International Conference on Smart Energy Systems and 4th Generation District Heating
Copenhagen, 25-26 August 2015

Influence of stray currents on district heating pipelines failure rate

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VEOLIA

4DH
4th Generation District Heating
Technologies and Systems

4DH
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VEOLIA

- 529 district and local heating and cooling networks around the world.
- Operates in 49 Polish cities: Warsaw, Łódź, Poznań and others.
- 3 core businesses: Water, Waste Management & Energy Services .

Heat-Tech Center
Research and Innovation

- R&D center for district heating of Veolia.
- 3 projects: Reliable DH, Smart Substation, Smart DH
- Laboratory for testing the quality of pre-insulated pipes

Content

Influence of stray currents on district heating pipelines failure rate

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Introduction

What is stray current and its influence?

- **Stray current is electricity flow via ground, underground structures (for example pipelines), and buildings caused by imbalanced electrical supply.**
- **Stray current is generated by train and tram electricity supply systems.**
- **Stray current causes electrochemical corrosion, thus, it increases the corrosion rate and causes more pipelines failures.**

Introduction

- **Future district heating system should use preventive maintenance approach, it means to forecast failures and take actions before they happen.**
- **In case of stray current such an action is installation of cathodic protection.**

Input data

This analyses used data from GIS (Geographical Information System) about:

- Pipelines
- Failures
- Zones of risk of stray current

Input data

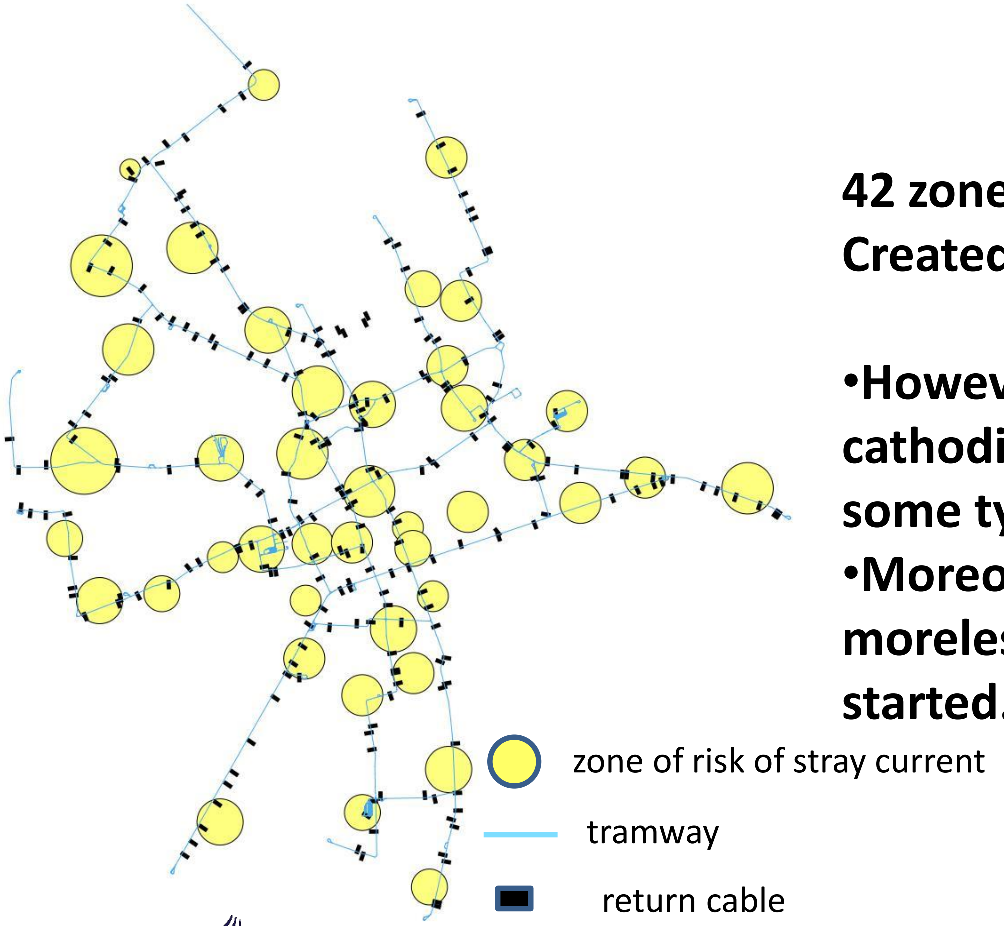
Length of network: 1691km
(the biggest DHN in EU)
Lenght of duct channel network: 989km
Lenght of preinsulated network: 702km

Failures in years 2003-2012: 4616
Identified failures: 2096
Identified duct channel failures: 1803
Identified preinsulated failures: 113
Identified failures of devices: 180

● failure

Map of failures prepared by
Heat-Tech Center (Artur Pszczółkowski)

Input data



42 zones of risk of stray current
Created by tramway electrical substations.

- **However, some of those zones have cathodic protection or are near it. Therefore, some types of zones should be created.**
- **Moreover, cathodic protection was installed moreless when the observation period started.**

Map received from
Electrotechnical Institute

Methodology

In order to compare influence of stray current a failure rate indicators have to be calculated for each type of zone for traditional pipelines.

Failure rate indicator = number of failures/length of network/observation period

Methodology

Assumptions for analysis:

- Include failures of pipelines only (excluded failures of „devices" – valves, etc.)
- Indclude failures for traditional technology only
- Take into account zones with length larger than 3,2 km

Results

Area	Number of failures	Length [km]	Failure rate indicator [failure/km/year]
All zones	272	131,36	0,21
Zones without protection and longer than 3,2 km	231	98,31	0,23
Zones with protection or near it	41	33,05	0,12
Outside zones	1509	828,6	0,18

Reduction of failures by almost 50%

Conclusions

- Stray current increases the failure rate of duct channel pipelines by 22%
- Cathodic protection can decrease a failure rate in zones with risk by 48%
- Applying cathodic protection can decrease cost of operation due lower number of failures:
  - cost of cathodic protection 5000 €
  - average cost of failure in Warsaw 6000 € (data for 2012)

Thank you for your attention.

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