

Risk Management of Knowledge Loss in Nuclear Industry Organizations

School of Nuclear Knowledge Management

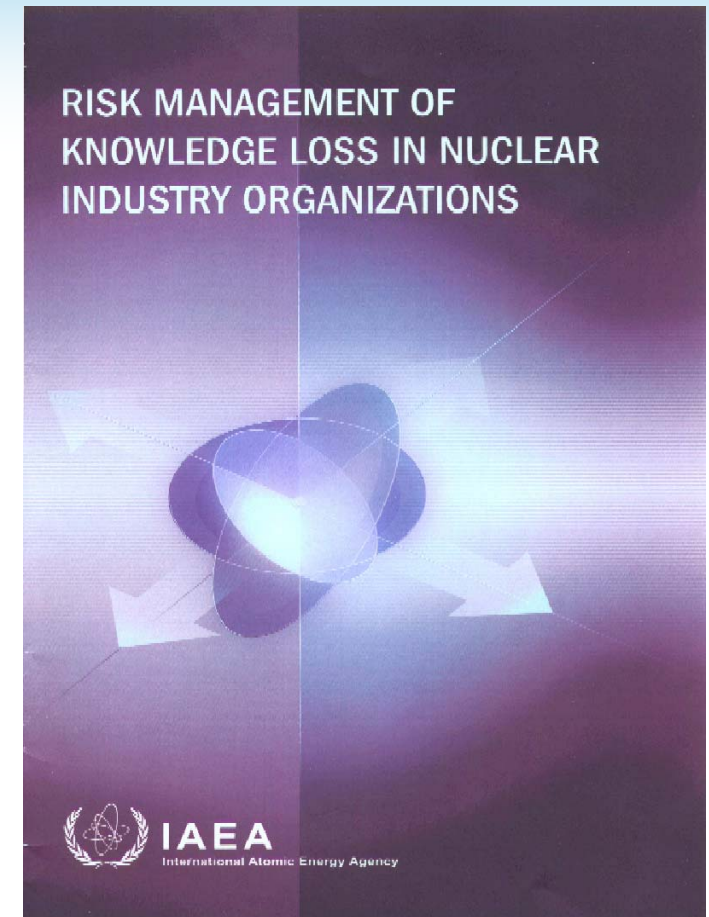
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Agenda

- ❖ **“Risk Management of Knowledge Loss in Nuclear Industry Organizations” – Published July 2006**
- ❖ **Objectives**
- ❖ **Knowledge Management Terminology**
- ❖ **Managing Work Force Issues – A Strategic Approach**
- ❖ **Knowledge Loss Risk Assessment Processes and Tool**
 - **The Three Step Process**
 - **Employee Self-Assessment**
 - **Institutional Knowledge Loss**
- ❖ **Summary and Conclusions**



Objectives

- ❖ Increase awareness among NPP management
- ❖ Emphasize need to develop a strategic approach
- ❖ Provide practical processes and tools
- ❖ Enable NPP management to utilize this knowledge to improve the skills and competences of new and existing workers.

Terminology

- ❖ **Knowledge:** The acquiring, understanding and interpreting of information. Knowledge is often used to refer to a body of facts and principles accumulated by humankind over the course of time. *Explicit knowledge* is knowledge that can be easily expressed in documents. *Implicit knowledge* and *tacit knowledge* represent knowledge or know-how that people carry in their heads. *Explicit knowledge* is contained in documents, drawings, calculations, designs, databases, procedures and manuals. *Implicit knowledge* and *tacit knowledge* are held in a person's mind and have typically not been captured or transferred in any form (if they had, they would then become *explicit knowledge*). Compared with *explicit knowledge*, such knowledge is more difficult to articulate or write down and so it tends to be shared between people through discussion, stories and personal interactions. It includes skills, experiences, insight, intuition and judgment.
- ❖ **Knowledge Management:** The integrated, systematic approach to identifying, acquiring, transforming, developing, disseminating, using, sharing, and preserving knowledge, relevant to achieving specified objectives. Knowledge Management helps an organization to gain insight and understanding from its own experience. Specific activities in knowledge management help the organization to better acquire, store and utilize knowledge.

