MANAGEMENT OF MISSION-CRITICAL INFORMATION IN BÁTAAPÁTI LLW/ILW PROJECT, S-HUNGARY

F. Fedor[1], **V. Feurer**[2] **J. Geiger**[3] **L. Menyhei**[1], **Z. Szikszai**[1]
[1]MECSEKÉRC Ltd., [2]Intercomp Ltd., [3]University of Szeged, Hungary

Abstract

Research and repository implementation projects targeting the geological displacement of LLW/ILW radioactive waste at Bátaapáti site are producing huge amount of information and documents. More than 44 million data items originating from 5 500 locations, (40 000 objects, 39 000 samples), presented in more than 25 000 documents created by almost 400 experts of 61 companies have been processed and regularly applied. Users soon demanded an easy-to-use, well-designed, self-explanatory reporting system, so called Integrated Report System (IRS), supporting the scientific approach as well as their everyday work.

Introduction

Research and repository implementation projects targeting the geological displacement of LLW/ILW radioactive waste at Bátaapáti site are producing huge amount of information and documents. More than 44 million data items originating from 5 500 locations, (40 000 objects, 39 000 samples), presented in more than 25 000 documents created by almost 400 experts of 61 companies have been processed and regularly applied.

For collecting, governing and using this amount of data a unified information system (UIS) has been implemented containing GIS database, relational research database (RRD) and research portal (RP). Implementing the so called integrated report system (IRS) fulfilling the user requirements mentioned before, a unique toolset was produced with the following capabilities:

- Presenting information stored in separate sub-databases can be queried, presented and downloaded by different approaches (by research categories, by objects, by monitoring activities etc.).
- Essentially different kind of information (2-D GIS, 3-D visualisation, traditional alphanumerical research, technical and monitoring data) can be integrated.
- Knowledge-base information can be embedded into the reporting system.
- Data packs for visualisation toolsets can be collected and downloaded using the built-in visualisation interface.

Using the IRS, whose improvement is in progress and partly has already worked, three different way of query are aided. The classical parameter oriented query helps finding the given data (results of different measurements, observations) in a given place and in a given time. The object oriented query helps collecting all the information needed about a given object (incline shaft, surface and underground boreholes, geophysical logs, cross sections, surface geophysics) in a given time. The monitoring oriented query helps finding monitoring information (hydrogeology, meteorology, geotechnical and geophysical monitoring, Rn monitoring, etc) in a given time interval. In this paper firstly, a general overview and then detailed information with some examples will be shown.

The integrated report system

The IRS can be used by anyone having the necessary permissions granted individually by the administrators, for example researchers or sub-contractors (either customer or contractor side). The sub-contractors have audited quality management systems to eliminate data quality problems. The database itself is under continuous quality-oriented supervising and revision. At the current "under development" state of the IRS mostly raw and computed data, objects and monitoring datasets are available. Specialists are working on assigning the uploaded reports (documents, pdf files etc) to datasets. The assignment of *in situ* reports, datasheets, pictures (borehole structure, geological cross section, geotechnical and geophysical visualisation) required for the object-oriented approach has mostly been completed. For the safety assessment one can compose unique data packs containing both raw and computed data. The raw and computed data required for modelling can be selected according to various selection criterions even at basic data level (one distinct value only), too. The selected data sets can be downloaded in a compressed file having a table of contents and containing all the selected information and additional auxiliary files (spreadsheets, pictures, documents). This is required for the evaluation of data used by 3-D modelling. The computed models are stored on a separate portal system (Security and Environmental Subportal), on the long run these models are to be integrated into IRS. The objects (having correct coordinates) are incorporated into a 3-D visualisation programme called "Wanderer" as well as the GIS part of the IRS. "Wanderer" provides an unique feature to virtually wander around the facility and its neighbourhood and to examine the objects (raw and geologically, geotechnically interpreted drift section photos, tunnel pictures, boreholes, geological and geophysical information, geophysical profiles, surface objects etc.). According to the regulations created by the customer every project member can use and must use the database (or its subsets according to the current privilege level). On the basis of these regulations the database can be upgraded only by checked and validated information. Hence, the dataset need for specific models (geological, tectonical, geophysical, hidrogeological, transport etc.) created by the Mining Visualisation System (MVS) originated from RRD. The tunnel profiles are recorded and interpreted (geological and geotechnical) by the JointMartix3D. The 3-D pictures coming from these programmes are not integrated yet into the IRS. Monitoring datasets can be demonstrated as total sets (all data) as well as daily, weekly or monthly subsets. The reports include basic statistics (mean, 5% trimmed mean, minimum, maximum, standard deviation) and a box-plot. The continuous intervals as well as gaps are marked in the datasets and every interval has a computed sampling frequency marker. Using the IRS complex reporting activities can be performed effectively supporting the scientific studies as well as the daily work.

