Nuclear Air Treatment Topics at Department of Energy Savannah River Site
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Savannah River Site Background

- Established in 1950
- 310 sq miles in South Carolina along the Savannah River
- Currently Supports
  - Management and treatment of radioactive wastes
  - Nuclear materials storage and disposition
  - Research and Development

Salt Waste Processing Facility

- Separates High Level Waste in to two streams
  - Cesium rich that goes to the vitrification plant
  - Salt rich that is stabilized in grout
  - Hot commissioning started in October of 2020

Salt Waste Processing Facility

- No state-of-the-art air treatment technologies
  - Five main exhaust HEPA Filter Banks with ~80,000 cfm of total capacity
  - Contain fire suppression per DOE-STD-1066
  - First filter banks at SRS with this type of fire suppression system

Salt Waste Processing Facility

- Air Filtration Operational Challenges
  - Cold Commissioning Phase
    - Filter Housing Door Bags being drawn into round housing for size 5/6/7/8 HEPA filters
      - System operates in 30 inches WC vacuum range
  - Hot Commissioning Phase
    - Radioactive material build-up on prefilters in Process Vessel Vent System
      - Filtration prior to main filter banks
      - Change prefilters at an increased frequency based on dose rate

Surplus Plutonium Disposition

- Program to dispose of surplus Pu Oxide at WIPP
- Three additional glovebox lines to come on-line in 2026 to 2028 time frame
- Additional lines use a clean agent fire suppression system for glovebox and room

Surplus Plutonium Disposition

- Ventilation system for new glovebox lines switches to reduced air flow rate during clean agent fire suppression discharge
  - Mississippi State University (MSU) Institute of Clean Energy Technology (ICET) performed smoke/soot loading tests of pre-filter and HEPA filter configurations to support validation of ventilation model during fire conditions

Plutonium Processing Facility

- Baseline is to use a Sand Filter for final stage of filtration
  - Primary confinement will be HEPA filtered before discharge to Sand Filter
  - Filter Bed will be between 300,000 and 400,000 cfm
  - Last sand filter of this type came on-line in 1995
  - Closest sand filters to this size came on-line in 1975 and 1976

Plutonium Processing Facility

- Sand Filter uses multiple layers of aggregate/sand in an up-flow direction at a superficial velocity between 5 and 7 fpm to provide filtration

