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Essential Elements of Knowledge Transfer and Retention

BACKGROUND

To ensure the safe and reliable operation of the industry's nuclear power plants, personnel must possess and maintain the requisite knowledge, skills, and attitudes to do their jobs properly. Industry training and qualification programs typically have focused on the explicit and critical knowledge that is contained within written documents, policies, and procedures. Because of anticipated increasing rates of departure from the workplace and potentially decreasing numbers of qualified replacements, the expert undocumented (tacit) knowledge of an aging and mobile workforce must be captured before personnel leave or move within the organization. Also, this body of explicit and tacit knowledge must be transferred to new personnel as they enter the workforce, to support the long-term viability of nuclear power plants to operate safely and reliably.

Note: This document was released as preliminary for industry comment in November 2006. It was released as final with no changes in September 2008.

OBJECTIVE

This document identifies essential elements to be considered as the basis for a knowledge transfer and retention plan. The objective is to support the capture, transfer, and retention of critical knowledge and skills within the nuclear industry in response to an aging and mobile workforce. Greater success with knowledge transfer and retention is likely to be achieved by organizations that are already cultivating a learning culture through encouraging and reinforcing the sharing of information by individuals and work groups. The implementation of knowledge transfer and retention activities does not necessarily require the acquisition of new tools; rather, it builds on established systems and processes to capture and retain important tacit knowledge. Examples of existing processes are operating experience and events analysis, corrective action/performance improvement systems, and the systematic approach to training (SAT). Typical feedback systems include maintenance work history, system notebooks, work-site observations, postjob critiques, and subject-matter-expert (SME) review and validation of new and revised procedures.

DEFINITIONS

Explicit Knowledge – information contained within written documents or electronic media

Knowledge Acquisition – the process used to capture and document the important tacit knowledge, or know-why, of experienced personnel—Once documented in a useful format, tacit knowledge becomes explicit knowledge.

Knowledge Retention – the process by which an organization ensures that critical knowledge is preserved, thereby mitigating the risk of loss

Knowledge Transfer – the process used for distributing important tacit knowledge within the workforce from experienced workers to less experienced personnel

Tacit Knowledge – knowledge that is undocumented and unique that resides within an individual's brain

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STRATEGIC OVERVIEW

BENEFITS

The benefits of an effective knowledge transfer and retention (KT&R) strategy include the following:

- Important knowledge is retained within the organization when personnel leave.
- Unique and expert knowledge of a few individuals can be made available to others when and where needed, independent of the availability of experts.
- Productivity and efficiency can be maintained and improved when personnel use existing expertise rather than going through their own trial-and-error experiences.

REDUCING VULNERABILITY TO SUDDEN KNOWLEDGE LOSS

As part of an overall KT&R strategy, actions are taken to reduce organizational vulnerability to sudden knowledge loss. The following ideas for minimizing such vulnerability may be helpful when a plan is being formulated:

- Cross-train personnel, or train them as a team, to spread knowledge across disciplines.
- Identify and establish procedures for critical and infrequently performed tasks.
- Prioritize plant modifications to eliminate unique systems and components with single experts before those experts are expected to leave.
- Increase leader awareness of tacit knowledge through planned interactions such as job-site observations.
- Maximize the use of existing knowledge capture tools throughout the organization.
- Hire replacement personnel with sufficient overlap before experienced personnel leave.
- Implement incentives for knowledge-sharing.
- Engineer options such as state-of-the-art upgrades or replacement of processes, equipment, and systems that currently need the support of subject-matter experts.

ESSENTIAL ELEMENT SUCCESS FACTORS

The essential elements of an effective knowledge transfer and retention plan include the following:

- Senior Leadership Endorsement and Support
- Organizational Knowledge-Loss Risk Assessment
- Knowledge Acquisition Techniques

- Knowledge Transfer Techniques
- Knowledge Retention Techniques

Each of these essential elements is discussed in the following section as a success factor. The experience of early implementers has shown the importance of these essential elements in providing an effective structure for a knowledge transfer and retention plan.

The one-page essential elements tactical summary identifies the attributes to include when the knowledge transfer and retention plan is being developed.

SENIOR LEADERSHIP ENDORSEMENT AND SUPPORT

Senior leadership endorsement and support will help ensure organizational alignment and effectiveness for KT&R. Knowledge transfer and retention are included as part of the business plan and make use of existing infrastructure and processes as the basis for capturing, transferring, and retaining important organizational knowledge. Additionally, KT&R should be thought of as a long-term and ongoing activity driven by workforce demographic change as a result of an aging and mobile workforce. Developing a vision and clearly defining the desired end-state of the KT&R activity will help guide the planning and execution of the overall activity.

