TEMPLATE

Output factsheet: Tools

Version 1

Project index number and acronym	CE32 - AMIIGA
Lead partner	Central Mining Institute (Główny Instytut Górnictwa)
Output number and title	O.T1.1 –FOKS tools adaptation to FUAs scale and amendment for enlargement of operating window
Responsible partner (PP name and number)	PP7-Polytechnic of Milan (POLIMI)
Project website	http://www.interreg-central.eu/Content.Node/AMIIGA.html
Delivery date	10.2017

Summary description of the key features of the tool (developed and/or implemented)

A project works at a scale larger than FOKS and it focuses on FUAs, because groundwater contamination is often an issue that goes beyond administrative boundaries of a single local public authority. At FUA scale, data to be processed increases dramatically and additional tools are essential to manage and analyze it, as it plays a key role for contaminant plumes and source identification. In this context, AMIIGA proposes WebGIS as an open-access tool for data representation and consultation, improving Public Authorities data analysis efficiency. At the same time, the ordinary statistics is used to study more in depth the large FUA idrochemical dataset. Finally a methodology for inverse iterative simulations applied to numerical flow and transport models, combined with statistics, aims to separate Point Sources (hot spot, PS) and Multiple-Point Sources (diffuse, MPS) groundwater contamination.
The key features of the tools developed are:

- webGIS: innovative approach to share data and information among institution and technical offices, improve internal and external communications, support and facilitate decisions, advance data analysis and conceptual model interpretation. Simply through a web client (Firefox, Essential etc.), everyone, allowed to access, may check for the most *up-to-date* information in the WebGIS, where investigation results is updated regularly
- statistical analysis: to explore large monitoring datasets (detect outliers, errors and missing values) at FUA scale, distinguish PS and MPS contamination data in urban groundwater, define the FUA's zones affected by MPS contamination and estimate the background levels of diffuse contamination over large areas
- numerical flow and transport model (inverse iterative simulations): to spatially delimit the boundary of the plumes, to separate PS and MPS groundwater contamination, to identify the area most likely to contain MPS responsible of the diffuse contamination, to support the implementation of groundwater resource management plans.

NUTS region(s) where the tool has been developed and/or implemented (relevant NUTS level)

IT: Lombardy Region (ITC4), NUTS-3 Milano (ITC4C)
PL: City of Jaworzno, PL22
DE: Stuttgart DE11
CZ: Novy Bydzov CZ05
IT: Parma Municipality ITH5
SI: Geological Survey of Slovenia SI02
HR: University of Zagreb HR04

Expected impact and benefits of the toolfor the concerned territories and target groups

At FUA scale, the contamination depends on single punctual sources (known or under investigation), but groundwater may present also an anthropogenic diffuse pollution. This kind of contamination originates from the overlapping of a series of unidentifiable small sources clustered within large area. The AMIIGA tools allow Public Authorities to easily access and understand shared geospatial data. Furthermore, the statistical methodologies, combined with the inverse modeling tool, allow to explore big monitoring datasets and separate the PS contamination contribution from the MPS one. When MPS contamination exists, it represents an essential aspect that has to be evaluated to implement a groundwater management plan accurately. Finally thanks to the inverse modeling, it is possible to provide maps showing areas with an associated occurrence frequency where MPS may contribute to contaminant concentration values. This kind of maps with relevant information can support Public Authorities in *decision*-making process to plan and prioritize groundwater investigations in those areas that are most likely responsible of MPS contamination.

Sustainability of the tool and its transferability to other territories and stakeholders

The AMIIGA tools are based on these freeware software:

- WebGIS: QGis, Postgre and Lizmap
- Statistical tool: R
- Inverse modeling: Modflow, Modpath, MT3DMS and PEST

This choice guarantees the economic sustainability, allowing every European stakeholder to apply the tools to their environmental data. Nevertheless, if some public bodies have already purchased some commercial software, the methodology can be completely transferred in them: in this aim Guidelines of work package T1, have been written without any specific or strict reference to the software. The only one exception is concerning the freeware PEST as, at present moment, it is the only inverse software available that can be applied to groundwater flow and transport models. The sustainability of the tool will be in charge of the main actors of the Project. For example, WEB-gis for Pilot Area of Milan, will be furtherly improved by Politecnico di Milano in cooperation with RL for next RIG. Statistical and numerical modelling will be furtherly developed by each PPs (e-g. Polimi with RL will use inverse modelling to assess responsible of contamination in some zones of the FUA) in order to develop further analyses in each FUA.

For that reasons the tools can be transferred to any other territory or stakeholders. Limitation on transfer could be linked only to the competences of the users on concepts concerning statistics and modeling.

Lessons learned from the development/implementation process of the tool and added value of transnational cooperation

The webGIS is a good way to share information among institution and technical offices, but AMIIGA experience showed that sharing data is not an easy process.

The main difficulty is that multiple subjects (regions, municipalities, environmental agencies) tend to develop their own dataset. So, they may not know about the availability of other datasets or ignore modifications (correction of errors, update of geographical information, new survey campaigns results, etc.). This may influence the processes of evaluating groundwater contaminant background, considering alternatives, making choices about the necessary actions. The data exchange among different stakeholders can be difficult and extremely time consuming: professionals specifically dedicated to the development and maintenance of environmental datasets are not always available in the working team structure, consequently the duty to prepare data is inefficiently sparse among many professional figures that often duplicate the same work; there is a presumption that data may be "wrongly" used if shared with a third party and their ownership can be lost; it is difficult to gave away the control of data.

References to relevant deliverables and web-links
If applicable, pictures or images to be provided as annex

Deliverables:

- D.T1.1.1, WebGIS tool specifically developed for groundwater database management and open-access consultation among the partners and the Public Authorities involved in the project; the AMIIGA WebGIS for the 6 partners' FUAs is available at http://131.175.56.100/lm/
- D.T1.1.2, Guideline for statistical method and geostatistical analysis for GW quality studies at FUA
- D.T1.1.3, GW contamination modeling at FUA: "inverse iterative modeling" guideline for implementation and use
- D.T1.1.4, Technical protocol for statistical analysis coupled with transport modeling for GW pollution assessment

https://www.interreg-central.eu/Content.Node/D.T1.4.3-final-version-guidelines---ITA.pdf

https://www.interreg-central.eu/Content.Node/D.T1.4.3-final-version-guidelines---ENG-1.pdf