Modern environmental technology tests in the Old Gasworks area in Bydgoszcz (project PROMOTE ETV-SGS)

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Abstract

PROMOTE is one of the currently running research projects evaluating and implementing ETV (Environmental Technology Verification). It is funded by the European Union in the 7th Framework Program. An ETV certificate guarantees that new equipment or innovative technology corresponds to the producer's description of advantages and simultaneously responds to the environmental requirements of EU experts.

ETV-SGS (Soil-Groundwater Systems) has to answer several logical requirements to be useful and understandable. The general rules of system operation are compliant with the PRINCE2 methodology applied in many countries. This involves laboratory and field test stages. In the PROMOTE project the research site in Poland was chosen for field tests of innovative measurements and monitoring technology. The site was located at the Old Gasworks in Bydgoszcz whose terrain is strongly contaminated. The area is recognized and documented with contamination by organic compounds of ground and groundwater – vestiges of 140 years of gas production from coal – hence became for PROMOTE project purposes and the ETV system an ideal research site. Despite the number of years since the site has been used, tests conducted in cooperation with the Municipality of Bydgoszcz and the land owner i.e. Pomorska Spolka Gazownictwa, confirmed the longevity of pollutants and the high risk assessment for the ground and groundwater environment. The results obtained are all the more credible as the innovative technology tests were verified with classical methods and simultaneous analysis in three different, independent European laboratories in Stuttgart, Barcelona and Warsaw.

Keywords: brownfield, old gasworks, groundwater contamination, Environmental Technology Verification.

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1 Introduction

PROMOTE is one of the currently running EU research projects evaluating and implementing ETV (Environmental Technology Verification) [10] coordinated by DECHEMA e.V. (Germany). ETV systems are already working in the USA [4], Canada [6], Korea and Japan [5]. It is reasonable to take advantage of existing patterns and experiences to implement the system in EU area. An ETV certificate guarantees that new equipment or innovative technology corresponds to the producer's description of advantages and simultaneously responds to the environmental requirements of EU experts. The objectives of PROMOTE are: 1) strengthening the competitiveness of technology developers and the acceptance of European technologies in the field of soil-groundwater remediation and monitoring systems. 2) Faster entrance and full access to innovative technologies in the European market.

ETV-SGS (Soil-Groundwater Systems) has to answer several logical requirements to be useful and understandable – "cost-efficient and fast", "valid", "un-bureaucratic" and "fair and generally comprehensive". The general rules of system operation are compliant with the PRINCE2 methodology that has already been applied in many countries. The ETV system involves laboratory and field test stages.

The PROMOTE field tests of innovative measurements and monitoring technology took place in Poland. The site was located at the Old Gasworks in Bydgoszcz whose terrain is strongly contaminated. The brownfield area had been examined by the PGI Working Group in the frame of INCORE in the 5th FP of the European Union (Irminski and Konieczynska [3]). The area is recognized and documented with contamination by organic compounds of ground and groundwater – vestiges of 140 years of gas production from coal (Hoppe and Perlinska [2]) – hence became for PROMOTE project purposes and the ETV system an ideal research site. Despite the number of years since the site has been used, tests conducted in cooperation with the Municipality of Bydgoszcz and the land owner i.e. Pomorska Spolka Gazownictwa, confirmed the longevity of pollutants and the high risk assessment for the ground and groundwater environment. The results obtained are all the more credible as the innovative technology tests were verified with classical methods and simultaneous analysis in three different, independent European laboratories in Stuttgart, Barcelona and Warsaw.

The city of Bydgoszcz was the first user of the Polish stage of PROMOTE deliverables (the investigation of industrial terrain located in the center of City). However the main goal of the field tests was an evaluation of several tools and technology being a "guinea pig" of the planned European ETV system. Within the project activity there were verified as follows: a photometer LF 300 (made by SLANDI, Poland), a sensometric sond MOX (made by VEGAS, University of Stuttgart, Germany), a minipressure pump (MPP made by IMW - Innovative Messtechnik Weiß, Germany) in combination with a fluorometer (made by VEGAS, Germany), a MPP with double packer, a minipiezometer system CMT

pipe (provided by IMW, Germany), and ceramic dosimeters in the form of passive samplers (made by IMW, Germany).

Each of the tools by design will facilitate and festinate field work in environmental protection. In consequence it will be economic with less impact on environment.

This presentation will show the results of field work and comparison to the traditional, classical research methods.

