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THE KNOWLEDGE MANAGEMENT PROJECT AT IRSN

THE IRSN, A FRENCH ACTOR IN THE FIELDS OF RADIOPROTECTION, NUCLEAR SAFETY AND SECURITY ISSUES

The French "Institut de Radioprotection et de Sûreté nucléaire" (in English: Institute of Radioprotection and Nuclear Safety), IRSN, is a public organization with industrial and commercial activities, placed under the joint authority of the Ministries of Defence, Environment, Industry, Research, and Health. It is a Technical Safety Organization (TSO), the nation's public service expert in nuclear and radiation risks. Its activities combine expertise – particularly for the French nuclear safety authorities – and research and development. These activities cover all the related scientific and technical issues in many domains: safety of nuclear reactors (nuclear power plants, research reactors…), safety of fuel cycle nuclear installations, transports of radioactive materials, waste treatment and storage, radiological protection (human and environmental), emergency response, security and non-proliferation, medical treatment for irradiated persons, etc.

IRSN interacts with all parties concerned by these risks (public authorities, in particular nuclear safety and security authorities, local authorities, companies, research organizations, stakeholders' associations[1], etc.) to contribute to public policy issues relating to nuclear safety, human and environmental protection against ionizing radiation, and the protection of nuclear materials, facilities, and transport against the risk of malicious acts. IRSN employs around 1,750 persons, including many specialists, engineers, researchers, physicians, agricultural engineers, veterinary surgeons and technicians, as well as experts in nuclear safety, radiation protection and control of sensitive nuclear materials.

THE MAIN REASONS FOR IMPLEMENTING A KM SYSTEM

The IRSN ambition is "Enhancing nuclear safety", and an essential lever is enhancing the knowledge at IRSN: Knowledge is one of the three values of the institute (Knowledge, Independence and Proximity). This knowledge originates from diverse sources:

- the experience: operating experience of nuclear installation or equipment using radiological sources, particularly the incidents and accidents which occur,
- research and development programmes on different relevant issues, displayed by IRSN alone or at an international level and in which IRSN is highly involved,
- analysis and expertise, which can lead to specific concepts, approaches, positions,
- Studies (in criticality, reactor physics and mechanics (metallic structures and concrete buildings) – under accidental conditions and hazards solicitations –, fire and dispersion…), probabilistic safety assessments (PSA) for NPPs…

The related KM issues are to ensure the development, sustainability and efficiency of IRSN strategic knowledge, in order to maintain the quality and relevance of its expertise – in an anticipating view of the scientific needs –, and to promote the Knowledge transfer between generations.

The first steps (2012-2014): In 2011, Management Seminars revealed strong expectations in terms of KM. On 1st January 2012, a KM Director function was created at the top management level, by appointment of a Chief Knowledge Officer. A budget line was created for identifying human and financial resources in the different units.

In 2014, the "Contract of Objectives and Performances" for 2014-2018, that binds the Institute to its five supervising ministries and that is a guideline for the governance of the Institute, identifies Knowledge Management as an objective.

THE GLOBAL KNOWLEDGE MANAGEMENT SYSTEM

The KM process

A KM process has been included in the process repository of IRSN (The Integrated Management System). A macro-process is the leading line for the KM actions (Figure 1).

The global KM system of KM aims at completing and strengthening actions and tools existing previously (archiving, reference books, some modules of the Corporate University, scientific watch…). It has four objectives.

At a strategic level:

- To have Knowledge capacities in accordance with strategic needs

At the operational level:

- To have structured, easily accessible, enriched Knowledge repository.

[1]For instance, with the CLI (local cells of information) and their association, the ANCLI.

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Knowledge Management expert and consultant, especially for the International Atomic Energy Agency.
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Has a PhD in fundamental mathematics (Paris University Denis Diderot), and a National Research Director Title in computer science (Bordeaux University)

- To transfer and share Knowledge.
- To update Knowledge with the evolutions inside and outside IRSN.

Some significant tools and actions for the deployment of the global KM system are presented below. But a major tool implemented at IRSN, contributing to identify and prioritizing KM necessary actions is the "KM Plan", corresponding to the first of the four objectives above.