Terminology

- ❖ **Attrition:** A decrease in the number of employees in an organization due to retirements, other terminations, or transfers to other organizations.
- ❖ **Human Assets:** The knowledge, skills and competencies of the people in an organization.
- ❖ **Critical knowledge:** The knowledge established in the context of a particular position that is deemed imperative for incumbents of said position to possess before being allowed to perform associated duties and tasks independently.
- ❖ **Institutional knowledge:** The collective knowledge of all the employees working in an organization or institution.

Managing Work Force Issues

A Strategic and integrated approach considers the interactions of programs and process that focus on managing human capital. This may include the following:

- Work Force Planning
- Recruiting Initiatives
- Training Programs
- Succession Planning and Leadership Development
- **Knowledge Management**

The Three Step Process to Retain Critical Knowledge

Three Step Process

Critical Considerations in Development of the KR Process

- ❖ Focusing on the critical (High Priority) positions where knowledge loss is the greatest threat
- ❖ Identifying and prioritizing the specific knowledge and skills at risk
- ❖ Developing concrete, actionable responses to mitigate this loss.

Three Step Process

- ❖ **Step 1.** Conduct a *Knowledge Loss Risk Assessment*
- ❖ **Step 2.** *Determine Approach* to Capture Critical Knowledge
- ❖ **Step 3.** *Monitor* and *Evaluate*

This process has been successfully utilized by The Tennessee Valley Authority

Three Step Process

Knowledge Loss Risk Assessment

Step 1

Step 2

Step 3

- ❖ The “Knowledge Loss Risk Assessment” is designed to identify positions/people where the potential knowledge loss is greatest and most imminent.

- ❖ Includes Ratings based on two factors:
 - Time until Retirement
 - Position Criticality

- ❖ Provides focus - Identifies “experts” where steps to mitigate knowledge loss may be needed.

Three Step Process

Knowledge Loss Risk Assessment

Step 1

Step 2

Step 3

$$\begin{array}{l} \text{Attrition Risk} \\ \text{Factor} \end{array} \times \begin{array}{l} \text{Position Risk} \\ \text{Factor} \end{array} = \begin{array}{l} \text{Total Risk} \\ \text{Factor} \end{array}$$

Attrition Risk Factor -- The projected retirement or other attrition dates will be assigned a retirement factor as follows:

- 5 - Projected retirement date within current or next fiscal year
- 4 - Projected retirement date within 3rd fiscal year
- 3 - Projected retirement date within 4th fiscal year
- 2 - Projected retirement date within 5th fiscal year
- 1 - Projected retirement date within or greater than 6th fiscal year



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Three Step Process

Knowledge Loss Risk Assessment

Step 1

Step 2

Step 3

$$\text{Attrition Risk Factor} \times \text{Position Risk Factor} = \text{Total Risk Factor}$$

Position Risk Factor -- An estimate of the difficulty or level of effort required to replace the position incumbent. Managers/supervisors are responsible for making these ratings based upon the following criteria:

- 5 - Critical and unique knowledge and skills** - Mission-critical knowledge/skills with the potential for significant reliability or safety impacts. Site-specific knowledge. Knowledge undocumented. Requires 3-5 years of training and experience. No ready replacements available.
- 4 - Critical knowledge and skills** - Mission-critical knowledge/skills. Some limited duplication exists at other plans/sites and/or some documentation exists. Requires 2-4 years of focused training and experience.
- 3 - Important** - Systematized knowledge and skills. Documentation exists and/or other personnel on-site possess the knowledge/skills. Recruits generally available and can be trained in 1 to 2 years.
- 2 - Proceduralized or non-mission critical knowledge and skills** - Clear, up-to-date procedures exist. Training programs are current and effective and can be completed in less than one year.
- 1 - Common knowledge and skills** - External hires possessing the knowledge/skill are readily available and require little additional training.



