A Recent Revisit Study on the Human Error Events of Nuclear Facilities in Korea

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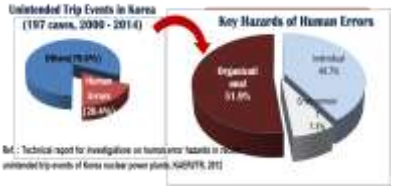
[BACKGROUND] ***Nuclear Industry in Korea :***
- 24 Units of NPPs and 1 Rs. Rx. after 1-st Research Rx(TRIGA-Mark) in 1958
- Self-Reliance of NPP tech. in Korea : Design and & Exports(APR-1400, HANARO)
- Operational Perf. and Competences : ~93% Availability, ~30% total grid

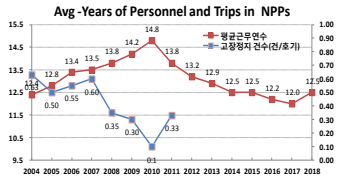
What and Why after Fukushima Accident?

Culture = 文化
-文 : literature
-化 : becoming

- Succeeding Events in Nuclear Industry and Facilities in Korea
- New Considerations due to the Digital tech. and the Wider Scope of Safety

Recent Human Error Events in Korea : 42 Cases after 2000 (~20% of total 197)
- HANARO (Research Rx.) : delayed emergency (WHITE)– a rotten can?
- YG #5 trip : a screw driver left in the pump?
- SK #1 : Containment Spray and SI - omitted slip, controls, procedure design, training, qualification, change/config-management, shift turn-over etc.
- Kori #1 : SBO & Concealment – subordinate, org.-violation, safety culture
- QA counterfeit, forgery in supply chain, drug, etc...





Basic Characteristics of Human Errors in Nuclear

Myths and Truths on Human Errors experienced in Nuclear Practice
(selected from the human error studies of the last decades)

- Human Error Accident does NOT happen Accidently
- Human Error is NOT an Error of Human alone
- Human Error is NOT a problem of Performance in average
- Human Error is NOT a primary concern of Human-in-the-Loop
- Human Error is NOT captured by Statistics itself
- Human Error is NOT limited by a limited system/system limitations
- Human Error is NOT totally suppressed by Enforces/Trainings/Cautions...
- Human Error is NOT prevented by Himself to conduct it (Lee et al. 1999)
- Human Error is NOT explained in ONE way (Rasmussen 1990)
- Human Error is NOT repeated by the same cause
- Human Error is NOT identified by the same consequence
- Human Error is NOT effectively prevented by Eliminating the Cause

Findings from the Revisit to the Human Error Events in KOREA
- Trial-and-Errors to the Rareness and the Non-Stochastic nature of HEs
- case-by-case Retrospection & *Hind-sight Effect from the* common-sense perspective
- Deeply Structured into the Flexibility and Exceptions of a system including Org.

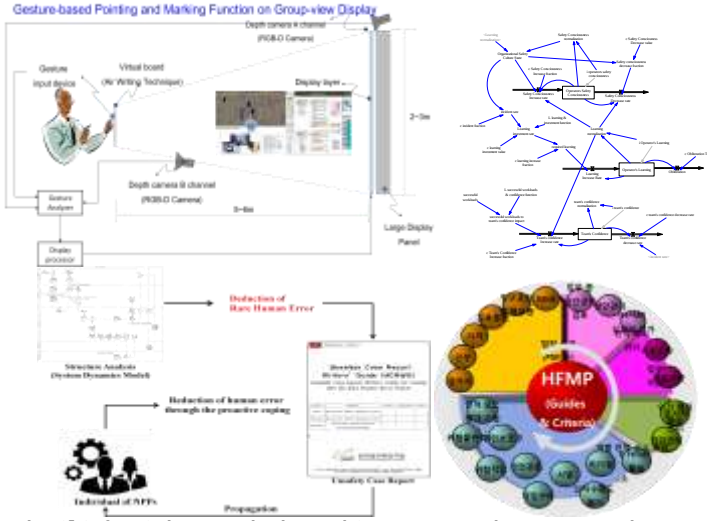
In Brief, on the Findings from the HE Revisit Study, especially for HRO
- Human error is Not a matter of Human -> But a matter of Human Factors in a System.
- Human error may Not be captured in HRA/Design V&V/Retrospection -> Proactive???
- Countermeasures best practical to an HE depend on the Strategy & Policy as well as CBA
- New/Wider scope of HE is demanding especially to **Violations :**
  - avoidance, negligence, and mannerism
  - routine/exceptional violation
  - permitted non-compliance
  - sabotage, intrusion,
  - Team/Organizational errors

Resolution to Human Error: ***Facilitate Human More Capable, at First and Last!***
- Maximize the lessons learned from the cases by identifying hazards than causes
- New types of human errors, especially in form of a structure rather than factor-by-factor
- Support the human himself by engineering the others beside human

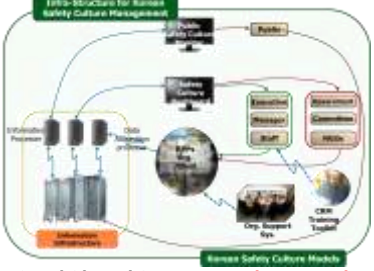
[TWO PROACTIVE PROJECTS ON HUMAN ERRORS AND SAFETY CULTURE]

[Project1] Countermeasures (CMs) against to Human Errors for Nuclear Safety
- Research-Infra for human error studies : Experimental setups and measuring tech.
- Models and Simulations of the human errors and the events including human errors
- Guides & Supports for the new/further hazards : FFD, EAP, Fatigue, Stress, and others

Current Outcomes
- Nu-TEB : Experimental Setup and Characteristics DB
- S/W Models of Emerg.-Beh. and HE Hazards : System Dynamics/Discrete Simulation
- 17 new guides additive to the existing on HF ; FFD, EAP, Emergency Tab -> HFMP (*HFMP : Human Factors Management Program)
- New HMI Features to support Team-Behavior : Gesture-based Group View, Inter-COM

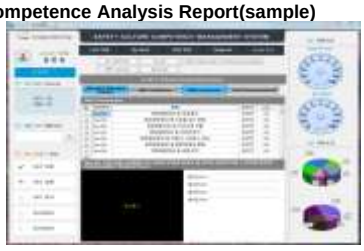


[Project2] Safety Culture Monitoring and Competence Enhancement Tech.
- *Monitoring and management system for the safety competences*
- *Competences enhancement tech. and programs :*



A Good Shared Space : IMT (Integrated Management System)
- to Support the Underlyings of NPP system to Surface Interest Group Continuously.
- a management system to promote and support a strong safety culture by~

*** Dash-Board for Detailed SC Measures, Competence Analysis Report(sample)**



[CONCLUSIONS] ***A Revisit Study on Human Errors: Paradigm Shift !***
- We can do More with Human Factors before the Human
- Do not expect this work will end, so do not try to Eliminate the HEs thoroughly
- But Get along with them in a system, and Utilize them
- Just Be Proactive than Retrospective before being evolved

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