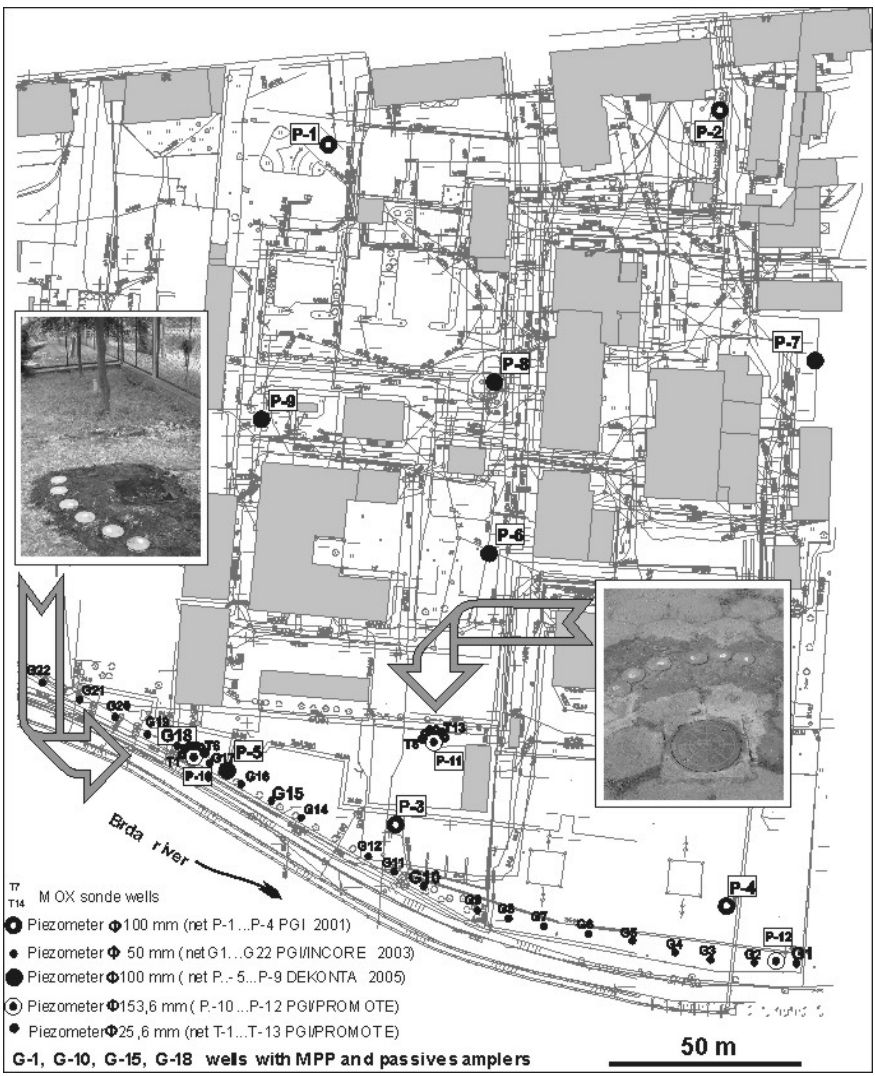

Figure 1: Localization of all investigation boreholes at the Old Gasworks area in Bydgoszcz (Poland).

2 Field ETV tests

For PROMOTE purposes (testing the innovative technologies) existing 2 inch piezometers from the INCORE project and new ones, designed in two additional research reference sites were used. Each of them constitutes a separate system of 1 inch piezometers in the very close neighborhood to some standard 5 inch piezometers which were treated as the comparative well (figure 1).

The holes were drilled in sand and gravel Quaternary deposits, to a depth of 7,5 m. Below this depth there are Tertiary silts and brown coal.

Both reference sites show insignificant differences of the level and type of contamination of the ground and groundwater consequent of location in different pollutant source areas (old pitch pits, underground containers of ammonia water, benzene and naphthalene etc.).

