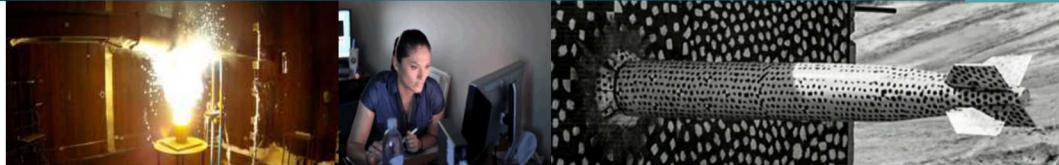
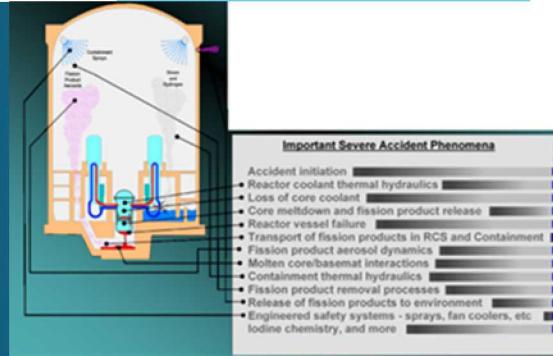




# CNWG Collaborative Research – SNL and JAEA – FY19



*David L.Y. Louie, Ph.D.*

## DOE NE-52 Advanced Reactor Technologies Fast Reactor Program – Review

December 18, 2019

SAND2019-xxxx PE

# Collaborative Area

- Sodium fire research
- Computer code development exchange
- JAEA staff at Sandia starts to use MELCOR for its sodium fire capability
- Collaborative research continues in FY20

# Sodium Fire Research

- 2 expert meetings were held in FY19
  - May 2019 at JAEA
    - Sodium fire research exchange on pool fire model improvement for MELCOR
    - JAEA sodium fire research, including touring the experimental facilities that cover the sodium concrete reaction and aerosol behavior
  - October 2019 at Sandia
    - Research exchange on sodium concrete reaction (SCR) from JAEA and Sandia
    - Experiment research exchange
      - Sandia provided the information on the sodium reaction experiments with limestone concrete
      - JAEA provided their recent experiments (SCR) on siliceous and perlite concretes
    - SCR Modeling approach by Sandia
      - The sodium limestone ablation model (SLAM) created from the SCR experiments will be implemented into MELCOR
        - Sandia has no plan to add any SCR into MELCOR in the near future
      - JAEA is developing a severe accident code that will include many physics models for sodium fire
- Publish a joint final report on the collaborative effort for FY2019

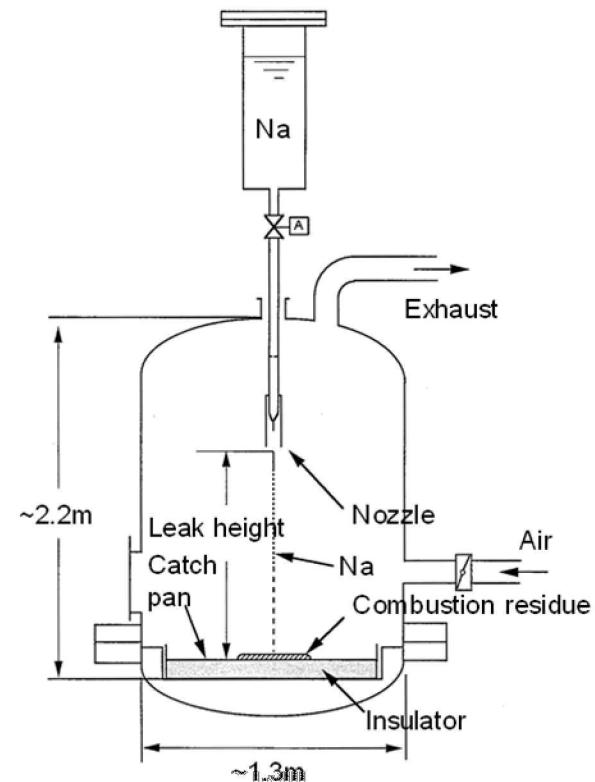
# Code-to-Code Comparison Exchange

- Sandia Code – MELCOR, developed for NRC
  - Over 30 years plus in light water reactor severe accident applications
  - Over 1000 licensed users
  - MELCOR capabilities expanded to model advanced reactors
    - Sodium fast reactors
    - High temperature gas reactors
    - Molten salt reactors
    - Heat pipe reactors
    - For this CNWG collaborative work, we only focus on the sodium fire models
- JAEA code – SPHINCS, AQUA-SF
  - SPINCS: lumped parameter codes for sodium fires
  - AQUA-SF: CFD code
    - BISHOP – chemical reactions
    - ABC-INTG – aerosol behavior
  - New integrated severe accident code being developed
- Code models shared between Sandia and JAEA
  - Improve Sandia's and JAEA's code(s)

# JAEA Visiting Researcher in FY20

5

- Continue to carry out MELCOR simulations for modeling the JAEA's F7-1 pool experiment
  - A better MELCOR input model is being developed to simulate the experiment more accurately
    - Use the better heat transfer model for liquid sodium and catch pan
    - Segment the catch pan heat structure
  - Develop SNAP post-processing display for MELCOR results
- Perform additional MELCOR simulations, such as ABCOVE AB5 (upward spray) and AB1 (pool fire) experiments.
- Share the thermal radiation model in AQUA-SF
  - Sandia will also provide thermal radiation models, such the net closure model, which will better characterize the radiative exchange
- Share fire capabilities of Sandia's SIERRA engineered tool –Fuego (CFD)
- Request to participate and observe upcoming sodium experiments at Sandia for solar power applications.
- Request Sandia to provide risk assessment and dynamic PRA training for SFR applications



# Main Collaborative Topic in FY20

- Complete the validation study using MELCOR to model JAEA's F7-1 test
  - Sandia will provide assistance and code improvement
  - JAEA will continue to test and validate existing models in MELCOR for SFRs
- Expand validation basis of MELCOR sodium pool fire model
- Continue participation in expert meetings:
  - May 2020 at JAEA in conjunction with 2020 CNWG meeting
  - October 2020 at Sandia
- Identify future collaborative research area beyond 2020

# Acknowledgement

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