Input and output data

Research project produces huge amount of:

- Research data (geology, geotechnology, hidrogeology, meterology etc.) about the research site.
- Technology data about tunnelling (shotcrete, RQD data, geodesic profiles, etc.).

The data sequences are basically alphanumeric although they can be visualised using 2-D (GIS) and 3-D technologies. Data sequences are stored in the Relational Research Database (RRD) among with the auxiliry information about the context of the data (metadata set):

- General information (connenctiong to the background of contract).
- Methodical description (method, short description of method, concerning standards, accuracy, value ranges, parameter, unit, medium of measurement, etc.).
- Properties of devices and instruments used.
- Data location information (EOVX, EOVY, Baltic Z, description, etc).
- Information related to the parameter (time, geological information, personal information (data collecting, handling, interpreting, checking), data format, related files, etc.).

These auxiliary types of information are required for the future users to determine the approximate level of confidence and usefulness of data. Non-alphanumeric data (geometry properties of real-life objects, maps, profiles, izo-lines, 3-D models) are impossible and/or ineffective to store in the RRD so they are placed in the GIS database and/or in the internal data storage subsystems developed for the 3-D modelling tools. Large amount of in-site data (basically geophysical profiles) are stored in the archive system using native format, only the processed data are loaded in the RRD. It is because gigabytes of raw data are impossible to load into the RRD and on-line access is not required.

The RRD and the 2-D GIS/3-D systems have their own – usually web-based – graphical user interface (GUI). The RRD GUI consists of reports of:

- Simple list (list of ordered data items).
- Simple tables (data items in rows and columns).
- Composite datasheets (sectioned reports, containing lists as well as tables).
- Charts (2-D charts of data sequences, usually line/bar charts).
- Composite sets (mix of lists, tables and charts).

The query parameters of the RRD reports can be specified using selections (selecting one or more options from a list) or entering value ranges. The query parameter specification can be done in several steps where options in each step based on the previous selections, enabling more precise choices and eliminating invalid parameter combinations.

The 2-D GIS system has a map-based GUI. It contains several thematic maps generated by web-enabled map server. The object selection can be done by usual map tools (resize, magnification, geometrical selections, layer selection etc.).

3-D visualisation system requires special training. Only the results (pictures and movies) are demonstrated on web.

Individual smart, easy-to-use and quick GUIs for each system are required for supporting the effective work. Hard-linking the systems internally is not a good practice. Simultanous application of multiple systems and GUIs for reporting can be an annoying experience for an ordinary user and surely ineffective. The integrated reporting system can solve these problems by publishing information gathered from several systems on a unified GUI.

The IRS is made for providing a unified GUI for enabling to search, publish and download data. The central element of the IRS GUI is a split-screen containing a relation database query panel and a map-based GIS query panel. These panels can access their parent systems and can communicate with each other.

The relational database query panel enable to select data according to several aspects (location, parameter, method, datapack etc.) enter parameters using the previously mentioned step-by-step method. The selected data items can be viewed using the reports or can be downloaded in package.

The IRS uses the RRD reports (opening in new windows) to present the collected data. These sets can be downloaded in ZIP packages. The packages can contain:

- The Excel files of the collected data.
  - They may be organised in a big table of all the data (e.g. all water sample data in one table).
  - However every datapack can be placed to separate worksheets (e.g. every water sample in separate sheets).
- Auxiliary files attached to the data (charts, reports etc.).

The downloaded package always contains a table of content in a separate Excel file which helps using the downloaded files.

The map-based GIS panel encompasses an overview map about objects according to the currently processed datapacks, e.g. when surface boreholes are examined in the RRD the overview map shows them. If required, other objects sets and layers can be made visible, too. Objects selected on the map can be activated on the RRD panel by one click and vice versa.

These integration and interaction helps the users by enabling the basic selection (locations) on any of the panels and the selection result can be immediately checked on the other one. So the IRS provides:

- Searching and presenting the data on a unified GUI.
- Collecting every relevant information into one query irrespectively of their origin.
- Downloading the collected data in a unified, easy-to-use format.

