IAEA's Fast Reactors Knowledge Portals and Catalogues

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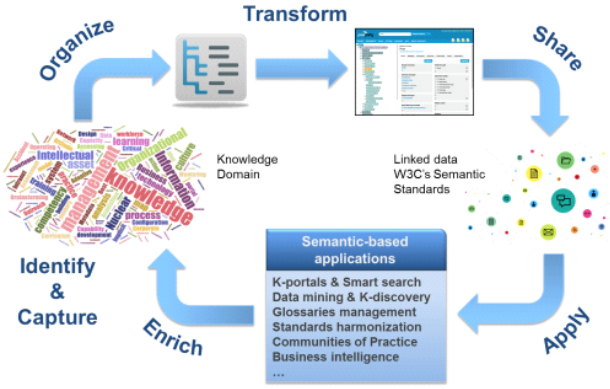
Abstract

The IAEA has been carrying out a dedicated initiative on fast reactor knowledge preservation since 2003. The main objectives of the Fast Reactor Knowledge Portal (FRKP) initiative are to, (a) halt the on-going loss of information related to Fast Reactors (FR), and (b) collect, retrieve, preserve and make accessible existing data and information on FR. The FRKP portal helps in knowledge sharing, development, search and discovery, collaboration and communication of fast reactor related information.

Knowledge portals are capable to control and manage both publicly available as well as controlled information. The portals incorporate the existing set of knowledge and information and also provide a systemic platform for further preservation of new developments. It includes fast reactor document repositories, project workspaces for the IAEA's Coordinated Research Projects (CRPs), Technical Meetings (TMs), forums for discussion, etc. In the portal a taxonomy based search tool is implemented, which helps using new semantic search capabilities for improved conceptual retrieve of documents. The taxonomy complies with international Web Standards as defined by the W3C (the World Wide Web Consortium). The interest for this initiative has been reconfirmed at several technical meetings held in this area along with a constant support from the IAEA Technical Working Group on Fast Reactors (TWG-FR). This is an initiative by IAEA and represents a collaborative effort to preserve fast reactor data and knowledge.

Key words: Fast reactor, knowledge portal, FRKP portal, taxonomy, LNFNS catalogue, LMFNS facilities database

1. IAEA Knowledge Organization System (KOS)



The Knowledge Organization System or "KOS" is a generic term for methods and tools, such as vocabularies, thesauri, taxonomies, or ontologies, used to describe a knowledge domain. Reffering to [1] "with the rapid development of Semantic Web Technologies and Linked (Open) Data, KOS's are increasingly occupying a prominent role in a wide variety of applications and usage. Member States are increasingly requesting the IAEA to develop and host broadly scoped knowledge bases. Rapidly increasing number of documents and limitation on free text search motivated the development of new tools and Portals.

The IAEA uses a special tool for managing KOS's according to international Web Standards as defined by the W3C (the World Wide Web Consortium). This tool allows for developing and editing KOS's, for publishing them as Linked Data in different media (foremost the Internet), and for deploying them in various scenarios where extraction of important concepts from text is required".

2. Knowledge portals as application of KOS

Knowledge based user interfaces include Portals, Wikis, Web Sites and other applications. The objectives of the knowledge portals are: knowledge sharing; knowledge preservation; knowledge development; search and discovery; collaboration and communication. Web-based knowledge portals, being developed by the IAEA, represent applications of KOS's in several nuclear power technology development areas.

These portals have been and are being created by the IAEA for the following purposes [1]:

- To provide a cloud-based infrastructure for Member States to store, retrieve, and share information and documentation.
- This cloud-based infrastructure is based upon Sharepoint Server 2013 and is provided free of charge to the Member States
- Member States can use this infrastructure as their sole means of storing, retrieving, and sharing information and documentation or in conjunction with Member States existing infrastructure

These objectives require the implementation of activities supporting digital document archival, data exchange, search and retrieval, as well as facilitating — by developing and using advanced information technology tools — knowledge preservation over the next decades.