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Three Step Process

Knowledge Loss Risk Assessment

Step 1

Step 2

Step 3

$$\begin{array}{l} \text{Attrition Risk} \\ \text{Factor} \end{array} \times \begin{array}{l} \text{Position Risk} \\ \text{Factor} \end{array} = \begin{array}{l} \text{Total Risk} \\ \text{Factor} \end{array}$$

Total Risk Factor -- An estimate of the effort and urgency necessary to effectively manage the attrition.

20-25 High Priority - Immediate action needed. Specific replacement action plans with due dates will be developed to include: method of replacement, knowledge management assessment, specific training required, on-the-job training/shadowing with incumbent.

16-19 Priority - Staffing plans should be established to address method and timing of replacement, recruitment efforts, training, shadowing with current incumbent.

10-15 High Importance- Look ahead on how the position will be filled/ work be accomplished. College recruiting, training programs, process improvements, reinvestment

1-9 Important - Recognize the functions of the position and determine the replacement need.

Three Step Process

Approach to Capture Critical Knowledge

Step 1

Step 2

Step 3

“Determine Approach to Capture Critical Knowledge”

- Conduct Interview to identify potential knowledge loss areas
- Assess consequences of loss using interview results and organization specific critical skills inventories
- Prioritize and identify options to retain or mitigate
- Develop and implement action plans

Three Step Process

Approach to Capture Critical Knowledge

Step 1

Step 2

Step 3

Conduct Interview to ID potential Knowledge Loss Areas

Interview Questionnaire

- General questions
- Task questions (how....)
- Fact or information questions (what...who...)
- Pattern recognition / lessons-learned questions

C. Questions About Facts or Information	
<p>A. General Questions</p> <p>1. What kinds of knowledge or skills do you now have that TVA will miss most when you leave?</p>	<p>about where best way to get experienced employee.</p> <p>or existence may be by an</p> <p>ts for expert scribe any such employee.</p> <p>ut where to scribe any employee.</p> <p>er parts, Describe any employee.</p> <p>ge</p> <p>a., uncommon problems. ame the</p> <p>ve about apid diagnosis or fix.</p> <p>have about res. In other experienced there things ually routine?</p> <p>ailure patterns on or lure or fix. Are</p> <p>ou have that ailure, related</p>
<p style="text-align: center;">Questionnaire</p> <p style="text-align: center;">Identifying At-Risk Knowledge</p> <p>Instructions</p> <p>The purpose of this questionnaire is to help you identify your critical skills and knowledge, especially those unique knowledge items and skills that might be lost when you leave TVA.</p> <p>Some things to think about as you work through these questions:</p> <ul style="list-style-type: none"> • Knowledge or skill can mean several different things. We want to use a very broad definition that could include anything that new employees would need to know to do a job like yours (except for the exclusions noted below). • Do not include standard skills that are common to your particular job or that are assumed for a particular certification or degree (e.g., journeymen electricians are expected to be able to read a blueprint, etc.). If you're not sure it is common, include it here. • Some of the questions will appear to ask the same thing several different ways. We do this on purpose to make sure we do not miss valuable information. When the answer is something you have already discussed, simply say so rather than repeat the information again. • When we ask you to describe or list things, give us a general description and not a detailed description. Don't try to tell us how to do something. We will come back and gather this level of detail later. For now we are just trying to build lists to evaluate and prioritize. • For each major piece of knowledge, try to give us some sense of how important it is and how much trouble we may be in due to attrition. Tell us if the knowledge is written down somewhere or not, who knows it besides you, what would likely happen if no one knew this, how long it takes someone to learn it, etc. <p>The questions under section B will produce lists. In many cases these lists will already exist in job descriptions, training programs, PM procedures, and/or in various databases. If so, simply refer to the appropriate source or list and tell us how to find it. In other words, there is no need to try to rewrite the list in the interview.</p>	<p>ecement, what would</p> <p>that you eventually</p> <p>job?</p> <p>racks" when you leave?</p> <p>someone else to learn?</p> <p>ams, work assignments, in positions like yours?</p> <p>hat already exist.</p> <p>ou must know how to with the tasks</p> <p>ct PM, diagnose & ould you prioritize this</p> <p>se to do your job?</p> <p>g new employees who</p> <p>ow how to operate to aining new employees</p> <p>de-energize, switching, ew employees who will</p>