Conclusion

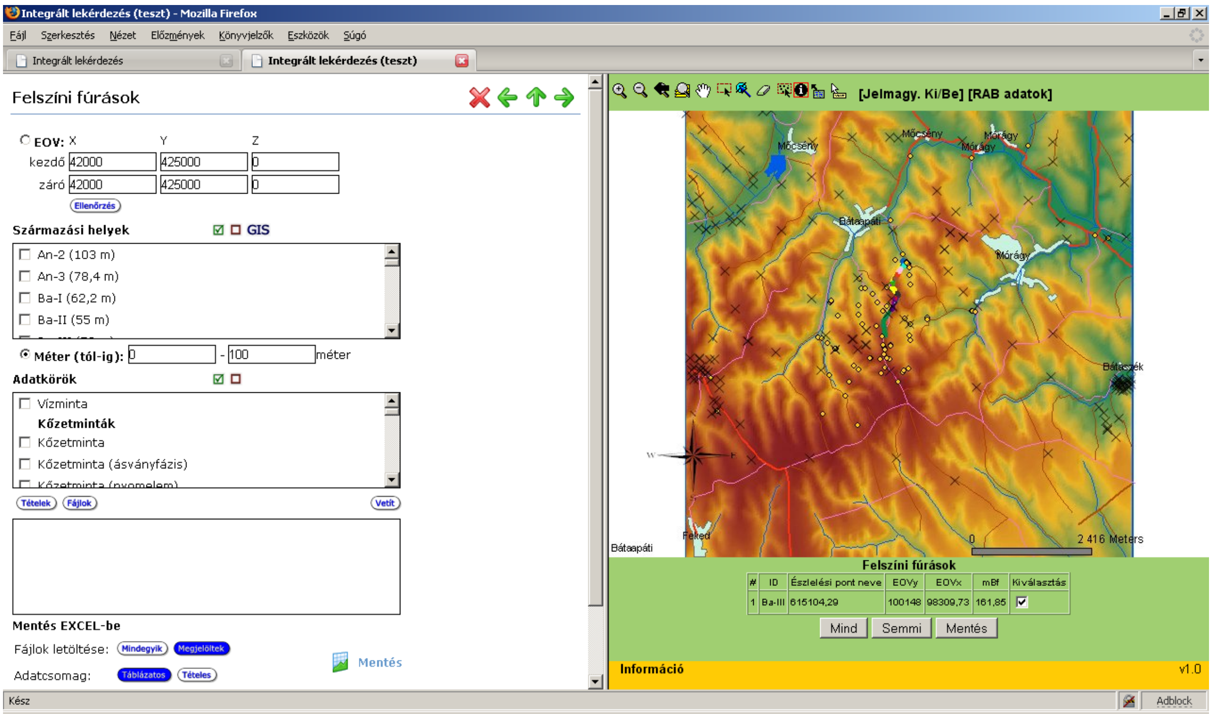
The IRS is a complex system for handling the huge amount of data which came from the research and investment of the Bátatapáti LLW/ILW site. Parameter, object and monitoring oriented queries help finding the information needed. Using the IRS complex reporting activities can be performed effectively supporting the scientific studies as well as the daily work.

Aknowledgement

We would like to thank Miss Eszter Lévay for grammatical overview of this article.