An important part of a knowledge portal is dedicated to the content management of documents and document repositories. Even with the availability of good quality search engines, retrieval can be improved by providing the search engine with metadata classifying the content of the documents into categories of domain-specific KOS's. Manually assigning metadata ("tagging") is however highly labour-intensive and error prone. Therefore, means are sought to support this process as far as possible in an automatic or semi-automatic way. Furthermore, developing and editing high-level documents greatly benefit from KOS-based categorization of documents and/or parts of it. This allows for improved consistency of document series, and opens the path to connecting documents with approved glossaries. The development of knowledge based applications relies heavily on dependable taxonomies, and therefore there is a dedicated effort to develop the Taxonomy as well.

3. Taxonomies as part of KOS' development

A Taxonomy, defined as "a hierarchical structure in which a body of information or knowledge is categorized, allowing an understanding of how that body of knowledge can be broken down into parts, and how its various parts relate to one another" [2, 3], is the key element of the KOS which allows using new capabilities such as semantic search in an IAEA- wide tool.

In future, applying the software adopted by the Agency, it will be possible to install any knowledge organization system within the IAEA IT environment to perform improved functions, e.g. document search, based on that particular KOS. A prerequisite consists in the compliance of the KOS's to international web standards as defined by the W3C (the World Wide Web Consortium). Therefore, new IAEA taxonomies are being developed by means of a tool which complies with those standards. This tool allows for developing and editing KOS's, for publishing them as Linked Data in different media (foremost the Internet), and for

deploying them in various scenarios where extraction of important concepts from text is required, e.g. for auto- tagging of documents on the basis of the adopted taxonomy.
To this end the IAEA is developing two new web-based applications of the KOS employing IAEA methodology to categorize knowledge of fast reactors (FR) and gas cooled reactors (GCR), allowing the creation of a comprehensive and well-structured international inventory of reactor data and information provided by Member States.
This paper presents the development of the knowledge portals on fast reactors (FR) and gas cooled reactors (GCR).

4. The Fast Reactors Knowledge Portal (FRKP)

4.1 Establishment of the FRKP

Each country has different methods of organizing and disseminating their fast reactor related information and knowledge within their existing fast reactor organizations. In response to needs expressed by Member States and within a broader IAEA-wide effort in nuclear knowledge preservation, the IAEA has been carrying out a dedicated initiative on fast reactor knowledge preservation.
Member States, which operated or are designing or operating fast reactors, were invited to use the Fast reactors knowledge portal (FRKP Portal). Initially 13 Member States expressed their readiness to upload their documents and use the FRKP portal as appropriate. The IAEA secretariat regularly updates on the status of the portal the FRKP Users' group.

4.2 The FRKP objectives

Most Member States have been contributing to this initiative through the IAEA International Nuclear Information System (INIS), which allows collecting, processing, preserving and disseminating bibliographic data and full texts of the world's nuclear literature.
There are still collections of documents and other information that is considered at risk of being lost or destroyed. This documentation is typically in countries and locations that don't currently have active fast reactor projects.
In response to needs expressed by Member States and within a broader International Atomic Energy Agency (IAEA)-wide effort in nuclear knowledge preservation, in order to foster the exchange of technical information and to contribute to the preservation of the knowledge base of fast reactor technology, since 2002 the IAEA has been carrying out a dedicated initiative on fast reactor knowledge preservation. The Fast Reactors Knowledge Portal (FRKP) has been established and is being maintained by the IAEA.

4.3 The FRKP contents

The FRKP Portal is currently located on the IAEA server and contains approximately 30 000 articles. The FRKP Portal is accessible through registration with the IAEA NUCLEUS, the common access point to the IAEA's scientific, technical and regulatory information resources, along with access to the INIS library.
The FRKP Portal provides users with authorized access to:

- Any fast reactor related documentation that Member States wish to share;
- Full papers and other materials of consultancies and technical meetings;
- Documentation from Coordinated Research Projects including the public and working materials;
- Old reports (which will remain available through the INIS repository);
- Document repositories on SharePoint.

