DD Supporting Evidence: EJP14

Pipeline Monitoring & Protection (Sleeves)

Contents

Table of Figures

Table of Tables

1 Context

This annex provides the additional evidence requested by Ofgem in Table 34 of the July 2025 Draft Determination, addressing concerns regarding the proposed sleeves workstack, specifically the split between nitrogen sleeves and construction sleeves and justification for the proposed unit costs.

To address Ofgem's queries, we are **providing supporting evidence and explaining the methodology we have followed**, to substantiate our proposed volumes and costs. This includes the latest (UKOPA) dataset along with our methodology for how the UK Onshore Pipeline Operators Association dataset has been used to inform the submitted investment and derivation of our unit costs. All costs in this annex are in 2023/24 prices.

For clarity, the feedback provided by Ofgem for EJP14 (Pipeline Monitoring & Protection) is shown in Table 1.

Feedback Source	Needs Case	Optioneering	Scope Confidence	Comments
RIIO-3 Draft Determinations – Cadent **Table 34: Summary of Cadent Engineering Recommendations**	Justified	Justified	Medium confidence	Cadent have stated that the workstack for sleeves differs between RIIO-3 and RIIO-2, proposing to use significantly more nitrogen sleeves in RIIO-3. This is proposed without substantive supporting evidence or justification for the increase in submitted unit costs. We have recommended overall workload is funded assuming all work is construction sleeves, applying construction sleeve unit costs for RIIO-3. Further evidence is required to support the need for nitrogen sleeves, specific volumes and justification for proposed unit costs.
22nd July Ofgem Engineering – Cadent Bilateral	• The session focused on explaining how inspection and UKOPA data informs pipeline sleeve interventions and how RIIO-2 delivery data supports unit cost forecasting. • Additional information is needed to support volumes, deliverables and cost alignment, specifically the split between nitrogen and construction sleeve volumes.			

Table 1: Specific EJP14 feedback from the RIIO-3 Draft Determinations Cadent Annex

2 Executive Summary

Our RIIO-3 workload and forecast expenditure have been developed using our assessment of high-risk faults, informed by maintenance activities and the UKOPA (UK Onshore Pipeline Operators Association, Managing Pipeline Sleeves UKOPA/GP/005 dated January 2016[1]) risk model for pipeline sleeves. The projected workload has been costed using individual unit costs for construction and nitrogen sleeve interventions, derived from supplier tender returns and cost data from our RIIO-2 programme.

Cadent's pipeline monitoring and protection programme is underpinned by statutory obligations set out in the Health and Safety At Work Act 1974 (HASAWA), the Pipeline Safety Regulations 1996 (PSR), specifically Regulation 13 (Maintenance), Regulation 15 (Damage to pipeline) and 16 (Prevention of damage to pipelines), and the Pressure Systems Safety Regulations 2000 (PSSR), specifically Regulation 9 (Examination in accordance with the written scheme) together with interventions required in relation to Regulation 12 (Maintenance).

Our approach supports compliance, safety, and network resilience through proactive interventions, guided by survey data and the subsequent risk assessment:

- **Detailed Asset Condition Data**: Current asset condition data for our pipeline sleeve asset stock, as assessed within UKOPA's risk-based model.
- **Forecast Workload Derivation**: Bottom-up engineering volumes derived from UKOPA's risk-based model and integrity engineering assessment.
- **Blended Unit Cost Methodology**: RIIO-2 delivery data used to calculate unit costs by asset type supported by business planning data tables and assurance processes.

Our preferred programme option reflects the minimum level of intervention required to maintain compliance and asset health. It proposes [redacted] sleeve interventions over RIIO-3 at a **revised forecast cost of £**[redacted] with delivery planned across all networks. This option is expected to maintain fault rates at current levels and aligns with our Network Asset Management Strategy (Appendix 10).

This annex demonstrates that our pipeline sleeve programme is justifiable, deliverable and cost reflective, addressing Ofgem's concerns and supporting a safe, resilient, and compliant gas network.