Example 1 – Boreholes

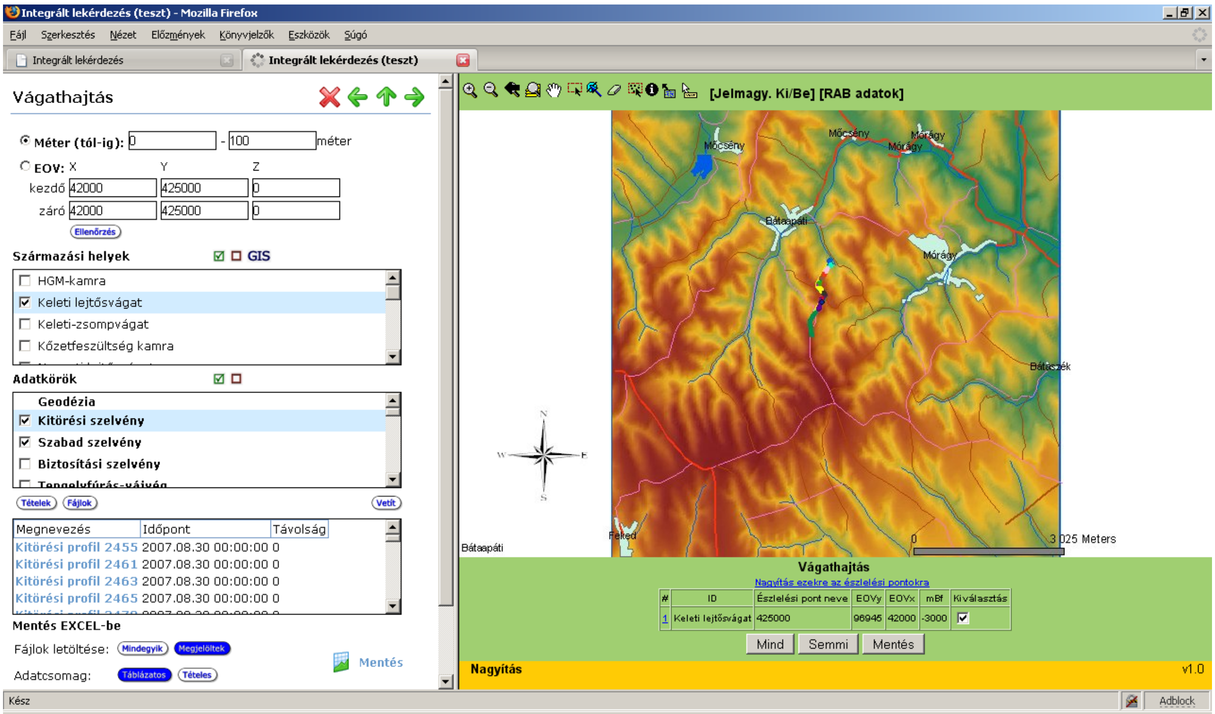
Figure 1. **A picture of boreholes query**



Left side (borehole and section selection)
Borehole selection: • By EOV coordinates as “EOV”, when the check button (Ellenőrzés) pressed, the boreholes in the specified region will be selected in the list below the check button. • Or individually by checkboxes as “Származási helyek”.
Section selection as “Méter (tól-ig)”: Section of the borehole can be selected as a range, 0 metre means the borehole 0 point (surface).
Datapack as “Adatkörök”: bold lines represents datapacks present in the selected section of the current borehole are for marking multiple datapacks.
Items button as “Tételek”: shows the datapacks from the current datapack type;
Files button as “Fájlok”: for selecting files attached for the selected section of the current borehole
Save to Excel as “Mentés Excelbe”: • Files can be downloaded by selection (Fájlok letöltése: Megjelöltek) or all of them (Fájlok letöltése: Mindegyik). • Datapack can be tabular (Adatcsomag: táblázatos) where items from same datapack type resides on the same worksheet or can be detailed (Adatcsomag: tételes) where every datapack resides on separate worksheet. • Note: web interface produces a ZIP file containing an Excel workbook (in XML format) and all the attachment files.
Display as “Vetít”: starts the „Wanderer 3-D” tunnel visualisation programme.
Right side
Map interface and file selection are the same on every report.

