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The Need to Identify Cornerstone Benchmarks

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What Are Cornerstone Benchmarks:

- All severe accident codes employ benchmarks with experiments where available.
- However when evaluating:

  1) how an accident can be prevented, or

  2) how a severe accident may evolve

  some benchmarks are more relevant than others.
- Those which are the most relevant for either Separate Effects (SE) or Integral Effects (IE) are the cornerstone benchmarks.

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How Should Cornerstone Benchmarks Be Used:

- As the name implies, these experiments and industrial experience are the cornerstones of knowledge in the understanding of severe accidents.
- Where applicable all analyses and computer codes should be compared with the Cornerstone Benchmarks.
- All analysts involved in reactor safety analyses should be aware of the important observations, i.e. engineers and scientists should receive training in these benchmarks.

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Training/Preservation of Knowledge

- These benchmarks provide a marvelous tool to describe the knowledge base for key severe accident phenomena.
- Using these experiments and experiences to train newcomers to the field is a convenient means of preserving the knowledge base.
- Incorporating these as continued computer code benchmarks is also a means of preserving the data.

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Computer Code Benchmarks

- Comparisons with the relevant Cornerstone Benchmarks should be a requirement for all computer codes used in severe accident analyses.
- Comparisons with these benchmarks will minimize discussions related to differences between results from different codes.
- Comparison with relevant Cornerstone Benchmarks will help to identify the areas for future enhancements in individual codes.
- These benchmarks will help to differentiate between uncertainties in the results and the need for enhanced mathematical models.

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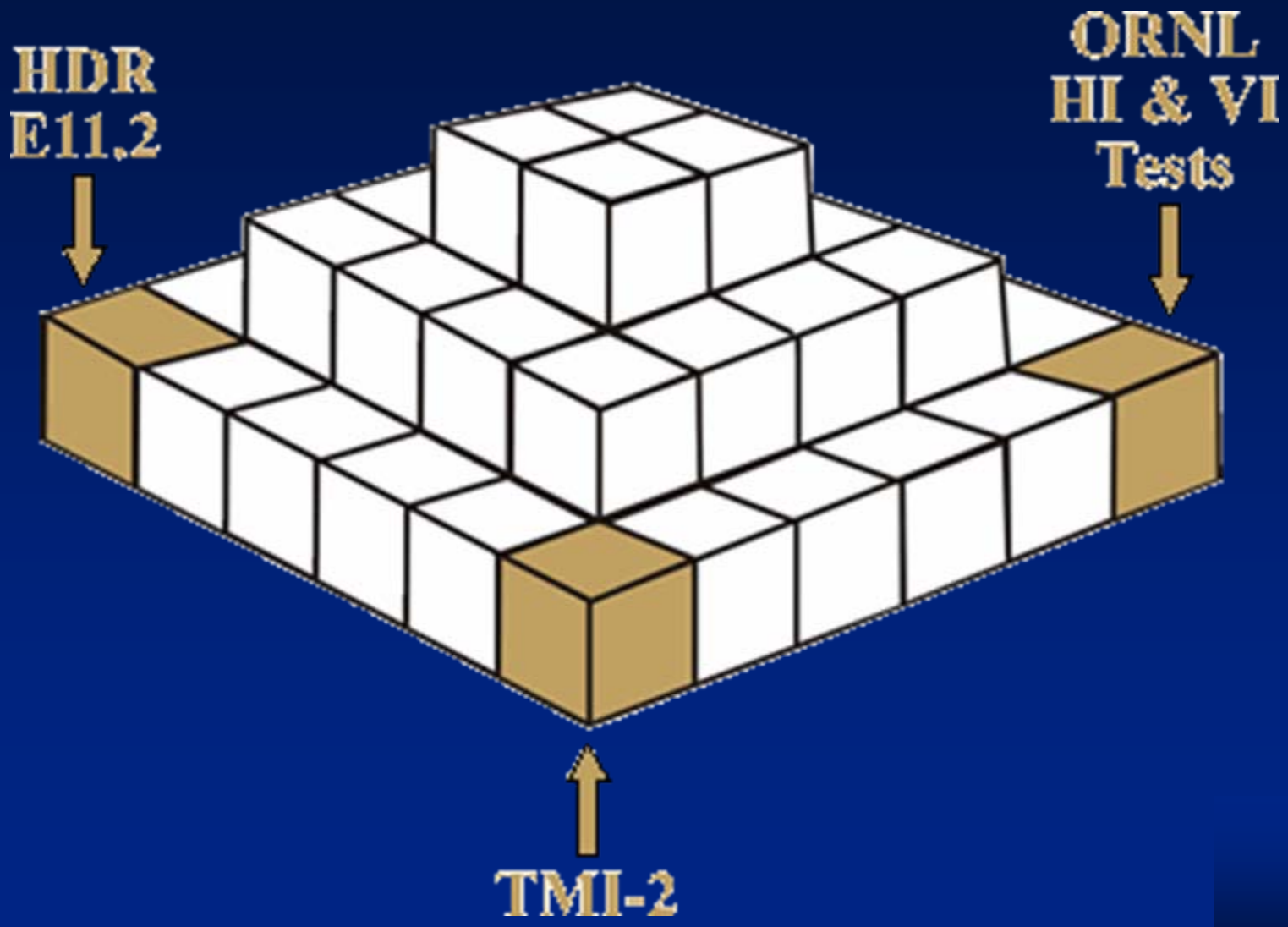