The RIIO-2 and revised RIIO-3 workload and expenditure are summarised below for completeness.

	RIIO-2 Sleeve programme	Proposed RIIO-3 sleeve programme
Sleeve interventions (number)	[redacted]	
Capex £m	[redacted]	

Table 2: Summary of RIIO-2 / 3 Sleeve remediation programme

While the number of interventions has decreased between RIIO-2 and RIIO-3, the complexity and cost per intervention have increased due to the risks highlighted on nitrogen sleeves and improved data insights. This focus ensures that investment is aligned with asset risk, regulatory expectations, and long-term network resilience.

[1] http://www.ukopa.co.uk/documents/UKOPA-GPG005.pdf

3 Purpose of Document

This document provides additional information in response to Ofgem's engineering review comments in Table 34 of the Draft Determination (July 2025). It addresses concerns regarding workstack and unit cost uncertainty, asset health condition data, and workstack differences between RIIO-2 and RIIO-3. The response outlines our methodology for forecasting intervention volumes and unit cost derivation, supported by historical data and engineering analysis.

4 Our Asset Management Approach

The following process flow illustrates how Cadent's maintenance inspection data underpins the pipeline monitoring and protection investment case, aligned with Ofgem's expectations for transparency in workstack and asset health condition data.

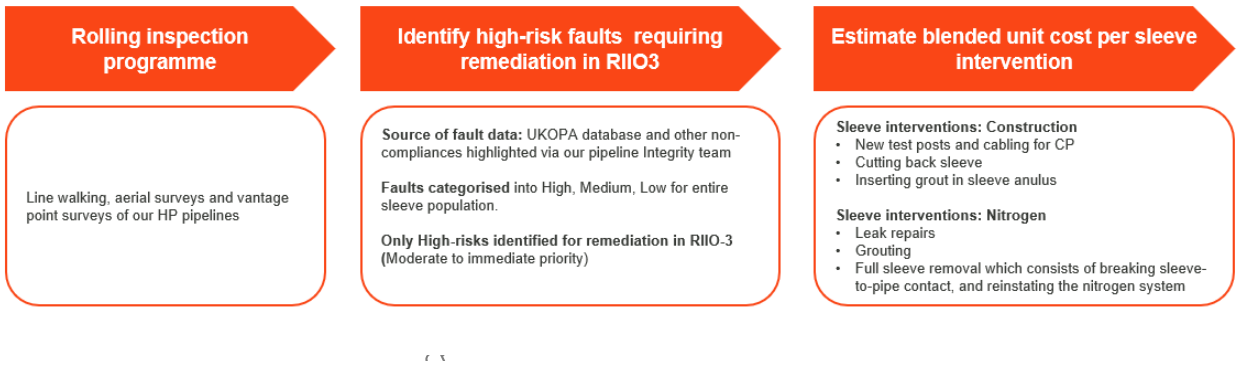

Figure 1: Process flow from inspection to intervention forecasting for Pipeline Monitoring and Protection (EJP14)

Cadent uses UKOPA's risk-based model, supplemented by additional internal integrity engineering assessment, to underpin the investment case. Our approach is summarised below, with further detail for each step presented in the subsequent sections.

1. Undertake maintenance inspections
   - Line walking specifically for pipeline sleeves
2. Review our asset risk categorisations from our maintenance inspections and UKOPA database:
   - All high-risk sleeves require remediation within the next 5 years, and the volume of high-risk sleeves has formed the basis for our RIIO-3 workload.
   - We understand the volume of nitrogen and construction sleeves within this high-risk cohort.

3. Apply Unit Cost
   - In our December 2024 submission, we used a blended unit rate based on RIIO-2 workload and intervention volumes to forecast programme expenditure. However, as part of the draft determination, we have reviewed RIIO-2 actuals alongside recent external quotations to gain a more accurate and granular understanding of intervention requirements. As a result, we consider it appropriate to apply individual unit costs for nitrogen and construction sleeves.

