Approaches of Knowledge Management System for the Decommissioning of Nuclear Facilities

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Current Status of Decommissioning NPPs in Japan

- **6 units shut down for decommissioning**
  - **Mihama 1,2, KEPCO (PWRs)**
  - **Shimane 1, Chugoku (BWR)**
    - 460 MWe (Mar.1974-Apr.2015)
  - **Ikata 1, Shikoku (PWR)**
    - 566 MWe (Sep.1977- May 2016)
  - **Genkai 1, Kyushu (PWR)**
    - 559 MWe (Jul. 1975 - Apr.2015)

- **4 units are under decommissioning**
  - **Fugen, JAEA (ATR)**
    - Heavy water moderated, light water cooled
    - Decommissioning: Feb.2008 - 2033JFY
  - **JPDR, former JAERI (experimental BWR)**

- **Operational**
  - **Fukushima-Daiichi 1-6, (Specified nuclear facilities)**
    - **TEPCO (BWRs)**

- **6 units are shut down for decommissioning**
  - **Hamaoka 1,2, Chubu (BWRs)**
    - Decommissioning: Nov. 2009 - 2036JFY

**Additional Information:**
- [http://www.jaia.go.jp/04/ntokai/decommissioning/01/decommissioning_01_01.html](http://www.jaia.go.jp/04/ntokai/decommissioning/01/decommissioning_01_01.html)
- [http://www.chuden.co.jp/energy/hamaoka/hama_about/location/](http://www.chuden.co.jp/energy/hamaoka/hama_about/location/)
Background

- The decommissioning of a nuclear facility is a long term project.
- The decommissioning project is likely to be delayed.
- The transfer of knowledge and education to the next generation is a crucial issue.
- In Japan, based on the past experience, the increasing decommissioning projects are going on.
- Organized methods or a system for knowledge management is necessary in order to solve it.
- Knowledge Management (KM) (for decommissioning) should be well planned through all the life stages of nuclear facilities.
Characteristics of knowledge for decommissioning

• **Required knowledge** is different from that of construction or operation phase
• The knowledge of the design is used in different manner in the dismantling stage.
• Decommissioning is one-time project. It may not be cost effective to collect and organize the knowledge.
• If the knowledge is valuable or general, it can be **reusable** inside the project or a similar project.
• It is possible to transfer knowledge by moving staff, but it is not always rational.
• For the normal decommissioning project, it is possible to implement with combination of existing technologies. In this case, the important knowledge is “Which technology is suitable?” for low risk, low cost and short time project.
Outline of the Knowledge Management Approaches

1. Establishment of Knowledge Acquisition
2. Formulation of Knowledge Acquisition
3. Construction of KM Support System

- R&D Results of Domestic & International Decom. Facilities
- Data of Design, Construction, O&M of a Specific Plant
- Engineers with Experience of Design, Construction, O&M
- Personal Knowledge (Explicit or Tacit)

Systemized Information for Decommissioning
Systemized Knowledge of Decommissioning
Systemized Explicit Knowledge for Decommissioning of a Specific Plant

Sharing and Utilization of Knowledge (Practicing, Education, Transfer)
Knowledge Still Tacit
Transfer by Practicing
Examples of Activities for the KMS

**STEP 1:** Establishment of knowledge acquisition method necessary for decommissioning

- Extraction and Arrangement of data and information from international or domestic decommissioning results of research
- Organization and Systematization of information by establishing rules and methods to extract necessary information from plant specific data
- Establishment of method of knowledge extraction based on the decommissioning taxonomy

**STEP 2:** Formulation of knowledge acquisition from experienced engineers

- Externalization of implicit knowledge of employees along with their occupational history
- Establishment of method for extraction of knowledge and know-how from communication with experienced employees such as questionnaires, interviews, or event simulations for socialization and externalization
STEP 3: Construction of KM support system for decommissioning

- Enhancement of *information access* system by knowledge engineering technologies
- Application of advanced information technology such as 3D-CAD, VR or AR
- Enhancement of knowledge internalization of present employees by discussion meetings
- Establishment of knowledge transfer by *special lectures* or training by retiring employees
- Knowledge transfer support from retirees by *continuous communication* even after retirement
- *Information exchange* framework with other decommissioning facilities
- *Making documents of standardization* of decommissioning knowledge
Knowledge Management Support System
(Information Exchange and QMS based IT systems)

◆ Enhancement of communication between employees
  • Personal profile and expertise data
  • Enhancement of daily communication
  • Knowledge search such as Q&A system

◆ Extraction of useful knowledge
  • Knowledge acquisition during the daily work
  • Knowledge acquisition process based on the Quality Management System

existing QMS

Knowledge acquisition process (SECI Model)

Socialization
Sharing & creating tacit knowledge through direct experience

Externalization
Articulating tacit knowledge through dialogue and reflection

Internalization
Learning & acquiring new tacit knowledge in practice

Combination
Systemizing & applying explicit knowledge & information

Information exchange by person to person level
Enhancement of information sharing and knowledge acquisition
Knowledge Management Support System
(Knowledge Transfer and Education etc.)

◆ Transfer of knowledge from retirees to existing employees
  • Questionnaire or interview to elderly employees
  • Education in the office or field
  • Study meeting or face to face education

◆ Support system by advanced technology Virtual Reality or Augmented Reality based on 3D-CAD
  • Embedding of necessary data, information and knowledge in the virtual model
  • Provision of significant knowledge of decommissioning planning and implementation when necessary

Material: SUS316, High contamination, Dismantling experience in XXX NPS
Conclusions

• **Enhancement of Communication**
  - You can know whom you should ask something to know by sharing personal field each other.

• **Extraction of Useful Knowledge**
  - Activities based on running Quality Management System are useful

• **Transfer of Knowledge to Next Generation**
  - We have to effectively get explicit and tacit knowledge of retiring employee

• **Support system by VR or AR based on 3D-CAD**
  - Advanced IT tools are useful, but you should be careful not to spend too much cost.
Thank you for your attention!