Risk Management of Knowledge Loss in Nuclear Industry Organizations

Based on IAEA Publication 1248

IAEA – KAERI School on Nuclear Knowledge Management

November 2014 – Daejeon, Korea

David Heler
Why Do We Need Knowledge Management Tools?

Please watch the video and look for the following aspects of knowledge management:

- Tools used
- Challenges
- Behavior of the worker (culture)
- Work processes
Why Do We Need Knowledge Management Tools?
Why Do We Need Knowledge Management Tools?

What did you learn from watching this video

• Did the worker have the proper tools?

• Did the worker have the “Knowledge” to perform the work?

• What knowledge was missing?

• What would you do to “Fix” this knowledge gap.
Risk Management of Knowledge Loss

Content

– IAEA Publication 1248 - A three step process
  1. Risk Assessment (5X5 Risk Criteria)
  2. Determine Approach to Retain
  3. Monitor and Evaluate
– Examples for discussion
– Identifying Mission Critical Knowledge?
“Risk Management of Knowledge Loss in Nuclear Industry Organizations” – Published July 2006

Knowledge Loss Risk Assessment Processes and Tools
KNOWLEDGE LOSS RISK ASSESSMENT PROCESS

Step 1: Conduct of risk assessment
- Prepare management
- Assess risk factors
- Prioritize positions

Step 2: Determination and implementation of plan
- Inventory knowledge/skill clusters
- Assess criticality
- Develop knowledge retention plans
- Coordinate and review knowledge retention plans
- Implement knowledge retention plans

Step 3: Monitoring and evaluation
- Monitor and evaluate knowledge retention plan progress
Knowledge Retention

“Knowledge Loss Risk Assessment”

- “Knowledge Loss Risk Assessment” is designed to identify workers where the potential for knowledge loss is greatest and most imminent

- Assessment ratings are based on two factors:
  - Time until retirement or loss (Attrition Risk Factor)
  - Position criticality (Position Risk Factor - assigned by management)

- Step provides focus by identifying workers where actions to mitigate knowledge loss may be needed
**Knowledge Retention**

**Attrition Risk Factor** -- Projected retirement dates will be assigned a risk factor as follows:

- 5 - Within 2 years
- 4 - Within 3 years
- 3 - Within 4 years
- 2 - Within 5 years
- 1 - Within or greater than 6 years
Knowledge Retention

Position Risk Factor -- An estimate of the difficulty or level of effort required to replace the position based upon the following criteria:

5 **Mission-critical knowledge/skills.** Important to the safe and efficient operation of the facility. Knowledge undocumented - unique, no duplication - requires significant time to replace (years of training and on the job experience).

4 Critical knowledge and skills. Some limited duplication exists at other plants/sites and/or some documentation exists - requires 2-4 years of focused training.

3 Important, systematized knowledge and skills. Documentation exists and/or other personnel on-site possess the knowledge/skills.

2 Procedure based or non-mission critical knowledge and skills. Training programs are current and effective and can be completed in less than one year.

1 Common knowledge and skills.
### Knowledge Retention

#### "Knowledge Loss Risk Assessment"

<table>
<thead>
<tr>
<th>Attrition Risk Factor</th>
<th>Position Risk Factor</th>
<th>Total Risk Factor</th>
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</thead>
</table>

**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 will be accomplished.** College recruiting, training programs, process improvements, reinvestment.

- **1-9 Important - Recognize the functions of the position and determine the replacement need.**
# Knowledge Retention

## “Knowledge Loss Risk Assessment”

<table>
<thead>
<tr>
<th>Attrition Risk Factor</th>
<th>Position Risk Factor</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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</tbody>
</table>
Knowledge Retention

“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 (What)
- Prioritize and identify options to retain or mitigate (So What)
- Develop and implement action plans (Now What)
Knowledge Retention

Conduct Interview to identify 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

A. General Questions

Questionnaire
Identifying At-Risk Knowledge

Instructions
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.

Some things to think about as you work through these questions:
- 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 job, such as a blueprint. 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.
- 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.

Step 1  Step 2  Step 3

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Knowledge Retention

Identify Options to Retain or Mitigate Knowledge Loss

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

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

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

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

Monitor and evaluate knowledge retention plans

- Review updated Projected Attrition Data
- Monitor previous Knowledge Retention Plans
- Identify areas that need to be reassessed
- Coordinate with appropriate organizations and repeat three step process where necessary

ACTION PLAN - KNOWLEDGE TRANSFER & RETENTION

Section I
Critical Knowledge / Skill:
Person Holding Critical Knowledge / Skill:
Manager / Department / Unit:

Section II

- Completed Questionnaire to Assess Your Existing Employee’s Knowledge (Check if Completed):

<table>
<thead>
<tr>
<th>ACQUIRING KNOWLEDGE</th>
<th>TRANSMIERTING KNOWLEDGE</th>
<th>RETAINING KNOWLEDGE</th>
<th>SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit Interviews</td>
<td>Cross Training</td>
<td>Database Mining / Use of Search Engines</td>
<td>6 to 6 months</td>
</tr>
<tr>
<td>Incumbent Interviews</td>
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<tr>
<td>Post-Job Briefings</td>
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<td>Self Capture</td>
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<tr>
<td>Video-Record Task Performance</td>
<td>Mentorship</td>
<td>Job Shadowing</td>
<td>6 months to 1 year</td>
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<td>Procedure / Processes</td>
<td>1 year or greater</td>
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<td>Simonations &amp; Walk-Through</td>
<td>Electronic Media</td>
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<td>Training</td>
<td>Procedures / Processes</td>
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<td>Rotational Assignments</td>
<td>Desk Guides</td>
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</tbody>
</table>

Section III

<table>
<thead>
<tr>
<th>KNOWLEDGE / SKILL</th>
<th>ACTIONS TO CAPTURE</th>
<th>ACTION OWNER</th>
<th>COMPLETION DATE</th>
</tr>
</thead>
</table>

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Evaluating the Risk of Knowledge Loss - Practical Examples

**Position: Specialist, Electrical Installation and Cables**
- Knowledge and experience related to wiring and cable at all NPP sites
- Known as industry expert
- Represents company on IEEE’s Insulated Conductors Committee
- Maintains a volume of journals that log experiences in Technical Library.
- Maintains list of industry experts and vendor contacts.
- Only go to guy that can do failure analysis on wire and cable

**Position: Specialist Structural Dynamics**
- Knowledge and experience dealing with structural dynamics and integrity
- Covers analysis and testing (vibrations fatigue, fracture mechanics, hydrodynamics, etc.) for all site NPP structures and containments, piping, fuel racks, etc.
- Incumbent serves as representative on EPRI’s Structural Reliability & Integrity Utility Advisory group and NEI’s Environmental Fatigue Task Force, Seismic Shutdown
- Most of knowledge and expertise shared with two peers
### Who Has Critical Knowledge?

**Positions Titles**

- Specialist, Containment Leak Rate & Integrity
- Unit Operator
- Site Vice President, NPP
- Instrumentation & Control Specialist
- Professor Reactor Physics
- Chief Engineer
- Personnel Services Consultant
- Administrative Assistant

- Modification Manager
- Electrical Engineer
- NDE Level III inspector
- Plant Manager
- IAEA Technical Secretary
- Electrical Maintenance Apprentice/Trainee
- Welding Specialist/Inspector
- President and CEO
Who Has Critical Knowledge?

Positions Titles

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Questions & Answer