



Assessment of Thermal Hydraulics Codes for RTRs

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- Inconsistencies identified between TRACE and RELAP5 code results
- NRC Assessment of RELAP5 and TRACE

Two parallel reviews

- NRC efforts (NRR and RES)
- Argonne National Laboratories (ANL) efforts (Reference: Summary of RELAP5 Assessments Performed in Relation to Conversion Analysis of Research Reactors, Report No. ANL/GTRI/TM-14-3)

- Ensure that Thermal-Hydraulic codes used have a well-documented regulatory and technical basis

RELAP5 Applications

- Developed and assessed for power reactors
- Also used for RTRs:
 - Conversions
 - Other licensing actions

- RELAP5 results
 - compared to experiments
 - compared to other codes



U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

Comparison to Experiments

- RELAP5 results were compared to experiments:
 - RTR Conditions
 - Applications

Comparison to Experiments - Results

- Good agreement under single-phase conditions for all versions of RELAP5
- Good agreement with limited subcooled nucleate boiling

Code to Code Comparison

- ANL compared RELAP5 results to PLTEMP, PARET/ANL, STAR-CD
- Cases included:
 - steady-state
 - loss of flow events
 - reactivity insertion events

Code to Code Comparison - Results

- Good agreement for thermal-hydraulic conditions:
 - Flow rates
 - Temperatures (coolant, cladding and fuel)
 - Power
 - Pressure drops under single-phase and limited nucleate boiling conditions

Additional Consideration

- Critical Heat Flux (CHF) correlations in RELAP5 result in a non-conservative estimate of power at which CHF occurs
- Results vary based on CHF correlation chosen

Conclusions

- A strong technical basis exists to justify continual use of RELAP5
- Potential improvements of the CHF modeling were identified

- Assess RELAP5 and TRACE CHF correlations against the University of Wisconsin CHF data (Reference: Yang et al., “Critical Heat Flux at Conditions Representative of TRIGA-Type Reactors - Single, Three Rod and Four Rod Bundle CHF Data,” UWFD-1419, October 2012)

NRC Future Work (Cont'd)

- Create models of existing RTRs using TRACE to assess licensee calculations
- Modify TRACE to include the Bernath correlation for CHF

Questions?

