

## **AGEING OF INFORMATION – A NEW SOURCE OF UNCERTAINTIES?**

**Z. Nagy**

Public Limited Company for Radioactive Waste Management (PURAM), Hungary

### **Abstract**

According to the Hungarian legislation safety assessment is required in the preparation-, establishment-, operational-, closure-licensing phase of repository development and during the operation of the repository the safety assessment should be reviewed and updated regularly. It means that the safety assessment will be made many times during the repository developing process, between two consecutive safety assessments more decades may elapse and between the first and the “last” safety assessment more than one century will elapse.

The assessment of long-term safety is based partly upon geoscientific information. Will the information originated from many decades or 100 years old research be really used as the basis of the new safety case? Does the geoscientific information “age”? Does the confidence in information or quality of information remain on the same level during several decades? If not, what are the causes and consequences of this confidence-level decrease, what can we do to prevent or to postpone this confidence-level decrease? When does an information become too old to use it in a safety assessment? Are each part of the assessment capability touched by the decrease of confidence in the same extent?

### **Hungarian legislation**

The safety assessment is required in the preparation-, establishment-, operation-, modification-, termination-, closure-, and for the change-over to active or passive regulatory inspection licensing phase of repository. During the operation of the repository the safety assessment should be reviewed regularly, because the operating license for a final waste disposal facility could be issued for determined duration, for 10 years at most, which – in case of meeting the operating conditions – can be extended for at least 10 years more on request.

### **Some questions**

- Will the data originated from many decades old assessments really be used as the basis of the new safety case?
- Does the confidence of many decades old “results” remain on the same level?
- If not, what are the causes and consequences of this confidence-level decrease?
- What can we do to prevent or to postpone the confidence-level decrease?

### **The elements of a typical structured procedure for the development and compilation of a safety case**

The elements of a typical structured procedure for the development and compilation of a safety case at any particular stage of repository development, are the following:

- The establishment of an assessment basis.

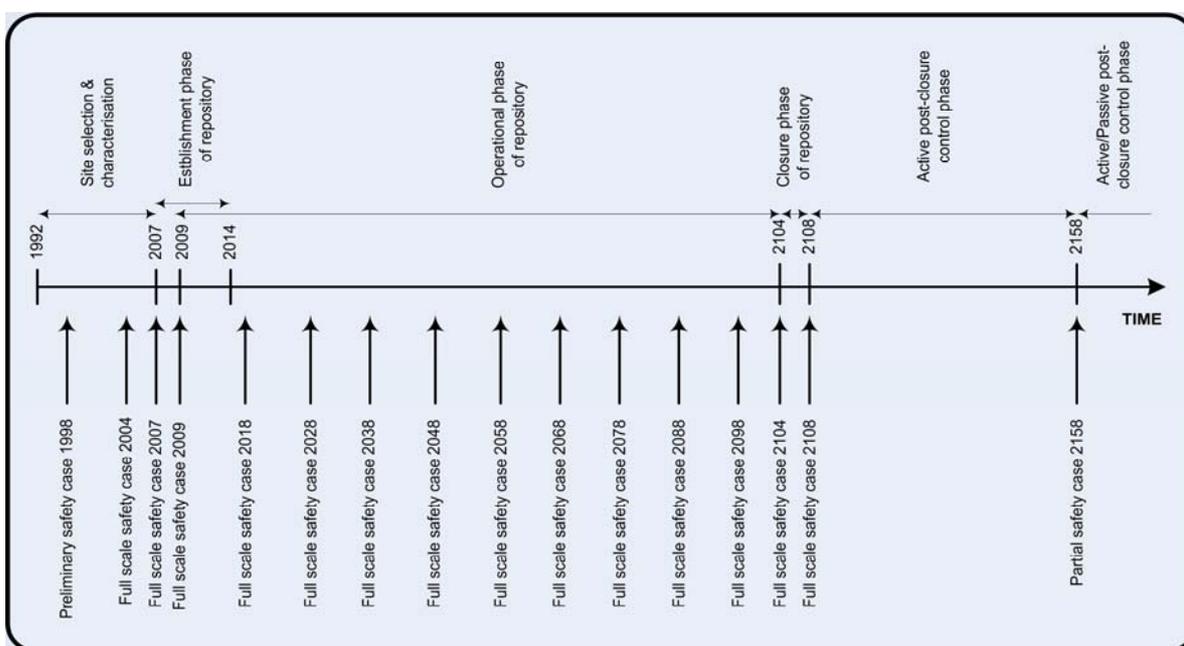
- The application of the assessment basis in a performance assessment.
- The evaluation of confidence in the safety indicated by the assessment.
- The compilation of the safety case.

