
KNOWLEDGE MANAGEMENT FOR ASSURING HIGH STANDARDS IN NUCLEAR SAFETY

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Abstract. The primary incentives for introducing knowledge management in organisations active in the nuclear field are the impending loss of knowledge due to an ageing workforce and the necessity to transfer knowledge to the next generation. However, knowledge management may reach much further, and it is shown that ultimately, the goals of knowledge management are congruent with establishing, maintaining and further developing high standards of safety. Knowledge-based activities to reach these goals are discussed, and examples given for producing, utilising and sharing knowledge in organisations and in national and international networks.

1. INTRODUCTION

Knowledge has become a crucial factor for the success of an organisation in our information society. In the nuclear domain, handling knowledge has always been at the core of many organisations involved in the field. Most of these organisations would have been fully entitled to claim being a “knowledge-based” organisation - long before this attribute became established as a key concept in knowledge management.

So what is new in the surge of knowledge management which we have witnessed in the last years? Two aspects appear to be at the heart of the widespread attention knowledge management has gained: first, the proposition to look at the various aspects of knowledge such as generation, distribution and use of knowledge from an analytic point of view - with the aim of promoting and improving knowledge-intensive processes; second, the advances in information technologies, which allow the practical implementation of the developed methods as well as the participation of large audiences.

In the following, the benefit of introducing knowledge management in organisations involved in nuclear safety will be considered, the potential of knowledge management techniques assessed, and the connection between knowledge management and standards of safety discussed. Finally, some examples of successful application are highlighted.

2. BENEFIT OF KNOWLEDGE MANAGEMENT

In general, knowledge management is primarily mentioned in the context of the ageing workforce in the nuclear domain and the transfer of knowledge to the next generation.

It is common knowledge by now that in most of the countries operating nuclear power plants, an alternation of generations is taking place. In Germany for instance, no new reactors have been built since 1985, and personnel has been kept constant, but not significantly renewed, and is now approaching retirement age. With the great uncertainties about the long-term future of nuclear power, it is difficult to attract people into the nuclear domain: particularly in countries where measures have been taken to terminate operations prior to the scheduled end of plant life or where a phase-out has been decided. Working in nuclear power has less prestige than in the past, the opportunities for education have been diminished, research programmes reduced. However, it is important to recognise that this does not hold for the countries continuing construction and commissioning of new plants, mainly in Asia.

The situation in Germany illuminates some of these problems in a bright light. Courses in the nuclear area are offered by only a few universities; the number of students with degrees dropped to almost zero in 2001. However, irrespective of the phase-out policy, the next

decades will demand maintaining the competence in nuclear safety in order to meet the mandate of ensuring the safety of nuclear installations and waste disposal. Accordingly, an "Alliance for Competence" has been established by the four major research establishments, with the aim of registering trends in development of employment and educational capacities, increased co-operation with universities and international initiatives, co-ordination of research programmes, promotion of qualified students, and co-operation in furthering international safety standards. Similar initiatives have been established in many countries.

First studies indicate that deficiencies in maintaining knowledge at state-of-the-art levels and a subsequent degradation in education and training of operating personnel may endanger the safe operation of nuclear installations. Furthermore, knowledge deficits at authorities and expert organisations due to a lack of qualified successors to retired experts have been depicted as an imminent threat to the qualified supervision of reactor plants and thereby to safe plant operation.

3. POTENTIAL OF KNOWLEDGE MANAGEMENT

With knowledge retention and knowledge transfer being major topics in knowledge management, it is obvious that knowledge management methods offer significant contributions in trying to capture the knowledge of leaving experts and convert tacit knowledge into an explicit one. However, the scope of knowledge management has to be seen in a much broader context: in addition to maintaining knowledge, the continuously narrowing financial and personnel environment compels all organisations to establish a persistent knowledge management system, improving the allocation and use of the resource "knowledge" as well as the efficiency of everyday work.

From a knowledge perspective, an organisation will support and foster its explicit knowledge base, which often is addressed as the "corporate memory", and the tacit or implicit knowledge of its experts. The main pillars supporting explicit knowledge are the management of the company's documents and its information systems, which rely on information technology, and the business processes. Implicit knowledge is carried by the networks found in every company contributing to its development, and most prominently, by the people employed in the organisation, who should be motivated and involved by an exemplary management.

The establishment of a knowledge management system may account for these pillars in different ways. For information technology many companies provide corporate Portals or Intranets as access points to all information in the company.

In general, the organisations operating in the nuclear field are strongly involved in national and international networks. Most of the organisations have started or have already accomplished constructing knowledge management systems as described above. The consequential next step consists in introducing inter-organisational knowledge management methods. Knowledge-oriented organisations have the qualification to provide the cornerstones of a vision how the national and international networks should develop, sharing the enormous resources of documents, which today are duplicated in every organisation, allowing to find experts by common yellow pages, also setting up teams across organisations and providing state-of-the-art communication and collaboration facilities.

Ultimately, this is the basis for the overall goals of establishing, maintaining and further developing high standards of safety.

However, first the foundations have to be laid in each organisation itself. To help them along this way, better information exchange on how organisations proceed in introducing knowledge management systems and methods is asked for, and guidelines should be provided. This conference is an excellent place to engage in these activities. In this regard, I would like to mention the co-operation between the IAEA and my company. The early experience at GRS helped along initially. The subsequent interchange has now evolved into

co-operation on topics such as knowledge mapping or document management, where both will profit from each other's lessons learnt.

