Contaminants in Hotel Room Exhaust Air

Conference Paper Session 13 (Intermediate)
Contamination and Environment Control Applications
Wednesday, June 27, 11:00 AM-12:30 PM

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Learning Objectives for this Session

1. Site an alternative method to save energy for large hotels
2. Describe the types of contaminants present in guest room toilet exhaust in large hotels
3. Describe the range of concentrations present in guest room toilet exhaust in large hotels

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Acknowledgments

- Coauthor
  - Bryan Ligman, AAF International
- Project Assistance
  - Aflal Rahmathullah, AAF International
  - Rob Schick, AAF International

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Outline

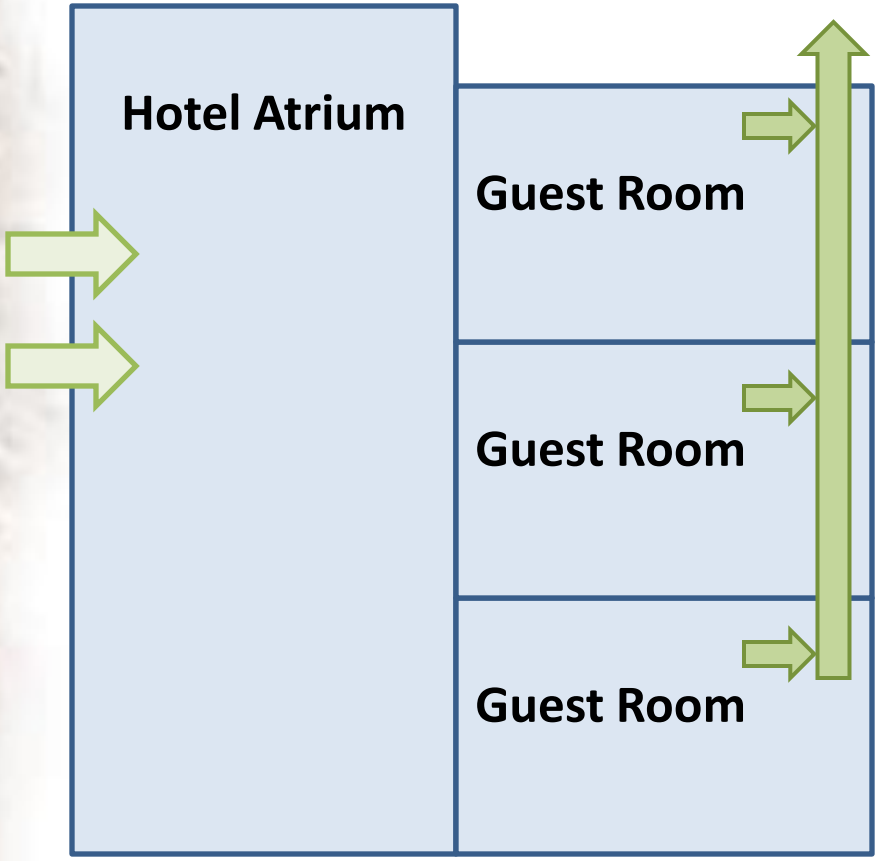
- Introduction
- Overview of Hotel
- Contaminant Selection Methodology
- Specific Contaminants & Sampling Methods
- Sampling Location
- Results
- Conclusion

Introduction

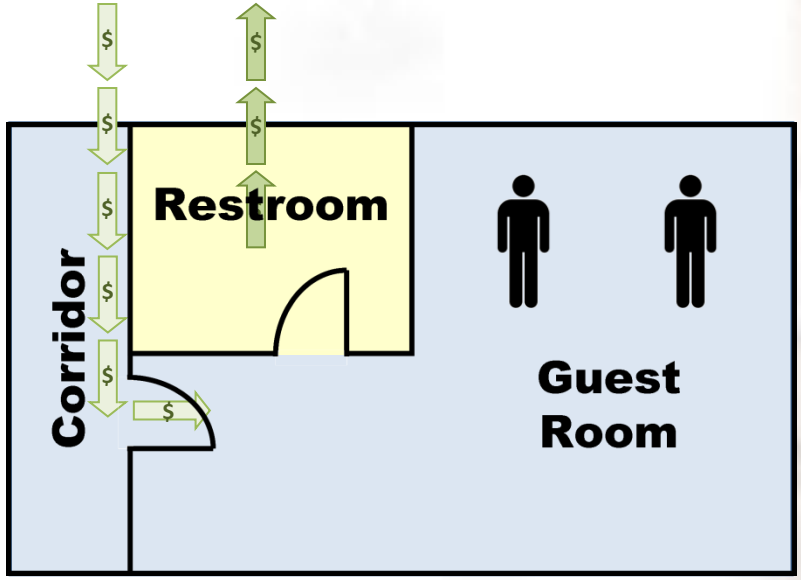
- Data from this study is in three groups
  1. Contaminants Downstream of Filtration System
     - Already published Indoor Air 2011
  2. Contaminants Upstream of Filtration System (Unfiltered Room Exhaust Air)
     - Current Presentation / Publication
  3. Contaminants in Outdoor Air at same location
     - Plan to publish in future and compare to other two groups

