Workshop Summary

INTRODUCTION

A workshop on "Managing Nuclear Knowledge" was held in Trieste, Italy from 22 – 26 August 2005 and was jointly organized by the International Atomic Energy Agency (IAEA), the Abduls Salam International Center for Theoretical Physics (ICTP), and the World Nuclear University.

The purpose of the workshop was to continue efforts to raise awareness of the nuclear knowledge management challenge, to share best practices, and provide a forum for the exchange of information among participating nuclear professionals. The need to manage (preserve and transfer) knowledge has been widely recognized in the international community. The need is compounded by aging work force issues in many industries and is not limited to areas of nuclear technology.

The workshop was attended by 41 participants from 24 counties and three international organizations. Presentations by several of the participants covered a broad range of nuclear knowledge management issues, including the role of technology, preserving expert knowledge, and preparing the new generation of nuclear worker.

At the conclusion of the workshop participants voiced a desire for the continued support by the IAEA, ICTP and World Nuclear University in facilitating future meetings on nuclear knowledge management, assisting organizations in developing effective programs, and providing services from experts in the area of knowledge management.

THE WORKSHOP CONTENT

The meeting covered methodological and design practices for NKM including the information technology impact on NKM implementation, presented the lessons learned and accumulated national experiences and good practices from NKM programs in academia, industry, the governmental sector and technical support organisations.

The style of the meeting was series of leading presentations followed by working sessions discussing the issues raised and difficulties envisaged. All participants were actively involved in discussions, panel reviews and workshop activities. During the technical sessions participants presented case studies and examples from their national activities/projects.

The following issues have been addressed during the Workshop as the issues forming the framework for activities in nuclear knowledge management:

- Policies and Strategies in Nuclear Science and Technology,
- Managing Nuclear Information Resources,
- Human Resources and Knowledge Transfer for the Nuclear Sector,
- Managing and Preserving Knowledge in Nuclear Sector,
- Networking for Education, Training and Knowledge Transfer.

The issues outlined in the workshop programme including strategies, approaches and current activities on the subject were discussed and the participants presented their views, experience

and the current difficulties being faced in the areas of Nuclear Knowledge Management during panel discussions and breakout sessions.

The technical summary of the workshop sessions is given below:

Session 1. Policies and Strategies in Nuclear Science and Technology (Chair: Yanko Yanev)

Besides the opening and the introduction of participants the session had two main objectives. First to present the current status of development of the Agency Nuclear Knowledge Management Initiative and second to present knowledge management initiates in countries with developed and well-established nuclear programmes. Presentations from IAEA, Canada, Japan, UK and Philippines touched on different aspects, both theoretical and practical, of nuclear knowledge management.

The following key conclusions and recommendations emerged from the discussion.

- Knowledge and management have many definitions meaning different things to different people but mainly knowledge management is retrieving wealth and investing in people.

- Economic principles at this time do not appear to include knowledge as a resource- but this is evolving (material resources can be easily replaced/knowledge can't always be replaced). Knowledge is a resource, it has to be managed

- No universal definition of knowledge management. Nuclear knowledge must be managed responsibly- for safety, for a "nuclear" future, for security and for future generations (i.e. long-term management of spent- fuel)

- NKM is critical due to renaissance of nuclear power this is also creating an increased interest in nuclear production

- IAEA has a key role since no other international body includes nuclear

- With attrition/downsizing- facing critical shortages/loss of ability for peer reviews (singleton experts)

- Proprietary information further complicates, access to "open literature" in international databases

- Benchmarks are needed they don't exist now and are needed

The Panel Discussion, which included all lecturers and the participants, yielded further comments and recommendations. Value of knowledge which knowledge do you preserve, what do you get rid of. Keeping too much old or unnecessary knowledge can stifle innovation and new ideas or approaches. Organizations have to be cautious of what you get rid of perhaps build on what exists and encourage growth, and store as archive the knowledge. Scientists/ researchers/ should be pushed towards better record keeping, documenting their work. This should be resolved by the company/organization's culture and procedures. It was suggested that the IAEA puts together some guidelines/best practices in a TECDOC including KM benchmarking. At the same time IAEA wants to develop through the KM some common indicators that individual countries can use

Session 2. Managing Nuclear Information Resources (Chair: Anatoli Tolstenkov)

This session was organized to discuss and exchange practical experiences on main aspects of managing nuclear information such as information identification and capturing, evaluation, access and dissemination, sharing and transferring to future generations (preservation). The session consisted of 7 presentations, one breakout session and final discussion.

The Chair opened the session by an overview the INIS system and provided participants with practical information about INIS products and services. In addition each participant received a special INIS folder containing materials about INIS.

Mr. David Beraha of GRS highlighted main steps of GRS in Knowledge Management (KM) since 2002 and stressed that a structured taxonomy is very essential for efficient KM.

