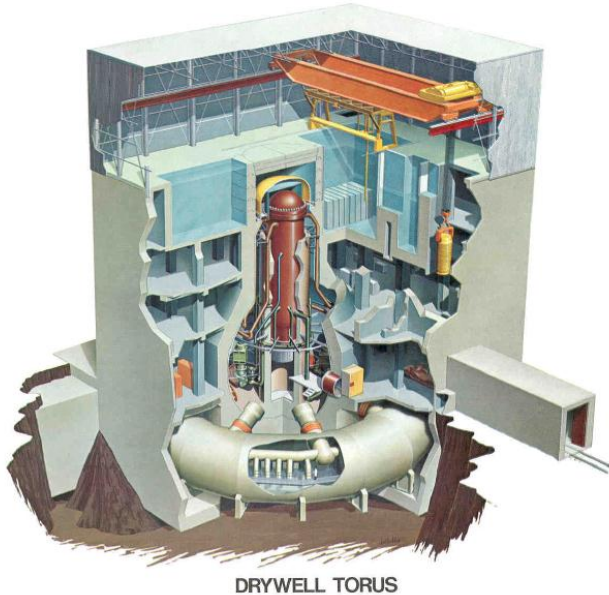# Severe Accident Analysis Research Based on Fukushima

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Joint DOE-NRC MELCOR reconstruction of Fukushima Daiichi Accident