A word of warning: knowledge management is not a panacea for all deficiencies of the past, and not the cure for all problems in the future. After all, knowledge management is a management principle; it may deliver transparency into knowledge processes. It may not reverse the demographic developments of the past, and it is not a political instrument in the discussion of the future of nuclear power. However, it is essential for maintaining high standards of safety.

4. KNOWLEDGE MANAGEMENT AND STANDARDS OF SAFETY

The levels of safety reached today, reflected and codified in Safety Standards, are fruit of intensive co-operative efforts nationwide and internationally. They represent the state of the art, agreed upon in expert commissions and in regulatory work. By its nature, the evolution of standards of safety is a dynamic process which is developing over time. Maintaining standards at a high level requires ongoing efforts which counteract the tendencies of decay. Further developments need efforts in excess. A predominant part of these activities is entirely knowledge-based, such as:

1. Sharing of knowledge on relevant safety issues. This involves the discussions and exchange of information in working groups, the exchange of recent knowledge on specific topics, the definition of requirements for safety assessment methods, the discussion of cross-cutting issues by multi-disciplinary expert groups (for example the activities on safety margins), the definition of the state of the art, and collective opinions on key safety issues.
2. A generation of new scientific information is entirely knowledge-based: the specification of primary research areas and experimental projects, analytical exercises such as benchmarks and international standards, and information collection on safety-relevant events and their evaluation.
3. Also knowledge-based is the contribution to competence maintenance: transfer of information to countries with shrinking resources in nuclear safety research, training of young scientists through involvement in national and international research projects, and maintenance of unique experimental facilities and capabilities.
4. Archiving and distributing information is entirely knowledge-based: document management on joint programmes, the management of experimental data, conducting seminars and conferences, and the release of reports to the public.

It is no coincidence at all that these topics are congruent with knowledge management and may be directly mapped to knowledge management methods. Putting it strongly, not minding overstating the case: knowledge management is at the heart of high-level safety. Again, as already mentioned before, this does not imply that many of the "knowledge-intensive processes" and many of the "knowledge management methods" are totally new inventions. They often existed already but under a different label. Some examples shall illustrate knowledge management at work in different domains.

The pressure on preserving and transferring knowledge has led to joint efforts at national and international level. In Germany, the "Alliance for Competence" mentioned before has been established; similar activities are recorded in other countries. Pooling education and training in a supranational structure is the aim of the European Nuclear Education Network (ENEN). It has been initiated as a project of the European Union and continued by the ENEN Association as a Virtual European University. Its aim is the development of co-operative nuclear education in Europe. 18 universities from 17 countries are participating, offering courses ending with the European Master of Science in Nuclear Engineering. In 2003, the World Nuclear University WNU was founded with the support of the IAEA, the Nuclear Energy

Agency of the OECD, the World Association of Nuclear Operators, and the World Nuclear Association. Its mission consists in strengthening the international community of people and institutions so as to guide and further develop the safe and increasing use of nuclear power.

With regard to knowledge networks, GRS is co-operating with the IAEA in a pioneer international project of a nuclear safety network to compile, analyse and share safety knowledge among Asian countries – the Asian Nuclear Safety Network, ANSN. A hub already established at GRS serves as a portal for access to German nuclear safety knowledge and experience in the ANSN. Experience emerging from this project will be most valuable for the further development and integration of safety networks in Germany. The ANSN will be discussed in other papers presented by the IAEA at this conference.

My company is involved in the European Network of Excellence for a Sustainable Integration of European Research on Severe Accident Phenomenology (SARNET). Communication and collaboration of about 25 organisations and 200 participants is supported by advanced communication tools operated on our servers. The tools provide facilities to manage documents, discuss topics of common interest, organise the project's work packages, search and retrieve information on different topics, and more. In the context of promoting co-operation on safety issues, the co-operation of several member states in the EUROSAFE initiative has to be mentioned.

In the field of regulation, the Western European Nuclear Regulators' Association (WENRA) has been established as an association of the heads of nuclear regulatory authorities of Western European countries. This association pursues the development of a common approach to nuclear safety and regulation, in particular within the European Union, providing an independent capability to examine nuclear safety and regulation in candidate countries, and achieving a common approach to any arising nuclear safety and regulatory issues.

With regard to implementing knowledge management methods and systems in the organisations themselves, this conference will offer many insights into different approaches, describing the deployment of portals, document management, information systems, expert's networks, and communities of practice, process-oriented knowledge management, skill databases, methods to collect tacit knowledge, and much more.

5. CONCLUSION

The present situation is characterised by the problem of a retiring workforce, lack of successors and deficiencies in education and training as well as the dangers to the safe operation of nuclear systems. Knowledge management is seen as an important means to alleviate this situation. In addition, the knowledge-based approach to management offers the potential to increase the efficiency of everyday work not only within the organisations themselves, but also in inter-organisational networks. This is mandatory under tight financial and personnel circumstances. The congruence of knowledge management and standards of safety have been stated, and some examples have been given. Concluding, the knowledge-oriented approach in organisations and networks is a good base for maintaining and further developing high standards of safety. I am convinced that this conference, which is taking place just in time, is the right signal to a wide audience. I wish you all an interesting and successful event.