Mr. Wei Lei of IAEA, MTIT, provided a status of the development of the IAEA Nuclear Knowledge Portal and a background for the breakout session on Requirements for Nuclear Information Portal, where the participants organized into two groups discussed and elaborated their visions and requirements for the Nuclear Knowledge Portal.

Mr. A. Tolstenkov of IAEA shared the experiences in Preservation of Nuclear Information and Records addressing various aspects of information preservation including digital preservation, Web information harvesting, practical methods and standards.

Messrs A. Tolstenkov and A. Kossilov of IAEA presented the main IAEA knowledge preservation initiatives within the IAEA Programme C. Participants were provided with references to IAEA knowledge/information sources.

Mr. H. H. Over, JRC Petten, addressed various information systems and tools developed in Institute for Energy of Joint Research Centre of the European Commission. This presentation was supported by the following presentation on WWER reactor pressure vessels knowledge: A Preservation and Knowledge Management Project Concept, which provided a practical solution for the particular case.

In the end of the day each group of the breakout session presented results of their discussions and observations. The results were very interesting. All recommendations were discussed, combined and will be used for the development of the IAEA Nuclear Knowledge Portal.

Session 3. Human Resources and Knowledge Transfer for the Nuclear Sector (Chair: Thomas Mazour)

This Session was organized to be interactive and to provide practical ideas that participants could use in their organizations related to knowledge management.

The Chair opened the session by leading a discussion of issues and terminology related to knowledge management (KM). He made reference to the draft glossary of terms for KM that were provided with the participant materials for the workshop, and that were introduced in Session 1.This discussion highlighted that many of the tools and methods for KM that are most prominently publicized relate to capture and transfer of explicit knowledge in databases, etc., but that the most difficult knowledge transfer challenges are for tacit knowledge which, unless it is suitable for conversion to explicit knowledge, needs to be transferred person-to-person through mentoring, redundancy, communities of practice, etc. Such methods require considerable resources and a culture that supports/encourages knowledge transfer.

Mr. David Beraha of GRS, Germany shared the experiences of his organization in KM in a practical way, with particular emphasis on capture and transfer of explicit knowledge.

Mr. Robert Workman, IAEA INIS Section Head, facilitated a break out session where four groups discussed topics on knowledge capture, knowledge transfer, knowledge gaps, and knowledge targets, respectively. These groups then reported their overall conclusions to the plenary session.

Mr. Clive Bright of British Nuclear Group provided a practical description of safety case information capture, and maintenance, while Mr. Luis Perez of the Chilean Commission for Nuclear Energy, described human resource management issues in his organization.

Mr. Ed Boyles of TVA provided a very practical session on his organization's approach to retaining critical knowledge in an ageing workforce, including development of an integrated staffing plan, which includes an objective knowledge loss risk assessment that has received considerable interest in the nuclear power industry.

The final activity of the session was a panel discussion regarding development of guidelines that could be used either by a nuclear industry operating organization in conducting a self-assessment of its Knowledge Management (KM) functions, or for an independent, external review of such an organization. This activity helped both to provide a focus on what is included in KM for nuclear industry organizations, and how these organizations might identify both their KM strengths as well as areas for improvement. The review of these guidelines was only partially completed in Session 3, and was carried over into Session 4.

Session 4: Managing and Preserving Knowledge in Nuclear Sector (Chair: Andrei Kossilov)

Nuclear knowledge management is a critical input to the nuclear power industry, the associated nuclear fuel cycle activities and nuclear applications. It has an equally critical role to play in facilitating the development of innovative nuclear technologies. Ten presentations of the day provided the broad range of topics related to the subject.

The Chair started the session introducing the development of a new IAEA technical report on Knowledge Management for NPP Operating Organizations. The document will identify the fundamental elements needed for an effective KM system, as well as providing guidance concerning methods for KM implementation. For an NPP operating organization, specific knowledge management activities help focus the organization on acquiring, storing and utilizing knowledge for such things as effective transfer of knowledge from an ageing workforce to the next generation, problem solving, dynamic learning, strategic planning and decision making.

Mr. M. Petri, Federal office for Radiation Protection, presented the German approach to nuclear knowledge management. It was pointed out that many ongoing activities are to expand nuclear information and KM at all levels, and international cooperation in the field is helpful.