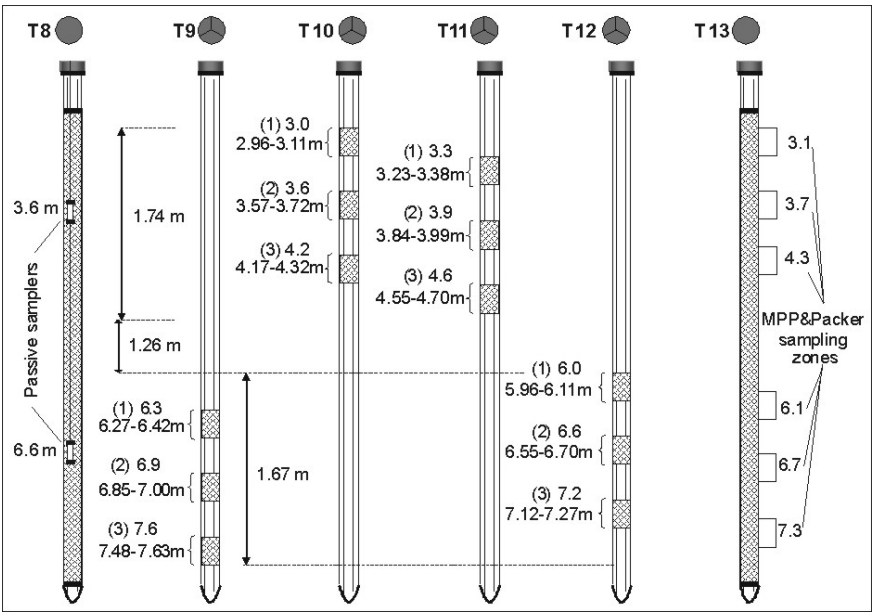

Figure 2: Sampling system of CMT pipe and 1 inch piezometer next to the well P11.

This piezometer system (figure 2) enabled testing of the horizontal diversification, either organic or inorganic contamination, in the water bearing layer. It was attained by providing triple comparative tests in a standard well (5 inch) using a set of MP-1 Grundfoss pumps with a double packer with a test in the CMT piezometer using a manual pump and a last test in the 1 inch hole using a minipressure pump (MPP) in combination with a double packer. Additionally passive samplers were installed in defined depth levels in 5 inch and 1 inch wells.

Similarly, the MPP results were checked with passive samplers in a set of nine pieces in the same four 2 inch holes located at the outflow of contaminated water into the Brda River.

The whole research site was controlled by the electronic measurement of the water table and water-air temperature in holes with the device called a diver. It recorded data every 15 minutes giving almost continuous information about the changes of the conditions at the site.

3 Tested technologies

The minipressure pump (MPP) is particularly useful for precise sampling of groundwater in aspects of volatile compound analysis such as naphthalene and BTEX [7]. The pump driving it is chemically inactive compressed nitrogen. The MPP size is small and its construction simple. It can be installed in small diameter piezometers at the water bearing layer or directly in the ground.

The small size and simplicity of operation give the MPP the greatest advantages. It was applied in two test reference sites at the Brda River in the Bydgoszcz Gasworks.

It is possible to obtain different combinations of several minipressure pumps at the different depth levels of the investigated water bearing horizon. Each pump was sampling water independently thanks to packer installation in the 5 inch hole (figure 4).

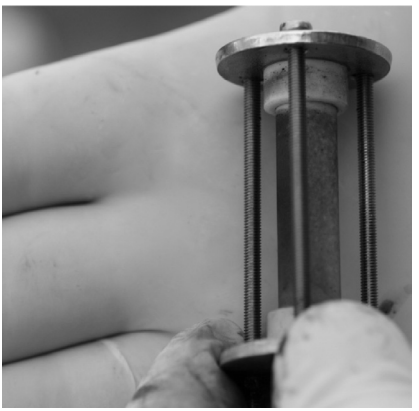

Figure 3: Disassembled sampler contaminated with polycyclic aromatic hydrocarbons. A stainless steel “cage” secures the ceramic tube in the field and during transport to the laboratory.

The photometer LF 300 is the newest product of the SLANDI company, designed for field applications to determine almost 150 substances in water or wastewater [11]. Because of instability of some of the chemical compounds a direct diagnostic at the borehole site is required. This research method doesn’t require a high budget and allows for speedy field work. A repeated analysis with

the photometer conducted in the mini field laboratory against the chosen chemical compounds was verified by analysis at certified laboratories in Barcelona (CSIC - Consejo Superior de Investigationes Cientificas, Spain) and Warsaw (PGI - Polish Geological Institute). It was possible thanks to the sampling methodology, which took three water samples simultaneously.

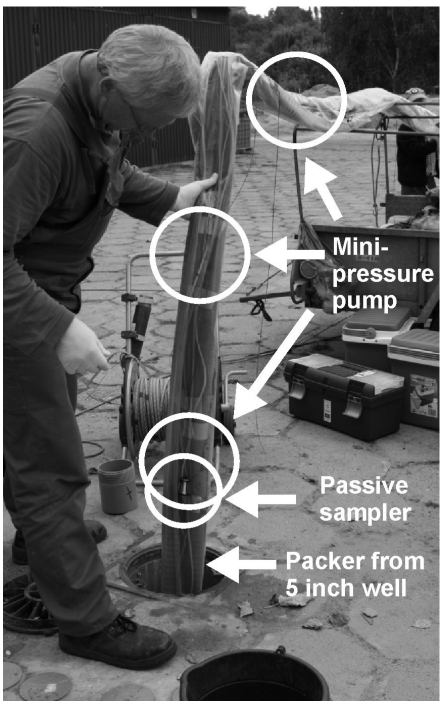

Figure 4: Packer disassembling in classical 5 inch well. A small sampler is seen tested in combination with the minipressure pump MPP (inside the protective cover of the packer).

