

**P19: Consideration of Human Error in
Operations at Exelon NPPs**

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presentation by

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Objectives:

- Reinforce importance of human error prevention
- Review typically important human errors as determined by PSA
- Present methods used at Exelon NPPs to reduce human errors.

Nature of Human Error:

- Human error is inherent in all human activity (basic assumption/mind set)
- “Human error” typically a combination of multiple errors which erode safety margin:
 - Organizational/Managerial (“Safety Culture”)
 - Design/Procedure
 - Personal/ “Group Think”
- Human error results from external pressures –too much and not enough

Human Error “Forcing Functions”:

- Each person has a self-perceived “envelope of safety” to allow correct behavior:
 - Enough time, enough money, enough personal safety, enough interest in successful result, etc.
- External pressures push in on this envelope, forcing humans to “cut corners”
 - Schedule, budget, supervision, peers, fear of reprisal, family, personal problems,
- Result is error
 - More likely to repeat behavior if negative impact delayed or remote

Examples of Accidents Initiated by “Human Error”

- Three Mile Island partial meltdown
- Browns Ferry Fire
- Davis-Besse vessel head erosion
- Chernobyl explosion/fire
- Etc.

Role of PSA in Human Error

- PSA typically used for quantification of “errors of omission”, the failure to act.
- PSA used in limited way for “inherent” failures such as undetected errors left after maintenance.
- PSA not used for “errors of commission”, doing the wrong thing (unbounded)
- PSA not used for “safety culture” errors

Significant Human Errors Determined from Exelon PSAs:

- Failure to start long term containment heat removal
- Failure to restore off-site power if lost
- Failure to restore DC power
- Failure to restore room cooling
- Failure to isolate Steam Generator Tube Rupture
- Failure to restore component (pump) cooling
- Lesson: actions not automatic.
 - If human doesn't do, not done at all
 - Effect is like “common cause failure”

Methods Used to Reduce Human Error

- Recognition “it can happen here” (mind set)
- Hi level management commitment (“safety culture” & conservative operation)
 - Rewards to employees for finding problems (procedures, design), even at low risk level
 - Management attention if personnel don’t find problems as part of normal work (CR tracking)
 - One of Engineering “Fundamentals” (One of top 10 priorities)
 - Part of regular employee training.

Methods Used to Reduce Human Error (continued)

- Risk significant failures hi-lighted as part of Operator training (PSA input)
- Human error prevention techniques taught
 - Pre-job briefings (“Three Questions”)
 - Self-check, (Stop, Think, Act, Review)
 - Peer check, Independent check
 - Physical identification of equipment
- Mitigation of potential errors
 - Identify “protected equipment”
 - Part of PSA input to maintenance planning (Maint Rule Section a(4))