Clear sponsorship and ownership for the KT&R activity will help ensure organizational continuity. Functional and line managers should understand their responsibilities for creating the values and culture that will support the behaviors needed to share, capture, and apply tacit knowledge derived from experienced workers. Establishing activity metrics will help senior leadership gauge the status and effectiveness in areas such as workforce demographics, knowledge acquisition and retention, acquired knowledge effectiveness and ease of use, and human performance issues attributed to knowledge loss.

To reinforce the KT&R activity, the vision, purpose, expected outcomes, and status need to be periodically communicated to the workforce. The sharing of success stories in which KT&R has made a difference is valuable in helping personnel understand why KT&R is important and how it will help support the long-term viability of the organization.

ORGANIZATIONAL KNOWLEDGE-LOSS RISK ASSESSMENT

Current projections of attrition and workforce demographics are needed to understand the extent of potential lost knowledge and to help determine the number of personnel eligible for retirement and the dates of such retirements. Human resources history can be a good indicator of the age at which personnel are likely to seek retirement. Other factors to consider that can result in lost knowledge include layoffs, promotions, long-term training programs, job rotations, and new plant construction.

A knowledge-loss risk assessment will help determine the scope and breadth of the KT&R activity. It will also identify the individuals and activities for which potential knowledge loss has the greatest impact on the organization. Factors to be considered in a knowledge-loss risk assessment include the projected retirement dates for at-risk personnel, the anticipated difficulty

in replacing that knowledge, the identification of critical tasks, and the determination of the susceptibility of those tasks to personnel attrition. Also, highly specialized and technical functions are considered, as well as infrequently performed tasks. Knowing this important information will help prioritize knowledge capture activities.

There may be value in asking the question, "What is the cost of doing nothing?" A key consideration is whether the cost of capturing, retaining, and making this information available to the workforce overshadows the relative worth of the information to the organization. In some cases, a cost-benefit analysis may indicate that some information is too costly to justify its capture and retention.

Resources devoted to KT&R activities are commensurate with the scope and complexity determined by the knowledge-loss risk assessment. A graded approach is used that matches allocated resources to the level of effort anticipated for the KT&R activity. For example, if a utility is a single-unit nuclear operator and has identified only a few individuals within the organization with important knowledge to be captured, an extensive KT&R activity team and plan are not likely to be needed. In this example, immediate supervisors may be able to readily attain the needed tacit knowledge by conducting thorough interviews. However, utilities with a fleet of nuclear operating units and large support organizations may benefit from a more expanded approach that addresses KT&R activity member responsibilities and the organizational complexity of the KT&R activity.

KNOWLEDGE ACQUISITION TECHNIQUES

Knowledge acquisition is the capture and documentation of important tacit knowledge. Knowledge acquisition involves helping personnel verbalize intuitive thought processes that enable them to perform their work at a level of quality, effectiveness, and thoroughness not common to others. Tacit knowledge is typically comprised of extensive experience that involves the following:

- effective thought processes and know-why of the reasons for completing tasks
- organizational understanding of how work is accomplished and the interactions and relationships necessary for effective navigation within the organization
- historical knowledge regarding important events and the bases for decisions made in the past

The following criteria will help identify personnel to include in knowledge acquisition activities:

- recognized by managers and peers as "expert"
- typically the "go-to" person for that function
- expertise in handling rare or infrequent events
- unique skills and knowledge

- recognized by possession of certain "critical" skills such as the following:
  - — has the ability to look at a situation and properly envision a range of possible outcomes
  - — identifies the problem without wasteful consideration of a large range of alternative diagnoses and solutions
  - — sees the big picture and understands situations as a whole, rather than in terms of situational components
  - — is able to anticipate most situations and takes appropriate action as required
  - — notes the subtle but critical cues that others miss

A requisite level of skill is needed to extract tacit knowledge from expert personnel. Knowledge interviewers should have appropriate skill sets that ensure effective interviewing techniques. They should be thoroughly conversant on the topic or task at hand or be supported during the acquisition process by personnel who are familiar with the topic or task. The desired end product of knowledge acquisition is information that will enable other personnel to achieve the same result if they were to perform the same task.

The following are examples of knowledge acquisition techniques that are being used successfully:

- incumbent interviews
- exit interviews
- postjob debriefings
- management observations
- self-capture through annotation of documents, procedures, notebooks, and databases
- videotaping of individual performing the task(s)

KNOWLEDGE TRANSFER TECHNIQUES

Knowledge transfer is the sharing and distribution of knowledge from experienced workers to less-experienced personnel. The transfer can occur directly, as in person to person, or indirectly, as in person to process. The difference is that in direct transfer the information is coming from the knowledge source and going directly to the recipient. An example of this is the transfer of knowledge from a mentor to a mentee. Indirect transfer occurs when the information is provided by a knowledge source and is then formatted and stored for later access by potential users. Because indirect knowledge transfer involves the long-term storage of tacit knowledge within some type of medium prior to being accessed by users, indirect transfer will be addressed as knowledge retention techniques.

