Key Information File for Radioactive Waste Repositories – Preliminary Tests – 16169

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ABSTRACT

The Key Information File (KIF) is a document designed to provide a summary of the existence, location and content of an engineered facility for the permanent disposal of radioactive wastes. It should be recognized as part of an internationally integrated system of records and memory. Its primary function would be to maintain awareness of the site, and long-term confidence in the effectiveness of the disposal system, so that the likelihood of unnecessary human disturbance is minimized. In order to ensure this document is accessible to a large audience, it would need to be limited in size. A draft format for the KIF has been proposed, and testing is being conducted on two cases, that of the "Centre de stockage de la Manche", the closed French Repository (surface) and that of the planned Swedish Spent Fuel Repository (geological). Preliminary results show the potential for such a document. Comments and questions raised by the 'Records, Knowledge and Memory preservation' (RK&M) initiative, coordinated by the Nuclear Energy Agency (NEA) of OECD, are presented.

INTRODUCTION

Several OECD/NEA member countries are currently developing deep geological disposal projects for high-level and/or long-lived radioactive waste and spent fuel. These projects take decades to implement and operate. Once closed, the facilities are meant to remain safe for millennia and their safety should not depend on human presence and intervention. There is, in some cases, no solution planned to preserve the oversight and the records, knowledge and memory of the repository and the waste it contains.

Against this backdrop, countries in various stages of development of their programs for final phase of radioactive waste management (RWM) are seeking to improve their understanding of the preservation of records, knowledge and memory (RK&M) about radioactive waste and geological repositories. The NEA Radioactive Waste

Management Committee's (RWMC) initiative on Preservation of Records, Knowledge and Memory (RK&M) across Generations was launched in March 2011, for an initial duration of 3 years, to meet the demands from member countries for facilitating exchange and fostering reflection in this area.

The initiative is based on the understanding that preservation of RK&M is needed to support lengthy and complex decision-making processes across the long operational and post-operational lifetimes of radioactive waste repositories. These processes concern, for instance, licensing, monitoring, potential retrieval, support to land-use restrictions and assisting with the transfer of responsibilities for oversight. The initiative is also based on the need to enable future members of society to make their own informed decisions regarding a radioactive waste repository.

In March 2014, a second phase of the initiative was launched by the RWMC [1]. It will run through March of 2017. At present, 19 organizations from 13 countries, representing implementers, regulators, policy making and R&D institutions, have joined the initiative: SKB (Sweden), SSM (Sweden), ANDRA (France), ONDRAF/NIRAS (Belgium), BfS (Germany), ENRESA (Spain), SURAO (Czech Republic), STUK (Finland), GRS (Germany), JAEA (Japan), RWMC (Japan), RWM (UK), SCK (Belgium), NAGRA (Switzerland), SFOE (Switzerland), NWMO (Canada), PURAM (Hungary), USDOE (USA) and IAEA.

In Phase-II, the initiative is seeking to identify and examine inter-relations between the issues that emerged in Phase-I as strategic for the preservation of RK&M. This is based on the key finding from Phase-I, namely that successful RK&M preservation necessitates multiple strategies which draw on multiple means. This is referred to as the "systemic approach". The concept of a Key Information File (KIF), which has emerged from phase I of the RK&M initiative, serves as a capstone bridging these various means. It has been identified as one of the work priorities of phase II [2].

The KIF would provide a summary of the existence, location and content of an engineered facility for the permanent disposal of radioactive wastes, and should become part of an internationally integrated system of records and memory preservation. In order to allow diffusion of this document to a large audience, its size would be limited to less than, say, 40 pages of generally readable text. It would be part of the information system related to the repository. The place of the KIF in the general set of documents, as seen by the RK&M working group, is illustrated in Figure 1.

ELABORATION OF A PRELIMINARY LIST OF CONTENTS OF THE KIF

Functional requirement

The Key Information File (KIF) is required to provide a summary of the existence, location and content of an engineered site for the permanent disposal of radioactive wastes. Its primary safety function is to maintain awareness of the site, and long-term confidence in the effectiveness of the disposal system, so that the likelihood of

unnecessary human disturbance is minimized.

