

Information Sheet

1. Title of Co-ordinated Research Project:

Comparative Analysis of Methods and Tools for Nuclear Knowledge Preservation

2. Executive Summary:

The objective of the Coordinated Research Project (CRP) on Comparative Analysis of Methods and Tools for Nuclear Knowledge Preservation is to support the preservation of nuclear knowledge in Member States and the IAEA by selection and implementation of appropriate cost-effective technological solutions.

The objective will be reached through coordinated research and analysis by a CRP Team (members from participating organizations) which will identify alternative knowledge preservation methods and tools necessary to understand, capture, interpret, analyze, visualize, retrieve, archive and disseminate data and information, as well as the knowledge ultimately derived from them.

Different types of information will be under consideration. The existing incompatibilities between data formats, software systems, methodologies, standards and models in Member States and the IAEA will require research and analysis in multiple disciplines.

Based on the result of the comparative analysis, recommendations/solutions and benchmarks for nuclear knowledge preservation will be developed. Alternative solutions are indicated due to the technology gap between Member States. These alternatives will facilitate interoperability, knowledge exchange and integration, improve the present understanding of various technological aspects of nuclear knowledge preservation and increase the efficiency of nuclear knowledge preservation projects in the IAEA and Member States.

The CRP Team (from organizations both within and outside of the nuclear science community) will recommend alternative technologies. Subsequently, the CRP Team will document these technologies and applications within their areas of expertise. The results will be disseminated in print and electronic form. Revision could be issued based on changing technology and tools, and evaluation of the results of the recommended solutions.

3. Background

In response to long-term energy scenarios, it is necessary to preserve and maintain the accumulated knowledge in nuclear science and the nuclear industry. Within these scenarios is the reality of ageing of the human workforce in the nuclear sector and the sharp decline in the number of entrants to education and training in nuclear science and engineering.

The challenge of the IAEA to this reality is to enhance the capacity of Member States to maintain and preserve the information and knowledge resources related to the peaceful uses of nuclear energy.

The targeted users of these practices include, but are not limited to the IAEA Member States participating in nuclear knowledge management activities, and other appropriate organizations that wish to participate. Implementation of the recommendations coming from this CRP, in some cases, will be difficult due to resources, legal factors and legacy systems. Regardless, the goal of nuclear knowledge preservation should be interoperability that will allow knowledge sharing for as long as the knowledge remains useful.

This Coordinated Research Project is derived from the IAEA Program for the period 2004-2005, Programme C, Capacity Building and Nuclear Knowledge Maintenance for Sustainable Energy Development, Section C.3, Nuclear Knowledge Management and section C.3.03, Maintenance and

preservation of knowledge in specific areas of nuclear science and technology, specifically “a CRP on knowledge preservation technologies leading to archiving of information.”

4. Definition

Knowledge Preservation is part of the larger process of Knowledge Management. A variety of concepts and terms are used to describe this overall process, including but not limited to the following: Knowledge Identification, Knowledge Acquisition, Knowledge Development, Knowledge Dissemination, Knowledge Use, Knowledge Preservation, Knowledge Sharing.

The IAEA has formalized the definition of **Knowledge Management**:

“An integrated approach to identifying, managing and sharing an organization’s knowledge, and enabling groups of people to create new knowledge collectively in order to achieve the objectives of the organization.” (IAEA Management Glossary, 2004).

As the IAEA does not have a formally accepted definition of Knowledge Preservation, the following is proposed for the purpose of this CRP:

Processes to capture, understand, archive, retrieve and protect explicit and tacit knowledge and to maintain accessibility and readability to it as technology evolves for as long as the knowledge remains useful.

This proposed definition should be redefined by the CRP Team and adopted by the IAEA.

5. Overall Objective

The objective of the Coordinated Research Project (CRP) on Comparative Analysis of Methods and Tools for Nuclear Knowledge Preservation is to support the preservation of nuclear knowledge for as long as that knowledge remains useful by selection and implementation of appropriate cost-effective technological solutions.

6. Specific Research Objectives

This objective will be achieved by research and comparative analysis of technological knowledge preservation practices by the CRP Team during the period of 2005-2008. Concurrently, they will prepare recommendations to be delivered by 2008.

These recommendations will provide benchmarks, alternative methods and tools that can be used for nuclear knowledge preservation. These include processes to capture, understand, analyze, retrieve, visualize, archive and disseminate knowledge. Various types of information and media will be considered, including numerical, graphical and textual data, databases, computer programs, video and multimedia, as well as tacit knowledge.

7. Technology Framework

The recommended technology framework for this CRP is:

Tools and Methods

A. Communications

B. Retrieval

C. Storage Media

D. Capture (Source/Preservation/Web)

E. Multilingualism

This recommended framework would be validated/modified by the CRP Team.

