Engineering Justification Paper

High Volume Gas Escape

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Classification: Highly Confidential

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2 Introduction

This paper is for the next step in implementing the High Volume Gas Escape (HVGE) Toolbox developed under the Network Innovation Allowance (NIA) framework within SGN Innovation department.

This project is developing a range of tools capable of responding to HVGE on pipelines operating up to 7bar (excluding those within buildings).

2.1 General Background

Gas Networks currently deal with high volume gas escapes through applying a range of temporary solutions, which avoids contact with the pipe or intervention on the leak by Gas Operatives. These gas escapes also have the potential to provide significant disruption in supply to customers.

2.2 Site Specific Background

This equipment relates to all of the UK.

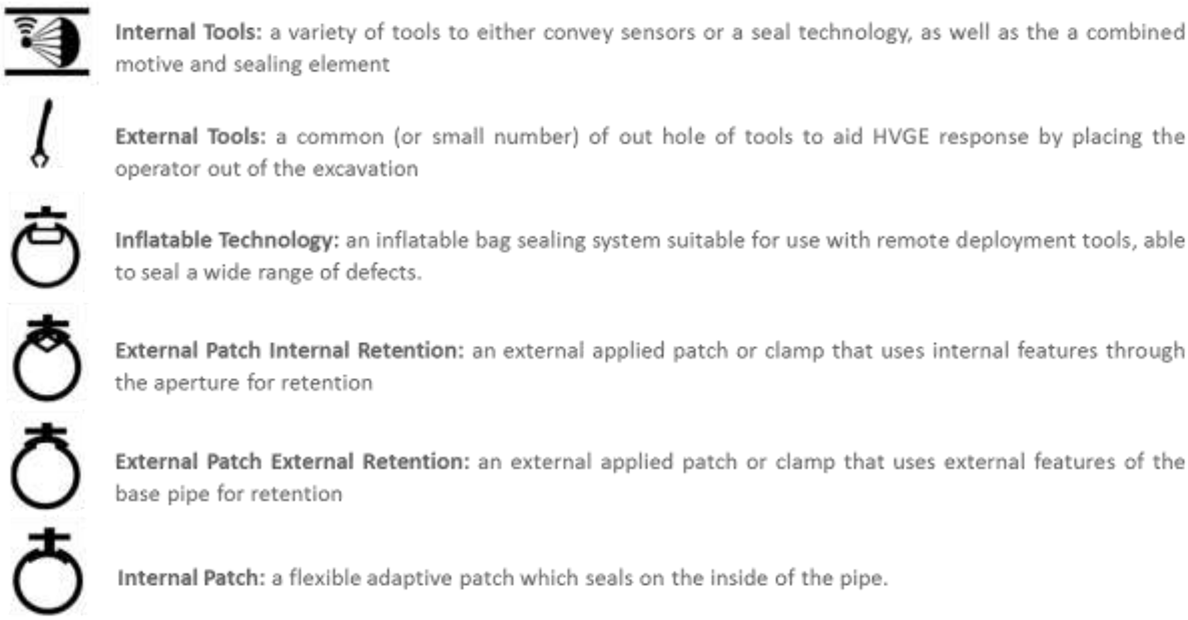
3 Equipment Summary

The purpose of this HVGE Toolbox enables a safer and smarter process of stopping the escape through a range of interim and permanent repair options allowing the gas escape to be repaired safer, quicker and cheaper. The Toolbox allows for a particular tool to be selected depending on the type of gas leak encountered.

As the project is still in the development phase, these options will be devised by undertaking a wide technology review with a firm basis in the operational environment and the demands faced.

The concepts are being investigated as listed in **Figure 1** below.

Figure 1: List of tool concepts



4 Problem Statement

SGN currently respond to between 1,000 and 1,500 gas leaks per year (not including interference damage) from Polyethene (PE) pipes. Based on similar information from the other Gas Networks, the total UK figure is likely to be around 6,000. HVGE, although uncommon, pose a risk to individuals and infrastructure in their vicinity. The causes of HVGE are often by third party damage but it is SGN's first responders and subsequent incident management team's responsibility to remedy the situation safely and quickly with as little damage to the surrounding environment.

In effect, there are 3 issues that need responding to:

1. Removing risk of explosion etc. to public, staff and contractors.
2. Mitigating the consequences of the loss of gas.
3. Ensuring continuation of supply to customer.

Current procedures for repairing PE piping systems (pipes and fittings) only allow cut out and replacement as a permanent repair for a leaking or damaged section. This proposes a threat to the operative as they are required to remedy the gas escape in a live gas environment. The types of PE damages that require repairs can be seen in Error! Reference source not found. below, all three w ould likely require differing.

