Concepts of Operations/Control Room

Technology Overview/Scope

- Advanced control room technologies, e.g.,
  - Human system interface
  - Procedures
  - Alarm systems
  - Decision support systems

- New concepts of operation, e.g.,
  - Remote operation
  - Control room staffing
  - Load following
  - Non electric applications of nuclear energy
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Summary of Pre-Meeting Survey Input

- Reduced staffing
- Single operator, multiple units
- Online refueling
- Automated operations
- Different control parameters
Summary of Break-Out Sessions Input by Reactor Type

- **HTGR**
  - Electricity is byproduct, main product is heat
  - Need high reliability (>99.9%), I&C and concept of operations need to support achieving that high reliability
  - Hybrid system
  - really don't need operators for protection and control functions, but required for licensing.

- **MSR**
  - taking advantage of passive safety to simplify control room functions, control room is more of the conventional approach.

- **Fast reactor**
  - Passive safety should influence requirements for post-accident monitoring.

- **LWR**
  - have some field operators for field equipment operations (<10% of total equipment operations). This is for infrequently operated equipment. Other reactor types reporting no field operators required.
  - some important human actions but none credited in safety analysis.
Common Development Needs Among Reactor Types

- Autonomous/semi autonomous operation
  - Minimize operator actions
  - Operator may serve the role of investment protection in passively safe systems
  - First deployment will take a more conventional approach (with reduced staffing) until the concept is proven
  - Challenge is regulatory acceptance (and public acceptance, rather than technical one)

- Regulatory approval of getting full credit in ConOps/Control Rooms for passive plants

- Maintaining operator engagement and skill will be a challenge
  - Make use of VR for infrequent operations and field activities
  - Information visualization to support operators
  - Define a different role for operator
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Common Development Needs Among Reactor Types

- Control Room requirements
  - Post accident monitoring
  - Habitability
  - Remote operation
  - Portable control room, e.g., single laptop
Ideas for DOE Sponsored Research Topics

- Regulatory acceptance of reduced staffing and/or autonomous operation, including gaining full credit for passively safe systems.
- Identification of operator roles in passively safe systems, what functions does he or she perform?
- Understanding of how to maintain operator skill and engagement in autonomous/highly automated operations.
- Development of decision support tools and information visualizations to provide actionable information to operator.
- Developing the technical basis for minimal control rooms, e.g., remote operations or single workstation or laptop.