



Molten Salt in the Advanced Test Reactor

September 2024

Changing the World's Energy Future

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**Prepared for the
U.S. Department of Energy
Under DOE Idaho Operations Office
Contract DE-AC07-05ID14517**

Molten Salt in the Advanced Test Reactor

A Safety Study



PRESENTER:
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BACKGROUND: The Advanced Test Reactor (ATR) is one of the world's most important resources for fuel qualification. Prior to this project, **ATR could not support molten salt irradiation** experiments. This work expands ATR's capability to support fuel qualification for molten salt reactors.

METHODS

1. UPDATE SOURCE TERM ANALYSIS

Molten salt behaves significantly different in during accidents than solid fuels, especially when considering fuel handling scenarios. The source term analysis for handling accidents needed revised to encompass greater releases that could occur from molten salt.

2. DETERMINE FAIL-SAFE MATERIAL LIMITS

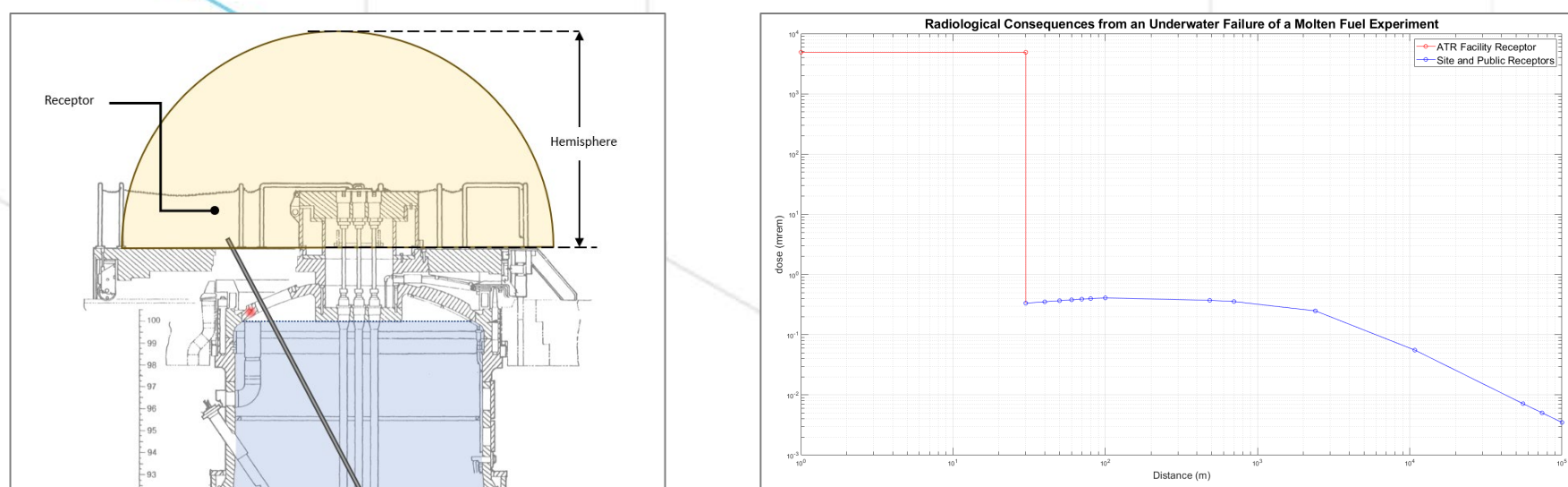
There is always the potential for damage to an experiment. If this happens, the ATR driver fuel must be protected. We determined how much salt (NaCl-UCl_3 and $\text{UF}_4\text{-NaF-KF}$) could be released into the reactor without exceeding chemistry limits that protect the fuel.

3. DEFINE EXPERIMENT DESIGN CRITERIA

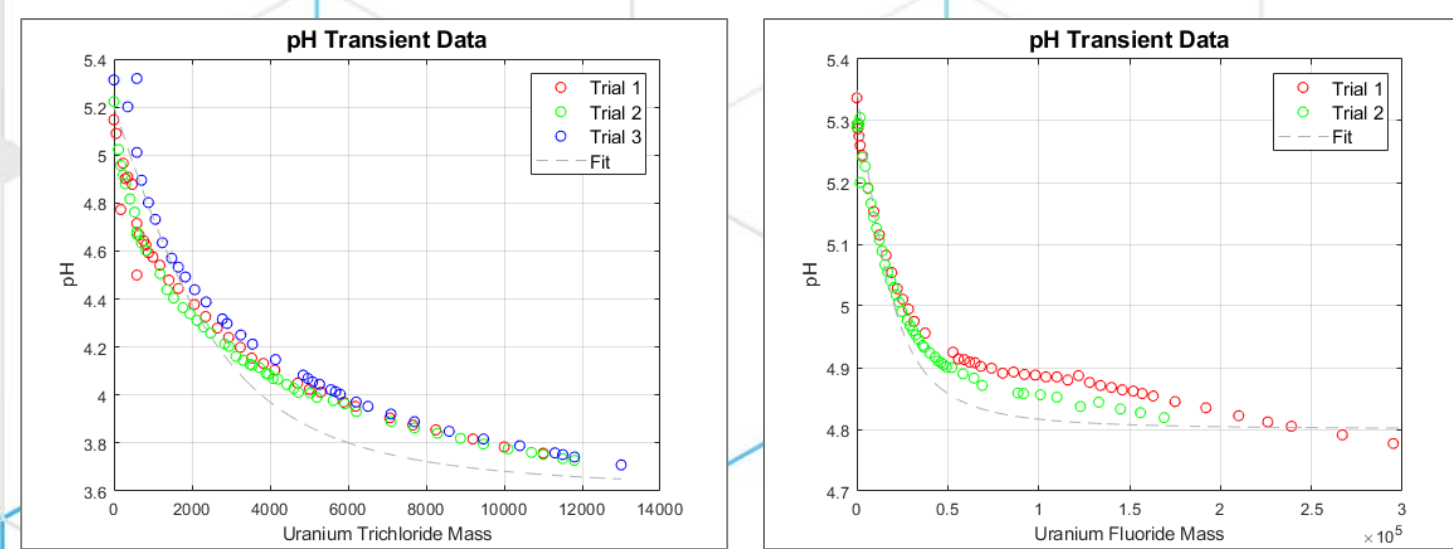
Molten salt experiments will be performed in a high-temperature regime. Design-by-rule pressure vessel codes aren't the optimal design codes for molten salt irradiation experiments. We explored alternatives to design-by-rule pressure vessel codes.