However, other factors will be considered that are outside the scope of the CRP, but essential for the successful implementation of nuclear knowledge preservation. These include (as necessary):

Management Factors

A. Training

B. Workflow

C. Knowledge Identification

D. Participant Identification

E. Standards

F. Security

8. Expected Research Results

Technology - Research results should recommend benchmarks, alternative methods and tools for knowledge preservation during the current, mid-term (5 year) and long term (10 year and beyond) periods. The following frames are suggested (to be modified and expanded by the CRP Team):

Communications: The requirement to rapidly disseminate and access nuclear knowledge will be dependent on alternative communication systems that are particularly critical considering the technological differences in Member States. These alternatives will vary from near instantaneous knowledge transfer to reliance on postal services. These alternatives will shrink over time, and it is anticipated that during the long term period most facilities would have instantaneous communications.

Retrieval: Basic to the utilization of nuclear knowledge is the requirement for timely retrieval of all relevant documents, regardless of their location, format and language. Ideally this would utilize advanced retrieval software that would incorporate multilingual and fuzzy searching (to retrieve knowledge in core languages and allow for transliteration variables).

Storage Media: Alternatives in media technology should consider longevity, robustness, cost, conversion, volume, standards, existing formats, historical data and other factors.

Capture: Alternatives in capture will consider media, format, speed, costs, volume and intellectual property issues. This should also include alternatives for source capture and guidelines for hard copy publication (to enable subsequent imaging), preservation of historical documents, standards and quality control procedures.

Multilingualism: Cross language information retrieval (CLIR) and multilingual tools (i.e., thesauri) should be incorporated. This will impact several other frames, such as Retrieval and Standards.

Other considerations that are out of scope for the CRP will be addressed in order that technological solutions can be implemented.

Management - Issues will include, but are not be limited to, the following:

Training: The technologies recommended may require training at various levels, both for producers and users. Distance learning should be utilized to the maximum extent possible.

Workflow: Alternative workflows may be required, considering for example centralized vs. decentralized models, outsourcing and standards, all leading to interoperability. Existing exemplary models, to be identified by the CRP Team, may be examined and copied in whole or in part.

Knowledge Identification: Which knowledge should be captured, processed, maintained and preserved? How will it be identified, and how will changes over time be identified? Which bibliometric tools (i.e., citation analysis) are appropriate for such analysis?

Participant Identification: Who are the users and producers, both current and future, and what are their requirements for nuclear knowledge? How will these participants and their requirements be identified over time?

Standards: Standards will impact all frames of technology. Both technical and data (metadata) standards will be considered. The change and adoption of standards are a responsibility of management. Without appropriate standards, interoperability will not be possible.

Security: Management procedures should assure that the documents are authentic. Internal practices are required for computer security, authentication and archiving to prevent loss and unauthorized modification of documents.

9. Needs Analysis

It is necessary to ascertain the current and anticipated environment of participants in nuclear knowledge preservation. A survey should be conducted of sample groups involved in nuclear knowledge preservation. The CRP Team should prepare the survey form. The survey results would be compiled and used to support the CRP Team research and analysis, and the development of appropriate benchmarks.

10. Action Plan (Activities)

Comparative Analysis of Methods and Tools for Nuclear Knowledge Preservation	2005	2006	2007	2008
1. <u>Complete CRP Proposal.</u> Complete CRP Proposal and distribute for approval.	May			
2. <u>Approval of CRP Proposal.</u> Obtain approval for CRP.	May			
3. <u>Send invitations for participation to organizations listed in CRP Proposal as approved or modified.</u> Participating organizations will receive an invitation with background material, meeting date and location, funding, tasks and expected outputs.	Jun			
4. <u>Establish a website to coordinate the work of the CRP Team and to monitor progress of the project.</u> The CRP Team will be able to exchange ideas, references and submit drafts of their work for comments. It will also be used to disseminate changes in technology and standards that will impact nuclear knowledge preservation.	Nov	*	*	*
5. <u>Meetings of the CRP Team from participating organizations.</u> The CRP Team will initially meet to: Approve/and modify the proposed technical frames and definition(s); develop the survey form and identify institutions to be surveyed; comment on managerial issues and develop an Action Plan. They will provide a detailed outline of the communication, retrieval, storage media, capture and multilingualism frames (as modified) that can be used for preparation of nuclear knowledge preservation recommendations in future meetings; identify	Nov	*	*	*

Comparative Analysis of Methods and Tools for Nuclear Knowledge Preservation	2005	2006	2007	2008
benchmarks to be developed; agree on the assignment of research activities by organizations. Subsequent meetings will be held to review the CRP progress, share information and discuss solutions.				
6. <u>Survey form to selected institutions and compile results.</u> The survey form will be sent to institutions identified by the CRP Team. Results of the survey will support preparation of nuclear knowledge preservation recommendations and benchmarks.	Nov	*		
7. <u>Research Activity within CRP organizations.</u> Participating research organizations will prepare specific solutions and benchmarks as tasked at earlier meetings according to the Action Plan and individual contracts/agreements.		*	*	*
8. <u>Disseminate nuclear knowledge preservation guidance.</u> Solutions and recommendations will be disseminated in appropriate electronic and conventional documents.				*