Introduction

Simplistic Atrium Hotel Design

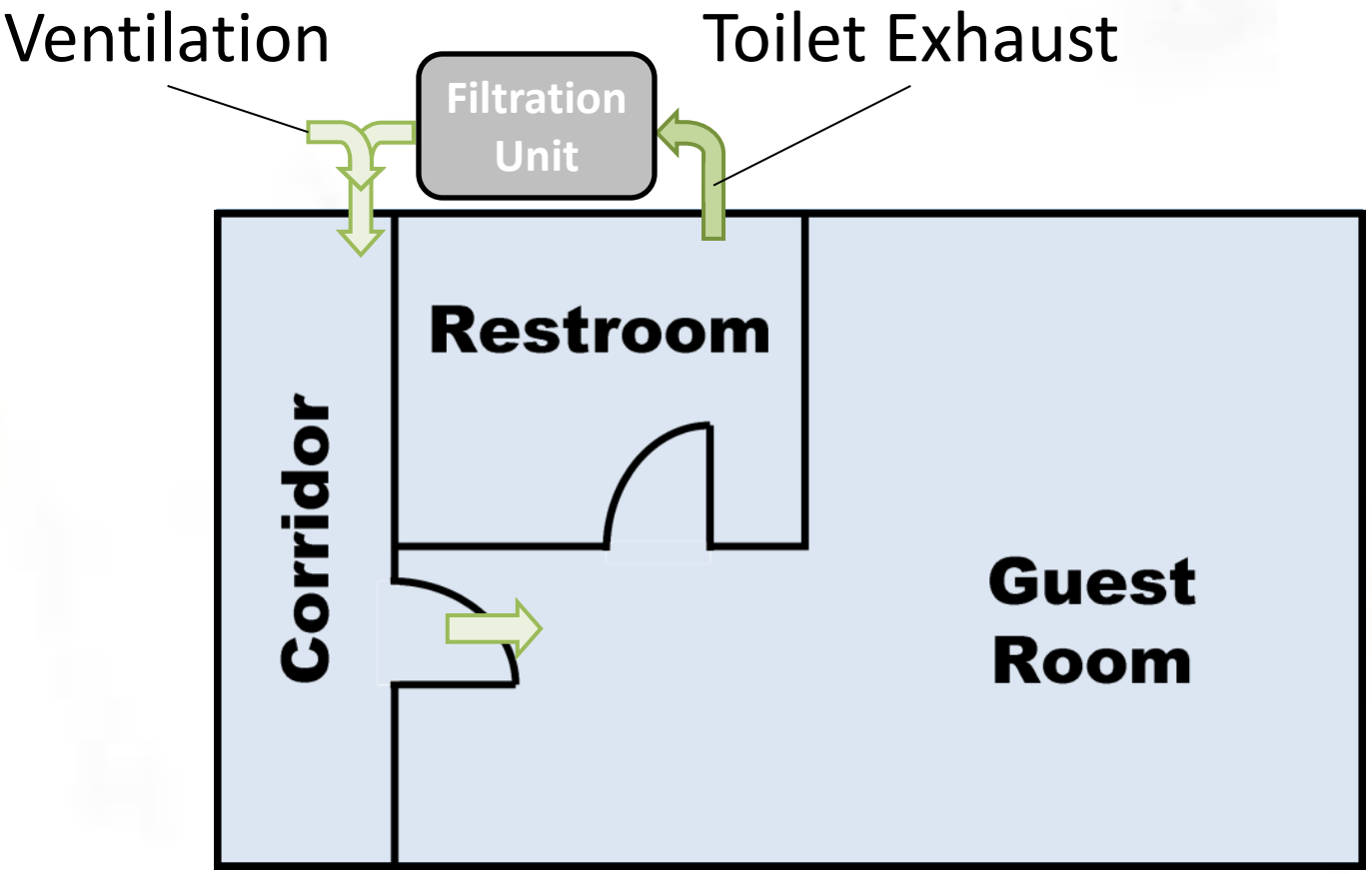


Hotel Room Design