DRYWELL TORUS

- **Scope of Effort**
  - Collect and archive data on accidents (portal)
  - Reconstruct accidents
  - Assess validity of MELCOR models
- **Sandia-led effort with INL and ORNL**
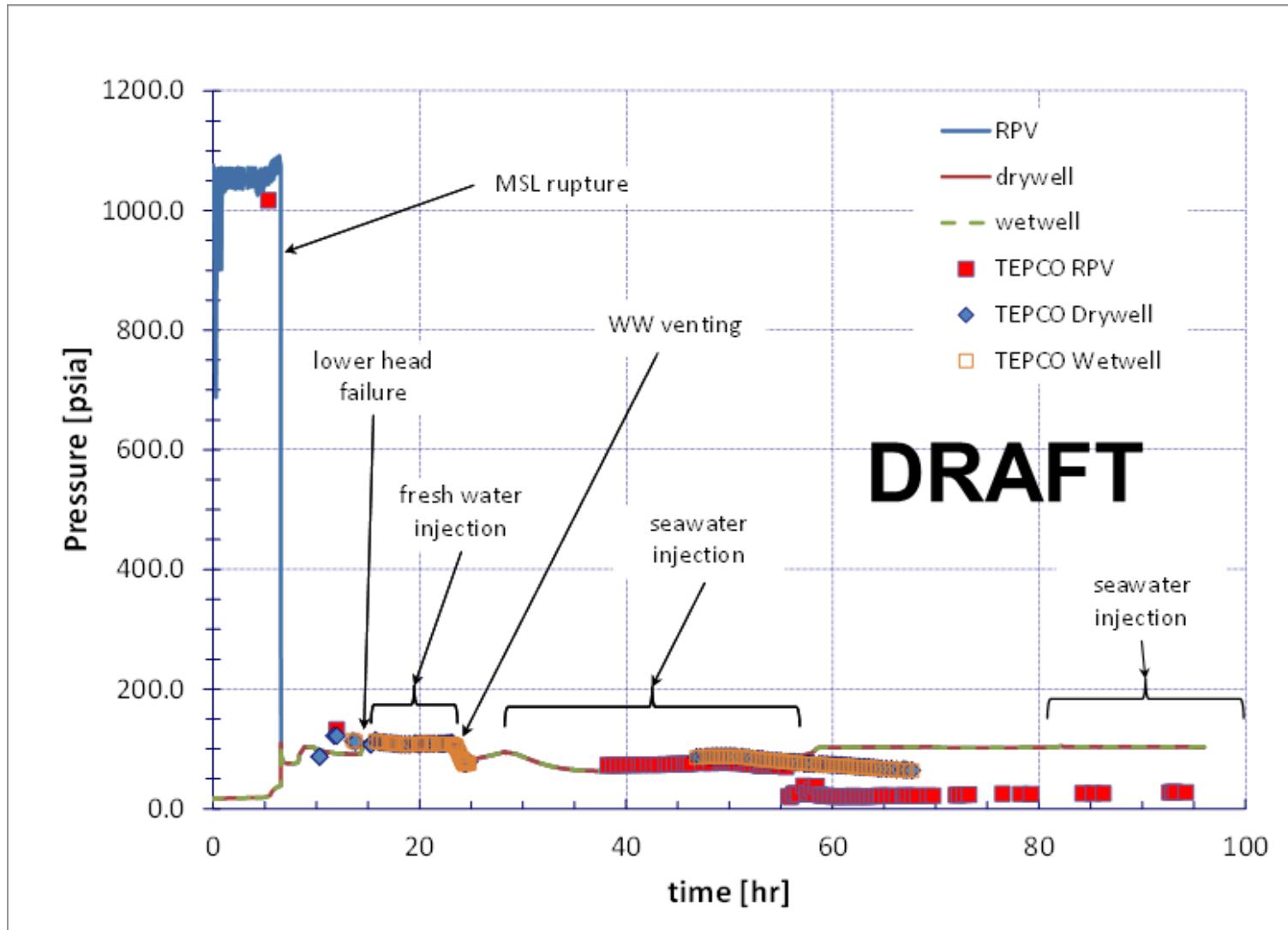- **SOARCA Mark-I MELCOR model used as starting point to reconstruct accidents**
- **Collaboration with and peer review by**
  - NRC, JNES, TEPCO, EPRI
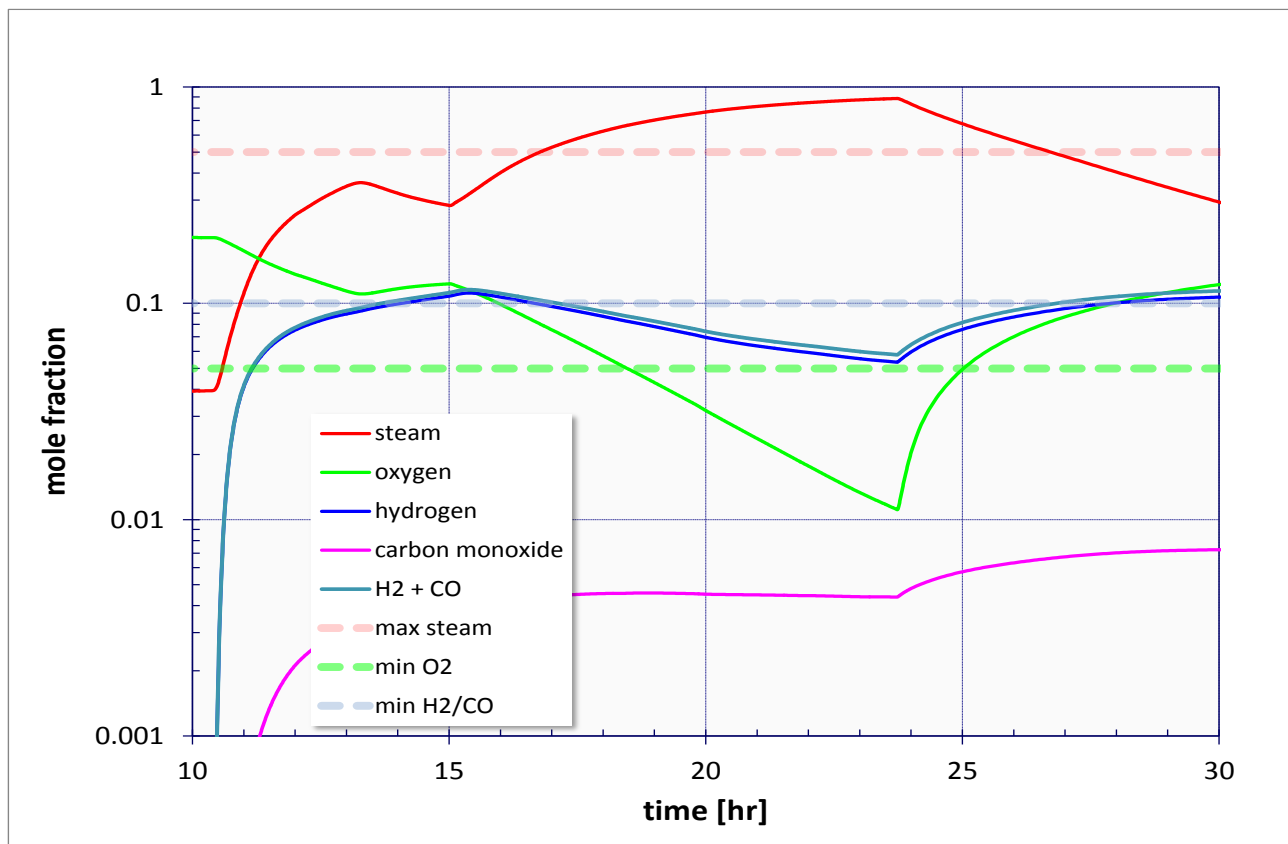- **Report published in August 2012**