Three Step Process

Approach to Capture Critical Knowledge

Step 1

Step 2

Step 3

Assess the Consequences and Develop Plan

- What is the relative importance of this knowledge item?
- What is the rarity of the knowledge item?
- What is the difficulty (cost and feasibility) of recovery for this knowledge loss item?
- Develop & Implement Knowledge Retention Plan

ANALYSIS FORM FOR ASSESSING KNOWLEDGE/SKILL CRITICALITY				
Position:		Incumbent:		
General position description:				
Factors to Consider	Importance	Rarity of Knowledge	Recovery Difficulty	
	<ul style="list-style-type: none"> Impact on safe, reliable, and efficient operations Localized vs. system-wide impact Existence of alternative methods 	<ul style="list-style-type: none"> Redundancy of knowledge locally and TVA-wide TVA-specific knowledge Existence & cost of outside resources New hires with this knowledge available Loss gradual or abrupt 	<ul style="list-style-type: none"> Documentation or records exist Lead time needed to document or transfer 	
Rating scale	1 = Low	3 = Moderate	5 = High	
risk skill or knowledge	Importance	Rarity of Knowledge	Recovery Difficulty	CRITICALITY SCORE
	X	X		=
	X	X		=
	X	X		=
	X	X		=
	X	X		=
	X	X		=
	X	X		=
	X	X		=
	X	X		=
	X	X		=

Knowledge/Skill Criticality Worksheet, rev. 2 May 2001



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Three Step Process

Step 1

Step 2

Step 3

ID Options to Retain or Mitigate Knowledge Loss

Codification

- Documentation & Procedures
- Checklists, Inventories, etc.
- Performance Support Systems
- Concept Mapping

Alternative Resources

- Agency/site/department expert
- Rotational or “Visiting” Staff
- Multi-skilling or Cross-training
- Contractors, part-timers, retirees

Engineer It Out

- Process Improvement
- Update Equipment
- “Smart” tools and technology
- Eliminate task, product or service

Education & Training

- Classroom and Simulator Training
- CBT, Video-based, and alternative delivery
- OJT and Targeted Work Assignments
- Coaching, Shadowing and Mentoring
- Apprenticeship Programs



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Three Step Process

Monitor and Evaluate Knowledge Retention Plans

Step 1

Step 2

Step 3

- ✓ Review, evaluate and update attrition data.
- ✓ Review, evaluate and update previous Knowledge Retention plans
- ✓ Identify areas that need to be reassessed
- ✓ Repeat the process as necessary (start at step 1)

Three Step Process

Step 1

Step 2

Step 3

Monitor and Evaluate Knowledge Retention Plans

- ✓ Review, evaluate and update attrition data.
- ✓ Review, evaluate and update previous Knowledge Retention plans
- ✓ Identify areas that need to be reassessed
- ✓ Repeat the process as necessary (start at step 1)

Employee Self-Assessment

Employee Self Assessment

What are we after?

❖ Tacit Job Knowledge:

- Familiarity, awareness, or understanding gained through experience or study
- What has been discovered, or learned
- Specific information about something

❖ Preventing errors due to knowledge loss:

- Avoid situation where tasks/jobs are missed due to loss of knowledge

Employee Self Assessment

Who has this knowledge?

