OUTPUT FACT SHEET

Pilot actions (including investment, if applicable)

Version 2

Project index number and acronym	CE32 AMIIGA
Lead partner	Główny Instytut Górnictwa
Output number and title	O.T2.5.1; In-situ biologically Enhanced remediation in Novy Bydzov FUA (CZ)
Investment number and title (if applicable)	O.I6.1 Treatment and restoring of natural conditions of groundwaters in Novy Bydzov FUA (CZ)
Responsible partner (PP name and number)	Technical University of Liberec (TUL) / PP5
Project website	http://www.interreg-central.eu/Content.Node/AMIIGA.html
Delivery date	03.2019

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

The pilot action performed at Functional Urban Area (FUA) Novy Bydzov site has demonstrated the exemplary case study of conducting the biologically enhanced remediation of groundwater polluted with chlorinated hydrocarbons. Before the construction of new monitoring wells [which was among others a subject of the investement 6 (I6)] there was performed an initial groundwater sampling at the locality. In January and February 2017 there was a sampling action in the Novy Bydzov, including the BMT analyses of samples that were performed at Technical University of Liberec. The next work performed at the locality was devoted to evaluation of the specification of groundwater and dissolved pollution transport pathways at the site (Deliverable T2.5.2). Furthermore, Technical University of Liberec has conducted laboratory tests with groundwater samples taken from Novy Bydzov locality in order to choose the best (bio)treatment for the site. At first, four different carbon sources (lactate, glycerol, cheese whey and PHB (polyhydroxybutyrate)) have been tested and basing on several analyses (BMT, pH, ORP, conductivity), the best one was chosen for application i.e. cheese whey (Deliverable T2.5.4).

Owing to investment (I6) it was possible to construct five new monitoring wells (more details can be found in the uploaded deliverable evidence D.T2.5.1), the drilling works were performed by the contractor of Technical University of Liberec - DEKONTA a.s; the work was monitored by project partner 4 (PP4; Novy Bydzov city and Forsapi company). The partner PP4 has supported activities of Technical University of Liberec via mutual cooperation in site intrastructure preparation, external expert of PP4 and project team assistance – communication with properties owners, entrance on private properties for Technical University of Liberec experts and their technics and equipment. In addition, there were 5 monitoring rounds of the whole Novy Bydzov functional urban area (the monitoring program was carried out twice a year; the initial groundwater monitoring campaign was carried in January 2017. The next campaigns were performed in June 2017, in November 2017, in July 2018 and in December 2018).

Moreover, investement 6 also included injection of the biosubstrate (cheese whey) in 3 separate injections rounds (10 injection points each), which resulted in natural restoration of the initial conditions at the site (overall 15 operational monitoring rounds were performed; samples were taken for chemical, BMT and isotopic analyses; more details can be found in the uploaded deliverable evidences D.T2.5.5, D.T2.5.6 and D.T2.5.7). It has to be mentioned that the PP4 team as well as the external expert of PP4 assisted Technical University of Liberec with expert services (groundwater, monitoring, supervision on determined services etc.) during realization of investment I6.

Thanks to the invented by Technical University of Liberec – BMT tools as well as CSIA tools developed by PP7 it was possible to assure the effective and sustainable remediation (both at the laboratory and field scale). The innovative BMT tool was developed in WP1 by Technical University of Liberec and was continuously tested and successfully validated *in situ* in the frames of WP2 and Investement 6.

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

Nuts0: CZ, CZECH REPUBLIC
Nuts1: CZ0, Česká Republika
Nuts2: CZ05, Severovýchod
Nuts3: CZ052, Královéhradecký kraj

Investment costs (EUR), if applicable

All cost related to the Investment 6 can be found in the Output O.I6.1.1; Treatment and restoring of natural conditions of groundwaters in Novy Bydzov FUA.

