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Knowledge Management Fundamentals

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Knowledge Management Fundamentals

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Objectives of IAEA NKM Programme

• To increase Member States’ application of nuclear knowledge management strategies, through:
  • the development and dissemination of methodology, guidance and tools, as well as
  • their implementation in national programmes, and by
  • providing knowledge management services and assistance

• To enhance the synergy and benefit of the Agency’s nuclear information and knowledge resources and services
Key Areas of the NKM Programme

1. Methodology (documents, methods & tools)
2. Services and support (assist visits, missions)
3. Nuclear Education (schools, networks)
4. Technology & Resources (platforms, content)
By the end of this lesson the student should be able to:

- To be familiar with the basic principles and important definitions of knowledge management
- To understand the need for and importance of knowledge management in nuclear organizations
- To have a basic familiarity with the key focus areas of nuclear knowledge management
- To confirm this basic understanding (questions to be asked at the end of the presentation)
KM Topics to be Discussed...

1. What is Knowledge?
2. What is Knowledge Management?
3. Why is KM important?
4. Why is KM difficult?
5. What are KM objectives and benefits?
6. Summary (some key points)
What is Knowledge?

- The Sum of what is known (OED).
- The State of understanding (OED).
- Both mind and memory (Plotkin, 1994)
- Interpretation and understanding of acquired data and information (IAEA)
- True knowledge is theory wrapped with practical commonsense (James, 1950).
- “Capacity for effective action”
- Knowledge is a familiarity with someone or something, that can include facts (data), descriptions, information, and/or skills acquired through experience or education (Wikipedia).
Knowledge Pyramid

Data
Information
Knowledge
Wisdom

Jonathan Hey, 2004
A simple example...

The Cake Analogy

- Data: observed properties (looks nice, tastes great)
- Information: the list of ingredients
- Knowledge: recipe, tools and skill needed to make it right!
- Wisdom: don’t eat it all at once!
Explicit vs. Tacit Knowledge

**EXPLICIT**

- Knowledge that can be captured and codified (e.g., documents, equations, procedures etc.)

**TACIT**

- Knowledge possessed by individuals (personal)
- Experiential knowledge (e.g., “know how”)

**KNOWLEDGE IS A RESOURCE**

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Knowledge Transfer/Creation
(Nonaka and Takeuchi Model)

FROM Tacit

Socialisation

Explicit

Externalisation

FROM Explicit

Internalisation

Combination

TO Tacit

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Knowledge Continuum

Tacit Knowledge (of expert 1)

Tacit Knowledge (of expert 2)

Explicit Knowledge

Abstract, theoretical
intangible

factual, details, tangible,
measurable or observable

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Examples – K Transfer & Creation (Nonaka and Takeuchi Model)

FROM Tacit

Explicit

Tacit

TO Explicit

Socialisation

Externalisation

Internalisation

Combination

Mentoring & Coaching

Self-directed Learning

IS (e.g. Records Management)

Document Capture

Tacit

Explicit

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Characteristics of Knowledge

- Knowledge is contextual, can be re-used
- Value of knowledge realized only if it is utilized
- The value of knowledge may change over time
- Knowledge has to be renewed or maintained
- It can be difficult to transfer, capture, distribute
- Developed through learning processes
  - Learning depends on memory, experience, expertise, transfer mechanism, & opportunities
  - Facilitates effectiveness and “sense-making”
  - Knowledge enables higher learning
  - Creation and utilization enhanced with technology
In Reality...

Organizational Knowledge Base (i.e. capacity for effective action)

Continuous Organizational Learning Processes

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Knowledge Management

• ‘…the processes that governs the creation, dissemination, and utilization of knowledge...’ (Newman, 1992)
• ‘...managing the organization’s knowledge by creating, structuring, dissemination and applying it to enhance organizational performance...’ (O’Leary, 1998)
• ‘…process to acquire, organize, and communicate knowledge of employees so others may be more effective in their work...’ (Alavi and Leidner, 1999)
• ‘…process to acquire, organize, and communicate Knowledge (Andriessen, 2004)
KM is an integrated, systematic approach to identifying, acquiring, transforming, developing, disseminating, using, sharing, and preserving knowledge, relevant to achieving specified objectives (IAEA)
Knowledge Processes

Knowledge Generation & Validation

Knowledge Acquisition & Adoption

Knowledge Retention & Storage

Knowledge Utilization or Application

Knowledge Transfer & Sharing
Knowledge processes embedded in...

- Equipment reliability programs
- Systematic approach to training
- Plant Configuration management
- Documented operational procedures
- Plant work management systems
- Outage planning systems
- Pre-job briefing
- Document management systems
- Etc.
K-Processes Support Business Processes

Business (Work) Process A
- K-Sharing
- K-Transfer
- K-Utilization

Business (Work) Process B
- K-Retention
- K-Validation

Timelines may be years apart.
Results of Global IAEA NPP KM Survey


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Knowledge Management focuses on...