The KM Plan

For each domain (safety of power reactors, human radioprotection, environmental radioprotection, emergency preparedness and response...), a KM plan is built in four phases:

- ***Phase 1: Strategic Capacity Analysis***

The basic tool for strategic capacity analysis is a "Strategy Map". The strategy map is a representation (tree like model) of the operational strategy of the company. This map represents the main objectives of the organisation. Each strategic objective is then related to the capacities involved in achieving those strategic goals. Each capacity is qualitatively evaluated by its criticality level (from 1 [low criticality, coloured in green on the map] to 4 [high criticality, coloured in red on the map]). A capability is more or less critical if it is more or less rare, useful for the company, difficult to acquire, difficult to implement.

This phase is realised by interviewing 5-10 top managers (Figure 2).

- ***Step 2: Critical Knowledge Analysis***

This analysis starts with the realization of a knowledge map. The knowledge map (or knowledge domains map) is a representation, given by the knowledge actors, of how the knowledge domains are structured. The design of the map must be adequate to the operational vision of the people concerned. This map will be used as support for the evaluation of the criticality of the knowledge domains. Subsequently, for each domain of knowledge, one has to designate reference people that will conduct the critical analysis of their domain. The credibility of the analysis is based on the legitimacy of the people asked. Criticality analysis takes place systematically with the criticality grid built with the set of Critical Knowledge Factors (criteria) and a rating procedure. In the software, a generic criticality grid is suggested but the users are invited to add / delete some of the criteria to ensure that the grid is well fitted to their concerns. Evaluation of the criticality of one knowledge domain consists in rating every criterion for that domain. The higher the rate is, the more critical the domain is (same as strategic capacity analysis). Each domain is evaluated independently of the others. At the end, each knowledge domain is associated to a score (and its justifications), that represents its criticality, and all the results are graphically synthesized in various diagrams

This phase is realised by interviewing 10-20 knowledge experts.

- ***Step 3: Strategic Alignment and action planning***

This step aims to compare strategic visions and business visions, and make relevant recommendations on Knowledge Management actions/devices to be implemented. These recommendations come from cross-analysis of the strategic capacity analysis and the critical knowledge analysis. This is called the strategic alignment. The large amount of information collected during the interviews with stakeholders, in strategy and business, can be summarised, according to this strategic alignment, into recommendations for a Knowledge Management action plan.

This phase is realised in a one day seminar with top managers and knowledge experts.

For each domains, prioritizing leads the relevant Pole Director (in charge of the domain) to notify the actions (KM Action Plan), with persons in charge of them.

For the moment, KM Plans have been finalized for the domains of the safety of French power reactors (challenged particularly by the long term operation (LTO) objective of EDF and ageing management concerns), the radioprotection of the environment and the emergency preparedness and response. Others KM Plans are in progress.

Actions adopted and prioritized in the KM Action Plan are of diverse nature: capitalization of experts, constitution of specifics modules for the IRSN Corporate University, impulse mobility (Human Resources aspect), constitution of communities of practice, etc.

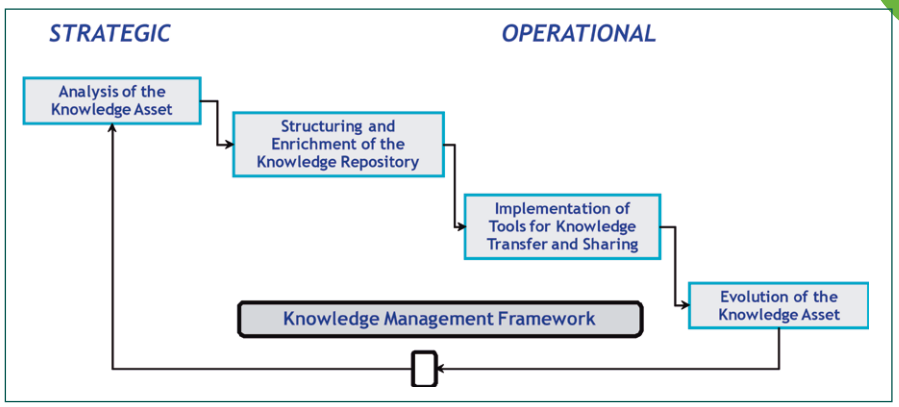

Figure 1. The KM Macro-Process.

