High Density Polyurethane Foam for Radiation Shielding & D&D Applications

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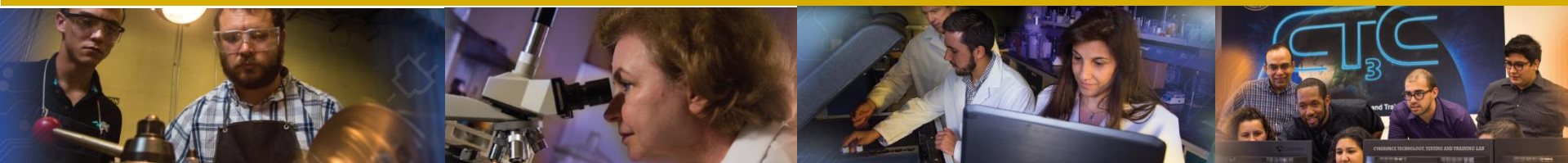


Project Description/Background

Savannah River Site has many radioactive facilities that are in the process of being deactivated and decommissioned. Improvements in D&D tools can greatly save time and money, but most importantly, increase worker safety. Fixatives are a common tool used in D&D applications.

SRS Building 235-F

235-F Hot Cells

Scope/Objective

Objective: Assess how well polyurethane foams can be used for D&D activities.

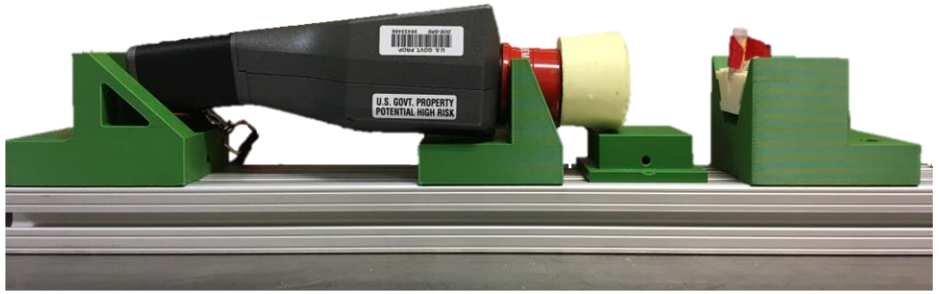
Benefits:

- Allows for fixation of contamination on a given surface
- Capable of filling regular and irregular voids (gloveboxes, etc.)
- Enables partial shielding
  - Reduces worker dose
  - Allows longer worker dwell time
- Potentially provides a level of flame protection

Method / Approach

Foam Synthesis and Rad Hardening

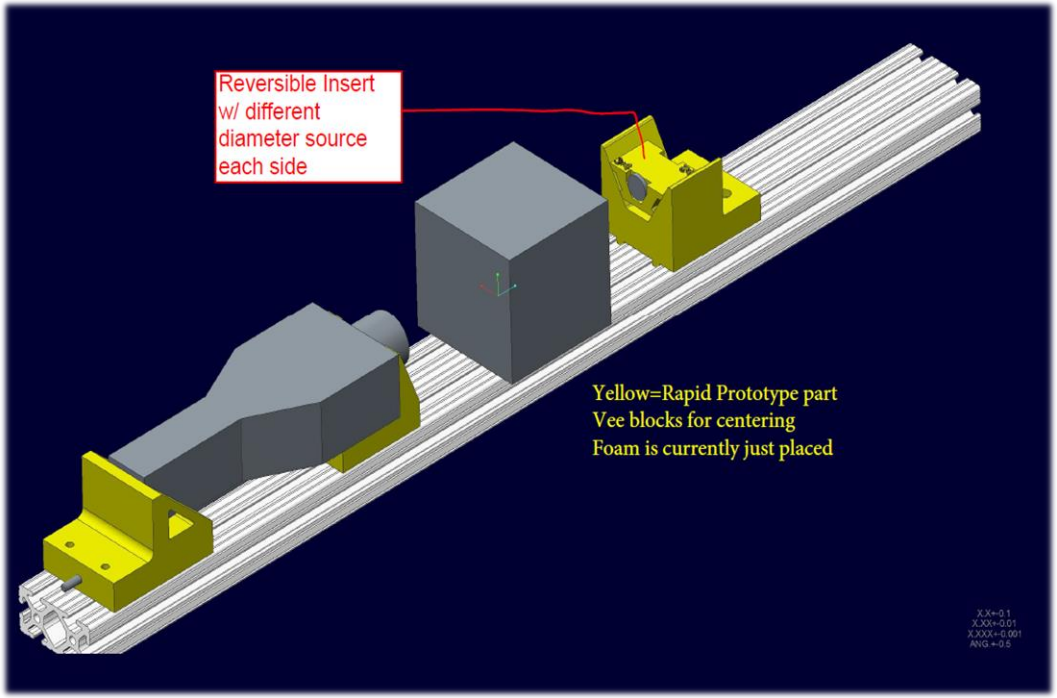
- Analyze foam expansion and curing properties
- Different materials are added to foam solutions for rad hardening
- Foam samples tested with various sources for shielding at a specified distance



