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# Some thoughts on operator intervention arising from safety reassessments of research reactors in the light of the Fukushima Daiichi NPP accident

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# Outline

- SSR-3 requirement
- Proposed factors for operator intervention
- OPAL case study
- Conclusions

# SSR-3 Requirement

- SSR-3 Requirement 22 states “that a set of design extension conditions (DECs) for a research reactor be derived”
- Focus is on engineered protection, such as the provision of additional safety features or the extension of the capability of existing safety systems
- No specific requirements in relation to claiming operator intervention

# Operator Invention

- There is a lack of guidance as to when can operator intervention be considered as an acceptable primary means of mitigation for a DEC
- This presentation is intended to identify some of the factors that should be considered when claiming operator intervention

# Operator Intervention

- The time available for the operators to intervene is a key factor in order to
  - correctly identify or diagnose the design extension conditions
  - determine the appropriate response
  - implement that response correctly
- This presentation proposes five factors for consideration when assessing the these factors

# Information and Indication

- The operator must be provided with information and indications to be able to correctly identify or diagnose the DECs
- Information and indications should be in an appropriate form, e.g. understandable, reliable
- Adverse effects of the DEC on the information and indications needs to be considered

# Procedures and Instructions

- Procedures or instructions need to be in place to both assist the operator in correctly
  - Identifying or diagnosing the DEC
  - Determining and  implementing the appropriate response
- Symptom-based emergency procedures (as opposed to event-based) likely to be more appropriate for DECs

# Operator Training

- Operator training must include training in procedures and instructions for DECs
- Training and management needs to ensure operators have the support and confidence to intervene where such intervention could result in irreparable damage to the facility
- For extreme external events, operators concerns for family also need to be recognised

# Systems and Equipment

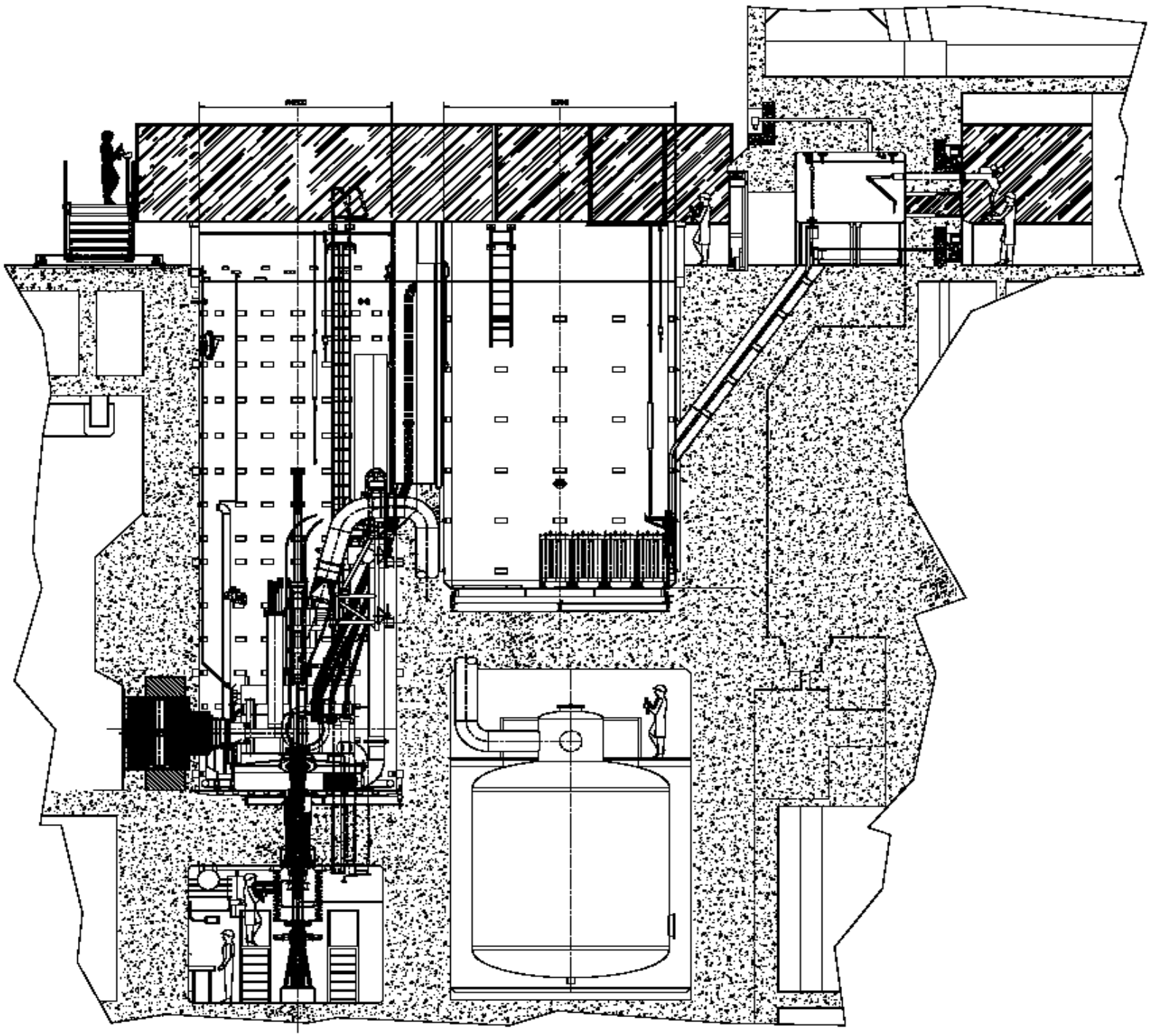
- Systems and equipment required to implement a response to a DEC must actually be available and operable under the anticipated DECs
- This needs to include
  - Power supplies and other support services
  - Whether access is possible if local action or control is required

# Testing and Demonstration

- The responses to DECs should be demonstrated through testing or demonstration exercises as far as possible
- Need to verify that they can actually be implemented

# OPAL Case Study – Introduction

- Similar to a number of other research reactors, the control rod drives (CRD) are located in a room beneath the reactor pool with the five control rods penetrating the bottom of the pool
- CRD Room is intended to be water-tight; failure of a seal only leads to 3.65 m drop in pool water level
- What happens if this room is not water-tight?



# OPAL Case Study – DEC Analysis

- DEC defined as CRD seal LOCA (2 $m^3$/hr) with complete failure of the CRD room to remain water-tight
- Most conservative assumptions result in the core being uncovered in about 60 hours
- More realistic assumptions result in the core being uncovered in about 223 hours
- Both cases assume no operator intervention

# OPAL Case Study – Operator Intervention

- Considering the factors identified previously:
  - Time available is in days
  - Multiple independent and diverse indications available
  - Symptom-based emergency procedures are in place and operators trained in them
  - Multiple (nine) independent and diverse means of make-up available
  - Demonstration exercise scheduled

# Conclusions

- The paper considers the issue of claiming operator intervention in response to DECs
- It proposes some of the factors that should be considered when claiming such intervention
- A case study for an identified OPAL DEC shows the successful application of these factors

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