This approach ensures that the proposed RIIO-3 workload is evidence-based, risk-prioritised, and compliant with statutory obligations under PSR (1996) and PSSR (2000). More information on our approach to deriving workloads can be found in Section 6.

5 Identifying Faults

To discharge our legal obligations under PSSR 2000 to maintain all HP pipelines and associated sleeves, we undertake a range of pipeline monitoring activities. The aim of this approach is to keep the risks associated with operating these assets ALARP.

5.1 Fault categorisation

We use our maintenance data combined with our UKOPA model to derive an overall risk ranking factor (high/medium/low) for each sleeve. The UKOPA model combines:

- **Probability of failure**: The asset factors used include the age of the pipe/sleeve, coating type, whether subject to In Line Inspection (ILI), status of the Cathodic Protection (CP) system, sleeve material and thickness, and the annular fill type. These factors are combined in the model to determine a pipeline leakage factor and an associated ranking factor (high/medium/low).
- **Probability that failure will lead to an impact:** Within the UKOPA model, a range of consequence factors are used to take account of the location, hazard size, and the probability of ignition. These are combined to determine a consequence factor and an associated ranking factor (high/medium/low).

The two ranking factors are then combined to provide an overall ranking (high/medium/low).

The detailed UKOPA data extract that has been used for our submission can be found in Appendix A.

6 Deriving Forecast Workload

Our asset management policy, in adherence with PSR 1996 and PSSR 2000, states that high risk sleeves will be resolved within 1 to 5 years, and medium and low-risk sleeves do not pose sufficient risk for any intervention or remediation in advance of the next examination date. The volume of high-risk sleeves has therefore formed the basis for our RIIO-3 workload.

At the time of the business plan submission, UKOPA risk data, internal engineering and operational expertise highlighted [redacted] high risk sleeves in the network, of which a large number had an unconfirmed classification of nitrogen or construction. In our December 2024 submission, we did not apply any mathematical assumptions to the classification of unconfirmed sleeves, however, we acknowledged that a proportion of these sleeves would likely be identified as nitrogen sleeves following further investigation. This was reflected in our planning assumption of five nitrogen sleeve interventions per region per year, as outlined in Section 8.4 of EJP 14 - Pipeline Monitoring and Protection.

As part of our recent validation process, we have revised our approach to enable a data based forecast of construction and nitrogen sleeve intervention volumes.

To do this, we have applied the observed ratio of known sleeve types across the asset base, 24% nitrogen sleeves and 76% construction sleeves, to the unconfirmed population. This proportional allocation allows us to infer the likely distribution of sleeve types across the full asset base, ensuring our planning reflects the expected complexity and cost of future interventions.

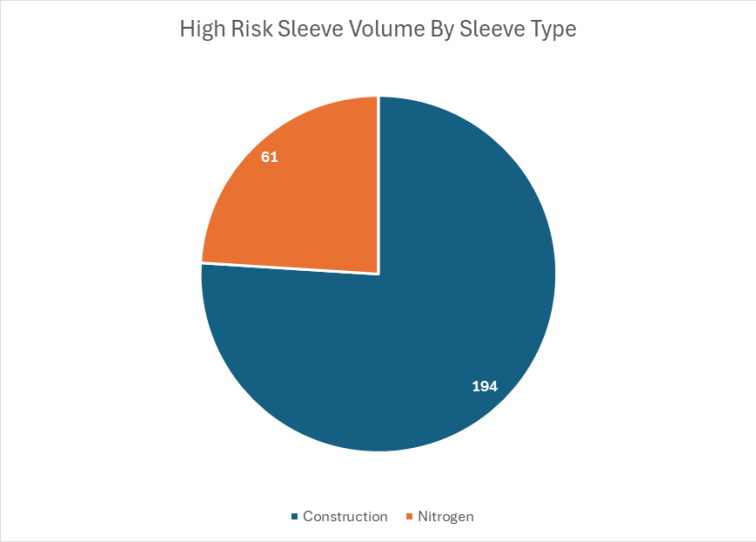

Figure 2: Volume of high risk sleeves by sleeve type with inferred 76:24% ratio applied