4.4 Using and maintaining the FRKP portal

The end-users (typically the Member States that have a fast reactor programme) can upload their documents into the system with full control as far as setting permissions to access and download the documents [4]. Control of the data security of the system will be the same as that already in place in the IAEA. In this regard the Member States are expected to trust the classified users. However, the Member States will, as noted, have the power to define the level of access for various users (e.g. definition of rights for other parties).
The FRKP portal is envisioned to control and manage both publically available as well as restricted forms of information, unlike INIS which manages just publically available information. The FRKP portal is designed for the use by a specific community; however web-pages providing general information about the FRKP portal, taxonomy applied in the portal, will be published.

In summary, the new pilot FRKP Portal allows for:

- Document repositories on SharePoint 2013;
- Uploads by MS users themselves;
- Principle for Rights Management: Documents provided by MS will be in control of MS (e.g. definition of rights for other parties) ;
- Taxonomy to improve choice search terms;
- Links for searching into other collections of information such as INIS, OSTI's Science.gov, etc. ;
- Designing the portal pages to improve functionality;
- Uploading and auto-tagging documents from IAEA and MS.

To guarantee the continuous development of the FRKP Portal and to foster the FRKP initiative, an IAEA Technical Meeting on Status of IAEA Fast Reactor Data Knowledge Preservation Initiative is held annually since 2003.

