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1. Introduction

- Procedures of MSIV Room EQ Analysis

- Conventional EQ Analysis Methodology (w. Codes)

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<td>conventional</td>
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- Application of SGNIII and COMPARE Codes to APR1400

  - This methodology for APR1400 led to unrealistically conservative results and the EQ requirement was excessively conservative than necessary.
1. Introduction (cont.)

- SGNIII code basically assumes the discharged steam of MSLB to be always saturated steam, so it was forced to assume that the break flow has an enthalpy of the hot leg temperature during the steam generator tube uncover to make up for a superheating effect (most conservative model) required by NRC IN 84-90.

- COMPARE code has momentum equations only considering differential pressure and not considering of the gravitational forces based on buoyancy driving force.

- These characteristics of the computer codes make the result overly conservative, resulting in excessively high EQ temperature.
A new methodology has been developed to evaluate the MSIV room EQ temperature with appropriate conservatism by using mechanistic models for the steam behavior inside steam generators.

The methodology utilizes the RELAP5-ME and GOTHIC codes
2. New EQ Analysis Methodology (cont.)

- RELAP5-ME Code
  - Approved by Korean Regulatory Authority

- Purpose
  - To develop M/E release analysis method
  - To improve the conventional M/E analysis methodology
  - To increase design and/or operational margin to the containment design

- RELAP5-ME is a best estimate code and includes the models for the special design features of APR1400 such as SIT with fluidic device.

- M/E release analysis for the containment design for LBLOCA, SBLOCA and MSLB accident can be performed by RELAP5-ME code.
## 2. New EQ Analysis Methodology (cont.)

### Comparison of Computer Code Systems

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<td>SBLOCA M/E</td>
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<td>(Blowdown Analysis)</td>
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Note) * Used for Equipment Environmental Qualification
2. New EQ Analysis Methodology (cont.)

- RELAP5-ME
  
  *(Code Link: RELAP5K and CONTEMPT4)*

**Figure 1. Code System of RELAP5-ME**
2. New EQ Analysis Methodology (cont.)

- Application of the New Methodology to APR1400
  - RELAP5-ME and GOTHIC are highly generic thermal-hydraulic transient behavior analyses codes, and more realistic analysis codes in NSSS and containment, respectively
  - RELAP5 solves 6 eq's of mass, energy and momentum for 2-phase (vapor, liquid)
  - GOTHIC solves 9 eq's with multi-phase/component of 3-phase (vapor, drop, liquid)
3. Analysis Models and Results

- Thermal-Hydraulic Modeling of MSLB using RELAP5-ME
  - M/E release data using RELAP5-ME
    - Conservative values of I.C. and B.C.

Figure 2. MS Line and MSIV Room Model
3. Analysis Models and Results (cont.)

- REALP5-ME Nodal Scheme for APR1400

Figure 3. RELAP5-ME Nodalization
3. Analysis Models and Results (cont.)

- Thermal-Hydraulic Modeling of MSIV Room using GOTHIC
  - Beneficial models
    - Buoyancy driven flow
    - Chimney effect
  - Selected licensable GOTHIC user options at surfaces for condensation heat transfer model and radiation to steam model

- Compared to conventional methodology, MSIV room EQ temperature of APR1400 was lowered by more than 40 °F

Figure 4. MSIV Room Model
4. Conclusions

- A new methodology using RELAP5-ME and GOTHIC codes has been developed to evaluate the MSIV room EQ temperature with conservatism.

- By applying the new methodology to ARP1400, MSIV room EQ temperature of APR1400 was lowered by more than 40 °F.
Thank You!

Clean Nuclear, Safety First!

ICEPCO NSSS Division