Introduction

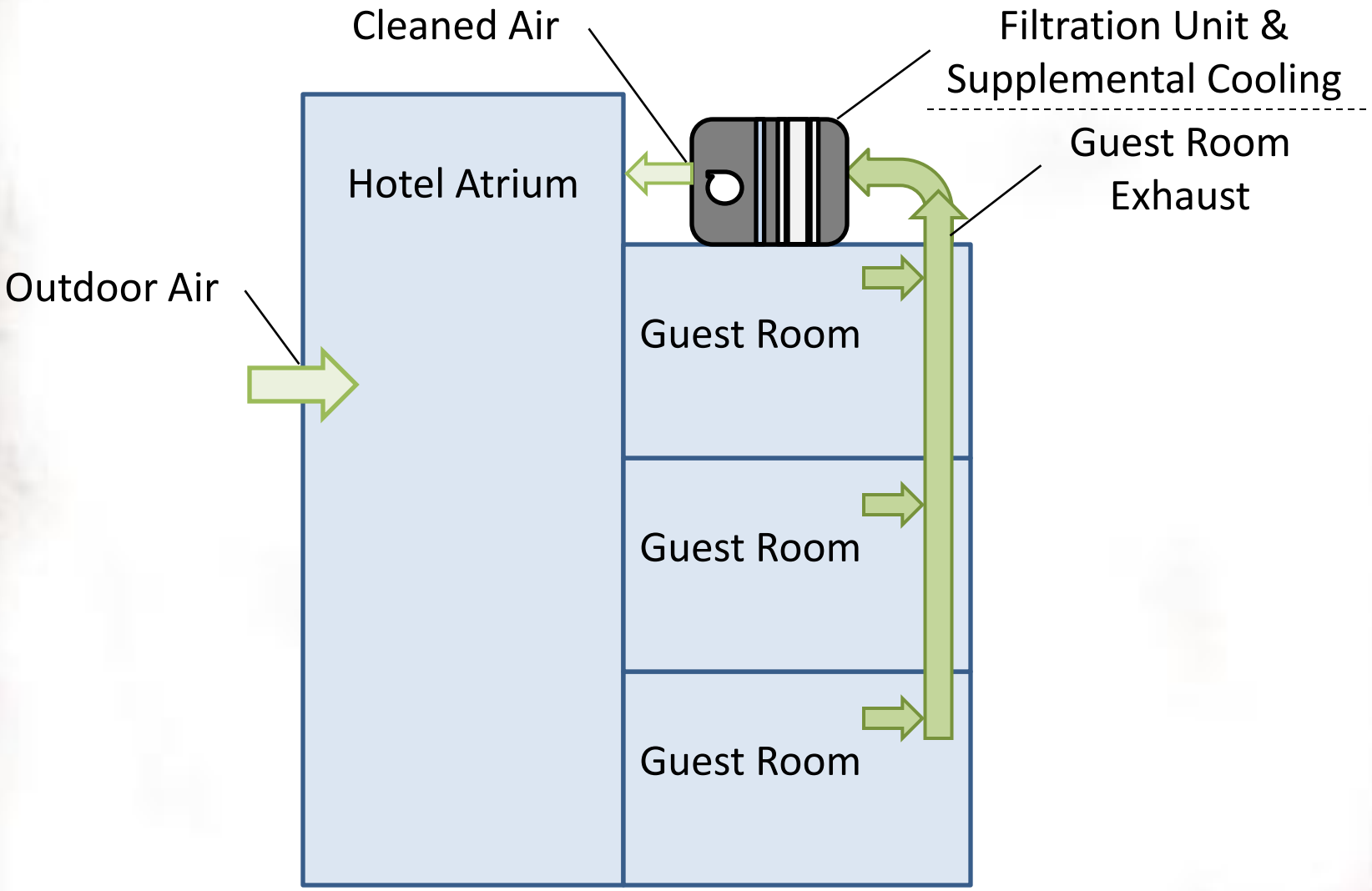
Energy Savings through “air recycling”



