Human resources and training in nuclear sector

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Definitions (1)

- **Knowledge** – The mental constructs used in acquiring and understanding facts, and the application and reassembling of facts to think creatively, solve problems and make judgments. Together with **Attitudes** and **Skills**, **Knowledge** provides the full requirements to undertake a given job or task. Knowledge is sometimes termed **Cognitive Ability**.
Definitions (2)

• **Competence** (Competency) – (1) The ability to put skills, knowledge and attitudes into practice in order to perform activities or a job in an effective and efficient manner within an occupation or job position to identified standards.

• (2) A combination of knowledge, skills and attitudes in a particular field, which, when acquired, allows a person to perform a job or task to identified standards. Competence (Competency) may be developed through a combination of education, experience and training.

Practical definitions

• **Knowledge** = is the capacity for effective action.

• **Competence** = Knowledge+Skills+Attitude
Knowledge Management Objectives

• Maintaining Competency
• Capturing / Preserving Existing Knowledge
• Advancing Nuclear Technology
• Maintaining R&D Capability

Basic Elements of Nuclear Knowledge Management

Strategy

• Human Resources Management
  ▪ Education, hiring, training, retaining, developing, etc.
  ▪ Enabling tools
• Engineering Tools
  ▪ Preserving knowledge
• Information Management Systems
  ▪ Sharing and pooling knowledge (Human, Equipment, Processes)
The long-term operation of NPPs requires that the requisite knowledge, skills, and attitudes be transferred to new personnel as they enter the work force. Transfer is critical to sustaining the safe, reliable, cost-effective operation of the NPP. Effective HRM is a key element in staffing policy.
Worker Supply Projected to Decrease in Key Areas

% Change In New Worker Supply (2002 - 2011)

Based on the NEI's industry-wide staffing survey (2001)

Cumulative Demand for New Workers

Universities
Fuel Cycle
Outages
Eng Design, Svcs & Const
Production Plants
Govt & Contractors

Number of People

0 10,000 20,000 30,000 40,000 50,000 60,000 70,000 80,000 90,000 100,000

2002 2003 2004 2005 2006 2007 2008 2009 2010 2011
Potential Retirees are defined as employees that will be older than 53 with 25+ years of service, or older than 63 with 20 years of service, or older than 67 within the next five years.

Source: NEI Nuclear Staffing Survey

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Diplomas in the Fields of Nuclear Technology (Germany)
The Attrition Challenge
An Ageing Workforce Nearing Retirement
Tennessee Valley Authority

IAEA IRS Study on the Loss of Corporate Knowledge (2000-2001)

- Total of 141 IRS Reports Reviewed
- 44 reports Contain Elements Relating to the Loss of Corporate Knowledge and Memory

IRS – Incident Reporting System
Core competencies to be maintained by an operating organization

- Identification of 'Core Competencies' - an important consideration in assuring competent personnel.
- Has broad implications for other issues related to the development of human resources.
- Knowledge of Core Competencies for every job within an organization will influence
  - recruitment and selection programmes,
  - identification of prerequisite knowledge and skills,
  - training programmes,
  - performance evaluations,
  - promotions,
  - succession planning,
  - interactions with outside educational institutions.

Integrated Approach to the Development of NPP Managers’ Competence

- Organizational Culture
  - Goals, Mission, Vision and Values
- Corporate Policy
- Business Environment
- Safety Culture
- Job Technical Requirements
- Administrative Requirements
- Regulatory Requirements
- Core Management Competencies
Managing human resources in the nuclear power industry: lessons learned

IAEA-TECDOC-1364, August 2003

KEY ISSUES RELATED TO EFFECTIVE MANAGEMENT OF HUMAN RESOURCES

They include the need to:
(1) effectively organize work activities and designate responsibilities and authorities.
(2) effectively train and develop personnel for their assigned responsibilities.
(3) establish clear performance expectations and assess the extent to which these expectations are achieved.
(4) provide effective incentives to achieve performance expectations.
(5) anticipate the long term human resource and knowledge management needs of the organization.
(6) establish effective communication methods.
MANAGEMENT ISSUE 5:
THE NEED TO ANTICIPATE THE LONG TERM HUMAN RESOURCE AND KNOWLEDGE MANAGEMENT NEEDS OF THE ORGANIZATION