The assessment basis is the combination of these three elements:

- The safety strategy.
- The system concept.
- The assessment capability.

The assessment capability represents the available resources, including the safety-relevant features, events and processes, assessments methods and models, site-characterisation data and other information (e.g. proper application of the methodology, models, databases and codes).

Figure 1. Safety cases within the lifetime of Bataapáti repository



### The safety assessment development process

Every safety assessment development process begins with the re-evaluation and modification of the assessment basis. The re-evaluation and modification to the three elements of the assessment basis proceed concurrently because of the strong coupling between the elements – thus modification of the safety strategy or of the safety concept may guide to the significant changes in the assessment capability. But the assessment capability may need to be modified without the modification of the safety strategy and/or of the safety concept, too because of the change of decision-assessment environment. It means that the assessment capability depends on the decision and assessment environment, too.

Some more important elements of the decision and assessment environment are the following:

- People who participate in the decision-making and safety assessment processes.
- The scientific and technological background.
- Legislation background.
- Data (information) concerning the repository.

- Guidance from previous development stage.
- Practical and programme constraints.

Within each safety case development process different people participate, they have different scientific knowledge, different scientific/technological background (tools – e.g. codes, models, methodologies, instruments) and the legislation background of each safety development process may differ from one another.

The change of decision-assessment environment is rarely fast, thus it could be not obvious within a some-years long timeframe, but it is evident within 40-50 years long perspective.

The change of usable information for safety assessment is always induced by the change of decision and assessment environment.

In the course of re-evaluation data need to be excluded from the new safety assessments development process in general if the measuring circumstances (e.g. properties of the measuring instrument used to produce the data, including type, manufacturer, serial number, calibration data, measuring method, measuring range, measuring accuracy, dependence of accuracy on measuring range, when, why and by whom was the measurement made, whether any additive was used in the preparation phase of the measurement, if yes, how many additive was admixed to the medium need to be measured, etc.) are not verifiable. It means that data may be excluded from further works because of lacking some additional (auxiliary) information related to this data and the information that could make the repeating of previous data processing or the adoption of a new method possible.

### **The re-evaluation process of data**

Most frequently the experts have difficulties with the verification of derived (not by them calculated) data (e.g. mean as a result). If they are not able to determine which data were used for the calculation of the derived data (e.g. lack of traceability of the results, via chain of decisions and calculations, to their sources), they will not be able to use it in the new safety assessment process, and they will need to begin the data processing from the starting point again.

No law ordains that results originating only from the recent safety assessment process might be used to compile the new safety case, so the authorities might not refuse the license from the applicant referring to results originating from the previous safety assessment processes. But we are not allowed to exclude the possibility, that authorities will attempt to put pressure on the waste management company that the safety of repository ought not to be documented on the basis of several decade-old safety assessments results.

Environmentalist organisations and inhabitants from the neighbouring settlements may put similar pressure on the waste management company.

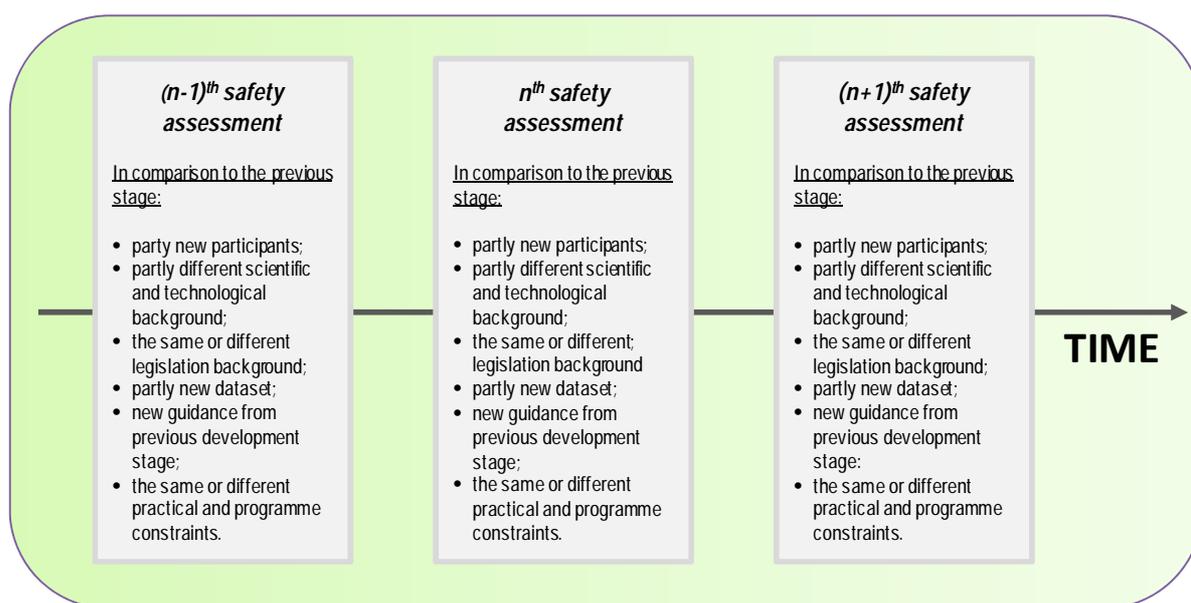
Similarly to the above mentioned, the experts are also averse to use several decade-old safety assessments results when compiling the new safety case so they might propose new investigational programmes. Their arguments will refer to meanwhile happened scientific and technological advance and they will keep quiet about that only trouble is they ought to use information issuing from the previous generations. This effort may be favoured by the legislation background, too (e.g. “In the course of the geological research the best methods and technologies which are technically and economically attainable shall be employed”).