Overview of Hotel

- Large Hotel (>1,000 rooms)
- Recycled air is reintroduced into the building via interior atrium
- Hotel is a non-smoking facility
- Sampling Dates & Times
  - Samples were taken two times in the spring approximately one month apart. The results from the second sample date are presented.
  - Hotel had >80% occupancy during testing

Hotel Design Schematic



Contaminant Selection Methodology

- Areas of Concern for Hotel
  1. Building product and furnishing emissions
  2. People generated contaminants (bioeffluents & those generated by various activities)
  3. Contaminants specifically associated with toilet room exhaust
- Groups of Contaminants Sampled
  1. Volatile Organic Compounds (75 compounds)
     - #'s 1 & 2 above
  2. Aldehydes (8 compounds)
     - #'s 1 & 2 (lesser degree) above
  3. Ammonia & hydrogen sulfide
     - # 3 above
  4. Bioaerosols
     - #3 above

Specific Contaminants & Sampling Methods

- Volatile Organic Compounds
  - Compounds
    - 75 VOC's
  - Method
    - Speciated EPA Method TO-15
  - Medium
    - Summa Canister with flow controller
  - Time Period
    - 24 hours

Specific Contaminants & Sampling Methods

- Aldehydes
  - Compounds:
    - acetaldehyde, benzaldehyde, butyraldehyde, formaldehyde, isovaleraldehyde, n-hexaldehyde, propionaldehyde, valeraldehyde
  - Method
    - EPA method TO-11A
  - Medium
    - Passive Radiello DNHP tubes (code 165)
  - Time Period
    - 24 hours

Specific Contaminants & Sampling Methods

- Ammonia
  - Method
    - OSHA ID-188/ID-164
  - Medium
    - Sulfuric Acid-Coated Anasorb-747 (carbon bead) tubes
  - Time Period
    - 4 hours

Specific Contaminants & Sampling Methods

- Hydrogen Sulfide
  - Method
    - CAS AQL 110 using spectrophotometer
  - Medium
    - Passive Radiello tubes (code 170)
  - Time Period
    - 24 hours

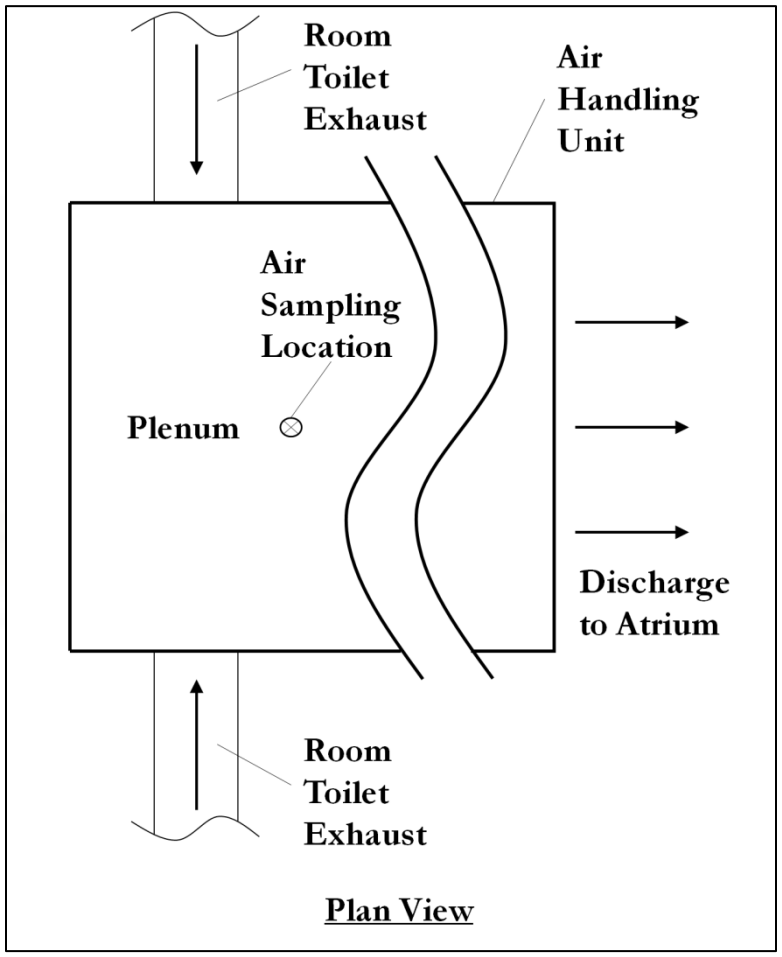
Specific Contaminants & Sampling Methods