Symptoms of problems related to this issue (1)

• It is difficult to recruit suitable people for certain positions.
• The organization is faced with the need to replace a large number of retiring employees in the near future.
• Training and professional development opportunities are routinely postponed or cancelled due to day-to-day demands.
Symptoms of problems related to this issue (2)

- Personnel aren’t prepared to take on new responsibilities needed in the coming competitive energy market.
- The organization has poor (or no) relationships with universities/educational organizations and professional organizations.
- People in the organizational don’t have a sense of belonging.
- People are concerned about what will happen to them when the plant closes/shuts down.

Attributes of effective management related to issue 5 (1) - IAEA-TECDOC-1364

- The operating organization has a strategic plan of which an integral part is the development of human resources needed for the plant life cycle.
Strategic Staffing Plan

- Identified demographics
- Pipeline for craft and professional positions
- Partnerships with universities and technical schools
- Partnerships with professional organizations

TVA Nuclear Integrated Staffing Plan Model

- Employee Demographics
- Attrition Data (Mgmt & Employee Input)
- Labor Cost
- Benchmarks
- Process Improvements

Work Force Analysis Projections

- Qualifications
- Training Program
- Reinvestment Planning
- Leadership Development/Succession Planning
- Recruitment Planning
- Retention Management
Human Resources - Program Flow Diagram

Manage the Asset - Identify Work Force Planning Needs and Competencies

TVAN Integrated Staffing Plan - Results

- Leadership Development/Succession Planning
  - INPO Strength at all sites
  - 18 Key Management Replacements in Past 3 Years (Cost Avoidance of $6MM)

- College Recruiting Success
  - Mentoring Program Implemented
  - Onsite Recruiting Event
  - New Hires Involved in Recruiting Process
  - Achieving Diverse Work Force Goal (25% New Hires)

- Reinvestment Plan
  - For Employees Impacted by Process Improvement and Work Elimination
  - Opportunity for Employees to Transition to Core Positions
  - No Forced Reductions
TVAN Integrated Staffing Plan -
Results (Continued)

• Integrated ISP Into Business Planning Process
  ▪ Managing Labor Budgets
  ▪ Work Force and Payroll Targets Met
  ▪ Attrition Projections Enabled Management to Identify Areas for Process Improvement

• Self-Assessment Utilized Industry Peers
  ▪ Strengths
    * Skill Gap Assessment
    * New Employee Mentors
    * College Recruitment
    * Reinvestment Program
    * Succession Planning
    * Line Management Support of ISP

Attributes of effective management related to the issue 5 (2) - IAEA-TECDOC-1364

• Programmes are in place for continuous development and training of staff based upon the long term needs of the organization. Succession planning and mentoring are included to transfer the tacit, undocumented knowledge of experienced personnel to their replacements.

• Senior and middle level managers are actively involved in national and international initiatives related to management and development of human resources.
Attributes of effective management related to the issue 5 (3) - IAEA-TECDOC-1364

• The organization has mutually beneficial partnerships with educational and industrial organizations.
• Senior managers spend a considerable proportion of their time on long term planning activities.
• The organization protects its significant investment in personnel through providing appropriate incentives to retain people. The explicit knowledge of the organization is collected and maintained in such a way that it can be easily retrieved, and utilized.

