A Proposition of Human Factors Approaches to Reduce Human Errors in Nuclear Power Plants

Jung-Woon Lee

I & C - Human Factors Research Center
Korea Atomic Energy Research Institute
leejw@kaeri.re.kr
Contents

I. Introduction
II. Experience
   ◆ In Research Domain
   ◆ In the Utility
III. Practices
   ◆ K-HPES
   ◆ PSR (Periodic Safety Review)
   ◆ HFMP (Human Factors Management Program)
IV. Proposition
V. Conclusion
I. Introduction

HE studies
- in NPPs - active in 1990’s after the TMI acc.
- Nowadays - Medicine, Aviation

HE still occurs.

In Korea
- Recent increase of trips due to HEs
- Gov. interests
- Committee for making Short-term and Long-term Plans for HE reduction

Thoughts for a proposition to the Committee
II. Experience

* In Research Domain
  - Not fully understanding workplace & task characteristics
  - Development of classifications or database
    - Translation of event raw data into a pre-defined form – loss of information
    - Expectation of statistical meaning, trend, frequency…
    - Conclusively, not much helpful for curing the problems
II. Experience

- In Research Domain (cont.)
  - TMI effects
  - Safety related
  - I & C related
  - MCR focused
    - APR-1400
    - Advanced HSI
  - Limited Gov. supports to HF R&Ds
  - Less efforts on HF related to local equipment operation, maintenance, test and surveillance, etc.
II. Experience

[*] In the Utility

- Less Utility’s efforts on improvement of site HF
- Have applied “the person approach” to reduce HE
  - Search for cause providers, blaming, moral education, job re-training, limitation of promotion, etc.
- Interested in the development of Advanced CR
- K-HPES
III. Practices

**K-HPES**

- The 1st Version in 1995 referring to INPO HPES, J-HPES
- Driven by Head Quarters of plants
- Enforcement of reporting – prohibit voluntary participation
- Additional to existing event reports – give burden
- Considerable use of cognitive terms - difficult to use by site personnel
- “the person approach”

- Environment - improved
- System - simpler and computerized
- Effects limited
III. Practices

• PSR
  • From 2001, for 11 Rx units from total 20 units
    • Procedures
    • MMI
    • Human resources
    • Human information requirements and workload
III. Practices

**PSR – Procedures**

- **Check Points**
  - the availability of procedures
  - the appropriateness of style and structure
  - the suitability of detailed elements

- **Methods**
  - procedure document reviews
  - interviews with plant personnel
  - on-site reviews
  - expert panel reviews

- **Scope**
  - Operation procedures: EOPs, GOPs, SOPs, AOPs, and alarm procedures
  - Many departmental procedures
III. Practices

★ PSR – MMI

♦ Check Points
  ★ the availability of MMI
  ★ the suitability of MMI
  ★ the effectiveness of MMI
  ★ work environmental conditions

♦ Scope
  ★ main control rooms (MCRs)
  ★ remote shutdown panels (RSPs)
  ★ local control panels
  ★ safety parameter display systems (SPDS)
  ★ main computer systems
III. Practices

☆ PSR – Human Resource

♦ Check Points

☆ Work management
  λ working hour management
  λ shift management
  λ job substitute management
  λ work management during an overhaul (O/H) period

☆ Health Management
  λ medical examination
  λ mental health and alcohol, substance abuse
  λ musculoskeletal disorders
  λ cardiovascular disease (job stress management)
  λ individual health promotion program
  λ job satisfaction and devotion, etc.
III. Practices

* PSR – Human Resource (cont.)
  
  ✭ Check Points

  ✭ Recruit and Qualification
    - recruit
    - qualification requirements for NPP personnel
    - maintaining a specialty of plant personnel

  ✭ Training Program
    - execution of SAT (Systematic Approach to Training)
    - assessment of instructors (academic career, job career, and site experiences)

  ✭ Safety Culture
    - plan and contents of safety culture education

  ✭ Operator Training using Simulators
    - training program for operators using simulators
    - suitability of simulators
III. Practices

PSR – Human information requirements and workload

- **Check Points and Scope**
  - mental workload related information requirements
  - other factors related information requirements
  - environmental factors related information requirements
  - workload; objective & subjective workload
III. Practices

PSR

- Reviews focused safety and legal requirements satisfaction
- Extended coverage of human factors - more than usual safety reviews
- Found many problems in each area by external specialist reviews
- Different attitude about HF PSR
  - Positive – help us to find more improvement points
  - Passive – not want outsiders to know their status

- Better to extend review points to HE possibility aspects
III. Practices

HFMP (Human Factors Management Program)
- Found many problems in each area by PSR
- PSR - every 10 years
- Necessity to handle HF problems in a continuous manner
- To help site personnel to apply HFE in an integrated and systematic way to their workplace
- Under development for the 1st unit waiting for the Continuous Operation Permit
IV. Propositions

**HF Efforts to reduce HE in NPPs**

- Analysis of HE events - Retrospective
- Work Condition Analysis - Prospective
- Others - Training, Qualification, Competence Maintenance, Knowledge Transfer, etc.
IV. Propositions

analysis of HE events – Retrospective approach

- Still powerful to reveal resident failures
- Focus on human performance affecting factors - more extensive than causal chains
- More the numbers of participants, better chances of problem finding (from our PSR experience)
- Keep raw data – uninfected by the classification or database system
IV. Propositions

- Work Condition Analysis – Prospective approach
  - Methods and scope similar to HE event analysis
  - More efforts to review jobs other than MCR operation
  - Consider factors such as workload, information requirements, job-stress, etc.
  - Cooperative works by many departments or many workers
IV. Propositions

Training & Qualification

- Provide an environment for job practice as much as possible
- Consider “Boundaries of safe operation” (Prof. Rasmussen’s) and Infrequent jobs
- Relation to practical qualification
IV. Propositions

- Competence Maintenance
  - Provide chances for workers from many plants in the same job domain to discuss and share their experience and knowledge

- Subcontracts
  - Be careful when changing subcontract scheme – during adaptation period
  - Better management of subcontractor qualification required
V. Conclusion

- Efforts for HE reduction in NPPs still necessary

- See work conditions in a HE point of view other than the satisfaction of safety and legal requirements

- Less HFE activities in NPPs – More frequent transactions to share experience and information on HFE in NPP domain
Thank you!