Method/Approach

Experiment Revision

- Foam Block
  - Fixed foam volume, thickness
  - Easily calculate density
- Track and Supports
  - Fixed orientation
  - Easily adjustable
  - Consistent values for distances
  - Alignment of components
  - Results are more replicable

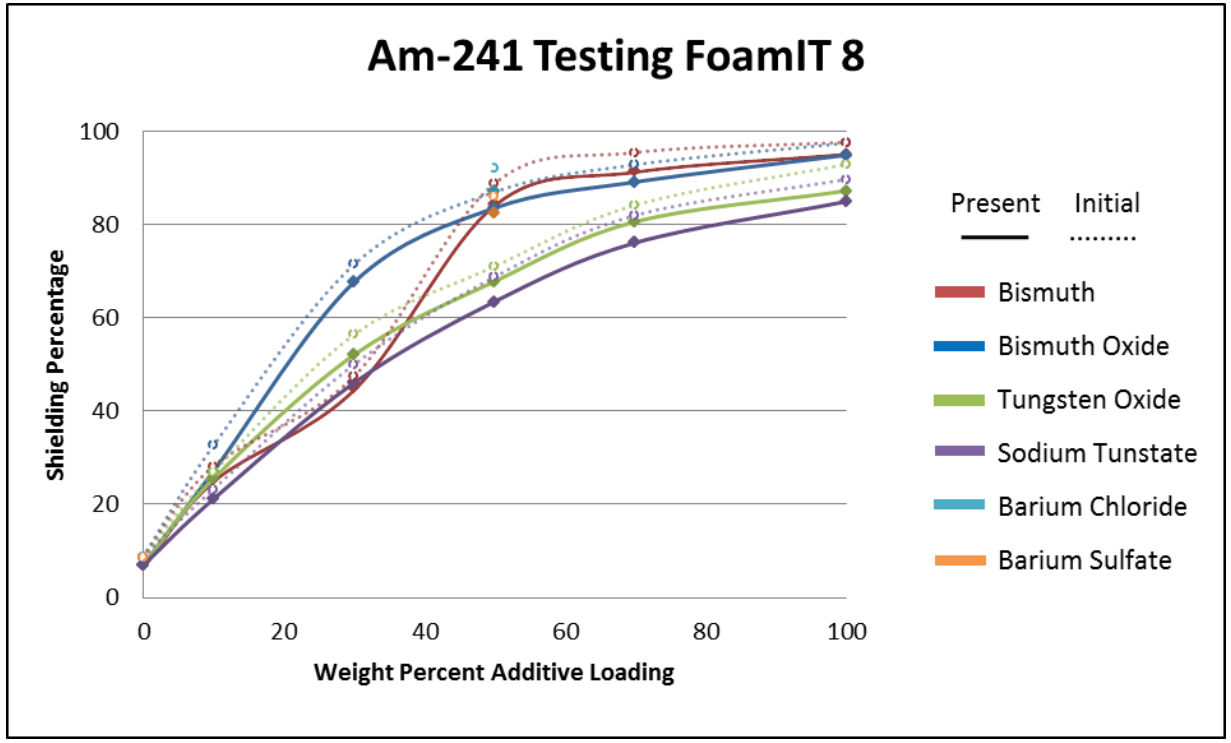


Method/Approach

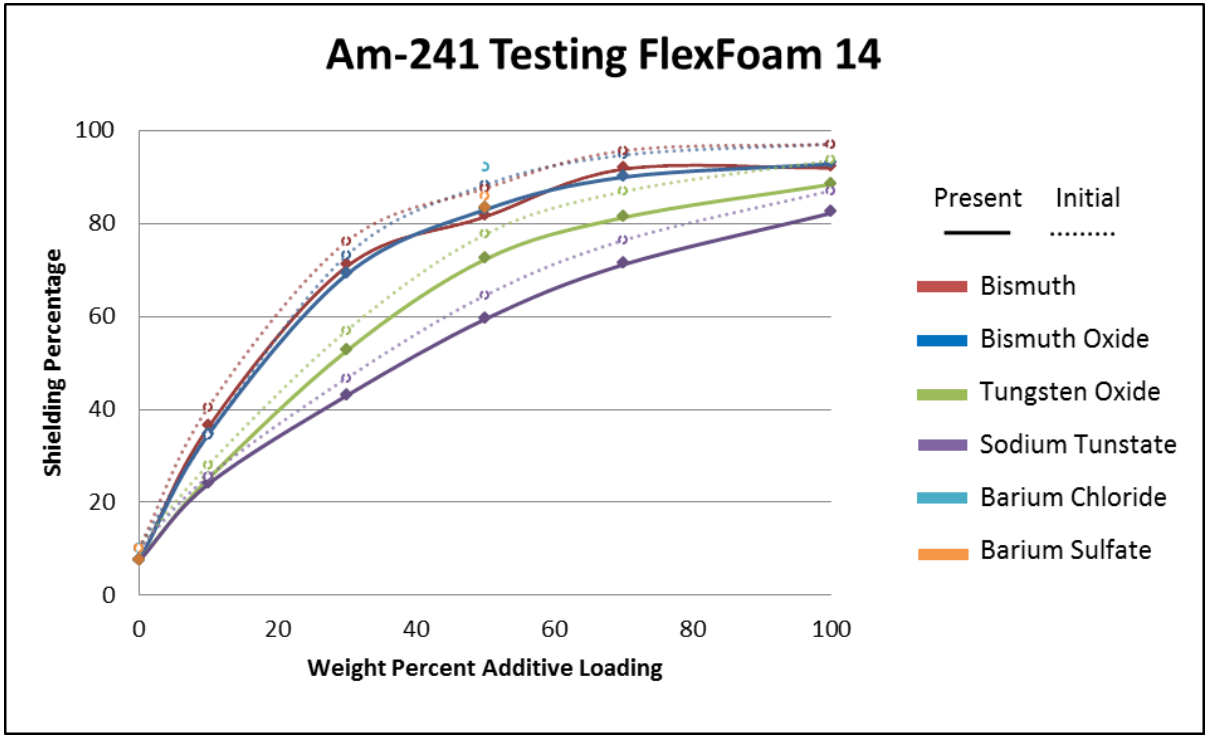
Long Term Assessment of Rad Shielding

- Stability of foam performance over time
- Rad shielding capability over time
- Two trials completed approximately 10 months apart