- Fungi - Non-Viable & Viable
  - Method & Medium
    - Spore trap active impaction
    - SAS Sampler with Anderson Style Active Plate Impaction

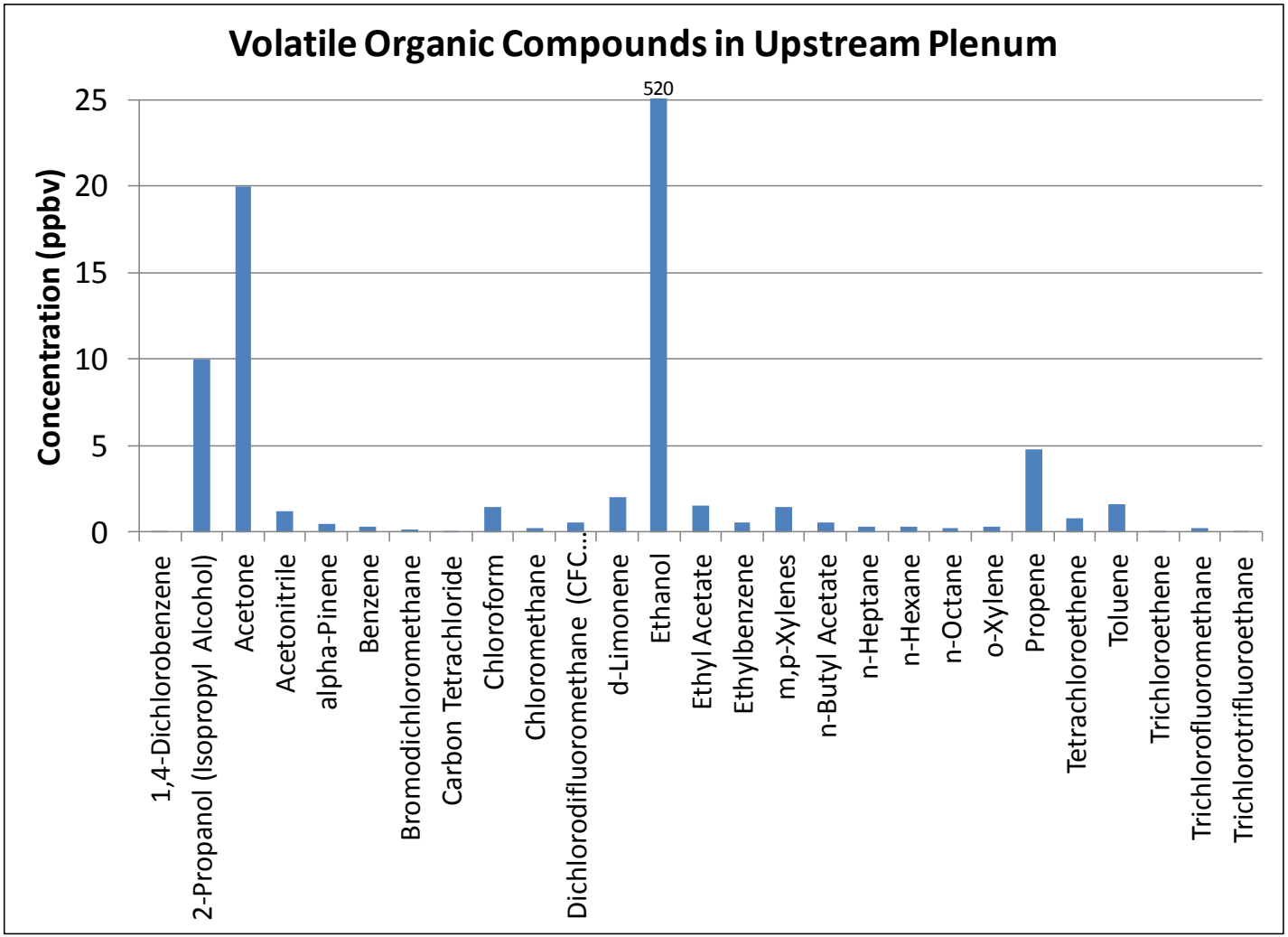
Specific Contaminants & Sampling Methods