- ❖ The worker who is leaving
 - Knows their job and what it takes to do their job
- ❖ The worker's supervisor
 - He/She may have done the job before but at least should be familiar with the work the current employee is doing
- ❖ Other workers
 - Those who may have assisted the employee to perform the job

Employee Self Assessment

Where can the process be of value?

- To capture information from employees who terminate
- To capture information from employees who are nearing retirement
- To assess critical jobs for incumbents that perform specialized or critical work

Employee Self Assessment

What does the process involve?

- ❖ **Self Assessment:** Employee is requested to Identify all tasks performed to support job functions
 - Day-to-day tasks
 - Unique Skills / Knowledge
 - Open Actions or ongoing commitments
 - Functional leads or Contracts managed
 - Level of Approval Authority
 - Certifications / Licenses
 - Departmental Interfaces
 - Names of others who can/do perform each task

- ❖ **Standard form (handout) for all terminations**
 - Team meetings
 - Industry / Peer groups
 - Emergency Response Organization duties
 - Outage role (Our site / other sites)
 - Current benchmarking efforts (etc)

Employee Self Assessment

Who has the responsibility?

- ❖ The supervisor or assigned team:
 - reviews employee self-assessment form to identify and itemize critical knowledge unique to the individual.
 - develops recommendation to recover loss knowledge/skill.
 - reassigns tasks, approval authority, and other responsibilities as necessary.
 - determines what other actions may be necessary (reorganization, work elimination, process improvements etc.).

Institutional Knowledge Loss

The collective knowledge of the organization

Institutional Knowledge Loss

- ❖ We often think about KM **only** in terms of what individuals know. However, it is also critical for organizational knowledge to be captured in a reliable fashion - to “be there” when people need it in the future.
- ❖ Institutional knowledge represents a tremendous investment and is an asset for the enterprise.
- ❖ Examples of this collective knowledge include; design changes, LERs, audit reports, budgets, expenditure patterns, vendors and equipment suppliers, procedures, training materials, blueprints, simulator codes, fuel configuration histories, etc. (Both tacit and explicit knowledge).
- ❖ This section of the report considers the impact of knowledge loss on the enterprise and the resulting impact on organizational competency (in other words, the ability to function safely and efficiently).

Institutional Knowledge Loss

Factors that may be consider:

- ❖ Current work activities
- ❖ Future work activities
- ❖ Areas where knowledge is at risk
- ❖ Impact on the enterprise
- ❖ Current initiatives that support KM

Current Work Load

An assessment of the current workload in the organization or department considering

- ❖ Work backlogs
- ❖ Amount of overtime
- ❖ Non-core functions performed
- ❖ Impact on employees

Future Work Load

An assessment of the current workload in the organization or department considering

- ❖ Expanding capacity
- ❖ Decommissioning
- ❖ Major modifications
- ❖ Plans for new build or restart

Areas where critical knowledge/skills are at risk

- ❖ Organizations or Departments areas (e.g., System Engineering, operations, maintenance, etc) or,
- ❖ Individual experts (Turbine Specialist, System Engineer, etc.)
- ❖ Identify causes (e.g., attrition, reorganization, competition, etc.)

Risk and Impact

- ❖ What specific risk exists?
- ❖ What will the impact be on the organization's performance?
- ❖ What work can go forward?
- ❖ What will or can be deferred?
- ❖ What impact on safety, performance, and cost?

Current programs/initiatives support KM

- ❖ Don't reinvent the wheel
- ❖ Utilize existing programs and processes
- ❖ ID gaps where process improvements are required

Summary and Conclusions

- ❖ The KM tools and processes presented here are intended for use by NPP operators to assist in managing the risk of knowledge loss.
- ❖ These processes and tools are easily adaptable and can be modified to meet the needs of a wide range of organizations.
- ❖ It should be emphasized that knowledge management is **not** intended to replace existing systems, processes or programs but rather to increase the overall benefit by providing an integrated approach to manage knowledge loss



Questions?

Thank You !



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