  - Same samples
  - Same sources

Preliminary Results/Discussion



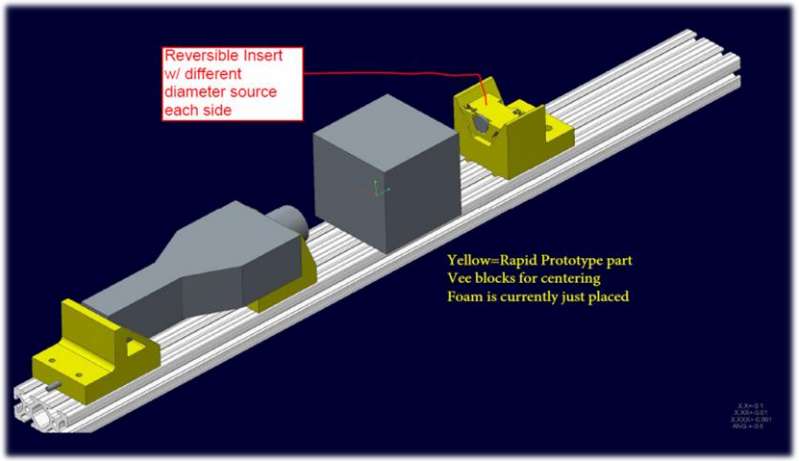
Preliminary Results/Discussion



Results closely resemble the initial trial for both foams

Conclusions

- The foams have no immediate change in shielding capacity
- Difference in data may be due to:
  - Sensor calibration
  - Small differences in component placement
  - Change in background radiation (source room)
- For successive testing, foam samples should be more uniform in shape and size