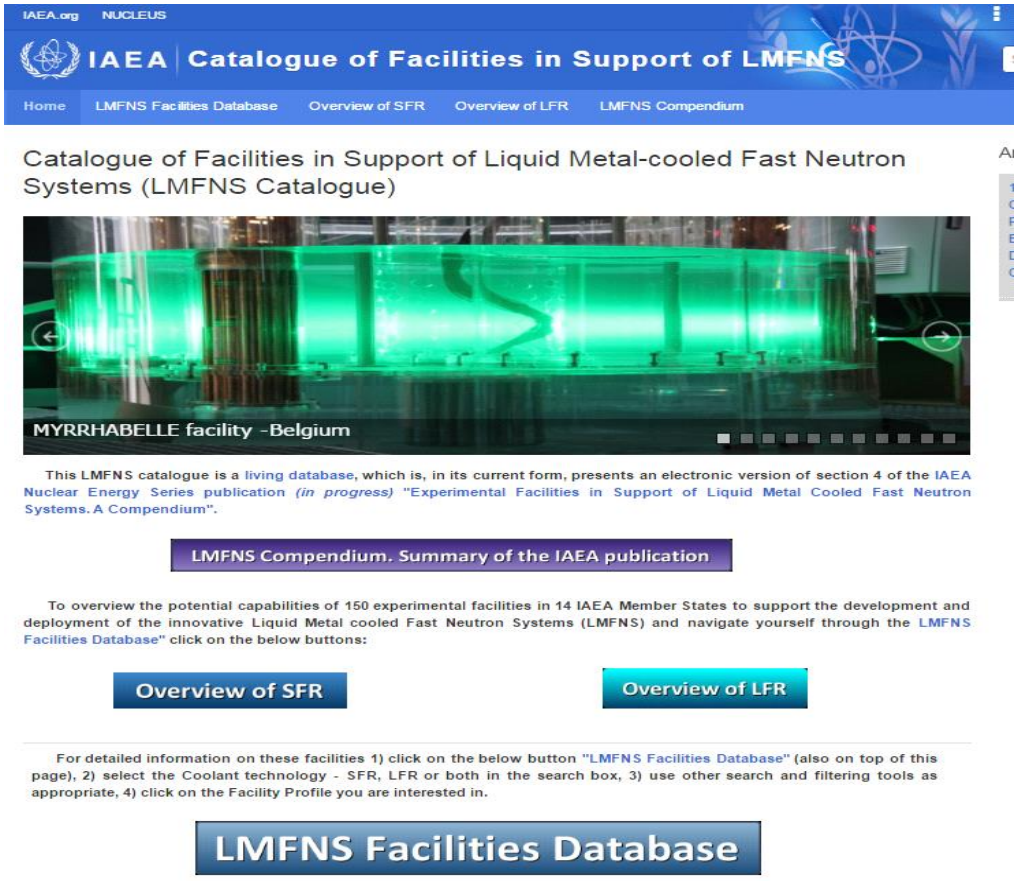
4.5 Fast reactor taxonomy

The taxonomy of fast reactors is the key element of designing the FRKP portal. The FR taxonomy was originally developed almost 10 years ago. It was revised and essentially restructured in 2015 taking into account new capabilities of semantic search in the Agency wide tools, in particular, auto-tagging and searching documents allocated in the portals.
In the new FR taxonomy new concepts have been introduced and interlinks have been incorporated. Alternate concepts to already existing and newly introduced concepts were included as appropriate. The new taxonomy has been created by listing high level "concepts" related to fast reactors and then breaking down those high level (parent) concepts into finer and finer concepts that allows for the organization of documents and information into finer detail. The new taxonomy is still under development.

6 C**atalogue of LMFNS facilities – a new IAEA database**

Committed to addressing the technology progression, the IAEA provides support to the Member States covering all technical aspects of current, evolutionary and innovative fast reactors and subcritical hybrid systems.

The newly developed catalogue of experimental facilities in support of development and deployment liquid metal-cooled fast neutron systems (LMFNS catalogue) is a living database [5], which is easy searchable in the internet by the key words "LMFNS catalogue". It presents an overview as well as detailed information on more than 150 experimental facilities under design, construction or operation in 19 institutions of 14 IAEA Member States.



The LMFNS Catalogue contains detailed data and information on 79 facilities in support of the development of sodium cooled fast reactors (SFR), as well as 72 facilities in support of lead and lead-bismuth eutectic cooled fast reactors (LFR). Several facilities are applicable to both SFR and LFR technologies. The detailed facility profiles are categorized according to their most relevant research fields (main application). Multiple-choice filtering options by main research fields, by reactor type (SFR, LFR, cross-cut SFR/LFR application) and by country are available.

The LMFNS Catalogue will be useful for a wide range of governmental and private sector organizations responsible for the development and/or deployment of innovative fast neutron systems in countries with active programmes on these nuclear energy systems, including designers, manufacturers, vendors, research institutions, academia, technical support organizations (TSOs) and other organizations directly involved in technology development programmes on fast neutron systems and, more generally, on advanced nuclear energy systems.

By providing the end-users with detailed information on existing and future experimental facilities able to support innovative LMFNS, both critical and subcritical, the open LMFNS database is aimed at facilitating cooperation between organizations with an active programme on fast neutron systems. It is expected that it will enhance the utilization of these facilities within the associated experimental programmes, and motivate the involvement of young engineers and researchers to be educated and trained in the field of advanced reactors.

A related IAEA Nuclear Energy Series publication is expected to be published in 2017.

References

[1] S. Monti, V. Kriventsev, F. Reitsma, M. Khoroshev, C. Batra, J. de Grosbois, M. Gladyshev, D. Beraha Development of the IAEA's Knowledge Preservation Portals for Fast Reactors and Gas Cooled Reactors Knowledge Preservation. Third International Conference on Nuclear Knowledge Management - Challenges and Approaches (Proc. Conf. Vienna 2016) IAEA, Vienna (2016) Contributed paper and poster Nr. 106.
[2] INTERNATIONAL ATOMIC ENERGY AGENCY, Knowledge Management for Nuclear Industry Operating Organizations, IAEA-TECDOC-1510, IAEA, Vienna (2006).
[3] INTERNATIONAL ATOMIC ENERGY AGENCY, Fast Reactor Knowledge Preservation System Taxonomy and Basic Requirements, Nuclear Energy Series No. NG-T-6.3, IAEA, Vienna (2008).
[4] Protected website for Fast Reactor Nuclear Knowledge Management Portal (restricted) http://nkmsp01.cloudapp.net/sites/frkos/SitePages/Home.aspx
[5] INTERNATIONAL ATOMIC ENERGY AGENCY, Catalogue of Facilities in Support of Liquid Metal-cooled Fast Neutron Systems (LMFNS Catalogue), https://nucleus.iaea.org/sites/lmfns