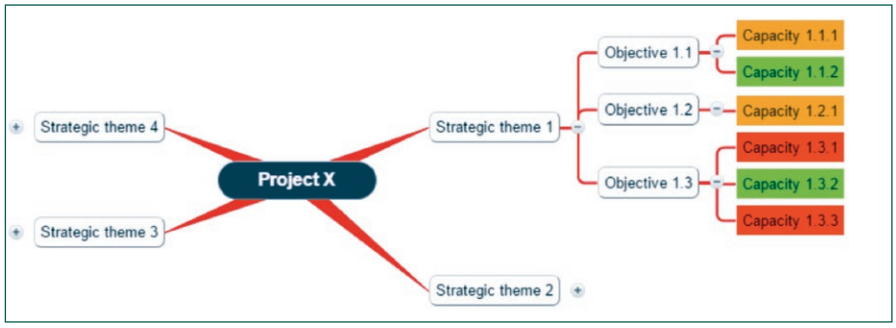

Figure 2. Structure of a strategy map.

Other significant tools and actions

- Knowledge retrieval

Implementation of a full text semantic search engine to access to fifty years of expertise and digitized reports on the French nuclear installations, and the rationales leading to the expertise decisions

- Knowledge codification in e-books

Some critical Knowledge is detained by top-level experts or specialists, 80% in a tacit form. Knowledge engineering techniques (as the Knowledge Books technique MASK 1) have been used to elicit that tacit knowledge. The knowledge e-books gather, in a condensed and available format (PowerPoint), a part of the critical knowledge of IRSN. A knowledge e-book is a working tool to re-use efficient solution and create new knowledge; it is a support for discussion, exchange and training.

Knowledge e-books have been designed on subjects as:

- Evaluation of the security functions of a PWR control-command,
- Incidents and accidents on spent fuel pools,
- Behaviour of PWR metallic structures,
- Safety evaluation of PWR civil engineering,
- Transfer of radionuclide in the atmosphere,
- Safety options in design for criticality risk,
- Dosimetric biology in case of accidental irradiation,
- Phenomenology, prevention and mitigation of severe accidents,
- Aspects of Radioprotection of populations,
- Safety aspects of the sodium fast reactors, etc.

- Reference books

For several years, the IRSN constitutes a library of reference books, accessible on its website (in French and in English), the writers of which are generally high level experts. These reference books are synthesis, guides or even positions (doctrines) on specific topics. Can be particularly mentioned, recently published, a reference books on core melting accidents issues for PWRs, and, in finalization, a reference books synthesising 30 years of R&D in the field of PWR's safety.

A challenge is the constitution of a new series of reference books "Elements of safety, radioprotection and security". The first achieved (2015) is related to security and non-proliferation concerns. A reference books related to safety concerns of PWRs is in preparation.

- Knowledge repository audit and enrichment

An audit of available knowledge resources and their use has been performed in the field of NPP safety, and an improvement of the architecture and the organization of the knowledge repository are currently in progress.

- Knowledge transfer and sharing

The IRSN Corporate University is under development. It is a collaboration programme between Human Resources and Knowledge Management, with the support of operational units.

Communities of practice or knowledge communities (for innovation and prospective) are under construction, particularly with the aim of updating e-books with knowledge evolutions inside and outside the IRSN, for instance those possibly issued of R&D programmes.

