28th Nuclear Air Cleaning Conference

Tracer Gas Control Room Habitability Testing:

Shared Experiences, Lessons Learned

Basic CRE HVAC Designs

- Pressurized Control Rooms
  - Equipment In Envelope
  - Equipment Outside Envelope
- Recirculation Control Rooms
  - With Filtration
  - With-out Filtration

Pressurized CR with Equipment inside CRE

- Apparent Attenuation of Outside Airflow
  - Tracer Gas Sample and Injection Locations
  - Back-flow from Idle Units
  - Tracer Gas Inleakage into OSA Duct from CRE

Pressurized CR with Equipment inside CRE

- Apparent Inleakage from Idle Units

  Especially if Large Proportion of Recirculated Airflow is Filtered

  Can Mitigate by Operating Idle Units or Isolating Them

Pressurized CR with Equipment outside CRE

- Ignoring Outleakage of Pressurized Sections

  Outleakage Does Not Change the Concentration of Tracer Gas

  But the Airflow for Pressurization is Reduced by this Outleakage

Pressurized CR with Equipment outside CRE

- Notion that Inlet and Outlet Tracer Gas Concentration Can Measure Leakrate

  If 100 cfm Leaks Into an AHU of 20,000 cfm Inlet Flow

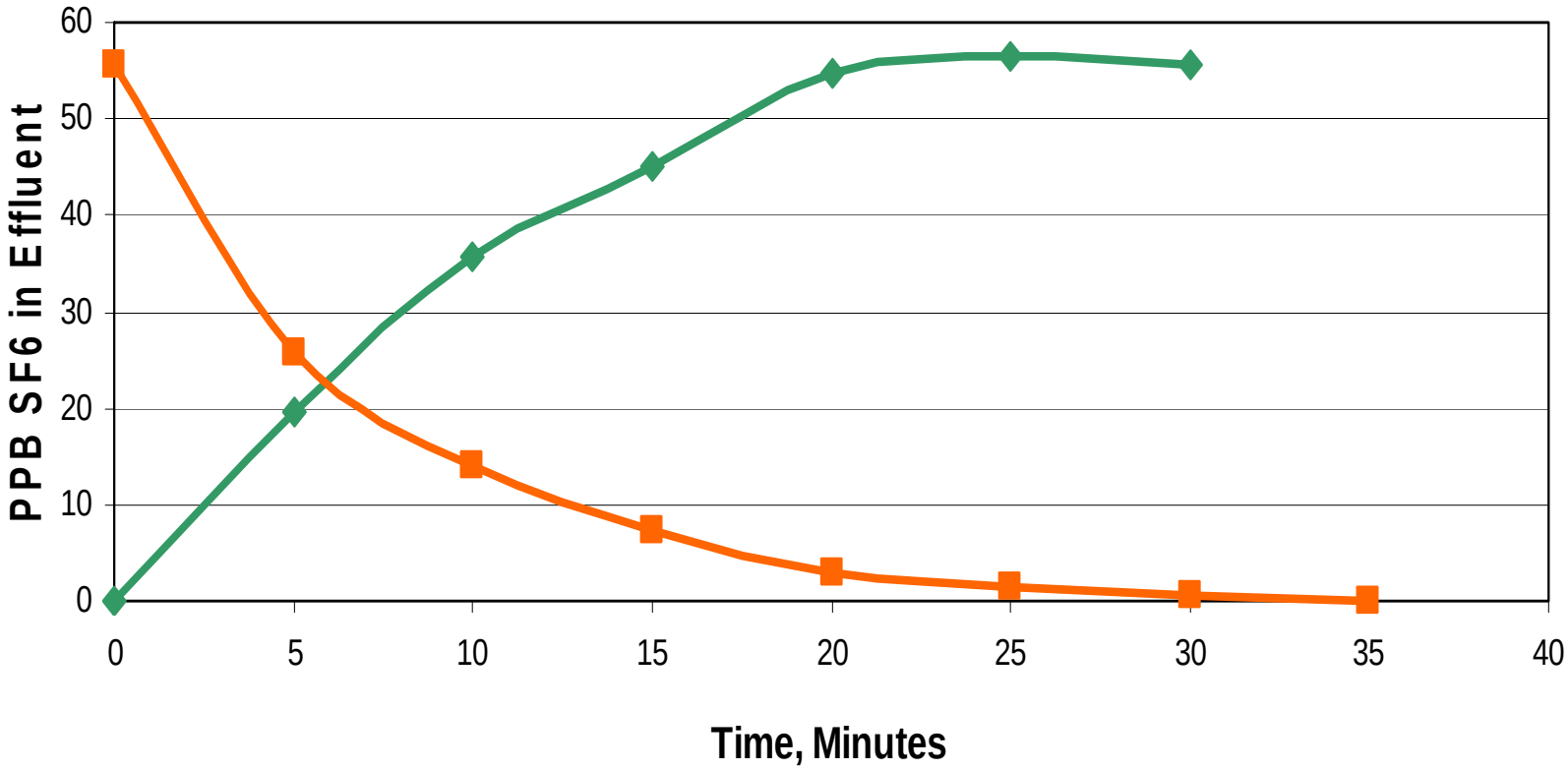
  The Outlet Concentration Would Change by 0.4%

Recirculation Control Rooms

- If a Large Proportion of the Recirculated Flow is Filtered

  Then Tracer Concentration is Attenuated by the Carbon to Lower Leakage Rates

Figure 1
Carbon Bed Effluent SF6 Concentration versus Time, 6 Inch Bed Depth, 40 fpm Air Flow



Recirculation Control Rooms

- Attenuation of Carbon Can be Mitigated by:
  - Using Average Decay Method
  - Estimate Leak and Use Constant Injection Method

Common to All

- Volumes Included in Envelope that Don’t Belong
  - Includes Volumes That Lose Their Ventilation Flow or
  - Volumes That are Poorly Ventilated
  - These Can Become Separate Envelopes

Recommendations

- Understand the Flow Logic for All Modes of Operation (Including Most Limiting and Failure Modes)
  - Measure Static Pressures in Ductwork, Especially in “Idle” Systems
  - Measure Relative Pressure of Envelope to All Adjacent Areas in Each Mode
  - Pressure and Flow Balance Problem Areas

Recommendations

- Have Personnel That Know the System Available to Assist for Vendor Walkdown
- Schedule Testing for One Mode A Night
- Schedule Contingency Nights
- Get Operations Input as Soon As Possible, Not the Night Before the First Test