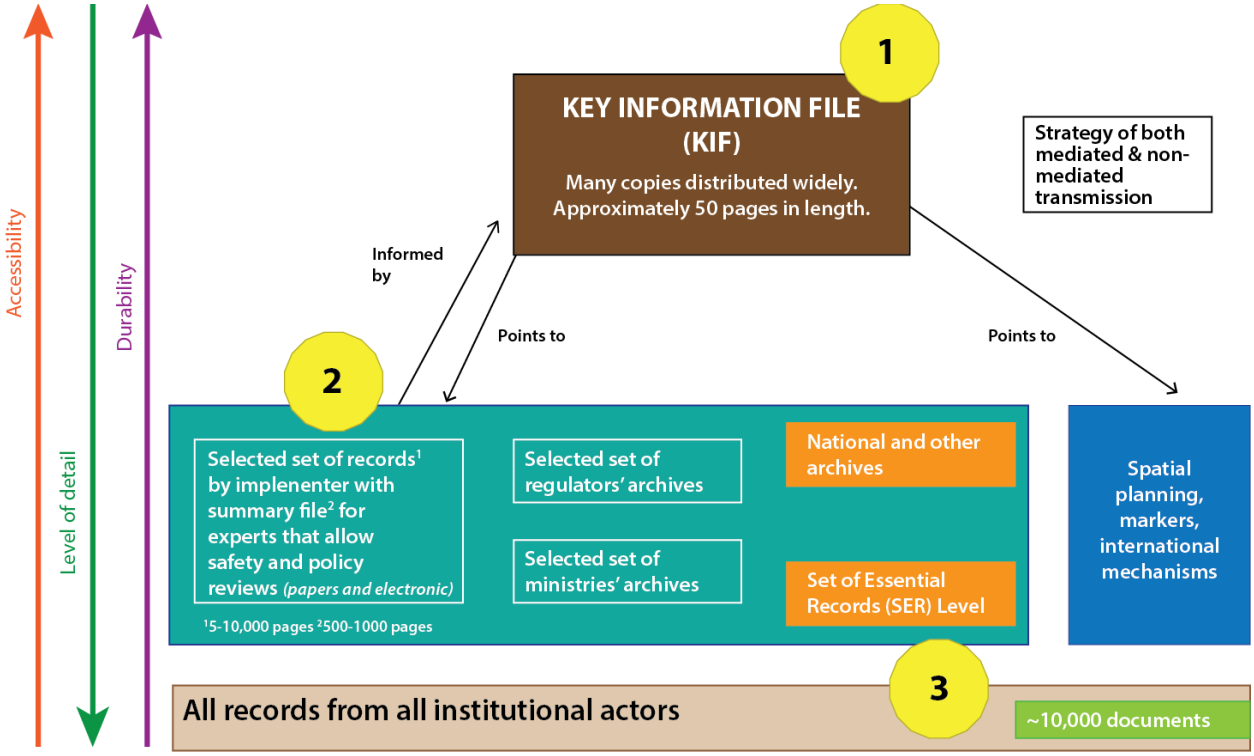

Figure1: Place of the KIF (1) within the larger records management and archiving efforts (2 and 3) in the field of radioactive waste management

Principles

The Key principles of the KIF structure should be:

1. The KIF should provide relevant information to future generations, to help protect the passive performance of the disposal site and to enable any necessary decision making.
2. The KIF should identify the hazard presented by the waste, describe the reduction in hazard with time, and describe the engineered and natural barriers that prevent human contact with the radioactive wastes.
3. The KIF should be written, so far as possible, in a succinct and non-technical manner. Where necessary, technical context should be provided to prevent ambiguous interpretations of the information.
4. Copies of the KIF should be preserved in formats and locations that are easily located and interrogated, so that it is readily available to all potentially interested parties.
5. The KIF should point to the planned preservation of more detailed information about the disposal facility, its content and associated safety cases, noting that the additional information is unlikely to have been

preserved with the same rigour.

Structure

The ANDRA 'Summary Record', which is under production to provide a lasting record of disposal of radioactive wastes at the near-surface facility 'Centre de la Manche' [3], was used as a starting point. Through a critical review of the structure of the "Summary Record" with regard to the needs identified for the KIF, a provisional structure for the KIF was established.

Comments from RK&M members were collected by the secretariat of the NEA and organized in a table. The resulting structure has been tested. It is presented in TABLE 1.

