

# OUTPUT FACT SHEET

## Pilot actions (including investment, if applicable)

Version 2

<b>Project index number and acronym</b>	CE32 AMIIGA
<b>Lead partner</b>	GIG, Central Mining Institute
<b>Output number and title</b>	O.T2.6 Passive groundwater treatment by bioreactive wall in Jaworzno FUA (PL)
<b>Investment number and title (if applicable)</b>	I1 Implementation of - passive GW treatment bioreactive wall in Jaworzno FUA
<b>Responsible partner (PP name and number)</b>	LP - Central Mining Institute; PP2 - City of Jaworzno,
<b>Project website</b>	<a href="https://www.interreg-central.eu/Content.Node/AMIIGA.html">https://www.interreg-central.eu/Content.Node/AMIIGA.html</a>
<b>Delivery date</b>	10/2019

## Summary description of the pilot action (including investment, if applicable) explaining its experimental nature and demonstration character

The Jaworzno FUA is dealing with a problem of groundwater contaminations as results of the Chemical Plant Organika-Azot S.A. activity in years 1965-1989.

Therefore, an urgent need for action aiming at solving the contamination problem in Wąwolnica Valley arose.

Within AMIGA project the following activities were performed and demonstrated in the contaminated sites of Jaworzno FUA:

- Supplementing of monitoring network to improve monitoring process of the current state of the environment at the Jaworzno site and to obtain the missing data on the actual extent of groundwater contamination. The collected data were used to modelling and development of dissolved pollution transport pathway in a 5- and 25- years perspective.

The pilot action consisted of 2 sampling campaigns carried out in July 2017 and July 2018. In particular the following items were investigated: BMT (Biological Molecular Analysis): total bacterial biomass (16S rDNA), organohalide-respiring bacteria, nitrifying and denitrifying bacteria, HCH degraders, sulphate-reducing bacteria, iron oxidizing and reducing bacteria, chemical analysis and carbon isotope analysis.

- Implementation and demonstration the novel technology of passive bioreactive barrier (PRB) for testing the effectivity of removal process of HCH contaminations in groundwater in the area of groundwater contamination with pesticides downstream the Chemical Plant Organika-Azot S.A.

PRB technology is an innovative groundwater remediation method which allows to combine of physical, chemical and biological in situ treatment of contaminated groundwater using different reactive materials, such as: iron chips, sand, peat, biochar and bacteria inoculum. The main goal of investment implementation was to test the effectiveness of the reactive barrier with microbiological deposit (especially prepared for this pilot action), as an appropriate component used for bioremediation of groundwater environment contaminated with persistent organic compounds, to elimination migration of contaminants, as well as to identify possible difficulties and the potential impact of carried works on the health of residents and the environment. Monitoring was conducted from May 2018 till September 2019. The samples for physical, chemical and biological analysis were taken twice a month. Laboratory tests (BMT and chemical analysis) were conducted in laboratories of Technical University in Liberec. The isotope analysis of groundwater samples was conducted in laboratory of Polytechnic of Milan.

The results showed the potential of the passive bioreactive barrier technology for groundwater treatment application, especially in the term of HCH pollution removal and allowed to calculate the sorption capacity of sand&peat bed for treatment of HCH load present in groundwater at the contaminated Jaworzno site. The operational monitoring results allowed to evaluate efficiency and progress of remedial technology as well as to prepare a guideline for further use.

### NUTS region(s) concerned by the pilot action (relevant NUTS level)

Nuts0: PL, Poland

Nuts1: PL2, Makroregion południowy

Nuts2: PL22, Śląskie

Nuts3: PL22B, Sosnowiecki

Functional area (FUA) Jaworzno is located in the southern part of Poland, in the eastern part of the Silesian Voivodship (PL22 - Śląskie) and the north-western part of the Małopolska Voivodship (PL21 - Małopolskie). Jaworzno FUA, the area of 201.9 km<sup>2</sup> covering the boundaries of homogeneous Groundwater Body (JCWPD) No. 146, includes the main part of the municipality of Jaworzno and partly surrounding cities and municipalities: Mysłowice, Sosnowiec, Bieruń, Imielin, Łęczyny and Chetm Śląski (Silesian Voivodship) and Libiąż, Chrzanów, Chetmek and the rural commune of Oświęcim (Małopolska Voivodship).

### Investment costs (EUR), if applicable

TOTAL INVESTMENT COSTS: 63.288,66 EUR

BREAK-DOWN OF MAIN COST ITEMS:

- 53.536,70 EUR - Implementation of the passive GW treatment bioreactive wall in the funnel & gate system;
- 3.110,15 EUR - Upgrading existing research points to collect data necessary to identify the effectiveness of the testing reactive barrier & monitor state of the environment;
- 6.641,81 EUR - Construction of new monitoring points necessary to identify the effectiveness of the testing reactive barrier & monitor state of the environment.

