

IAEA

Knowledge management now seen as a priority

The top-level management of key nuclear organizations is now fully committed to applying nuclear knowledge management (NKM), according to Bertrand Barré, the rapporteur of the International Conference on Knowledge Management in Nuclear Facilities, held June 18–21 in Vienna. This is the second international conference on the subject organized by the International Atomic Energy Agency since the 2002 General Conference adopted a resolution stressing the importance of knowledge management for nuclear institutions. The first meeting was in Saclay, France, in September 2004.

The status of NKM has grown since the Saclay meeting, conference scientific secretary Peter Gowin told *Nuclear News*. “Then, the global nuclear community was in a phase of recognizing that knowledge accumulated over decades had to be managed as a resource that could otherwise be lost. But there was no uniform view among nuclear stakeholders of what exactly knowledge management meant and how it could contribute to productivity or to solving problems. Today, in sharp contrast, it is not only being widely used, but all the stakeholders know the reasons why.”

According to the conclusions of the meeting, organizations throughout the nuclear community now consider NKM a “most important” management tool, including regulators such as the U.S. Nuclear Regulatory Commission; utilities such as Electricité de France and Canada’s Bruce Power; research and development organizations such as the Korea Atomic Energy Research Institute and India’s Indira Gandhi Centre for Atomic Research; and vendors/designers such as Atomic Energy of Canada Limited and the Franco-German company Areva.

The Vienna meeting was organized jointly by two agency departments—Nuclear Energy and Nuclear Safety and Security—and in cooperation with a cluster of national and international organizations, including the European Atomic Forum, the European Commission, the Japan Atomic Energy Agency, the Nuclear Energy Institute, the OECD Nuclear Energy Agency (NEA), the World Nuclear Association, and the World Nuclear University.

“All applications of nuclear technology are based on nuclear knowledge,” said Yuri Sokolov, IAEA deputy director general and

head of the Department of Nuclear Energy. “So managing, preserving, and building on the knowledge we have accumulated is both wise [in the] near term and an important intergenerational responsibility.”

Sokolov stressed that a “sustainable use of nuclear energy [and] a commitment to launch or expand a nuclear power program” must be accompanied by a commitment to nuclear safety. He pointed to standards, guidance, and other publications issued by the IAEA as examples of common wisdom developed and accumulated over decades by the entire world nuclear community. But managing nuclear knowledge is difficult and unique in many ways, he said. “[Nuclear knowledge] is complex, involving high development costs and often requiring significant governmental support. It must be developed and retained over long time frames, and it is subject to special constraints due to its dual use [characteristic],” he said, adding that the overall state of nuclear knowledge today is imbalanced globally for a variety of reasons, including past unawareness of the importance of systematically managing it, although it is now accepted as a very valuable management tool for the industry.

Important challenges must be addressed, Sokolov said, including a generational change in the workforce, the development of new and innovative designs, and the growth in knowledge demand for new nuclear plants and even for nonenergy applications.

Conference findings

The conference, which focused on industry needs and on operating nuclear facilities, began with a policy session that looked



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at the current status of NKM and strategies to meet future needs. This was followed by sessions on knowledge management for safety and regulation, for improved performance and economics, for innovation, and for human resources. Summing up the findings of the conference, Barré said that what knowledge management means is now understood as “create, validate, disseminate, and transmit knowledge.” NKM is important, he said, because it can contribute to maintaining the core knowledge that must be in place to operate the existing fleet of nuclear plants safely, improve economic and

operational performance, preserve existing knowledge and channel it toward future innovations, and facilitate the smooth and effective transfer of knowledge down the generations.

Of the troubling shortfall in the numbers of young engineers and scientists entering the industry, Barré said that participants agreed early in the meeting that despite signs of recovery, this issue will remain the industry’s “worst bottleneck.” There has even been talk of employers resorting to “poaching” from other companies. Human resource management is a key part of NKM, and, fortunately, good practices are spreading, he said. These include overlap between new and older staff, mentoring programs, and integrated training for new as well as existing staff. Conference participants suggested that the IAEA and NEA should publicize the prospective renaissance of nuclear energy in order to attract young talent.

“In national planning, there is recognition that we have to plan for education of the next generation, and understanding that availability of nuclear knowledge is a must for safety,” Barré said. “Nuclear power is a complex, knowledge-based, unforgiving technology that needs science and engineering, as well as experience and specific facilities. The IAEA could be a focal point and driver for NKM, along with other organizations, especially the NEA and WANO [World Association of Nuclear Operators].”