11. Logical Framework

Logical framework for the IAEA Coordinated Research Project on “**Comparative Analysis of Methods and Tools for Nuclear Knowledge Preservation**”

<i>Narrative summary</i>	<i>Objective Verifiable Indicators</i>	<i>Means of verification</i>	<i>Important assumptions</i>
Overall objective: The objective of the Coordinated Research Project (CRP) on Comparative Analysis of Methods and Tools for Nuclear Knowledge Preservation is to support the preservation of nuclear knowledge in Member States and the IAEA for as long as that knowledge remains useful by selection and implementation of appropriate cost-effective technological solutions.	N/A	N/A	Acceptance by Member States. This requirement was discussed at the 2004 Board of Governors meeting.
Specific objective: This objective will be achieved by obtaining recommendations/solutions for alternative technological practices, as suggested by the CRP Team, meeting initially in 2005. These recommendations will provide benchmarks, alternative methods and tools that can be used for nuclear knowledge preservation. This includes processes to capture, understand, analyze, retrieve, visualize, archive and disseminate knowledge.	The objective will be reached through coordinated research leading to the development of recommendations/solutions.	Feedback from Member States. Interoperability between systems developed by Member States.	Member States will adopt the recommendations/solutions within the scope of resources, legal factors and legacy systems.
Outputs:	1. A survey form	N/A	1. The survey form

<i>Narrative summary</i>	<i>Objective Verifiable Indicators</i>	<i>Means of verification</i>	<i>Important assumptions</i>
<p>1. <i>Needs analysis</i>: A survey form designed by the CRP Team and sent to representative producers to determine the current and future nuclear knowledge preservation environment.</p> <p>2. A website to coordinate the work of the CRP Team, to monitor progress of the project, and provide updates to the recommended practices.</p> <p>3. Recommendations/solutions of the CRP Team.</p>	<p>drafted by the CRP Team and the results of the survey.</p> <p>2. A website established and administered by the IAEA.</p> <p>N/A</p>	<p>2. Monitor website.</p> <p>N/A</p>	<p>will be promptly completed and returned.</p> <p>2. Member States will have access to the site.</p> <p>3. IAEA approval of the recommendations/solutions.</p>
<p>Outcomes:</p> <p>1. Preservation of nuclear knowledge in Member States for as long as that knowledge remains useful.</p> <p>2. Development of Methods and Tools to support the preservation of nuclear knowledge in Member States and the IAEA by selection and implementation of appropriate cost-effective technological solutions.</p>	<p>Acceptance by Member States.</p>	<p>Acceptance by Member States.</p>	<p>Alternative methods will be presented due to the technology gap between Member States.</p>
<p><i>Activities:</i></p> <p>1. <u>Complete CRP Proposal.</u></p>	<p>Complete CRP Proposal and distribute for approval.</p>	<p>CRP proposal submission.</p>	<p>Consultant and IAEA staff will complete proposal.</p>
<p>2. <u>Approval of CRP Proposal.</u></p>	<p>N/A</p>	<p>Proposal approved.</p>	<p>Obtain approval for CRP.</p>
<p>3. <u>Send invitations for participation to organizations listed in CRP Proposal as approved or modified.</u></p>	<p>Participating organizations will receive an invitation with background material, tasks and expected outputs.</p>	<p>Acknowledgement of receipt and response.</p>	<p>Approval of CRP and funding. Timely response from organizations.</p>
<p>4. <u>Establish a website to coordinate the work of the CRP Team selected by organizations and to monitor progress of the project.</u></p>	<p>Website.</p>	<p>Monitor use.</p>	<p>Approval of CRP and funding. CRP Team will have access.</p>
<p>5. <u>Meetings of CRP Team from participating institutions.</u></p>	<p>Output from the meetings: CRP Team approve/and modify the proposed technical frames and definitions; prepare survey form</p>	<p>Minutes of the meetings. Output from the meetings.</p>	<p>Approval of CRP and funding. Tasks can be completed within the time frame allotted.</p>

<i>Narrative summary</i>	<i>Objective Verifiable Indicators</i>	<i>Means of verification</i>	<i>Important assumptions</i>
	and identify institutions to be surveyed; comment on managerial issues; draft detailed outline of the communication, retrieval, storage media, capture and multilingualism frames, as modified. Establish benchmarks.		
<u>6. Survey form to selected institutions.</u>	Survey form.	Receipts from mailing.	CRP Team will complete survey form. Forms will be returned in a timely manner.
<u>7. Research Activity within CRP organizations.</u> Participating research organizations will prepare specific solutions and benchmarks as tasked at earlier meetings according to the Action Plan and individual contracts/agreements.	Delivery of the recommendations/ solutions and benchmarks.	Delivery of the recommendations/ solutions and benchmarks.	Deadlines will be met.
<u>8. Disseminate the nuclear knowledge preservation recommendations.</u>	Recommendations received from CRP Team.	Dissemination of documents.	Dissemination of recommendations in suitable formats.