- Bacteria
  - Method & Medium
    - SAS Sampler with Anderson Style Active Plate Impaction
      - Two plate protocol to select out gram-negative rods such as E. coli, coliforms or non-fermenters (Pseudomonas species)

Sampling Location

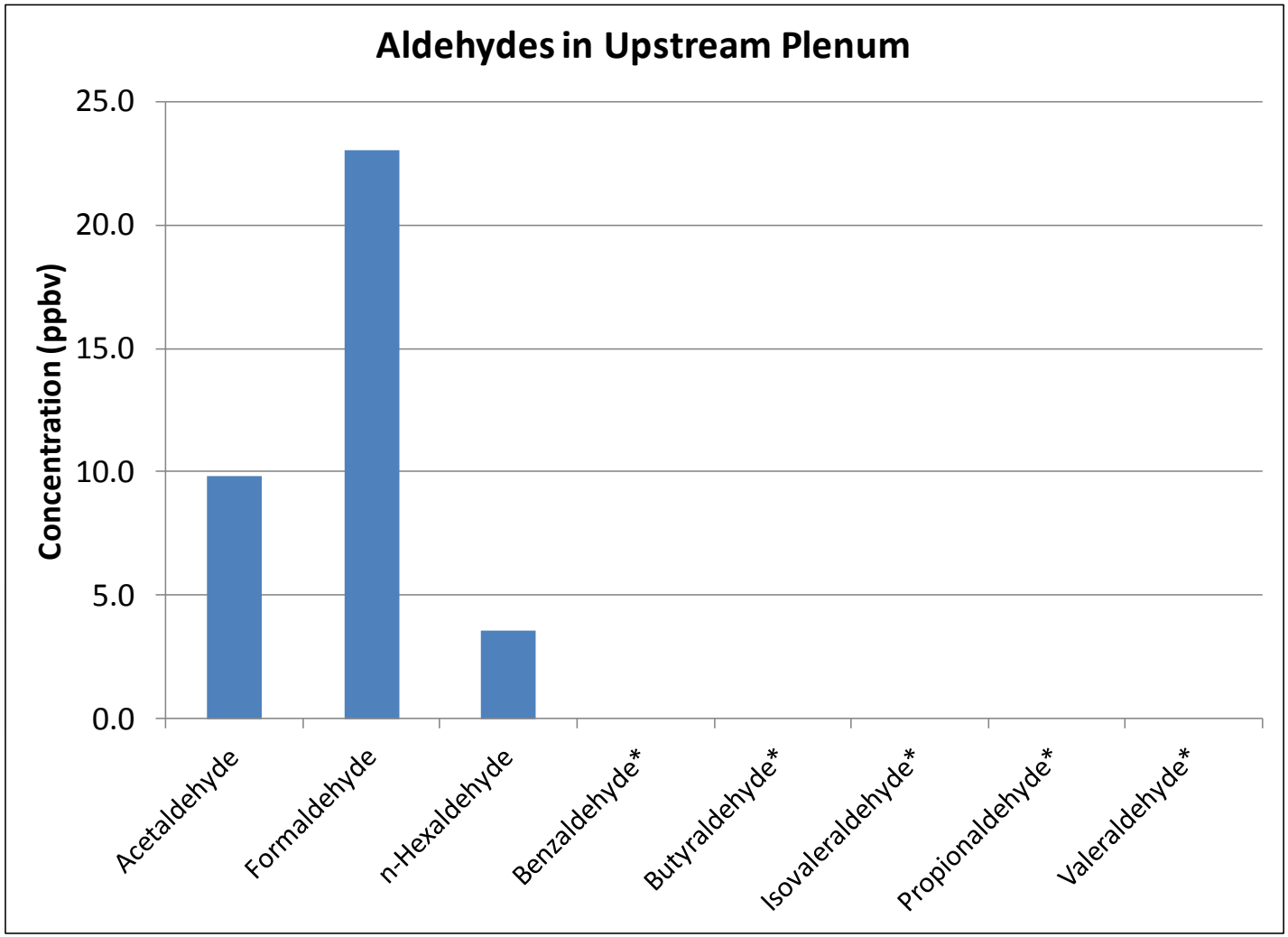


Results – VOC's



27 out of the 75 speciated compounds were above the method reporting limits.