The advantages and disadvantages of direct knowledge transfer are summarized below (DeLong, 2004—see References).

Advantages	Disadvantages
The techniques are simple and varied.	It can be time-consuming and requires that relationships be established.
It allows for interactive discussion and clarification of unclear points.	Work standards and expectations may not be accurately conveyed between peers. Undesirable practices may be perpetuated.
For tacit knowledge that is difficult or impossible to write down, it is the only method that works.	Transferred knowledge is retained only as long as the recipient remains in the position.

The following are examples of direct knowledge transfer techniques that have been used successfully:

- cross-training and rotational assignments
- coaching and mentoring
- storytelling
- apprenticeships and job shadowing
- simulations and walk-throughs

KNOWLEDGE RETENTION TECHNIQUES

Knowledge retention is the process by which an organization ensures that critical knowledge is preserved, thereby mitigating the risk of loss. Captured knowledge is reviewed and validated and is then formatted for ease of use. The following are examples of knowledge retention techniques that are being used successfully:

- personnel retention plan
- electronic media, such as audio and video recordings and intranet Web sites and databases
- communities of practice (groups of people united by common elements such as interests, functions, or problems)
- alternative forms of employment, such as phased retirements and use of retirees as contract coaches and subject-matter experts
- codification in the form of the following:
  - procedures
  - case studies

— training and qualification program materials

— job order work histories

— system notebooks

— desk guides and technical manuals

— engineering drawings

— prejob briefing guides

The advantages and disadvantages of knowledge retention (that is, indirect knowledge transfer) (DeLong, 2004—see References) are summarized below.

Advantages	Disadvantages
Once made explicit, previously tacit knowledge can be transferred quickly to speed personnel's time to competence.	Adding knowledge capture to people's workloads can be inconvenient.
Work standards and expectations can be clarified and accurately conveyed. A review of retained knowledge can screen out undesirable practices.	Initial costs to capture and format expert knowledge can be substantial.
Transferred knowledge is available to anyone in the organization and can, therefore, help raise overall performance.	

Typically, captured knowledge will be stored electronically. It is important, therefore, to provide an integrated strategy for capturing, storing, maintaining, retrieving, and formatting the knowledge. The need for an integrated strategy grows with the amount of information being captured. Because its capture will not organize the information in a structure optimized for the data storage, data maintenance, data search, or the end-user's needs, such considerations must be addressed before the knowledge begins to accumulate.

If knowledge is captured but not used by its intended end-users, the original risks associated with the loss of this information remain. Even after other analyses have been considered, captured knowledge should meet four criteria:

- It must be easily accessible to its intended user at the time the knowledge is needed.
- It must contain the information needed by its intended user.
- It must be in the format needed by its intended user.
- It must be sufficiently up to date such that if it is used as written, the correct result will be obtained.

CONCLUSION

Today's aging nuclear workforce must share the critical knowledge that has led to safe and reliable nuclear power generation and helped to create a future for nuclear energy. This critical knowledge needs to be identified, captured, transferred, and retained so that personnel entering the nuclear industry may benefit from gained efficiencies and lessons learned. Organizations within the nuclear industry will benefit from establishing a knowledge transfer and retention plan that is formed using the essential elements presented in this document. Knowledge transfer and retention should not be looked at as a short-term activity, but rather one that needs to be included within long-term business planning. The sharing of knowledge within an organization is an important factor for supporting sustained performance and cost competitiveness.

TACTICAL SUMMARY

The essential elements and supporting information below provide a basic framework of attributes that support an effective KT&R strategy. This information should not be considered as comprehensive detail for developing a KT&R plan.

SENIOR LEADERSHIP ENDORSEMENT AND SUPPORT

- ❑ The business plan includes a KT&R activity.
- ❑ Vision, scope, and expected KT&R activity outcomes are defined.
- ❑ Sponsorship and ownership are clearly established and have the authority to commit needed budgetary and personnel resources.
- ❑ Metrics gauge activity status and effectiveness.

ORGANIZATIONAL KNOWLEDGE-LOSS RISK ASSESSMENT

- ❑ At-risk individuals are identified.
- ❑ At-risk tasks and functions are identified.
- ❑ KT&R activities for at-risk tasks, functions, and personnel are prioritized.

KNOWLEDGE ACQUISITION TECHNIQUES

- ❑ Knowledge interviewers are skilled.
- ❑ Needed resources and knowledge acquisition processes are identified.

KNOWLEDGE TRANSFER TECHNIQUES

- ❑ Knowledge transfer options are identified.
- ❑ Transfer options are selected on a case basis determined by specific needs.

KNOWLEDGE RETENTION TECHNIQUES

- ❑ Knowledge retention options are identified.
- ❑ Retention options are selected on a case basis determined by specific needs.
- ❑ Strategies for validating, storing, and maintaining the accuracy of the retained knowledge are determined and assessed for cost and benefit.

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