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

The implementation of an investment contributes to improvement of groundwater quality at FUA Novy Bydzov as well as EU capacity to select cost-effective & appropriate remedial options for groundwater body management. The major social benefit of investment is the improvement of groundwater quality in Novy Bydzov in a very sustainable (green) process. Due to the fact that the treatment was made on a site located at many private properties, one of the main beneficiaries of this biotreatment are people to which these properties belong. The quality of water in the water wells on these properties has been improved. The major beneficiary of scientific results is Technical University of Liberec and water authorities as well as remediation and engineering companies that provided and supervised the remediation processes (Dekonta / Photon Water Technology). Thanks to the results obtained within the AMIIGA project, Technical University of Liberec enlarged the knowledge base on the sustainable control of the *in situ* attenuated bioremediation process and this will result in scientific publications as well as sharing the knowledge on various national and international conferences. The greatest benefit of the AMIIGA project for the state of the environment in FUA Nový Bydžov was the refinement of information for the solution of remedial measures, which led to the design of the Management Plan for the removal of groundwater pollution. This effort was crowned with the approval of MP by the Czech Ministry of Environment, which allocates 3.2 million euros for the removal of pollution in FUA Nový Bydžov for next period (2019-2023).

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

The results of the Novy Bydzov pilot action have scientific (one scientific publication will be created from herein obtained results) and practical benefit related to evaluation of treatment results. We have demonstrated that the BMT results, generated for such locality, can be very reliable, and conclusions drawn from them, can be correlated very well with the chemical analyses.
Moreover, the BMT tool that was developed in the frame of WP1 and validated in the frame of WP2 can be used by different institutions at different territories. We have demonstrated that the use of controlled biotreatment process can bring great value to site treatment in FUA and the results were shared and distributed as a good practice to all partners and stakeholders. The demonstrated remedial technology (Biologically enhanced Reductive Dehalogenation) will be applied as the main remedial technology in the full scale remediation in the next period (2019-2023) in the FUA Novy Bydzov

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

The pilot action was well planned, and we gained satisfying results. The transnational cooperation of Technical University of Liberec (Czech Republic) with Polytechnic University of Milan, PoliMi (PP7) within the AMIIGA project can be considered as a great success. Polytechnic University of Milan have a very well equipped laboratory and expert scientists/technicians, thanks to which, we were able to perform Compound-Specific Isotope Analysis (CSIA) on the Novy Bydzov groundwater samples and by this understand better the conducted bioremediation process on site. Thus collaborative results can help us in publishing valuable results, where both BMT and CSIA are used.
Pilot Action 2.5 was discussed in detail during each Partner Meetings and in Expert Panel workshops. Experts of other partners contributed to improving knowledge about the hydrogeological aspects, sources and transport of pollution in the FUA NB and helped to solve how to mitigate groundwater pollution. The special Expert Panel workshop was dedicated to Pilot action 2.5 in February 2019 in Milan. All lessons learned from the pilot action 2.5 are publicly available to all partners who can benefit from the lessons learned.

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-descrimination

- The biotreatment is considered as very effective and sustainable way of remediation. Also during the pilot action in Novy Bydzov we have demonstrated how toxic substances can be eliminated from the environment without the use of often dangerous chemical remediation agents (for example hydrogen peroxide or ozone).
- Within the AMIIGA project, both women and men amazingly contributed to the project outputs, and we believe that we had promoted equality between women and men. Moreover, during the project duration, we did not observe any discrimination on the grounds of racial or ethnic origin, religion or belief, disability, age or sexual orientation.

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

For further details see the website of Novy Bydzov City, which informed about AMIIGA activities in Novy Bydzov: https://www.novybydzov.cz/projekt-amiiga/gs-1358, and the Deliverables (D.T2.5.1 - D.T2.5.7):

D.T2.5.1Report on drilling of remedial application and remedial monitoring wells
D.T2.5.2Field sampling and laboratory analyses protocols from the initial groundwater sampling and laboratory campaign
D.T2.5.3Report on identification and specification of groundwater and dissolved pollution transport pathways
D.T2.5.4Report on the remedial laboratory test
D.T2.5.5Technical protocols from field remediation action
D.T2.5.6Report on testing of BMT tools to monitor remediation progress, efficiency and sustainability
D.T2.5.7Report on Pilot Action In-situ biologically enhanced attenuation

All mentioned deliverables have been uploaded to the eMS and can be requested at: stanislaw.waclawek@tul.cz e-mail. Moreover they are all available at this link: https://drive.google.com/open?id=1epplupxHZE-p4E5JfqzTdne33qLmxoyn