Mr. L. Ulfkjaer, IAEA, NS/SSCS, presented the IAEA activities in managing nuclear safety knowledge. A wide variety of activities were initiated by the IAEA relating to knowledge management and networking in the area of nuclear safety and a holistic approach has been adopted to enhance the effectiveness of programme delivery. Innovative approaches are being

utilized to capture, create and share safety knowledge and to assist Member States in their efforts to develop and to maintain sustainable education and training programmes. A major nuclear safety challenge is to foster a global knowledge-sharing culture to achieve the motto that '*a safety improvement anywhere is an improvement of safety everywhere*'. The measures being implemented include mapping and retrieving safety knowledge, development of process flows and facilitating the development of regional safety networks such as the Asian Nuclear Safety Network (ANSN). The presentation was concluded by giving a live demonstration of various ANSN web sites.

Ms. B. Duff, the Canadian Nuclear Safety Commission, shared the experiences of her organization in KM in a practical way, with particular emphasis on capture and transfer of explicit knowledge and information management and documentation. In relation to the various streams of KM work being undertaken at the Canadian Nuclear Safety Commission it was highlighted through questions that although much work was taking place there was still an apparent need to make more explicit the overall KM Policy. This was a theme that emerged throughout the week where it was agreed that any KM initiatives shoudl be situated within a clear KM policy and strategy.

Mr. J. Husarcek, Nuclear Regulatory Authority, Slovakia and Ms. F. Ivan, National Commission for Nuclear Activities, Romania, overviewed the KM activities in their organizations emphasizing the need to improve the knowledge transfer and document management as a key resource for the organization performance increase.

Ms. L. Alejeva, Lithuanian Technical Support Organization, presented a practical description of various databases providing information on equipment qualification as a practical tool for a preservation of nuclear knowledge at Ignalina NPP.

Ms. K. Tiyapun, Office of Atoms for Peace Bureau of Nuclear Safety Regulation, presented the overall status of KM in Thailand. Nuclear knowledge management together with promotional policies from both government and private sector will determine the possibility of the nuclear energy as an alternative sources and apply to the energy source for Thailand. The nuclear knowledge management is being carried out at several institutes in Thailand including Chlalongkorn University, Kasetsart University, Office of Atoms for Peace (OAP), Department of Alternative Energy Development and Efficiency (AEDE) and Electricity Generating Authority of Thailand (EGAT).

Ms. P. Pal, Bhabha Atomic Research Center, India, addressed the technology transfer issues in the context of KM.

The panel discussion chaired by Messrs. Y. Yanev and A. Kossilov addressed the attributes of an effective knowledge management and continued a discussion of the previous day. In addition, general comments and suggestion were made on how the criteria could be structured for use by different organizations (e.g., government agencies, regulators, research and development, etc.).

Session 5. Networking for Education, Training and Knowledge Transfer (Chair: Yanko Yanev)

This session was dedicated to sharing of experience in networking education and training and getting better efficiency of existing resources. The lecturers presented recent developments in the World Nuclear University and the Summer Institute in Idaho falls, the current status of the

ENEN (European Nuclear Engineering Network" and the ANENT – The Asian Network for Education in Nuclear Technology. These international platforms have all been successful in pooling resources and making them available to participating institutions through the network. Participants were informed on expected future events of WNU, ANENT and ENEN.

In addition some national networks (Argentina) and success stories of cooperation (The Eugen Wigner Course) in nuclear education were also presented.

The overall conclusion of the session participants was to further strengthen networking and continue to expand in areas of growth of nuclear technology application such as Asia, Eastern Europe but also Africa and Latin America.

EVALUATION OF THE WORKSHOP

The end-of workshop questionnaire and the evaluation session showed that there are no serious complaints and disadvantages in the workshop preparation and implementation. The most of the participants confirmed that the workshop was useful to them and that they would try to implement some of the ideas discussed at the workshop. This workshop was successful in achieving the participants' expectations – 85.2% of participants rated that specific aims of the Workshop were met (excellent and well).

Participants generally expressed satisfaction with the quality of presentations. The majority of participants (48.2% - excellent and 44.2% - good) indicated that the presenters demonstrated a thorough knowledge and understanding of their subject providing in their presentations theoretical knowledge concepts related to real life situation (33.4% - excellent and 37.0% - good).

Regarding the technical content of the workshop 55.6% of participants rated it as excellent and 29.6% as good. The diversity of participants from different type of nuclear institutions made it very difficult to meet their needs in presenting practical applications of nuclear knowledge management in specific areas, but 81.6% of participants indicated that the workshop was applicable (rating as excellent and good) to the needs of their organizations.

The facilities provided by the hosts for conducting the workshop were excellent with the appropriate presentational equipment and needed support services from the ICTP staff. The organization and administration staff fully deserved the appreciation received from all the participants and facilitators 74% - excellent and 26% - good).