TABLE 1: Key Information File –Proposed Structure

Section	Title and Contents
0.	Purpose and contents of this document (to be provided in several languages)
1.	Disposal Context: • Nature of radioactivity / radioactive waste • How this waste was produced • Why the waste needed geological disposal • Key dates • Regulatory provisions in force
2.	Facility Location: • Repository coordinates (latitude / longitude / depth) • Geological setting • Baseline 'hydro-geo-chemical' parameters at time of closure
3.	Container and Facility Design: • Container types used • Engineered features • Access and closure • Provisions for site monitoring (scope and timescale)
4.	Disposal Inventory: • Radionuclides • Toxic components • Hazard evolution profile, if undisturbed • How to regenerate information
5.	Safety Case: • Basis for safety case (isolation and containment) • Anticipated radiological impacts (natural evolution) • Impact of human disturbance (warning not to intrude)
6.	Disposal Records: • Updating schedule for the KIF • Distribution of KIF • Location and distribution of detailed records

7.	List of similar repositories in the world (to be provided in several languages): • Coordinates of disposal facilities • Coordinates of records retention

TESTING

In order to examine the suitability of the TABLE 1 structure, an earlier version was tested using information and data from the French and Swedish disposal programs. Comments collected from these tests regarding the KIF structure were taken into account to produce the proposed KIF structure shown in TABLE 1.

The French case

The material used as a basis for the test of a KIF for a French disposal program was drawn mainly from the intermediary version of the "Summary Record" for the Centre de la Manche (169 pages) [3], which was the starting point for the elaboration of the first versions of the proposed KIF structure.

More recent reflections on the French repository have also been incorporated in TABLE 1. Some of them regard the "Summary Record" and may be applied to the KIF. For example, the "Summary record" for the Centre de stockage de la Manche (CSM) is directed at present and future generations, therefore space is devoted both to medium term issues, at the timescale of a century, and longer term issues. On the other hand, part of the information presented in the intermediary version is now considered as overemphasized (for example the description of radioactivity in the "Context" chapter) or irrelevant (for example, regarding a tritium release incident during the repository operation, which will have no measurable consequence beyond a century: this incident will only be referred as far as it brings understanding of the repository for future human generations).

The French example also emphasized the need to refer in the KIF document to intermediate levels of documents, such as the last version of the Safety Report, namely for those seeking to understand the safety functions of the repository to a greater extent that provided in the KIF.

Working on a repository that is no longer receiving wastes, i.e. closed, but where activities related to surveillance, upgrading of the cover, refinement of records, etc. … are still conducted emphasizes the fact that the KIF is a living document. There will be several versions of the KIF for each repository, because of changes, and also because several languages may be used. The KIF should be directed at present as well as future generations: first to the present generation (through mediated transmission), but with the aim of being as legible as possible for future generations (through direct transmission).

The concept of the KIF has been presented to the French Nuclear Safety Authority, (ASN), and to a think-tank of local stakeholders related to the Manche Repository.

At present, the Summary Record and the KIF are two distinct documents, the Summary Record being commissioned by the ASN, whereas the KIF is only an emerging concept. But in the near future, the merging of the two documents is considered possible.

The Swedish case

It is worth noting that according to Swedish laws and regulations there is no requirement for long term monitoring or long term preservation of knowledge and memory. The Swedish Radiation Safety Authority requires archiving and "long-term preservation" of technical documentation and radiation protection documentation. When SKB has fulfilled its assignment and no longer exists as a company, it may be that archives would be submitted to the Swedish National Archives. The issue of preserving knowledge and memory of a final repository is addressed primarily by the concerned municipality.

The material used to retrieve information for a KIF on the planned Swedish Spent Fuel Repository was drawn from attachments to the applications submitted by SKB to the Land and Environment Court and the Swedish Radiation Safety Authority in March 2011 [4]. These include the Environmental Impact Statement, the Long Term Safety Report, and the Site Description.

The time-perspective is to write for a non-mediated transmission to a very distant future generation. This implies, however, the problem that the text taken from the regulatory application documents is too technical, legal, detailed and difficult to understand to be used by local societal land-use decision makers of the present or the future. Even understanding the non-technical summary of the Environmental impact statement (EIS) requires some basic knowledge about nuclear power and radioactive waste on the part of the reader.

Basic data such as information about facility location, facility design and container type are rather easily accessible, but not normally designed to be understood by a layman. How to design a map or provide definitive coordinates to make it possible to locate the repository, for example after an ice age, is also a challenge.