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What Are Some of the Cornerstone Benchmarks?

Region	Phenomena	Cornerstone Benchmarks
Core	Uncovering	• TMI-2 • Manshaan SBO • Browns Ferry • LOFT-FP2 • TLTA • THTF • IIST
	Core Damage/Melt Relocation	• TMI-2 • LOFT-FP2 • PHEBUS
Reactor Coolant System	Core-to-Upper Plenum Natural Circulation	• TMI-2 • Experiments by Stewart et al.
	Core-to-Steam Generator Natural Circulation for Inverted U-Tube Designs	• Experiments by Stewart et al.
	Natural Circulation Within the SG Tubes of Inverted U-Tube Designs	• Experiments by Stewart et al. • IIST
	Core-to-Lower Plenum Natural Circulation with Concentrated Boron	• BACCHUS Tests
Fuel	Fission Product and Inert Material Release Rates	• ORNL HI & VI Tests • PHEBUS • TMI-2

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What Are Some of the Cornerstone Benchmarks?

Region	Phenomena	Cornerstone Benchmarks
Containment	Thermal-Hydraulic Response	• CVTR-3, 4 & 5 • HDR E11.2 • HDR T31.5 • Battelle Frankfurt CASP Tests • NUPEC Test 35 • Marviken Blowdown Test #18 • AP600 LST • CSTF Ice Condenser Tests
	Hydrogen Stratification	• HDR E11.2
	Hydrogen Burns	• EPRI Nevada Tests • TMI-2 • SNL Inerting Tests
	Direct Containment Heating (DCH)	• SNL IET Program
	Molten Core-Concrete Interactions (MCCI)	• ANL MACE Tests • SNL SURC Tests • KfK BETA Tests
General	Aerosol Deposition	• ABCOVE Tests • SUPRA Suppression Pool Scrubbing Tests • Marviken Pressurizer Tests • DEMONA Experiments

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Steps Needed to Use Cornerstone Benchmarks

- NRC and industry (NEI/EPRI) agree that the codes will use the Cornerstone Benchmarks and these will be available for review.
- NRC and industry agree on the initial list of these benchmarks.
- NRC and industry agree on the process to add to the list of such benchmarks.
- NRC and industry agree on how differences between calculated results will be used once the benchmarks for individual codes are in place.

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Summary

- Identification of Cornerstone Benchmarks can simplify the comparison between calculated results.
- Identification of these benchmarks can be used to efficiently train new engineers and scientists.
- Identification of Cornerstone Benchmarks is a mechanism to preserve the important lessons learned through experiments and industrial experience.