Figure 2: Sample escapes on PE from Edinburgh Depot

It should be noted that disruption to customers can also pose a safety risk as many are heavily reliant on gas supplies for heating during the winter months, therefore maintaining a safe supply to the customers is critical. Particularly to those living in vulnerable circumstances.

The HVGE Toolbox eliminates these safety issues by providing the ability to apply a permanent repair technique helping to reduce time and costs, as well as providing significant safety benefits for operatives.

4.1 Narrative Real-Life Example of Problem

An example of a HVGE, where all three issues listed in Section 4 became evident, was at an incident in a significantly built-up area in Edinburgh. The damage was caused to a Medium Pressure (MP) main by a third party using an industrial pile driver rig as shown in Error! Reference source not f ound..

Figure 3: Bauer industrial pile driver that caused damage to main

The damage was considerable, as shown in Error! Reference source not found., requiring a s ignificant amount of manpower equipment and engineering to resolve the issue. The incident is not alone in causing disruption, in the Edinburgh area alone, we have seen a number of incidents of HVGE that have also led to significant repair and replacement costs.

Figure 4: Damage to PE Main

One such incident, an explosion in May 2016, resulted in one employee being severely injured whilst working within the excavation; another was treated at the scene. This happened after SGN had been onsite for nine hours fitting a bypass on a MP main in response to damage caused by a third party.

Over the last five years we have experienced 48 incidents which have resulted in fires and explosions and a total of 187 HVGE. As an average this equates to 37 per year.

4.2 Spend Boundaries

The proposed spend focusses on the list of tool concepts detailed in **Figure 1**. Funding is proposed via the uncertainty mechanism as this is an Innovation project and the costs are not yet certain.

5 Probability of Failure

There is a possibility that in the event of a HVGE the damage to the PE piping system could be so significant that the equipment within the HVGE Toolbox cannot be used to create a permanent repair, therefore conventional methods would be referred to.

5.1 Probability of Failure Data Assurance

No current failure data is known so assurance is not possible at this time as the uncertainty level is high.

6 Consequence of Failure

In the event of the HVGE Toolbox not being suitable, conventional methods would be referred to. These techniques are tried and proven and therefore would still be able to remedy HVGE events.

7 Options Considered

The two options considered within the EJP are listed below:

- **Option 1 – Do nothing (base case option)**

This option would mean we would continue with existing techniques for responding to HVGE and for carrying out repairs. Current methods put the response team, operatives and customers in a dangerous environment. The current method also takes more time to apply compared to the HVGE Toolbox method.

- **Option 2 – Invest in HVGE Toolbox kit (Preferred Option)**

This is the preferred option to improve safety on the HVGE sites and respond to escapes quicker. This also provides environmental benefits by being able to respond to HVGE more effectively. Please see Environmental Action Plan Appendix 3.

Due to each incident's individual nature, it is difficult to accurately estimate the savings, therefore a conservative analysis was carried out which outlines the minimum savings of the HVGE Toolbox. The information outlined below has been gathered and supported from within the business.

7.1 First Option Summary - Current Method

As mentioned in Section 4.1 in the past five years SGN have had 48 incidents that have resulted in fires and explosions and a total of 187 HVGE, an average of 37 per year.

These incidents result in a loss of downstream gas supplies to customers and the period of loss can vary. This affects our planned work and will require additional resources to deal with the HVGE situation. These events have implicit loss of supply and reconnection costs. The more effectively these events can be dealt with the greater the financial benefit. The cost of historic incidents has varied enormously from £5k up to £250k.

A conservative value of **£20,000** has been considered for each high-volume gas escape. Therefore, an estimated total cost of 37 events per year is approximately **£740,000**.

7.2 Second Option Summary - HVGE Toolbox

The potential savings estimated, when applying a live repair based on using prototype tools developed as part this project, is estimated to have an impact of between 20 - 30% of its cost. Therefore, being conservative and basing impact on 20% on potential cost savings, would result in a cost of **£592,000**. This equates to a total cost saving of **£148,000** per annum.

As previously mentioned, the main driver for this project is the safety aspect and reducing the exposure to high volume gas escapes to those in operations dealing with these situations; the potential financial benefit is to be considered a positive additional outcome to main driver.

The above costs are based on assumed costs, as an innovation project there is a degree of uncertainty. For this reason, we are requesting a total of £1 million for the roll out of the project via Ofgem's uncertainty mechanism, which will be split across years 3 and 4 of GD2 as shown in the Asset spend profile in **Table 3** (section 9.2).