The Long term safety report is a main component in the license application to construct and operate the Spent Fuel Repository at the selected site, and its role is to demonstrate long-term safety. The description of the safety case in the KIF should include both a short plain-language summary of the safety report, a warning not to intrude, and an instruction on how to access the repository in a safe way. All this is required in order to avoid inadvertent intrusion and facilitate the decision making for future generations. The repository design and instruction on how to access the repository and its canisters or containers with radioactive waste is identified as a critical part which will need special attention: it needs to be a message to future experts who understand the message and have the technology to deal with the material being accessed. It ought not be readily picked up directly from the text and contents of the safety report. It ought not encourage future accessing of the repository.

DISCUSSION

The results of the preliminary testing of the KIF have been presented and discussed by the full RK&M group, in September 2015. The main outputs of this discussion are presented in the following discussion.

General comments

This testing of the proposed KIF content showed that it is necessary to collaborate with non-technical actors (e.g. historians, communication and language experts, and local stakeholders). The KIF text is to be addressed to societal land-use decision makers, people not involved in the nuclear industry.

The use of a harmonized layout and several languages would facilitate understanding and readability in a very distant future, when some of the languages in use today may be heavily modified or even extinct. Some text sections, particularly concerning background and general context, should preferably be as identical as possible for all repositories: for example, the purpose of the document, the descriptions of the nature of radioactivity and the use of nuclear reactors. The last chapter of the KIF ought to include and provide information on other repositories worldwide, thus consolidating memory as part of a systemic approach.

The chapter “Disposal Context” brings information on the history of the repository, which might be the most interesting for future historians. This chapter explains why things are as they are, by describing processes. It may include a description of changes made over the lifetime of the repository. This chapter may be seen as telling a story.

The chapter “Container and Facility Design” brings another point of view: it describes the repository as it is at the time the KIF is written. It describes the original state which led to the situation archeologists of the future would find. It may be seen as describing a picture.

Pending issues

The concept of a KIF is at an early stage of development, and many issues will have to be fixed in the implementation process. Some of them have already been identified, as follows.

The test on the French case tends to show that, at least for the period where modifications of the repository works are still implemented, the KIF would need to be updated. Following this idea, the concept of an evolving KIF could be worth further development. In such a concept, each generation should review the KIF with two objectives in mind:

- Is the KIF useful and easy of understanding for the present generation? What should be done in order to improve its relevance and legibility?
- Will it be relevant for future generations? What should be done to improve this?

On the other hand, some argue that once the repository is closed, it might become difficult to allocate effort to updating of a KIF. This debate shows two different understandings of the concept of a KIF, mediated (being transmitted from generation to generation, with updating and possibly rewriting), versus non-mediated (being directly aimed at far future generations).

In the "Context" chapter, the relevance of including information on regulatory provisions in force has been questioned: what use would have future generations of that information in a 1,000 year perspective? On the other hand, it was acknowledged that knowing the regulatory context when the repository was operated, and its evolution during the operational phase, may help understand the variations in the design of the repository and waste packages that future generations would encounter if they chose to intrude into the repository. The extent to which information on the regulatory provisions in force would be useful is thus an issue still to be debated.

In the "Facility location" chapter, it was suggested to include descriptions of markers, if there are any.

Difficulties have been identified for the chapter "Similar repositories": information on other global repositories is independent from the operator of the repository described by the KIF. For various reasons (safeguards demands, lack of transparency and openness…), the availability of relevant data may be problematic. This underlines the importance of international cooperation and exchange of information about repositories and KIF´s. The list of repositories to be mentioned in this chapter will probably grow with time: this chapter can therefore only provide partial information on the list of similar repositories. This leads to another question: what should be the scope of repositories which would be described by a KIF? Of course, only repositories concerned with memory preservation issues, beyond one century, would be described by a KIF – and could be referred to in the chapter "Similar repositories" of other KIF's – but would a KIF for a low-level waste site focus only on other low-level waste sites or also address high-level waste or other types of radioactive waste repositories?

CONCLUSIONS

The two cases chosen for the testing of the KIF are very complementary:

- a closed repository versus a projected repository
- a surface repository versus an underground deep geologic repository
- low level wastes versus high level wastes (spent nuclear fuel)
- a mediated transmission and a living document versus aiming for writing directly to a generation in a distant far future.

Despite the differences in the nature of the disposal facilities, the evidence to date is that the KIF concept would apply to both. This is so in spite of the different time

periods over which these two types of repositories present risk to an intruder or its surrounding environment if inadvertently intruded. The scope and content differences would reflect the risk and timeline differences between two such facilities.

Work is continuing on this subject. Discussions will continue within the OECD NEA RK&M working group at least until the end of phase II of the RK&M initiative (March of 2017).

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