Release Notes for RELAP5-3D Version 4.5.2

Code Improvements from Version 4.4.2

The following is a brief description of improvements and new features in Version 4.5.2.

Adapted RELAP5-3D to GNU Fortran - "Forever Fortran"

- GNU translates Fortran into intermediate C-language before compiling.

    - GNU does this with all its compilers.

    - Compiles the C to generate the RELAP5-3D executable.

    - Almost every operating system is now written in C-language.

- Code compiles in both Intel and GNU Fortran

    - Modified over 1000 subprograms and took 1 full year.

    - Many conflicts between the compilers were resolved.

Remote RELAP5-3D

Remote RELAP5-3D is now available from Version 4.4.2 onward and is available via USER Container (module load relap53D). The RELAP5-3D executable, relap5.x is uncopiable, runs as if it were a Linux command, and includes fluid property files.

Remote RELAP5-3D also offers advantages to users:

1. Access to three supercomputers, 3 petabytes of storage, 616 terabytes of memory, and 155,000 computer cores.

2. Access to the HPC library of advanced commercial software for rendering and analyzing data, and for coupling with RELAP5-3D.

3. No license files.

4. Security: The INL HPC is a protected environment that allows users to access only specific directories. Users cannot access other users' files.

Developer's Remote RELAP5-3D

- Remote RELAP5-3D for developers is used for researchers and dissertations and offers the same capabilities as Analysts Access.

- The Developer receives RELAP5-3D coding that is minimally required (e.g., fluids coding to create a new fluid). The Developer modifies the coding and may add new subprograms.

- The Developer can test developments, running the build script to create a new, uncopiable RELAP5-3D executable which allows a comparison to original RELAP5 calculations.

Dissolved Gas Model (DGM)

- Allows NC-gases to go in and out of solution based on partial pressures compared to the phasing pressures.

Uniform Physical Units

- Made all constants and conversion factors the same level of accuracy throughout the code.

Molecular Diffusion (MD) Model Improvements

- Increased from 2 to 5 NC working fluids and mostly applies to accident scenarios.

Air as a Working Fluid

- Useful for modeling experiments and air-cooled constructs.

Inclusion of Molten Salt Reactor Kinetics Model

- Uranium salt is both fuel and coolant.

- Reaction continues and diminishes outside the core.

Updated CHF Table to 2006 Standard

- Modernizes the Critical Heat Flux calculation.

Cladding improvements

- Modelling for thin cladding coating.

- Cladding rupture model minor edits.

Operating Systems

- Adaptation to Windows 10.

- Adaptation to Rocky Mountain Linux O/S.

- Adaptations for Containers.

Other Updates

- GIT Version Control

- Uncertainty Quantification capability for reflood via Raven.

- Many User Trouble Report fixes.

- Change from static to dynamic libraries for new O/S & containers.

- Nitrogen and hydrogen accuracy and range upgrades for advanced reactors.