Main strengths of this Workshop (as stated by the participants)

- It gave a global view of the subject (NKM) and showed the complexity of the different kinds of approaches (dependent on country, nuclear history, and type of organization)
- The workshop brought together experts and newcomers from different regions with experiences that can be useful models to implement in our company
- Opened new communications channels with experts in NKM
- Provided Networking opportunities with others facing similar problems and encouraged future collaboration

- Workshop provided practical approaches and ideas to solve problems
- Panel discussions at the end of the day allowed in-depth evaluation of issues discussed
- The first day introduction of participants with personal work background information
- Provided benchmarks of NKM approaches, methods, results, and evaluation techniques
- Provided information about resources in NKM such as portables and databases available and under development
- The workshop was well organized and the daily session well structured by topic
- The theoretical knowledge presented gave a general framework, outlining the main steps that should be taken in order to develop a NKM program
- Highly practical workshop (in contrast to the usual very “theoretical approach to KM
- NKM is a necessity in the nuclear energy and science for future development, safety and reliability
- The format of the workshop included breakout sessions, technical sessions, and practical cases (good practical examples)
- The workshop location was very good, it encouraged networking and collaboration by all participants

Main faults or weaknesses (as stated by the participants)

- Theoretical examples need more detail to be effective in conveying information
- No faults but more breakout sessions and panel discussion are recommended
- Better time management is needed, some speakers went beyond the time limit which limited for discussions, perhaps a large clock should be provided to keep them on time
- From the technical point of view the workshop was very wide spread, maybe a concentration on selected disciplines would be helpful
- A few of the presentations were too general, not relevant or redundant (Portals, INIS, ENEN)
- Information about the presentations and presenters (background, experience, etc.) should be sent out before the workshop

General recommendation for the future organization of the Workshop of this kind (as stated by the participants), suggested topics

- The IAEA should continue to provide leadership in the NKM field. It is in a good positions because the IAEA KM program is quite advanced, provide guidelines on key issues (e.g., Knowledge Management Review Criteria)
- Provide an agenda earlier with a list of participants and presentations
- Presenter should provide specific ideas or concepts (risk assessment, criteria of NKM, a self-assessment tool, benchmarks, and cost benefit analysis of knowledge management) that can be taken back to organization and implement in NKM programs
- A better assessment of the content of presentations to avoid repetition, there was some duplication (e.g., databases and portals)
- Focus on specific subdivisions on NKM (IT, Knowledge Transfer, Education, Training), one workshop per subdivision
- Have the workshop at this location (or similar), it encourages participants to make contact after the meeting and to network
- Include models of artificial intelligence to be applied in elicitation methods
- Fewer presenters would allow more time for questions and discussions, perhaps questions should be recorded for discussions at the end of the day
- Similar meetings should take place in other countries
- Show practical examples that link technology to real situations (examples and demos)
- Establish a web based work space to enhance communication before the meeting
- Summarize the accomplishment at the end of each day
- Address topical areas of NKM with breakout sessions in each area of interest (NPP's, IT, Human Resources)
- Place more emphasis on NKM is R& D organizations
- Develop/present innovative approaches for emerging technology that may generate new knowledge or the need for new competencies
- Focus on knowledge capture during the work process, this approach is better that after the fact capture
- Provide KM fundamentals on the first day to ground all participants
- Connect KM and business management (provide assessment of knowledge loss due to business restructure, business development)

- Provide overview of KM solutions in other in other industries

CONCLUSIONS

- This Second Workshop on "Managing Nuclear Knowledge" was a further development of the joint IAEA/ICTP initiative of 2004. The workshop provided excellent opportunities to disseminate the best practices and achievements in the subject area based on the IAEA strategy in effective nuclear knowledge management and helped promote activities supporting the current national needs. As Knowledge Management is a relatively new and evolving area of importance to the nuclear industry, it was suggested to make this Work Shop an annual event for the next several years as a vehicle for collecting and disseminating lessons learned. In order to achieve this objective most effectively, more time in the programme for interactions and detailed discussions should be included.

- Based on the assessment of the participants, the objectives of the Workshop were achieved. The end-of-workshop questionnaire and the evaluation session showed that the most of the participants confirmed that the workshop was very useful to them and that they would try and implement some of the ideas discussed at the workshop.

- The wider objective of the workshop to create a personal network between professionals working in Nuclear Knowledge Management (NKM) area from different organizations and to enable continuing exchange of experience on Nuclear Knowledge Management between themselves and the Agency was also realized. To support this process a special publication (Knowledge Management Guide Book and CD ROM), which also includes all materials and presentations of the workshop, will be produced and distributed among participants.

- It has been recommended by the workshop participants to increase NKM awareness through the regional workshops and NKM training programs at the facilities, which should include management. Based upon the experience of this workshop, other topic-specific meeting should be organized enabling sharing of experience and identification of common problems for solution development through regional IAEA Projects on Nuclear Knowledge Management.

- The "end-of- workshop" questionnaire and the results of the evaluation session should be taken into consideration during a preparation the workshop on the subject in 2006.