Applying a mathematical ratio of construction to nitrogen sleeves (24%:76%) to the [redacted] high-risk sleeves identified in the UKOPA database results in an estimated [redacted] nitrogen sleeves, compared to [redacted] nitrogen sleeves assumed in our original engineering-based submission. While both approaches carry inherent risk (owing to both being assumption based and particularly given the uncertainty of the unconfirmed sleeve population) we believe that the mathematically derived volume of [redacted] nitrogen sleeves is acceptable tolerable risk for our RIIO-3 programme in allowing us to manage the risk in asset base sufficiently while continuing to improve our understanding of the unknown sleeve types through ongoing inspection and validation.

7 Unit Cost Methodology

7.1 Background

The root cause of a sleeve fault cannot be determined without further investigation. As a result, it is not currently possible to accurately forecast the underlying causes or the specific interventions that may be required as part of the forward RIIO-3 sleeve remediation programme. However, the typical remediation required per sleeve type is summarised in table 3 below.

Pipeline Asset	Risk / Fault	Intervention Mode Considered
Construction Sleeves	Sleeve touching pipeline	Excavate sleeve and pipeline, cut back sleeve, and repair pipeline.
	Sleeve deteriorating	Excavate and remediate sleeve
Sleeves: Nitrogen	Fault	Excavate, refurbish seals and sleeve and refill with nitrogen, replace nitrogen monitor
		Excavate, refurbish seals and sleeve and refill with alternative product

Table 3: Typical pipeline sleeve intervention modes

Intervening on nitrogen sleeves introduces additional complexity compared to construction sleeves. The scope of work can range from relatively straightforward leak repairs to more involved interventions such as full sleeve removal, breaking sleeve-to-pipe contact, and reinstating the nitrogen system. These activities often require significant excavation and specialist handling, driving increased variability and cost.

7.2 Unit Cost Derivation

For our December 2024 submission, we derived a blended unit cost for both nitrogen and construction sleeves based on the volume of work delivered and the average costs observed across our RIIO-2 sleeve intervention programme. These unit costs are outlined below:

- Construction sleeve: £[redacted] based on RIIO-2 average costs.
- Nitrogen sleeve: £[redacted] based on supply chain estimates, reflecting the known additional complexities and risks associated with nitrogen sleeve interventions, which are not adequately captured by historic averages.

This derived an average cost of £[redacted] which was applied to the forecast workload.

As part of our recent review, we have:

- Reviewed three external quotations for 2025/26 nitrogen sleeve interventions, with costs ranging from £[redacted] to £[redacted] [2]. Grout application constitutes the primary cost driver for these works, with overall costs strongly influenced by both the pipe length and annulus diameter. These costs do not include overheads and project management costs.

[2] 2023/24 price base

- Ascertained a sample of 20 construction sleeve interventions across the network over the course of RIIO-2, with costs ranging from £ [redacted] to £ [redacted]. Similar to the above, these costs do not include overheads and project management costs.

This updated cost evidence provides a more accurate and granular understanding of intervention requirements. As a result, we now consider it appropriate to apply the individual unit costs for nitrogen (£[redacted]k) and construction (£[redacted]) sleeves rather than a blended rate. This adjustment leads to a **reduction in overall expenditure** for this investment case, while ensuring the cost model remains reflective of actual delivery conditions and market pricing.

The increase in total unit cost from RIIO-2 to RIIO-3 reflects a more accurate understanding of the technical complexity and risk associated with nitrogen sleeve interventions, however, we consider the application of our unit costs to derive a programme that is cost-reflective and aligned with the actual intervention requirements, crucially, avoiding underfunding and ensuring continued compliance and safety.

