

## New trenchless methods for Gas pipelines renovation

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### Abstract

The causes of gas pipelines ageing and methods of their inspection are presented in this paper. The authors made a detailed analysis of trenchless methods of saeling and renovation of gas networks, available on the Polish market nowadays. The technical aspect of renovation methods are also described. A short review of most popular renovation methods, with their advantages and disadvantages.

**Key words:** gas pipelines, renovation of gas networks

### Introduction

The late 1990s are a time of a great development of trenchless techniques and technologies for gas-pipelines renovation in Poland. Operators started to readily use plastics, which are crucial for this kind of technology. It can be undoubtedly stated that trenchless renovation of pipelines is most advantageous, still the choice of the optimum method remains an open question. A good decision can be taken only on the basis of a sound knowledge of the present state of the renovated pipeline.

### Evaluation of the present state of the gas pipeline

Safe exploitation and ability to assess the real condition of gas pipelines remains one of the biggest problems set against the owners of transport networks. Inspections of gas pipelines, monitoring of their technical state, changes in the course of exploitation over the years are the basic tools used by the operators. Attention is drawn to the state of material structure, state of connections, insulation layers, corrosion, etc. These methods should enable an inspection inside long sections of the pipelines, without breaks in gas deliveries. The development of trenchless methods offers the user a possibility to gain all the needed data about the present state of the gas pipeline at minimized losses caused by inspections. Inspection are usually carried out on the basis of:

- Gyro control.
- Supersonic flow detector.
- Magnetic flow detector.
- TV inspections.

Failures of gas pipelines are usually classified on the basis the depth of cavities in the wall of the pipeline, as referred to its original thickness [2].

### The most frequent causes of aging

The untightness of gas pipelines can have a number of causes. The most significant one lies in the lowered bearing capacity of steel pipelines caused by a long exploitation and increasing external loads, e.g. traffic, which have not been accounted for in the design projects.

Among the basic factors of pipelines aging are [6]:

- construction and material conditions:
  - o kind and quality of material of the gas pipeline,
  - o strength and corrosion parameters,
  - o kind and quality of pipe-connections,
- technological deposition of the gas pipeline:
  - o its locality (pavement, greenery belt, road), landscape, traffic intensity, overhead power lines,
  - o kind of soil (degree of looseness, permeability, aggressiveness of soil),
  - o locality of other utilities with respect to the gas pipeline,

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- composition of delivered gas:
  - o physicochemical properties (chemical composition, humidity, aggressiveness),
  - o gas pressure.

### **Trenchless methods of gas pipelines renovation**

Trenchless technologies lie in deposition, fixing or renovation of underground infrastructure with little or even zero digging operations. Fixing operations are a special case of renovation, when the technical capacity of the gas pipeline is restored through sealing or local repairs. Sealing up operation lie in filling undug or leaking places with a sealing material or injecting liquid sealing materials inside the pipeline. Thus, external and internal sealing up methods can be distinguished.

World's technology offers a number of replacement, renovation and sealing up methods, which satisfy branch safety standards. Among the most frequently used trenchless renovation methods are [1, 3, 4, 5, 6]:

Sliplining:

- Relining

Close Fit Lining:

- U, C,  $\Omega$  - Liner
- Swagelining
- Cured-In-Place Lining
- Starline 2000

On-Line Replacement:

- Pipe Bursting
- Pipe Splitting
- Pipe Eating

Spray Lining:

- Subterra Method

Live Insertion:

- Steve Vick International Method

Segmental Lining:

- Sanlinick 2000
- Avonseal Two
- Encapsulation

### **4. Factors affecting trenchless method selection for gas pipelines renovation**

In the case of a bad technical state of the pipeline, the most suitable renovation method can be selected on the basis of the inspection results.

The use of trenchless methods of pipelines renovation as compared with the traditional ones gives the following advantages:

- minimization of earth work,
- minimization of traffic disturbances,
- comparable, or even lower cost than in the case of traditional methods,
- short time of completion.

To select the best renovation method, attention should be paid to a number of gas pipeline data, e.g.:

1. Kind of material for the gas pipeline,
2. Locality of the gas pipeline,
3. Technical state,
4. Kind of damage,
5. Diameter of gas pipeline,
6. Type of surface,
7. Inspection data,
8. Number of customers,
9. transported gas pressure,

10. Flow capacity of pipes,
11. Gas consumption.

On the other hand, it is also necessary to account for factors typical of a renovation method, i.e.:

Type of material used for renovation.

Technical limitations of a given renovation method, e.g. Decreased diameter of the gas pipeline.

Renovation technology.

Influence of a given method on underground infrastructure.

Equipment available and qualification of the renovation crew.

The trenchless technology method should be justified with respect to profitability and safety. Thus, a number of factors have to be analysed in detail:

- direct costs:
  - o maintenance – frequent replacements of damaged parts,
  - o gas losses through damaged pipes and connections,
  - o gas losses through connections caused by, e.g. increased gas pressure,
- indirect costs:
  - o technical supervision,
  - o cost of equipment needed for maintenance or repairs,
- other costs:
  - o safety,
  - o qualitative services,
- A quick renovation operation has the following advantages:
  - o reduced gas losses,
  - o smaller number of gas stealing incidents,
  - o reduced environmental pollution,
  - o better safety parameters.

Maximization of gas flow capacity is vital for renovation methods in the case of tight concentric pipe arrays.

### Conclusions

Gas pipelines renovation techniques are more and more commonly applied in Poland. Among the most important advantages of these techniques are:

- o minimized noxiousness for the citizens,
- o little or zero chance to damage cables and other underground utilities,
- o minimum environmental impact,
- o little co-operation with other technical services,
- o time and money savings.

Each gas pipeline renovation method has its advantages and disadvantages, possibilities and limitations, depending on the application. To conclude, trenchless renovation of gas pipelines certainly will be more readily used in the future because of the mass aging of the gas pipelines. The other reason is the lack of space for new utilities, increasing costs and road-surface restoration requirements.

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