Knowledge networks

At European and international levels, IRSN transfers and shares Knowledge via two instances:

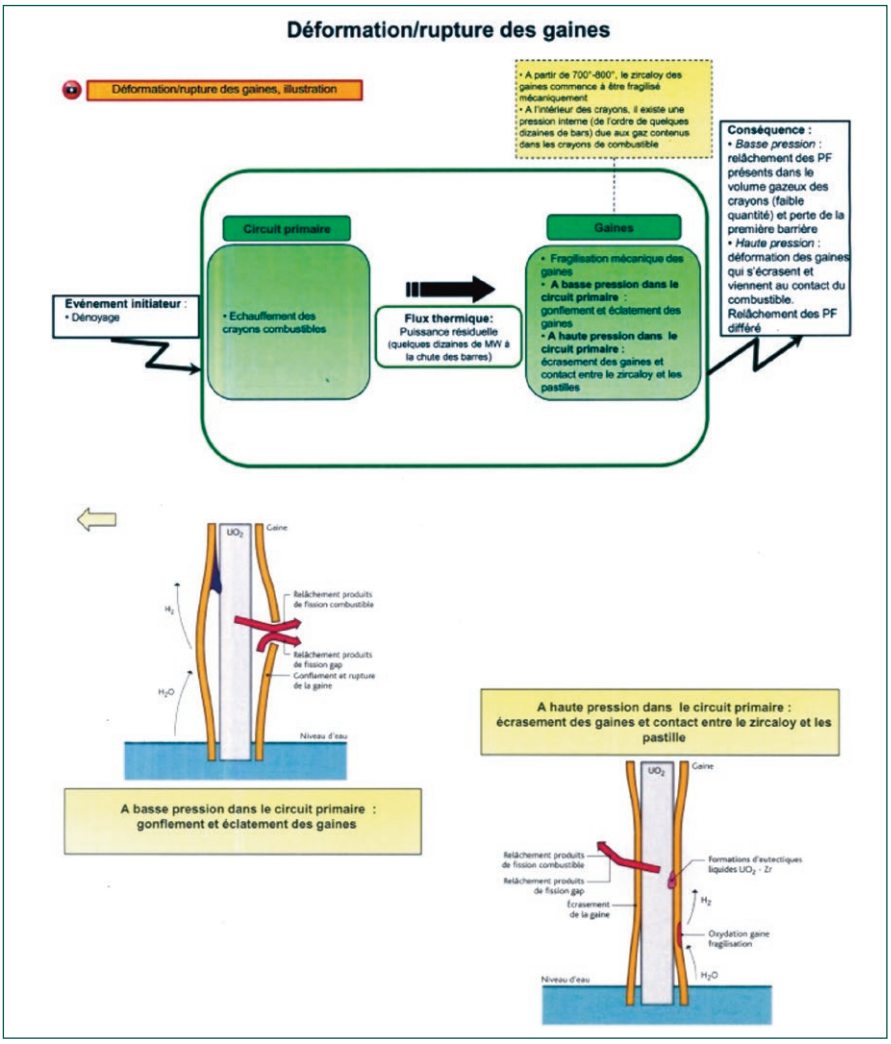

Figure 3. Two views of the e-book "Phenomenology, prevention and mitigation of severe accidents" (phenomenon of clad deformation after LOCA accident and illustrations).

- ETSON (European Technical Safety Organizations Network), associating European TSO partners; common guides for safety expertise, exchange of databases are some of the works of ETSON;
- ENSTTI (European Nuclear Safety Training and Tutoring Institute), associating European partners – and open to trainees and tutored outside the Europe. Starting with the IAEA, ENSTTI is increasingly commissioned to provide training and tutoring outside the European Union under initiatives such as the EC's Instrument for Nuclear Safety Cooperation. ENSTTI successfully adapts its approaches and organization to meet the specific needs of "embarking" countries, for example in Asia.

CONCLUSION : KEY FACTORS OF SUCCESS AND PERSPECTIVES

Knowledge Management at IRSN is a corporate objective, it requires:

- A sharing of the KM objectives inside IRSN, and an efficient process in terms of organisation, management and tools. KM correspondents will be appointed in the units, as levers to federate important and priority actions identified.
- A functioning with good visibility and with added value for staff. It is important to rely on proven methodologies that are appropriated by actors:
- A gradual deployment of strategic diagnosis by theme and shared action plans.
- Quick wins on real and operational projects, with visible objectives and motivated people. These projects are pilot projects for further generalisation.

The next challenges, for 2018, is to reach the nominal mode for the KM function and to complete a first round of strategic Knowledge diagnosis for all the major scientific and technical domains, in compliance with the "Contract of Objectives and Performances" 2014-2018. ■