Practical recommendations
Development of our employees

• Career development
  ▪ Rotational assignments
  ▪ Project assignments
  ▪ Employee Development program
  ▪ Training

We have to assure knowledge transfer

• Succession planning
• Mentoring
• Change management program
• Formal written procedures
• Internal training programs
• Corrective Action program
• Operating Experience program
Succession Planning

• Specific focus on Manager and above
• Pipeline for critical positions
• Identify
  ▪ Ready now
  ▪ Ready with minor intervention
  ▪ Ready with stretch
• Formally reviewed twice a year
• Develop employees
  ▪ Competency-based Individual Development Plan

Mentoring

• Formal and informal program
• Formal
  ▪ Across sites
  ▪ Part of succession plan
• Informal
  ▪ Within a site
  ▪ Inter and intra departmental
Change Management

- Nuclear change management policy
- Identify and document key knowledge and skills of personnel leaving department, site, or company
- Plan for transfer of duties with eye on work destruction
- Plan for training of replacement
  - OJT
  - Formal Training
  - Written guides
- Communicate changes to all stakeholders

Training to improve performance and transfer knowledge

- Formal classroom training
- Simulator training
- Mock-ups
- Video tapes of difficult and/or infrequent evolutions
  - Use in subsequent training
  - Use in pre-job briefs
- Classroom simulator under development
Strategies for managing an ageing workforce (1)

- There are two main strategic directions for managing the ageing workforce issues. The first direction must focus on retaining the existing nuclear workforce for as long as they choose to continue their careers. The second must focus on transferring the critical knowledge of the existing workforce to future generations.
- There is considerable potential benefit from international cooperation and information sharing in this area.
Strategies for managing an ageing workforce (2)

- **Transfer of knowledge** should be a part of the Strategic Plan and Management System of any Operating Organization

- **Items to be considered include:**
  - Long term staffing plans that provide a steady and predictable inflow of new personnel
  - Enhanced career development plans that aid both the NPP organizations and employees to chart career progressions and retirement planning
  - Increased emphasis on multi-skills development

KEY ISSUES RELATED TO EFFECTIVE MANAGEMENT OF HUMAN RESOURCES

They include the need to:

1. Effectively organize work activities and designate responsibilities and authorities.
2. Effectively train and develop personnel for their assigned responsibilities.
3. Establish clear performance expectations and assess the extent to which these expectations are achieved.
4. Provide effective incentives to achieve performance expectations.
5. Anticipate the long term human resource and knowledge management needs of the organization.
6. Establish effective communication methods.
MANAGEMENT ISSUE 2: effectively train and develop personnel for their assigned responsibilities

Where is a role of training in knowledge management?
Knowledge Management Objectives

• Maintaining Competency
• Capturing / Preserving Existing Knowledge
• Advancing Nuclear Technology
• Maintaining R&D Capability

Maintaining competency (Canadian Nuclear Utilities)

• Support a number of Industrial / University Research Chairs
• Development / Implementation of detailed staffing, recruitment and training plans (operations, maintenance and engineering)
• Participation in UNENE Program
• Improvements in the areas of Documentation and Accessibility of Technical Plant Information
Knowledge Management at NPP (France)

Examples of knowledge
- Engine operation during emergency stops
- Loss of a blade on turbine
- Rules for building site management
- Users instruments knowledge
- Proceedings
- Standards
- Technical Systems folders
- Rounders & engine operators "What’s the use of it ?" "How it works"

Steps of knowledge
- Expertise & Experience (Experiential Knowledge)
- Know How (practices located on each plant)
- « Technical » knowledge (normative processes & prescriptions)
- Basic Knowledge (Know-What needed in each job)

Knowledge Management
- Story telling
- Identification of Experiential Learning
- Communities of Practice
- Groupware
- Repositories, Video
- National REX (incidents…)
- Document management, Norms, Regulation
- Recruitment
- Training & Learning
- Mentoring & Tutoring

NKM (France)
- Document Management Systems
- Return on experience process
- Best practices
- Rare events & signals
- Access to infos & experts
- Collaborative work
- Communities of practice
- Capture

Socialisation
- Renewing & Creativity
- Transmission of skills
- - Mentoring-Tutoring
- - Training
- - Tacit knowledge
- - Loss of know-how
- - Story telling
- - Performance Indicators
- - « Good ideas »
- - Industrial watch

Renewing & Creativity
- Carry
- Access to infos & experts
- Collaborative work
- Communities of practice

Capture
- Return on experience process
- Best practices
- Rare events & signals
Systematic Approach to Training (SAT)

SAT - An approach that provides a logical progression from the identification of the competencies required to perform a job to the development and implementation of training to achieve these competencies, and subsequent evaluation of this training.
**Analysis Flowchart:**