### Expected impact and benefits of the pilot action for the concerned territory and target groups and leverage of additional funds (if applicable)

The benefits of the pilot action for the Jaworzno FUA and target groups related to problem of Jaworzno contamination are as follows:

- Supplementation of the groundwater monitoring network around the Chemical Plant Organika-Azot S.A. and obtained results of the monitoring allowed to improve knowledge about the Jaworzna FUA and developed exchanges of information with target groups (representatives of the public authorities and others stakeholders). The received information together with the cooperation with representatives of Chemical Plant Organika Azot allowed to develop the plan of the reorganization of network for further monitoring of plum distribution.
- The results of modelling of dissolved pollution transport pathway in a 5- and 25- years perspective were widely discussed with the representatives of the Water Supply company of Jaworzno. This has allowed the elaboration of the concept of an warning system for water intakes.
- Demonstration of operation of the PRB technology for treatment groundwater in pilot scale allowed to promote innovative approaches to remediation on site among the representatives of the public authorities, stakeholders, professionals, researchers, distributors of technologies for groundwater treatment.

Overall, the realization of AMIGA allowed to develop the understanding of the scale of the groundwater pollution problem, the potential risk for water intakes and to promote the new methods of remediation among stakeholders.

### **Sustainability of the pilot action results and transferability to other territories and stakeholders.**

Jaworzno site is mostly contaminated by lindane and others HCH isomers. The problem of lindane contamination involves several locations in different countries all the world. Lindane was a pesticide widely produced after the World War II around Europe and the world. Lindane production has been stopped in Poland from 1982 and use of lindane has been prohibited in EU regulation from 2007, but the Lindane related pollution constitutes a risk to the human health and the environment.

The results of pilot action in Jaworzno were important to improve the knowledge and to found solution of HCH contamination problem by testing of innovative remediation method.

Obtained results that should be transferred to other territories and stakeholders are as follows:

- the experience in the development of knowledge about the existing hazards based on the innovative tools (BMT analysis (Biological Molecular Tools), CSIA (Compound Specific Isotope Analysis) and modelling),
- the experiences and knowledge that contribute to building of the warning system for water intakes,
- the experiences and knowledge that contribute to the solution of the contamination derived from the lindane and lindane production wastes by using innovative remediation technology,
- the guidelines for the start-up of the PRB system,
- the guidelines for improving the operation of PRB technology.

### Lessons learned and added value of transnational cooperation of the pilot action implementation (including investment, if applicable)

LP, GIG cooperated with the experts from Technical University of Liberec (TUL) in order to collect data about pesticides and volatile compounds concentration in groundwater samples and to evaluate the effectiveness of bio-barrier treatment. GIG team also cooperated with the expert from the Milan Technical University (PoliMi) during bio-barrier groundwater sampling campaign in order to assure proper sampling procedures for isotope analysis. The collected data allowed to evaluation of the planned environmental benefits of using of bio-reactive barrier building in the frame of AMIIGA project.

LP together with PP2 organized the technical meeting in which participated the representatives of LP, PP2, PP4 and PP5. The meeting was an occasion for exchange of experiences concerning the innovative remediation technology to improve of functioning PRB system in Jaworzno.

**Contribution to/ compliance with:**

- relevant regulatory requirements
- sustainable development - environmental effects. In case of risk of negative effects, mitigation measures introduced
- horizontal principles such as equal opportunities and non-discrimination

The implementation of pilot actions in Jaworzno FUA during the AMMIGA project is an important value for further developing legal regulations, especially in the aspect of remediation of contaminated areas and human health protection.

In particular, the achieved outcomes of AMIIGA project are compatible with activities planned in „Projekt Polityki Ekologicznej 2030” (PEP, eng. Ecological Policy Project), such as identifying contaminated soils and supporting their remediation. The results of AMMIGA pilot action provide guidelines for actions aimed at removing or reducing the amount of harmful substances, their control and limiting the spread.

In addition, it is planned to update the River Basin Management Plans for the water cycle 2022-2027. The update of the River Basin Management Plans will take into account actions that should be implemented to improve or maintain good water status.

The results of the state monitoring of groundwater quality in Jaworzno revealed their good quality. The AMIIGA project has demonstrated the need to expand the monitoring system with additional monitoring points, in particular located between the contaminated site and the water intake “Jarosław Dąbrowski”. AMIIGA project also showed that the elaboration of the models of dissolved pollution transport pathway in a 5- and 25- years perspective is a good practice, allowing the development of warning systems for water intake.

**References to relevant deliverables (e.g. pilot action report, studies), investment factsheet and web-links**

If applicable, additional documentation, pictures or images to be provided as annex

- D.T2.6.1 Report from selection of area for bioreactive wall
- D.T2.6.2. Preliminary geo-technical studies - report
- D.T2.6.3 Non-technical concept for bioreactive wall implementation
- D.T2.6.4. Technical project for bioreactive wall implementation - documentation
- D.T2.6.5. Selection of appropriate sorbent for bioreactive wall- report
- D.T2.6.6. Concept for pilot site monitoring - report
- D.T2.6.7. Preparation of biological inocula for bioreactive wall - report
- D.T2.6.8. Report from implementation of bioreactive wall at Jaworzno site
- D.T2.6.9 Report from pilot site monitoring
- D.T2.8.1 Report on initial evaluation of preliminary design of Pilot Action
- D.C.5.2 Final brochure <https://www.interreg-central.eu/Content.Node/AMIIGA---final-brochure-LR.pdf>
- D.T1.4.3 Guidelines including AMIIGA integrated approach to GW management:  
<https://www.interreg-central.eu/Content.Node/D.T1.4.3-final-version-guidelines---ENG-1.pdf> (English version)  
<https://www.interreg-central.eu/Content.Node/DT143-final-version-guidelines-FINAL-PL-31-10-2019.pdf> (Polish version)