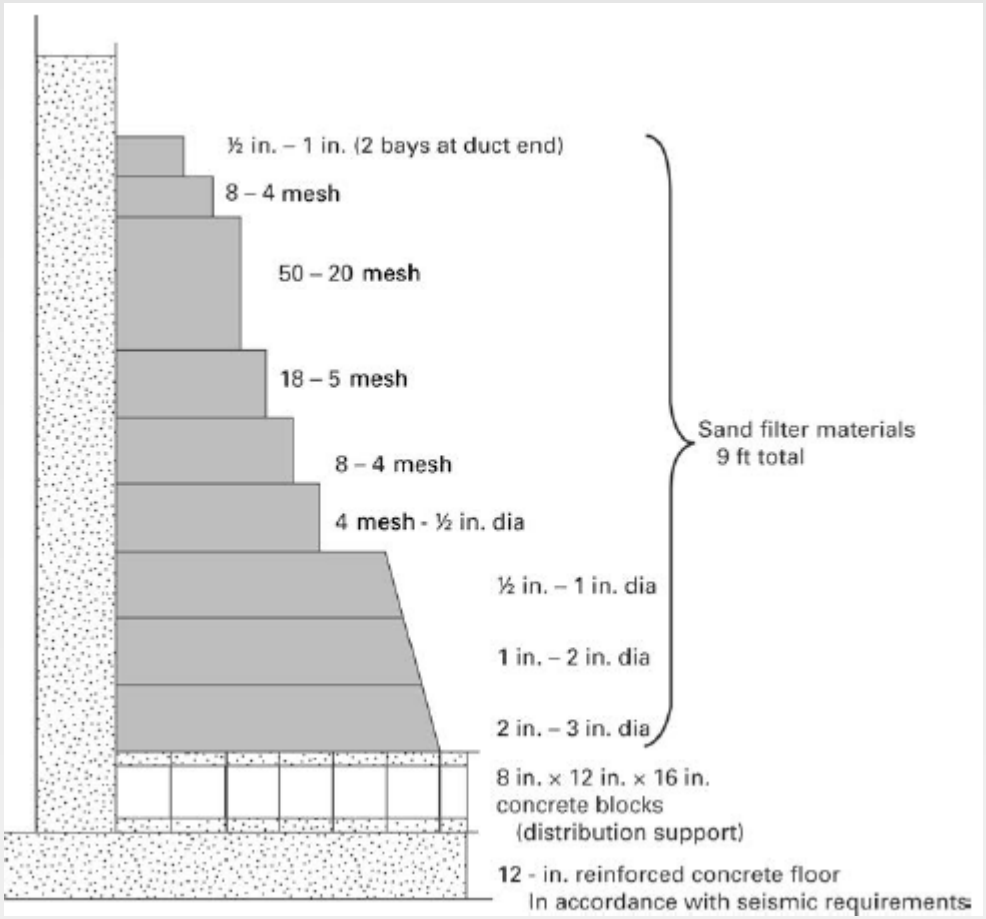

Figure 5.1 from DOE-HDBK-1169-2022 - Section through Typical Sand Filter

Plutonium Processing Facility

- ASME AG-1 (Code on Nuclear Air and Gas Treatment) Section FL “Deep Bed Sand Filter” basis of design
  - Record 21-1250 established to update code section testing requirements
  - Savannah River National Laboratory contracted to build model required by Article FL-4000
    - Re-learning lessons from the 1970’s on sand selection (See 13th AEC Air Cleaning Conference Proceedings)

EM / SRNL / MSU ICET
Partnership on Nuclear Air Filtration

- Savannah River National Laboratory is managing a five year $32M contract between DOE Environmental Management Technology Development and Mississippi State University Institute of Clean Energy Technology
  - SRNL Principal Investigator is Dr Katheryn Taylor-Pashow
  - Technical Work Group chair is Scott MacMurray

Areas of Focus in the EM / SRNL/ MSU ICET Partnership

- Current Work
  - Study performance of HEPA filters under fire scenarios
  - Study HEPA filter degradation due to aging
  - EM requests for testing or technical consultation

Areas of Focus in the EM / SRNL/ MSU ICET Partnership

- Future Work
  - Study performance of new HEPA filter media designs (High Strength, Ceramic, Metal)
  - Study impact of test aerosols on HEPA filter loading
  - Study correlation of penetration/efficiency of HEPA filters using different methodologies
  - Applied research-development agreed to with EM Technology Development

Questions and Discussion

References

- DNFSB SRS Activity Report for Week Ending 10/9/20
- DNFSB SRS Activity Report for Week Ending 1/8/21
- NNSA Surplus Plutonium Disposition Fact Sheet 20210928 - SPD.pdf (energy.gov)
- Project Overview Surplus Plutonium Disposition (SPD) Project AIPT Presentation SPD(cleansed).pdf (doe.gov)
- Evaluating SPD Filter System Different Pressure Response to Smoke Loading, Phase 2 Report – DOI: 10.2172/1865660
- SRS Pit Production Environmental Impact Statement Final Environmental Impact Statement for Plutonium Pit Production at the Savannah River Site in South Carolina (energy.gov)
- DNFSB Staff Report of 11/5/2021, Conceptual Design Review of the Savannah River Plutonium Processing Facility, Conceptual Design Review for the Savannah River Plutonium Processing Facility (dnfsb.gov)
- Nuclear Air Cleaning Handbook, DOE-HDBK-1169-2022
- ASME Code on Nuclear Air and Gas Treatment (AG-1)
- ASME Project Record 21-1250
- 13th NACC paper titled “Characterizing Sand Grains to Optimize Filter Performance”
- Press Release HYDE-SMITH ANNOUNCES $32.2 MILLION FROM DOE TO MSU FOR CLEAN ENERGY R&D | Senator Cindy Hyde-Smith (senate.gov)

- https://www.energy.gov/nnsa/articles/surplus-plutonium-disposition-fact-sheet