**INPUTS:**
- Management Recommendations
- Potential Human Resources Changes
- Job Performance Problems
- Training Program Evaluation
- Recommendations
- Feedback
- Procedures/Process Modifications
- Operating Experience

**OUTPUTS:**
- Training Needs
- Job Tasks
- Tasks Selected for Training
- Skill and Knowledge
- Performance Elements
- Test Questions

1. **Evaluation & Feedback Phase**
   - Conduct Needs Analysis

2. **Training Need?**
   - Yes: To Other Management Initiative
   - No: Conduct Job Analysis

3. **Conduct Job Analysis**
   - Conduct Task Analysis
   - To Design Phase

**Task Analysis**

**INPUTS:**
- Tasks Selected for Analysis & Identified for Training
- Assign Personnel to Conduct Analysis
- Prepare for Task Analysis
- Identify Steps
- Indentify Knowledge & Skills

**OUTPUTS:**
- Identify Needed Fundamentals Topics
- Develop Learning Objectives & Test Questions
- Tasks Selected for Training and Their Critical Elements, Skills & Knowledge Identified

**VALIDATE**
Facilitating the Information Exchange

The IAEA web resource
Nuclear Knowledge Management

Need for the Future and Challenge for the Agency

Alongside other developments, the changing nuclear architecture is raising issues of “knowledge management” which influence the safety and economic aspects of the nuclear community. Alternative energy sources, changing international and national frameworks, and the need to modernize nuclear facilities are raising new challenges. The Agency recognizes that the nuclear needs of many Member States are evolving and that awareness and understanding of the nuclear knowledge management (KNM) field is increasing. In recognition of this and other trends, a number of IAEA advisory committees, as well as the IAEA Board of Governors and General Conference, have called for measures to better identify the pattern and scope of the problems, to assess trends that Member States are facing in order to respond to the challenge. The efforts established in the KNM field are ongoing and will continue to evolve as the nuclear community works to develop and implement new strategies. The KNM perspective is also being considered in the context of the IAEA’s work on ensuring that nuclear knowledge is not lost as personnel leave the nuclear sector.

NPP Personnel Training

EFFECTIVE TRAINING TO ACHIEVE EXCELLENCE IN THE PERFORMANCE OF NPP PERSONNEL

The agency and regulatory authorities in the nuclear power sector are in need of coordinated support and expertise to maintain the required levels of training in order to ensure that personnel are adequately trained and prepared to perform their duties. The program provides training and support to organizations involved in the development, delivery, and evaluation of training programs. This includes the development of training courses, training materials, and training delivery systems. The program also provides guidance and support to organizations involved in the development and delivery of training courses, training materials, and training delivery systems. The program is designed to support the development of training courses, training materials, and training delivery systems that are effective and efficient.
ENTRAC (E-Catalogue) - a web-based tool for information exchange regarding training and qualification of nuclear facility personnel

entrac.iaea.org

SAT IAEA Software

The SAT IAEA 2.0 software was developed as an alternative way to access the content of the IAEA guidelines on "Effective and sound Personnel Training and Certification". The software includes:

- The use of training material in training courses on the principles, methodologies and applications of SAT, and as a reference for persons who have participated in such courses.
- The use of a user-friendly and interactive interface that allows users to search for specific topics and easily navigate through the content.
- The ability to customize training materials and modify them to fit specific requirements.

The Systematic Approach to Training

- Definition and Purpose
- SAT Model
- Management Role in Training
- Organization of Training
- SAT-NPP Relationship
- SAT Applications
- Glossary
To introduce SAT, the main inputs and prerequisites are:

- Needs: based on the need for establishing, updating and/or improving
Conclusions

• One of the important objectives of Knowledge Management is Maintaining Competence.
• Human Resources Management is a basic element of Knowledge Management Strategy.
• Effective management related to HRM includes the programmes for continuous development and training of staff based upon the long term needs of the organization.
• SAT is effective (and world-wide accepted) tool to implement training.

Thank you for your attention!