Example 2 – Tunelling

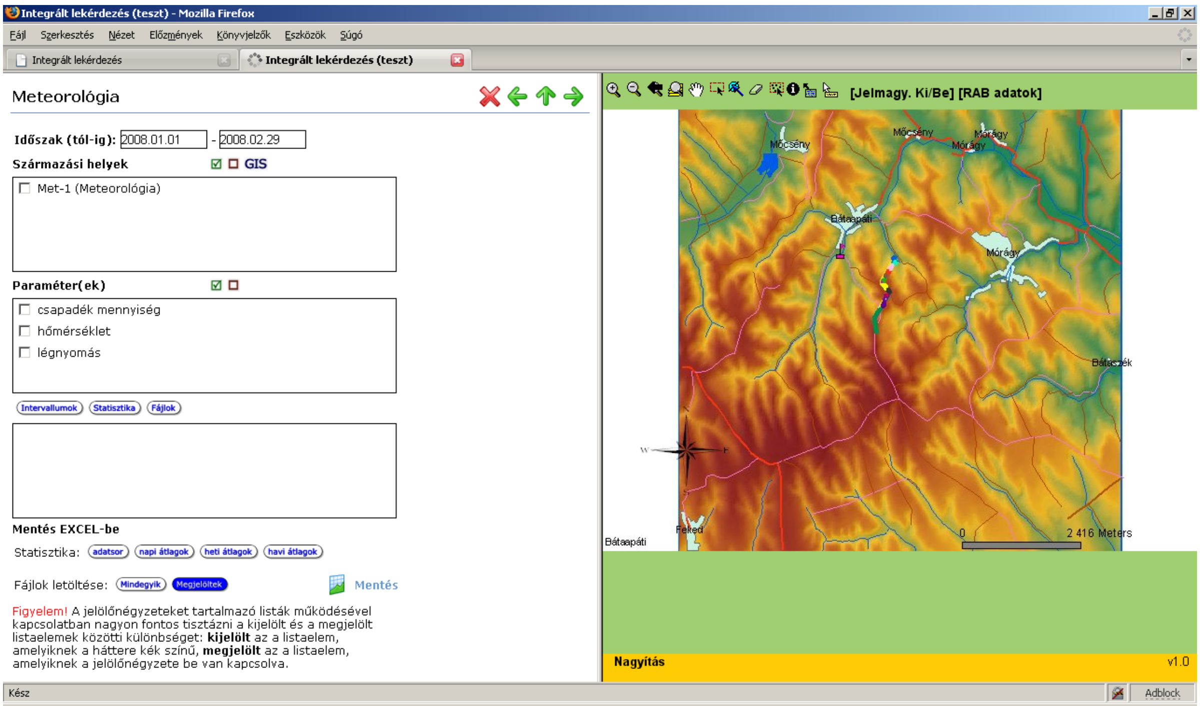
Figure 2. **A picture of tunelling query**



Left side (location and datapack selection)
Tunnel section selection: • by distance from portal as “Méter (tól-ig)”; • by EOV coordinates as “EOV”.
Tunnels as “Származási helyek”: list of tunnels, blue line means current tunnel, checkboxes are for marking multiple tunnels.
Datapack as “Adatkörök”: bold lines represents datapacks present in the selected section of the current tunnel; checkboxes are for marking multiple datapacks.
Items button as “Tételek”: shows the datapacks from the current datapack type.
Files button as “Fájlok”: for selecting files attached for the selected section of the current tunnel;
Save to Excel as “Mentés Excelbe: • Files can be downloaded by selection (Fájlok letöltése: Megjelöltek) or all of them (Fájlok letöltése: Mindegyik). • Datapack can be tabular (Adatcsomag: táblázatos) where items from same datapack type resides on the same worksheet or can be detailed (Adatcsomag: tételes) where every datapack resides on separate worksheet. • Note: web interface produces a ZIP file containing an Excel workbook (in XML format) and all the attachment files.
Display as “Vetít”: starts the “Wanderer 3-D” tunnel visualisation programme.
Right side
iMap interface to select locations on the map. Below the map there is the list of the selected locations from the map. In this list the checkboxes can be used to select any combination of locations. These combinations can be loaded on the left side using the “GIS” labels (buttons).

Example 3 – Meteorological monitoring

Figure 3. **A picture of meteorological monitoring query**



Left side (location and datapack selection)
Time range selection as “Időszak (tól-ig)”: time range can be selected by specifying the start and finish date.
Location selection as “Származási helyek”: we have only one meterological station.
Parameter selection as “Paraméter(ek)”: measured parameters found in the specified time range will be marked as bold line when selecting a location, the parameters required to download can be marked using the checkboxes.
Data sequences as “Intervallumok”: properties of data sequences can be viewed by pressing the interval button (Intervallumok), see the picture below.
Statistics as “Statisztika”: the computed statistic properties of the parameter data sequence can be vieweb by pressing the statistics button (Statisztika), see the picture below.
Files as “Fájlok”: attached files can be viewed and marked to download by pressing the file selection button (Fájlok). Save to Excel as “Mentés EXCEL-be”: the data sequences can be saved into EXCEL file, the file is composed according to the specified download settings:
Statistics (Statisztika): • Data sequence (Adatsor): whether to write the full data sequence into EXCEL or not. • Daily averages (Napi átlagok): wheter to write daily averages into EXCEL or not. • Weekly averages (Heti átlagok): wheter to write weekly averages into EXCEL or not. • Monthly averages (Havi átlagok): wheter to write monthly averages into EXCEL or not.
Download files (Fájlok letöltése): • All files (Mindegyik): attach all available files to the EXCEL. • Marked files (Megjelöltek): attach all marked files to the EXCEL.