Barré said that the conference attendees agreed that NKM should be made an integral part of all nuclear activities at the project, corporate, and national levels, especially for large nuclear projects and within organizations involved in R&D and the utilization of nuclear energy and radiation technologies. It should also be integrated into governmental planning and policymaking. There were also calls to bring operators into design teams, and operators and designers into regulatory teams and technical services organizations to ensure that knowledge is shared.

The session on safety and regulation stressed that regulators must not only implement their own knowledge management systems, but also oversee the licensees’ NKM. It was also stressed that the management of “tacit knowledge”—knowledge that is not documented or recorded in any way, but exists in the experience of practitioners—needs to be developed further. This is an important point to make, Barré said, and he called on the IAEA to take on the role of developing knowledge management guide-

lines for regulators, especially those in countries starting nuclear programs.

In terms of knowledge management for performance and economic improvement, it was noted that utilities have a responsibility to provide, share, and control knowledge needed by their contractors and subcontractors. Among the points made were the following:

- Project management and quality management are drivers for knowledge management.

- NKM systems need to be sustained over many decades, because a single facility can involve 100 years from drawing board to decommissioning.

- In order to get the right information at the right time, it is vital that NKM systems are well structured.

- Nuclear knowledge is intellectual capital for all stakeholders and must be secured and shared, and as employees are busy doing their jobs, it is up to management to push knowledge transfer.

Barré said that the session on knowledge management for innovation found that nuclear R&D has substantial spin-off potential, if properly linked to industry and academia. Research results, he said, should be released as soon as possible, within commercial and security limits. Among the other issues raised at this session was the need to transfer tacit knowledge from “oldtimers” to “newcomers,” with the suggestion of setting up multidisciplinary teams of experienced and young employees to ensure continuous knowledge transfer. It was also noted that textbooks written by experts should be considered knowledge management tools, as should simulation codes, which embody large amounts of knowledge and may be particularly useful for identifying gaps in knowledge.

Recommendations based on these findings included the following:

- Nuclear research centers should be closely linked to academia and industry.

- Although some research results and data cannot be released, these should be kept to a strict, justified minimum.

- Oldtimers should be encouraged to write textbooks.

- Experts should be motivated to share their tacit knowledge and record their explicit knowledge.

- Knowledge management requires a stable and robust intellectual property (IP) framework.

The session on human resources, education, training, and public information stressed the need to structure knowledge and know-how to prepare the next generation of experts. Barré said that “surprisingly for some of us,” it was revealed that more human resources are needed in nonpower radiation applications than in the nuclear power sector.

The conference recommended that organizations recognize and reward the transfer of knowledge as another form of expertise, Barré said. The IAEA was asked to provide best practices guidelines for the evaluation of nuclear knowledge packages and for the management of IP and access rights. The agency should also provide guidelines for a “minimum knowledge package” for entering the nuclear field. Other important recommendations were for the IAEA to assist in establishing an NKM culture and that it issue regular status reports on progress in NKM.

Asked about the NKM culture, scientific secretary Gowin, who is a member of the agency’s knowledge management unit, said the preferred term within the secretariat is “holistic approach,” rather than culture. “Either way, it is the understanding that it is not only about an organization managing its own knowledge more effectively. NKM is also an objective of international collabora-

tion, so we need to ensure that different stakeholders have good knowledge interfaces and interactions.”

Explained in national terms, he said, the NKM culture/holistic approach would mean that the operator, the vendor, the designer, the regulator, and the technical support organization would all work with the same knowledge, and therefore there has to be provision for connecting them.

From a broader perspective of long-term planning and policies, issues such as intergenerational responsibility, innovation lead times, and workforce development are not solvable by a single organization, Gowin said, but need to be resolved at a higher level, at least nationally, and perhaps at the international level. All stakeholders need to be able to be in touch and to communicate in an integrated NKM culture, he added.

On the call for guidance publications, Gowin said, several are already in the pipeline. One guidance document, on applying NKM in nuclear facilities, has already been published, and a second, on applying NKM in the context of radioactive waste management organizations, is planned for release in late 2007 or early 2008. Additional challenges also exist specific to radioactive waste and the various implications for NKM due to the long-term character of radwaste, such as liability issues. Also in the waste area, many scientific and technical communities such as geologists, hydrologists, and seismologists need to work together. The document also deals with materials science and other aspects related to radioactive waste.

A third guidance document, at a less mature stage, concerns R&D and innovation and how NKM can specifically help R&D organizations, Gowin said.—*Gamini Seneviratne*

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