INPO’s Approach to Human Performance in the U.S. Commercial Nuclear Industry

Tony Muschara
Principal Program Manager – Hu Institute of Nuclear Power Operations
INPO’s Mission

...to promote the highest levels of safety and reliability — to promote excellence — in the operation of nuclear electric generating plants.
1. Concentrated Power – reactivity management
   - Reactivity and power level controls
   - Rod control & drive reliability
   - Instrumentation reliability

2. Decay Heat Load – inventory and cooling
   - Reactor cavity and fuel pool
   - Secondary plant equipment reliability
   - Safety system reliability and controls
   - Plant materials integrity and design margins

3. Radioactive Material – barrier integrity
   - Containment integrity
   - Defect-free fuel
   - Primary systems integrity
An event that caused or had the potential to cause:

- an appreciable reduction in plant safety or reliability
- excessive radiation exposure or the discharge of radioactivity off site or
- serious harm to individuals
Error Rate Reduction

Before

After

Systemic Causes

Random Causes

Error Rate

Time
Hazard – Barrier – Asset

Hazard: Human – “touching”
Barrier(s): Less than Adequate or Missing
Asset: Object to Protect

error

event
What is Managed?

- **Assets**: people, plant, and property
- **Hazard**: human error
- **Exposure**: “People touching equipment”
- **Risk**: probability and consequences
- **Event**: ▼ frequency and ▼ severity
- **Controls**:
  - **error rate** (frequency) → reduce active errors
  - **defense-in-depth** (severity) → reduce latent conditions
Strategic Approach to Hu

\[ R_e + M_d \rightarrow \emptyset E \]

Reducing error and Managing defenses leads to ZERO Events

Identify
Analyze
Correct
Anatomy of an Event

Values & Beliefs

Mission Goals
Policies
Processes
Programs

Latent Organizational Weaknesses

Flawed Defenses

Error Precursors

EVENT

Initiating Action

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Performance Model

1. ORG’L FACTORS

2. JOB-SITE CONDITIONS

Leadership

3. INDIVIDUAL BEHAVIOR

4. PLANT RESULTS
Risk-based Approach*

- Human unreliability and equipment risk can not be managed the same.
- Process of assigning controls for human work activities uses a **graded approach**.
- Controls are *proportionate* to the risk or potential consequence.

Work Execution
“touching” the plant

- Work Preparation
  - planning, walkdowns, task assignments and pre-job briefings

- Work Performance
  - uneasiness (wariness), situation awareness, Hu tools, teamwork and supervision

- Work Feedback
  - reporting and observations
Critical Step – a procedure step, series of steps, or action that if done improperly will cause *(immediate)* irreversible harm to equipment or people, or significantly impact plant operation.
Defenses

- **Engineered Controls**
  - equipment reliability, software & hardware configuration, human-machine interface

- **Administrative Controls**
  - procedures, training, processes, policies, expectations and standards

- **Cultural Controls**
  - assumptions, values, beliefs, attitudes, work group norms, and leadership

- **Oversight Controls**
  - accountability, performance improvement
Managing Defenses

1. **Identify** unsafe condition(s)
2. **Analyze** its cause(s) and extent of condition
3. **Correct** the condition(s)
Organizational Factors

1. Mission
2. Organizational structure
3. Clear direction
4. Work management
5. Administrative controls
6. Hazard control processes
7. Training & qualification
8. Engineering processes

9. Performance improvement processes
10. Technology
11. Human resources
12. Conservative decision making
13. Communication
14. Managerial/supervisory practices
Safety Culture Principles*

1. Everyone is personally responsible for nuclear safety.
2. Leaders demonstrate commitment to safety.
3. Trust permeates the organization.
4. Decision-making reflects safety first.
5. Nuclear technology is recognized as special and unique.
6. A questioning attitude is cultivated.
7. Organizational learning is embraced.
8. Nuclear safety undergoes constant examination.

INPO Performance Improvement Model

**Implementing Solutions**
- Resource Management
- Action Tracking
- Task Assignment
- Management Oversight/Reinforcement
- Organizational Accountability

**Performance Monitoring**
- Trending
- Effectiveness Reviews
- Standards
- Problem Reporting
- Behavior Observations
- Independent Oversight
- Industry OE
- Benchmarking
- Self Assessments

**Results**
- Performance Assessment
- Performance Indicators

**Actions**
- Leadership and Oversight
- Excellence in Performance Improvement
- Knowledge and Skills
- Culture

**Gaps**
- Business Planning Considerations
- Action Planning
- Problem Analysis
- Management Review & Approval

**Analyzing, Identifying and Planning Solutions**

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OR.3 Human Performance

“Station personnel select and apply appropriate error prevention techniques commensurate with the importance of assigned tasks to minimize the frequency and consequences of events.”

- Organizational Factors
- Job-Site Conditions
- Individual Behaviors
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