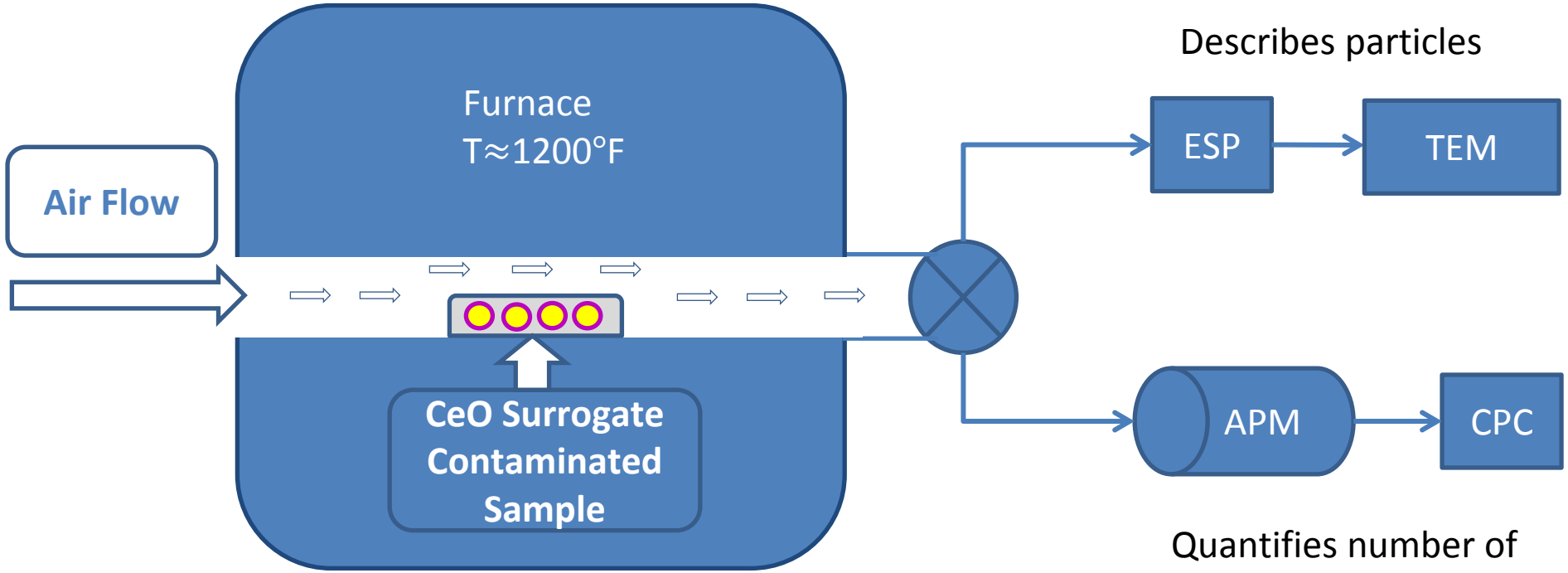
Future Work - SRNL

Adhesion & Off-Gassing Testing

- Ability to fixate particulates (fixating capacity)
- Off-gassing analysis
  - Composition/degradation products when subjected to heat

Future Work - SRNL

Particle Collector Design



APM = Aerosol Particle Mass analyzer
CPC = Condensation Particle Counter
ESP = Electrostatic Particle Collector
TEM= Transmission Electron Microscope

Future Work – SRNL/FIU

Structural Integrity Testing

- Items of interest
  - Structural support provided to foam filled glove box
  - Mechanical characterization
    - » Tensile
    - » Compression
    - » Impact

Future Work – SRNL/FIU

Thermal Sustainability & Mass Loss Assessment

- Heat exposure limits
- Flame response

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