## Conclusion

Data can easily lose their usefulness for the future generation if we do not retain, if we do not attach to them those information (metadata) which make their reproducibility, transparency and traceability possible.

The lack of metadata can conduce to reduction of the assessment capability (by decreasing the amount of available data) and as a consequence some measurements, observation and calculation will be needed to repeat in one of the following safety assessment stages.

Figure 2. **The change of decision-assessment environment**



## What do we need to do?

- Every measured, observed or derived information has to be built in the database together with their so called metadata describing the attributes of information.
- Requirement of reproducibility, transparency and traceability need to be taken into consideration during the specification of metadata.
- These requirements need to be built in the data acquisition plan already in the very beginning of every project.
- The representative of waste management company has to participate always in the specification process of the metadata because the guarantee of the long-term considerations only thus are possible.
- Each information need to be treated as individuality because it is not possible to find general rule for the specification of all metadata related to these information and needed by the future users.
- The relational database has to be preferred as a tool of information storage at present because a paper based information storage medium (e.g. reports) can appreciably reduce the chance of re-using of information.

- Deletion of any information from the database has to be forbidden.
- The information (and/or metadata) upload into the database has to be a data-supplier's duty.

The Hungarian data-gathering practice does prove the above described requirements. To facilitate the specification of the needed metadata a recommendation is given by PURAM for the contracting parties. This recommendation impose a minimal information content on the data-supplier that has to be guaranteed by the metadata.

In PURAM practice we met the following difficulties and problems concerning the confidence till now:

- We have limited information about the practice of other countries in this scope so it is hard to say we are on the right track.
- Users have various preconceptions, approaches about a database and feel.
- Users have aversion from using and supporting a centralized database, everybody would like to use the own one.
- The complex structure of the database must be explored and accommodated by the users (without a good knowledge of database structure a researcher cannot use the database or able to form a good report request).
- Users endeavour to make the identification of metadata formal, wherefore a strong supervision is needed from the waste management company.
- Gathering and presenting all metadata for the research data originating from a previous safety assessment stage demands unusually many time and expenses, moreover there is impossible to determine in many cases.

Data quality assurance (to prevent filling up the database with useless or incorrect data).

## Proposal

It would be useful to compile a guide about the interaction between data gathering and long-term maintenance of confidence in the reflect of the international practice. Within the scope of this work it would be expedient to sum up:

- The set of information used for the safety assessment.
- How those information should be arranged in groups.
- To determine metadata which are necessary for the long-term usefulness of those information in the safety assessment stages.
- How the wrong determination of metadata can influence the reproducibility, transparency and traceability of the information.

## References

- [1] *Confidence in the Long-term Safety of Deep Geological Repositories – Its Development and Communication*. NEA, 1999.
- [2] 47/2003 (VIII. 8.) ESZCSM Decree of the Minister of Health, Social and Family Affairs on certain issues of interim storage and final disposal of radioactive wastes, and on certain radiohygiene issues of naturally existing radioactive materials concentrating during industrial activity.

- [3] The Seventh Mid and Long Term Plan of Public Utility for Radioactive Waste Management For The Activities To Be Financed From The Central Nuclear Fund. Budaörs, 2006.
- [4] IKIM Decree 62/1997. (XI. 26.) on the Geological and Mining Requirements for the Siting and Planning of Nuclear Facilities and Radioactive Waste Disposal Facilities.
- [5] R. Thomas Peake *et al.* Review of a Site Developer's Geoscientific Data and Site-Characterization Information to Support Repository Certification. AMIGO2 Symposium, 2005.