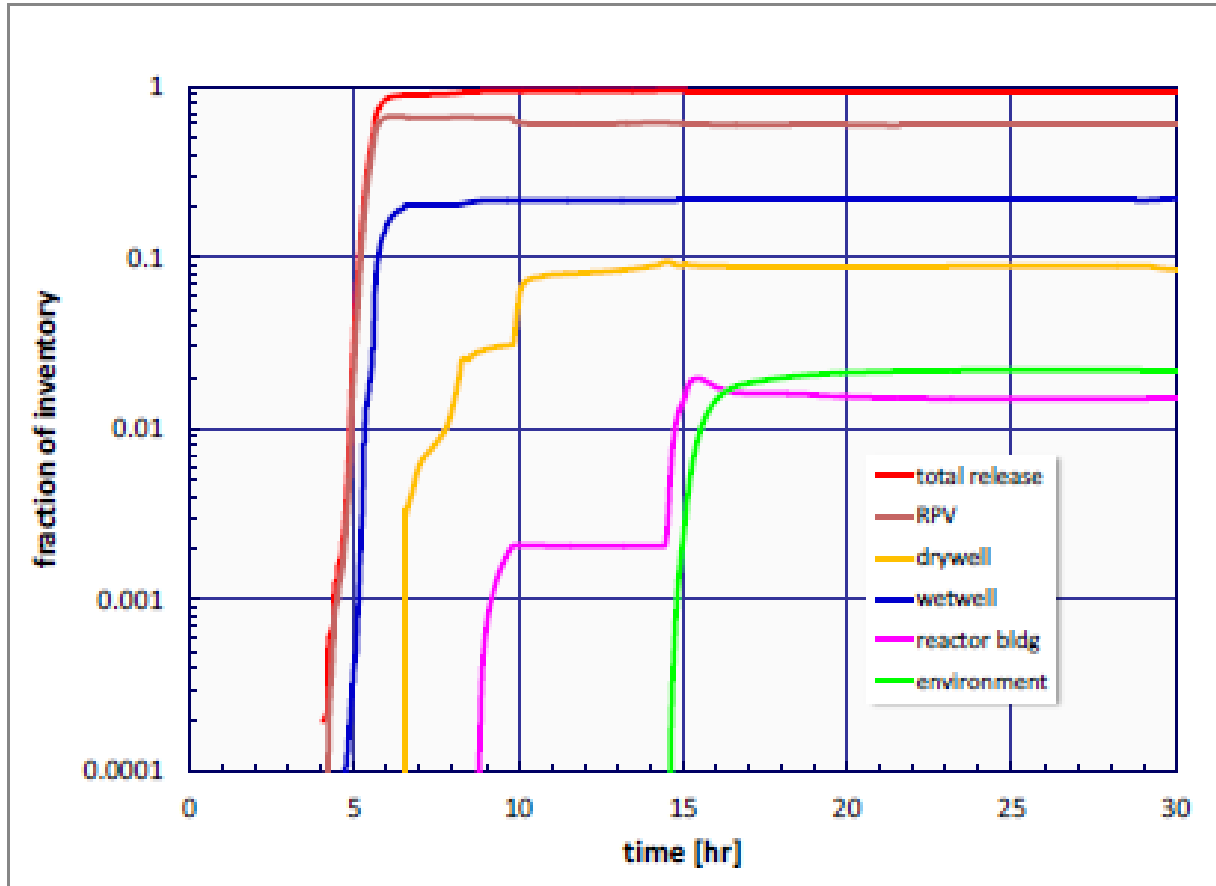# Comparison of MELCOR Unit 1 Analysis of RPV and Containment Pressures

Gas Composition in Refueling Bay

Predicted Cesium Release at 1F1

Radiation monitors at front gate jump at ~15 hr

Cs Environmental release about 400,000 Ci

Figure 49 MELCOR-predicted CsI distribution – note that release to environment from reactor building explosion is not reflected in this distribution.

MELTSPREAD & COREQUENCH Best-estimate Ex-Vessel analysis of Unit 1

- **1F1 ex-vessel behavior using best estimate codes for spreading (MELTSPREAD) and debris coolability (COREQUENCH)**
  - MELCOR and MAAP melt pour conditions used as input
  - MELTSPREAD calculates extent of spreading and shell heat-up
  - COREQUENCH evaluates coolability of debris
  - Predictions support TEPCO planning for 1F1 disassembly
- **Principal results:**
  - Axial ablation of the concrete below the reactor vessel predicted to be up to 60 cm out of a total thickness of 140 cm in the most extreme case
  - While there was significant concrete ablation the debris was coolable for all scenarios

NEA Fukushima Daiichi Project

- **NEA is organizing an international project on Fukushima**
  - Phase 1 is a code benchmarking study of Fukushima accident
  - Phase 2 would be to gather data as reactors are defueled
- **In Phase 1, numerous severe accident codes are being used to reconstruct accident and then cross-compared (MELCOR, MAAP, SAMPSON, SOCRAT, ASTEC)**
- **Objectives of this study**
  - Improve severe accident codes via benchmarking with actual data
  - Use code results to guide planning of defueling operations
- **Participating Countries Include:** US, Switzerland, Spain, France, Russian, Germany, Korea, France & Japan
- **Phase 2 is under discussion**
  - Program similar to post-TMI project is being considered
  - DOE conducting uncertainty quantification study to aid

DOE December 2012 Visit to Fukushima

DOE team on top of Unit 4

Kelly peering into Spent Fuel Pool

Aftermath of H_2 explosion