Managing the “Organisational Knowledge Base” (Knowledge Assets or Resources)

Influencing Organisational “Routines” (organizational culture, work processes, and learning etc.)
Organizational Performance: KM Perspective

Improved OM&A (pro-active work-force)

Knowledge-based decisions & action

K-utilization & organizational learning

Processes  People  Technology

Integrated & Shared Knowledge Base (supported by the information management infrastructure)
Knowledge Management Objectives

- Promote creating new knowledge and innovation
- Reduce costs of being effective, to innovate
- Preserve existing knowledge
- Reduce the K-loss from employees who leave
- Increase collaboration, K-sharing to enhance skills
- Increase productivity – make knowledge accessible
  - Enable a “pro-active learning and decision culture”
  - Help staff do the right things, and do them right!
**Why KM is a “Priority Issue”**

Maturing industry:
- Attrition - vulnerability to loss of tacit knowledge
- Concern over the “pipeline” of new NPP K-workers

Aging fleet of plants and need for refurbishment:
- Design basis information critical (must be up to date)

Need for the next level of productivity gains:
- deregulation and competition
- rising operating costs
- move towards “lean” operations and maintenance
- opportunities arising from new technology

Awareness that other industries doing more and benefiting
Threats to Nuclear Knowledge

Nuclear Knowledge

- Employee Life-cycles
- Economic Cycles
- National Nuclear Programme Cycles
- Plant Life-cycles
- Product Life-cycles
- Technology Life-cycles
- Organizational Life-cycles
- Design Life-cycles
- Projects Life-cycles
- Political Life-cycles

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Barriers to Mitigating K-loss Threats

- Ownership (responsibility)
- Commercial interests (e.g. intellectual property)
- Financial and resource limitations
- Awareness (importance)
- Management support (perceived priority)
- Time needed and available (urgency)
- Manageability

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Why KM in Nuclear Challenging

- a complex technology base (design and OM&A)
- long technology & plant life cycles, high capital intensiveness
- a need for life-cycle asset management strategies that are knowledge-driven (i.e. economic and risk informed decisions)
- dependence on multi-disciplinary technologies, expertise
- competing operational objectives (safety, production, cost)
- need for simultaneous integrated coordination of complex physical and human (socio-technical) systems
- a regulated industry environment (safety, EQ, & NQA)
- Individual understanding of KM often narrow
KM in NPP Organizational Context

Organizational Culture

People

Plant and Equipment

Information Management Systems

Business and Work Processes

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**KM Performance Model**

**KM Practices**
- Identification
- Acquisition
- Storage
- Retention
- Preservation

**KM Processes**
- Transfer
- Sharing
- Generation
- Utilization

**Organizational Effectiveness**

**Organizational Performance**
- Strong Knowledge Base
- Proactive Organization

(adapted from ref.[1])

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Attrition-related knowledge loss:

Loss due to insufficient knowledge transfer

Employee retires -> New employee (eventually) starts

Time
Attrition-related knowledge loss:

- **Expert departs**
- **Temporary Knowledge Loss**
- **Permanent Knowledge Loss**
- **Knowledge Gap**
- **Replacement arrives**

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Consequence of knowledge loss

• inability to make decisions effectively
• higher risk of making incorrect decisions
• when the decisions are important:
  • potential adverse impact on production
  • potential adverse impact on safety
Not all nuclear facilities practicing KM

Some typical reasons:

• Not realizing the importance or need
• Lack Costly
• Employees overwhelmed with info/data
• No knowledge sharing culture (“hoarding”)
• Lack of leadership and example
Learning organization

An organization whose key personnel view its future success as being based on continuous learning and adaptive behavior.

The organization, therefore, becomes renowned for creating, acquiring, interpreting and retaining knowledge and then modifying its behavior to reflect new knowledge and insights.
Organizational Learning & Knowledge

Organizational Learning (via knowledge processes)

“Building” and “Maintaining” the organizational knowledge base

Organizational Knowledge Base (knowledge assets)

Tacit Knowledge (people “know how and why”)

Codified Knowledge (info, process, technology)
Steps to Creating Effective KM

Awareness and Acceptance Of Strategic Importance of KM

Top Management Commitment and Development of Common Vision of Role/Benefit of KM in NPP

Wider Management Team Acceptance of Need for and Desirability of Improved KM and Organizational Learning

Local Ownership, Resources, and Action on Specific KM Initiatives

Workforce Commitment and Engagement: Developing the KM and OL Culture
Knowledge Management System

• When managed company-wide, KM can be viewed as a “knowledge management system” (KMS)
• Ideally KMS is an integrated and coordinated approach to affect the management of knowledge and is manifested in a variety of implementations including document repositories, expert databases, work processes, etc.
• Supported by organizational memory and an organizational memory system.
• One of the aspects of the overall management system.
Why Integrated and Systematic?
Expected Impact of KM on Nuclear Facilities

- Higher Levels of Safety Achieved
- Lower Quality Knowledge Processes
- Lower Levels of Safety Achieved
- Higher Quality Knowledge Processes

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KM is difficult and challenging
KM is an important strategic issue for NPPs
KM recognized as an important driver of organizational performance
KM initiatives need to be aligned to support the “best practices” already being performed
An integrated approach to KM is needed
Information management tools and infrastructure are important
Leadership and culture are important factors
References:


1. Give 5 examples of a threat to organizational knowledge that you can think of.

2. Name 5 reasons why KM is difficult.