RESULTS

1. Updated source term analysis to accommodate an 80kw molten salt experiment.

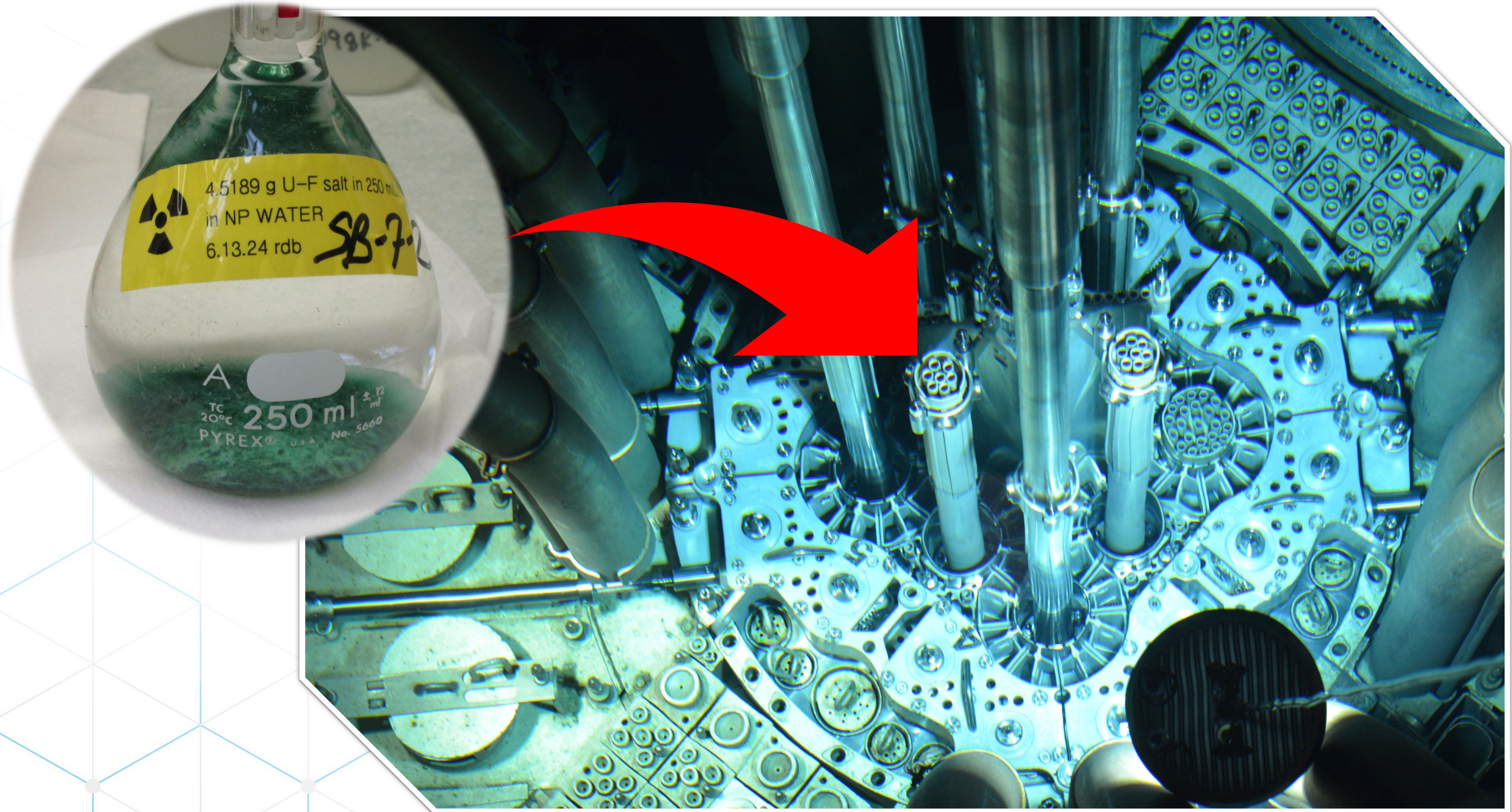


2. Performed experiments demonstrating a fail-safe material limit of >200g for NaCl-UCl_3 and $\text{UF}_4\text{-NaF-KF}$



3. Recommended a load and resistance factor design (LRFD) for molten salt experiment design.

$$\sum_i \gamma_i Q_i \leq \phi R_n$$



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The Advanced Test Reactor can support an 80kw fission power experiment containing molten salt.

Project Number: 23P1082-012FP

LRS Number: INL/EXP-24-80363

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Work supported through the INL Laboratory Directed Research & Development (LDRD) Program under DOE Idaho Operations Office Contract DE-AC07-05ID14517."

Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy

