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## ATWS Rule Application to SMR-160



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## Agenda

- Introductions
- Purpose & Outcome
- 10 CFR 50.62 ATWS Rule
- SMR-160 Response to ATWS
- Questions
- Open Forum

## Purpose & Outcome

### ■ PURPOSE

- ✓ To provide a high-level overview of the SMR-160 response to an ATWS event and discuss the Diverse Actuation System.

### ■ OUTCOME

- ✓ To obtain feedback from the NRC staff on the SMR-160 approach to the ATWS rule.

## 10 CFR 50.62 ATWS Rule

- (c) *Requirements.* (1) Each pressurized water reactor must have equipment from sensor output to final actuation device, that is diverse from the reactor trip system, to automatically initiate the auxiliary (or emergency) feedwater system and initiate a turbine trip under conditions indicative of an ATWS. This equipment must be designed to perform its function in a reliable manner and be independent (from sensor output to the final actuation device) from the existing reactor trip system.
  
- (2) Each pressurized water reactor manufactured by Combustion Engineering or by Babcock and Wilcox must have a diverse scram system from the sensor output to interruption of power to the control rods. This scram system must be designed to perform its function in a reliable manner and be independent from the existing reactor trip system (from sensor output to interruption of power to the control rods).
  
- (c)(3) through (5) are for boiling water reactors only.

## SMR Understanding of ATWS Rule Intent

- Reduce risk of common cause failures in the reactor protection system that would prevent a reactor trip when demanded.
  
- SECY-83-293 establishes a safety goal for the expected core damage frequency (CDF) of an unmitigated ATWS to be no more than  $1.0E-5$ /reactor-year.
  - ✓ ATWS CDF is a function of initiating event frequency, reactor protection system reliability, and ATWS mitigation system reliability
  - ✓ Per SRP 15.8 ATWS acceptance criteria for evolutionary designs are either:
    - 1) Provide a diverse scram system that significantly reduces the probability of an ATWS
    - 2) Demonstrate the consequences of an ATWS are acceptable
      - Maintain core in a coolable geometry
      - Maintain reactor coolant pressure boundary integrity
      - Maintain containment integrity

## SMR-160 Response to ATWS

- All AOOs to be evaluated in combination with ATWS, but loss of normal feedwater flow (LOFW) assumed to be bounding for SMR-160
  - ✓ LOFW will occur due to inadvertent closing of the main feedwater isolation valve or pump failures in the Main Feedwater System
  - ✓ Reactor trip and actuation of the Primary Decay Heat Removal (PDH) and Secondary Heat Removal (SDH) systems automatically occur
  - ✓ SDH actuation automatically causes the Main Steam Isolation Valve (MSIV) and Main Feedwater Isolation Valve (FWIV) to close
  - ✓ During an ATWS event (no reactor trip), SDH will remove some decay heat but secondary side pressure will continue to increase until the Atmospheric Dump Valve (ADV) and Main Steam Safety Valves (MSSV) open to relieve pressure.

## SMR-160 Response to ATWS (cont.)

- All AOOs to be evaluated in combination with ATWS, but loss of normal feedwater flow (LOFW) assumed to be bounding for SMR-160
  - ✓ ADV and MSSVs will discharge steam generator inventory until it empties, which renders SDH ineffective
  - ✓ With only PDH capable of removing heat, the RCS temperature increases
  - ✓ An equilibrium will be established between PDH heat removal capacity and reactor power (~5%) given negative moderator temperature reactivity coefficient

## Meeting SECY-83-293 ATWS Safety Goal



- SECY-83-293 established the ATWS Safety Goal as CDF attributed to ATWS not exceeding  $1E-5$ /year

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## SMR Plan for ATWS Rule

- Request exemption from 10 CFR 50.62(c)(1)

✓ [[

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- 10 CFR 50.62(c)(2) does not apply to SMR-160 as it is not manufactured by Combustion Engineering or Babcock and Wilcox
- Question: Does the NRC have any concerns with this planned approach?

## SMR Plan for ATWS Rule

- PSAR Section 15.8

- ✓ [[

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- PSAR Chapter 19

- ✓ Document PSA analysis of ATWS

- Question: Does the NRC have any concerns with considering ATWS a BDBE? SMR notes that both AP1000 and NuScale consider ATWS a BDBE based on the probability of the event being significantly lower than other DBEs.

# Open Forum