Results – Aldehydes

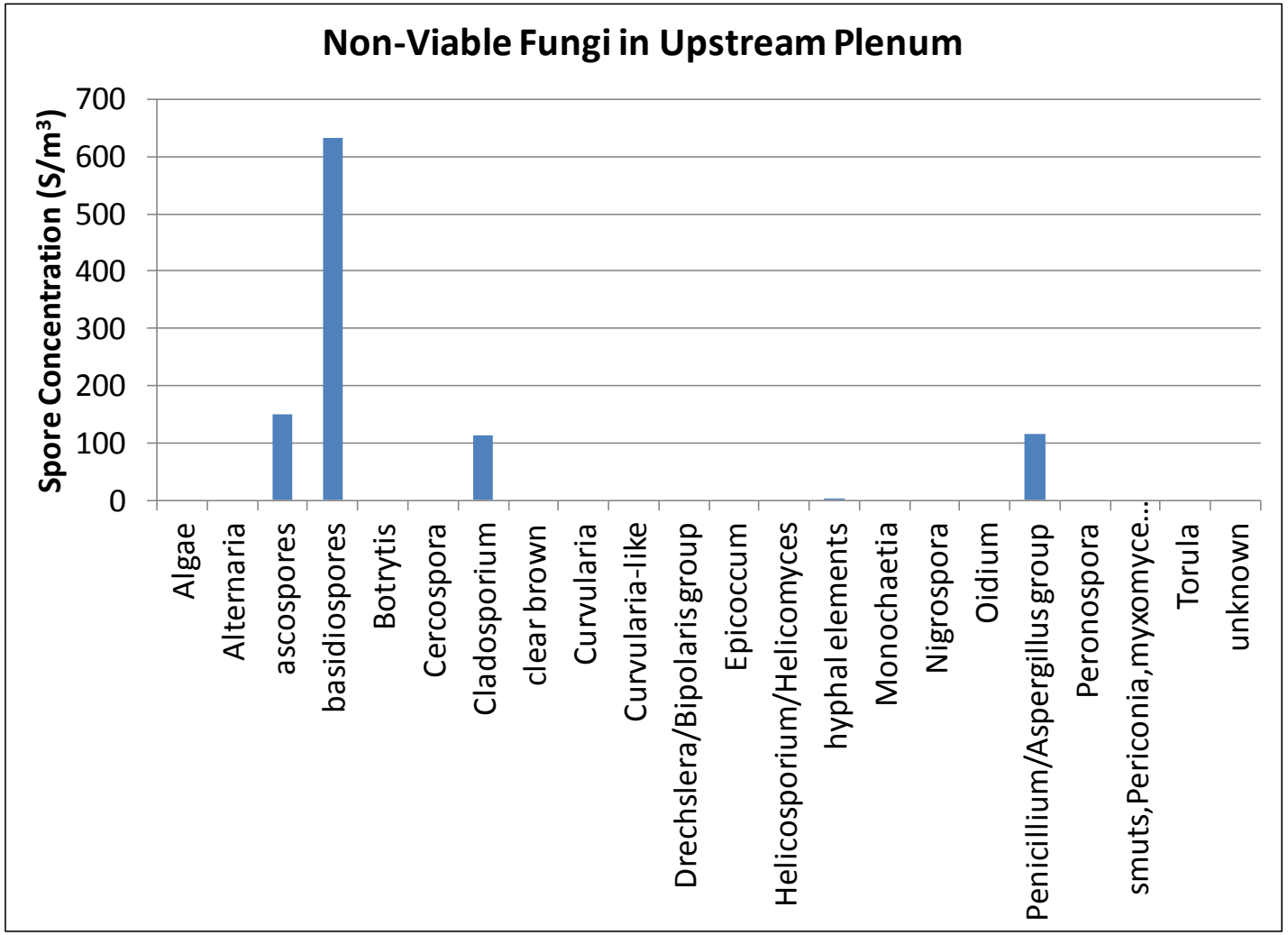


*These aldehydes were monitored approximately one month before at the same sampling location and found to be below the method reporting limit.

