplies.

Financial: Any pipeline failure including pipeline isolation valves will have resulting costs to respond and mitigate the failure, to re-establish operation, repair and restore supply, this could run into millions of pounds. Options that negatively impact the customer bill or result in penalties through fines is not favourable.

5.2 Narrative real-life example of problem

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Figure 6: Chester Jet fire schematic and image (www.Cheshire-Live.co.uk)

[section redacted]

5.3 Project Boundaries

[section redacted]

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Table 5: Scope of this Investment Paper

[section redacted]

6 Probability of Failure

[section redacted]

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Table 6: Failure modes of Pipeline Isolation Valves

6.1 Probability of Failure Data Assurance

[section redacted]

6.1.1 Below 7 Bar Line valves and ECVs

[section redacted]

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Figure 7: Fault Per Survey Rates for IP and MP Valves (Jan 2022 – July 2024)

[section redacted]

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Table 7: Failure rate per survey identified during RIIO-2

[section redacted]

6.1.2 Above 7 Bar Valves

[section redacted]

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Figure 8: Historic HP Valve Interventions

[section redacted]

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Figure 9: Age profile of HP valves

7 Consequence of Failure

[section redacted]

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Table 8: Service Risk Consequences

8 Options Considered

[section redacted]

8.1 How we have structured this section

[section redacted].

8.2 Modes of intervention

[section redacted]

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Table 9: Intervention modes

8.2.1 High Complexity (IP and MP valves) and Full Interventions (I&C ECV and HP valves)

[section redacted]

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Table 10: Summary of High Complexity (IP and MP valves) and Full Interventions (I&C ECV and HP valves)

8.2.2 Medium Complexity (IP and MP valves only)

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Table 11: Summary of Medium Complexity (IP and MP valves only)

8.2.3 Low Complexity (IP and MP valves only)

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Table 12: Summary of Low Complexity (IP and MP valves only)

8.3 Timing choices

[redacted section]

8.4 Options

[redacted section]

9 Business Case Outline and Discussion

9.1 Key Business Case Drivers Description

[section redacted]

9.2 Business Case Summary

[section redacted]

9.3 Conclusions

[section redacted]

10 Preferred Option Scope and Project Plan

10.1 Preferred Option

[section redacted]

10.1.1 IP and MP valve interventions

[section redacted]

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Table 13: Intermediate Pressure Breakdown of Work Volume by Complexity

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Table 14: Medium Pressure Breakdown of Work Volume by Complexity

10.1.2 Industrial and Commercial ECVs

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Table 15: Volume of Industrial and Commercial ECV interventions undertaken in RIIO-2

10.1.3 HP Valves

[section redacted]

10.2 Asset Health Spend Profile

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Table 16: Projected RIIO-3 intervention volumes

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Table 17: Projected RIIO-3 intervention costs

10.3 Investment Risk Discussion

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Table 18: Business Risks Table

10.4 Project Plan

[section redacted]

10.5 Key Business Risks and Opportunities

[section redacted]

10.6 Outputs included in RIIO-2 Plans

[section redacted]

11 Regulatory Treatment

[section redacted]

12 Glossary

Abbreviation/term	Meaning
HP	High Pressure (above 7 bar)
IP	Intermediate Pressure (above 2 bar and up to 7 bar)
MP	Medium Pressure (above 75mbar and up to 2 bar)
LP	Low Pressure (up to 75mbar)
SCMH	Standard Cubic Meters per Hour
I&C	Industrial and Commercial
ECV	Emergency Control Valve
ILI	In-line Inspection
AGI	Above Ground Installation
PRI	Pressure Regulating Installation
Multi Occupancy Building	MOB
PE	Polyethylene

Table 19: Glossary Table