



U.S. DEPARTMENT OF  
**ENERGY**

**Nuclear Energy**

## **Task 2 Desired Stakeholder Outcomes**

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*IRP Status Meeting*

*Nov 2-3, 2016*



## Task 2.1 (Sodium Loop Benchmarking)

### Initial Stakeholder Outcomes

#### ■ Historic Sodium Loops

- Identify a few tests and configurations of interest
- Recover geometric information and build models
  - *INL's support needed to dig out old documents, etc.*
- Compare to test data
  - *Pre-test loop checkout*
  - *Transient test*
- Use tools/methods useful for state-of-art modeling of sodium loops
  - *Leverage for modern MK-IV design effort*

### Observations from current meeting

- **Initial plan not viable due to unforeseen issues with document availability**
- **Instead, series of HEDL TREAT tests surveyed, HOP 1-6A identified**
  - Data reports and various loop engineering documents provided
  - Elusive fuel pin drawings found in INL archives, provided to OSU after arduous export control review
  - Some of the geometric features will be a little more “interesting” to model than initially expected, should be fun
  - We’ve had to cobble it together a little, but historic documents needed to define geometry appear complete



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### Observations from current meeting

- **Some historic data sets are not ideally resolved for CFD modeling, but it's the best we've got**
- **Task behind schedule, but now things are finally ready to break loose and catch up**
  - Timely delivery of problem description report is next priority
- **Discussed ways to document results that are interesting for future design**



## Task 2.2 (Water Loop Benchmarking)

### Initial Stakeholder Outcomes

#### ■ Future Water Loops

- No historic examples, must construct an “affordable” prototype of the in-pile loop TWERL (TREAT Water Environment Recirculating Loop)
  - *INL will eventually build a true-to-design TWERL prototype with superalloy piping, custom pump, etc. to verify design and operation*
- Prototype should be “true to the essence” of the TWERL
  - *Compact, upright, small internal volume, no pressurizer, pump/system curves*
  - *Something akin to the secondary enclosure is desirable*
  - *Modularity (ability to install other types of test train)*

### Observations from current meeting

- **TRTL design appears mature**
  - Remarkably similar to the TWERL concept
  - Fabrication proceeding without major concern
  - Excited to move forward with construction and shakedown testing
  - *TRTL has several instruments common, and some alternate instruments that might be considered for use in the eventual TWERL*
- **Pleased to hear that TRTL program will fall under INL’s same qualified supplier status as other flow loops**

## Task 2 (Water Loop Benchmarking)

### Stakeholder outcomes from Kick-off Meeting

- Heated rod simulant should be pursued if feasible
  - *Heating rates need not simulate that possible in TREAT*
  - *Single rod test train recommended*
  - *Only the most basic test train features and instruments need to be included*
  - *Other test train concepts can be installed later if scope remains*
- Run the loop through its paces, gather data, benchmark against models
  - *INL has primarily used RELAP5-3D to model TWERL thus far, other tools could be used and compared*

### Observations from current meeting

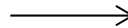
- Heated rod has been pursued and a novel concept appears viable
  - If successful, then TREAT-like heating rates could be simulated
  - One off-the-shelf heater as a backup plan
  - TRTL is modular and capable of other configurations, but the tests run for this IRP will be with one short rodlet
- INL will provide target power vs. time prescriptions to aid with definition of final matrix testing
  - Based on TREAT's PWR testing capabilities
- TRACE and RELAP models of TRTL performed
  - Compare reasonably well to each other, apart from a few features that will be better characterized during shakedown



## Task 2 (Water Loop Benchmarking)

### Initial Stakeholder Outcomes

- **IRP team should have two plans**
  - *One assuming that INL does not receive near-term project funding for TWERL detailed design*
  - *Another [hopefully more likely] scenario where INL is well funded to continue design and can stay in-sync with OSU during the IRP and TWERL design processes*



### Observations from current meeting

- *This is still the plan we are on, direct-funded TWERL detailed design continues to be at least one semi-annual IRP meeting away...*



- **Due to unforeseen circumstances task 2.1 is behind schedule**
- **But task 2.1 is finally poised to make a comeback, only two things can stop us now:**
  - Identification of another crucial, missing, and obscure historic document with weird document control status markings
  - Meshing
- **TRTL effort is aggressive, but tremendous progress has been made and things currently appear to be on track:**
  - More to come, assembly and shakedown testing forthcoming
  - TWERL design continues to be deferred, but the crucial opportunity for some engineering synergy has passed
  - But there is still some good opportunity to investigate synergistic input parameters (e.g. heating time responses)
  - TRTL will be a stepping stone, both to the ultimate TWERL in-pile design, and out-of-pile TH response used to target in-pile tests
- **Task 2 looks promising, successful outcomes will be relevant**