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8 Preferred RIIO-3 Workload and Costs

Using the known high-risk faults identified within the UKOPA database (as submitted in December 2024) we have applied the inferred sleeve population outlined in section 6 and then applied the individual unit costs outlined in section 7 to these volumes to derive a forecast spend.

The RIIO-2 sleeve intervention programme included targeted investment in nitrogen sleeves, specifically those exhibiting the highest levels of nitrogen leakage. These interventions were primarily delivered through grouting techniques, which addressed containment issues and mitigated environmental and safety risks. As outlined in EJP14, this approach will continue into RIIO-3, where our investment strategy remains focused on sleeves where containment is compromised. This ensures that nitrogen sleeves presenting the greatest operational risk are prioritised, supporting compliance with safety regulations and maintaining the integrity of the high-pressure pipeline network.

A summary of the revised workload and forecast costs is presented in Table 4 and Table 5 for Ofgem's assessment. This reflects the application of a mathematical assumption in place of the previous engineering assumption, along with the use of individual unit costs to improve accuracy.

Table 6 and Table 7 present the workload and expenditure as submitted in December 2024 to enable comparison.

The resulting reduction in nitrogen sleeves correlates with a reduction in overall spend for this investment case. We consider this justified to allow us to manage an emerging risk with this aging asset type yet work in RIIO3 to improve visibility of sleeve categorisations within the unknown population.

Volume of Interventions												
	26/27		27/28		28/29		29/30		30/31		RIIO-3 Total	
	Cons	N2	Cons	N2	Cons	N2	Cons	N2	Cons	N2	Cons	N2
EoE	[redacted]											
NL												
NW												
WM												
Cadent												

Table 4: Revised RIIO-3 forecast pipeline sleeve intervention volumes

Spend (£m)												
	26/27		27/28		28/29		29/30		30/31		RIIO-3 Total	
	Cons	N2	Cons	N2	Cons	N2	Cons	N2	Cons	N2	Cons	N2
EoE	[redacted]											
NL												
NW												
WM												
Cadent												

Table 5: Revised RIIO-3 forecast intervention spend (£m)

Volume of Interventions						
	26/27	27/28	28/29	29/30	30/31	RIIO-3 Total
EoE	[redacted]					
NL						
NW						
WM						
Cadent						

Table 6: Submitted RIIO-3 pipeline sleeve intervention volumes

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Spend (£m)						
	26/27	27/28	28/29	29/30	30/31	RIIO-3 Total
EoE	[redacted]					
NL						
NW						
WM						
Cadent						

Table 7: Submitted RIIO-3 pipeline sleeve intervention spend

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9 Conclusion

Our proposed RIIO-3 sleeve intervention programme is based on a structured, risk based approach to maintaining the safety and integrity of our high-pressure pipeline network. In response to Ofgem's feedback, we have strengthened the evidence base by using validated asset data, UKOPA risk modelling, and delivery experience from RIIO-2.

We recognise that nitrogen sleeve interventions are more complex and costly than construction sleeves due to the specialist techniques required, such as seal refurbishment and nitrogen system reinstatement. These differences mean that applying a single unit cost of a construction sleeve intervention for all sleeves, as suggested in the Draft Determination, does not reflect the true nature of the work.

To address this, we have applied individual unit costs that reflect both sleeve types. This approach is based on actual RIIO-2 delivery data and supplier quotations, ensuring our forecast is realistic and cost-reflective.

We also acknowledge that a large proportion of sleeves remain uncategorised. Our engineering analysis suggests that many of these will require nitrogen-specific interventions. Assuming all sleeves in the programme are construction risks underfunding the programme and could compromise safety and compliance.

We therefore recommend utilising the individual unit cost approach for RIIO-3. This reflects the mix of sleeve types, supports our legal obligations, and ensures the programme is safe, deliverable, and financially robust.

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10 Appendices:

Appendix	File Names
A: UKOPA data	[redacted]