Minipiezometers CMT are relatively cheap and easy to construct, mount and disassemble [8]. They enable drawing of the water samples from strictly determined depth levels (figure 2). Their disadvantage is the necessity of using the manual pump for a single application. It excluded application of the method for investigation of volatile compounds. The piezometer is a triple channel pipe of 1 inch diameter that can be applied for single tests and monitoring cases. Each channel has a different length to reach a different depth level that enables strict investigation of contamination variation with depth in the water bearing horizon. Drawing of the samples from the CMT triple channel piezometer is conducted with the simplest pump – a pipe with an inertial footvalve.

A special holes configuration was designed for CMT testing in Bydgoszcz. Their mutual localization together with classical 5 inch piezometers allowed

evaluation of the advantages and disadvantages of this method of water sampling.

CMT 1 inch piezometers were installed in holes drilled with the method of lost cone.

A Fibre Optic Fluorometer, made by VEGAS, University of Stuttgart, was constructed for detection of dissolved PAHs in groundwater, highly resolved over depth. The MOX – Metal Oxide Sensor System (made by VEGAS) detects chlorinated and non-chlorinated volatile compounds in soil air (Braun and Koschitzky [1]).

All the verified tools within the PROMOTE project were compared with a standard sampling method. There were double packer constructed on the base of the classic water pump MP-1 Grundfoss.

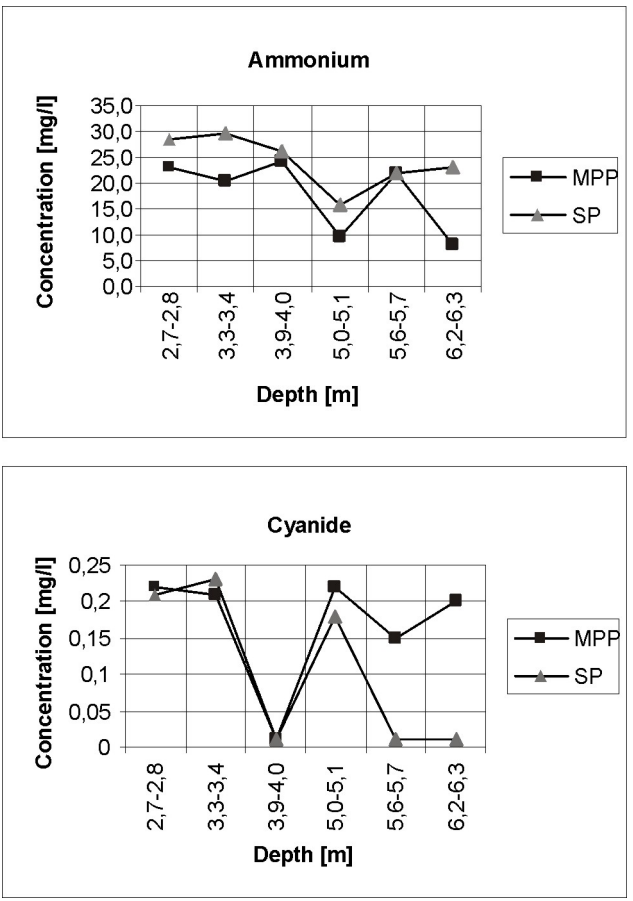

Figure 5: Preliminary comparison of the chemical analysis results of the water samples taken at the same depth level with different equipment (MPP – minipressure pump, SP – standard pump with packer system).

The results of all field test and laboratories analysis are currently being analysed by the international PROMOTE working group [10]. They are expected in April 2008.

Proper test execution verified the important part that can be played by operating the European ETV system in the future.

More information is available at www.promote-etv.org.

References

[1] Braun J., Koschitzky H.P.: The German Research Facility for Subsurface Remediation at the Universitaet Stuttgart. In: www.cetesb.sp.gov.br/rede/documentos/oficina_europeia/vegas_2.pdf
[2] Hoppe I., Perlinska A.: Od swiatla plomyka – 140 lat Gazowni Bydgoskiej, PGNiG S.A. Bydgoszcz 2000,
[3] Irminski W., Konieczynska M.: Dokumentacja hydrogeologiczna „Stara Gazownia", Bydgoszcz, ul. Jagiellonska 42. Arch. UM Bydgoszcz WGK.VII.753/4/05, Bydgoszcz 2005,
[4] www.epa.gov/etv
[5] www.epa.gov/etv/inter-partic.html
[6] www.etvcanada.com
[7] www.im-weiss.de/modell_409i.html
[8] www.im-weiss.de/produkte.html#multilevel
[9] www.im-weiss.de/produkte.html#passiv
[10] www.promote-etv.org
[11] www.slandi.pl/lab.html