7.3 Third option – Do nothing

This option has been discounted as we are obligated to attend and make safe gas escapes as part of our licence obligations.

7.4 Options Technical Summary Table

Table 1: Technical summary overview

Option	First year of Spend	Final year of spend	Volume of Interventions	Equipment Design life	Total cost (£m)
Option 1: Do Nothing	Pre GD2	TBC	Medium	N/A	0.74
Option 2: Stent Bag	2023	2025	Medium	20 years	1.00

7.5 Options Cost Summary Table

Table 2: Comparison cost and savings

Option	Cost Breakdown	Total Cost (£m)
Option 1 – Continue with current method (base case option)	£740,000 pa using current methods to respond to HVGE	0.74
Option 2 – Invest in HVGE Toolbox kit (Preferred Option)	We are requesting a total of £1 million for the roll out of the project via Ofgem's uncertainty mechanism	1.00

8 Business Case Outline and Discussion

8.1 Key Business Case Drivers Description

The key business drivers are:

- Remove personnel from the hazardous area.
- Reduce time of gas escape.
- Reduce disruption to customers who are heavily reliant on gas supplies for heating during the winter months, therefore maintaining a safe supply to the customers is critical.

8.2 Business Case Summary

Currently there are no efficient ways of resolving HVGE. The HVGE Toolbox looks to provide the operative with a safe and effective option to manage a range of HVGE scenarios.

9 Preferred Option Scope and Project Plan

9.1 Preferred Options

The preferred option for the GD2 period is to apply option 2 and provide a minimum of two HVGE Toolboxes within each of our depot sites.

9.2 Asset Health Spend Profile

Based on the cost model, the spend profile for GD2 is highlighted in the **Table 3** below.

Table 3: Asset Health Spend Profile

Asset Health Spend Profile (£m)						
Pre GD2	2021/22	2022/23	2023/24	2024/25	2025/26	Post GD2
0	0	0	0.75	0.25	0	0

9.3 Investment Risk Discussion

Project risk will be reduced by using Ofgem's uncertainty mechanism as described below.

9.4 Uncertainty Mechanism

Due to the nature of NIA projects there is a level of uncertainty of the delivered outputs. From our extensive experience on NIA projects, engagement with the wider business and experience with HVGE, we believe the information outlined within this report to be accurate. Our justification is as follows:

What is the issue/risk that the proposed mechanism addresses?

The HVGE Toolbox tackles the issue of HVGE, where SGN have a lot of experience, and policies in place to respond and resolve a range of different HVGE scenarios. With this experience the risk of introducing new kit is minimised.

The NIA project is in the development phase, therefore there is a risk that the project may not meet the set project deliverables. Agreements are in place with all parties to mitigate any issues occurring, therefore we request the sums above to support the uncertainty associated.

Where does the ownership of risk lie in relation to the uncertainty?

Ownership of the risks lies with both project partner and SGN as both rely on each other to achieve project outputs. With both parties wanting to achieve the set project deliverables the risk is minimised.

Materiality of issue

The issue of HVGE can incur large costs, for example outlined within Section **Error! Reference source not found.**based on the 37 incidents could cost over **£0.74m** in man hours and equipment. The HVGE Toolbox looks to reduce this cost to **£0.592m**, resulting in a **£0.148m** saving (outlined in Section **Error! Reference source not found.**).

Frequency and probability of issue over the price control period

Safety is critical for our staff and customers, the number of HVGE cannot be determined.

What is the proposed mechanism?

The proposed mechanism of investing in HVGE Toolbox is critical to maximise our performance against HVGE within GD2. Therefore, the proposed method for the GD2 period is to apply a minimum of 2 HVGE Toolbox within each Depot site.

What are the justifications for the mechanism?

The mechanism will allow us to improve our performance against HVGE, increasing safety for our staff and customers and reduce the environmental impact associated with HVGE. Therefore, the mechanism within this report is critical for our safety and environmental performance for GD2.

What are the drawbacks of the proposed mechanism?

With our extensive knowledge on HVGE and on NIA projects there are limited drawbacks to the proposed mechanism.

Can the drawbacks be reduced?

N/A

Explanation of how on balance, the mechanism delivers value for money while protecting the ability to finance efficient delivery.

The benefits of being able to respond to HVGE safely and efficiently, whilst reducing the environmental impact outweigh the drawbacks.

Treatment in Business Plan Data Templates (BPDTs)

The project described has been included in **3.05 (Other Capex)** BPDT.

Appendix A - Acronyms

Acronym	Description
HVGE	High Volume Gas Escape
MP	Medium pressure (up to 2bar)
pa	Per annum
PE	Polyethene