Results – Ammonia & Hydrogen Sulfide

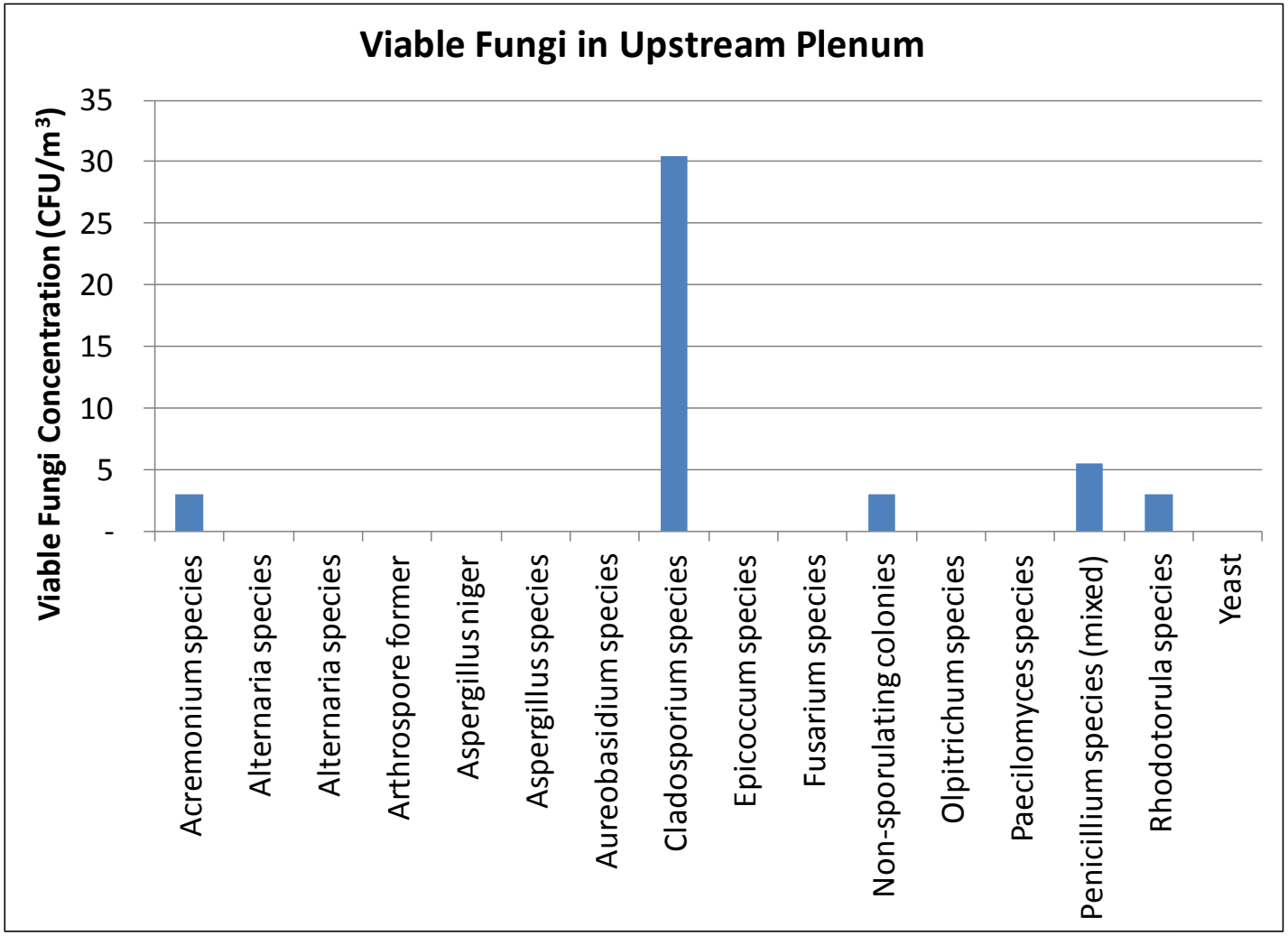
- Concentrations in the upstream plenum were below method reporting limits
  - Method reporting limits
    - ammonia: 120 ppbv (87 $\mu g/m^3$)
    - hydrogen sulfide: 3.6 ppbv (2.6 $\mu g/m^3$)

Results – Non-Viable Fungi



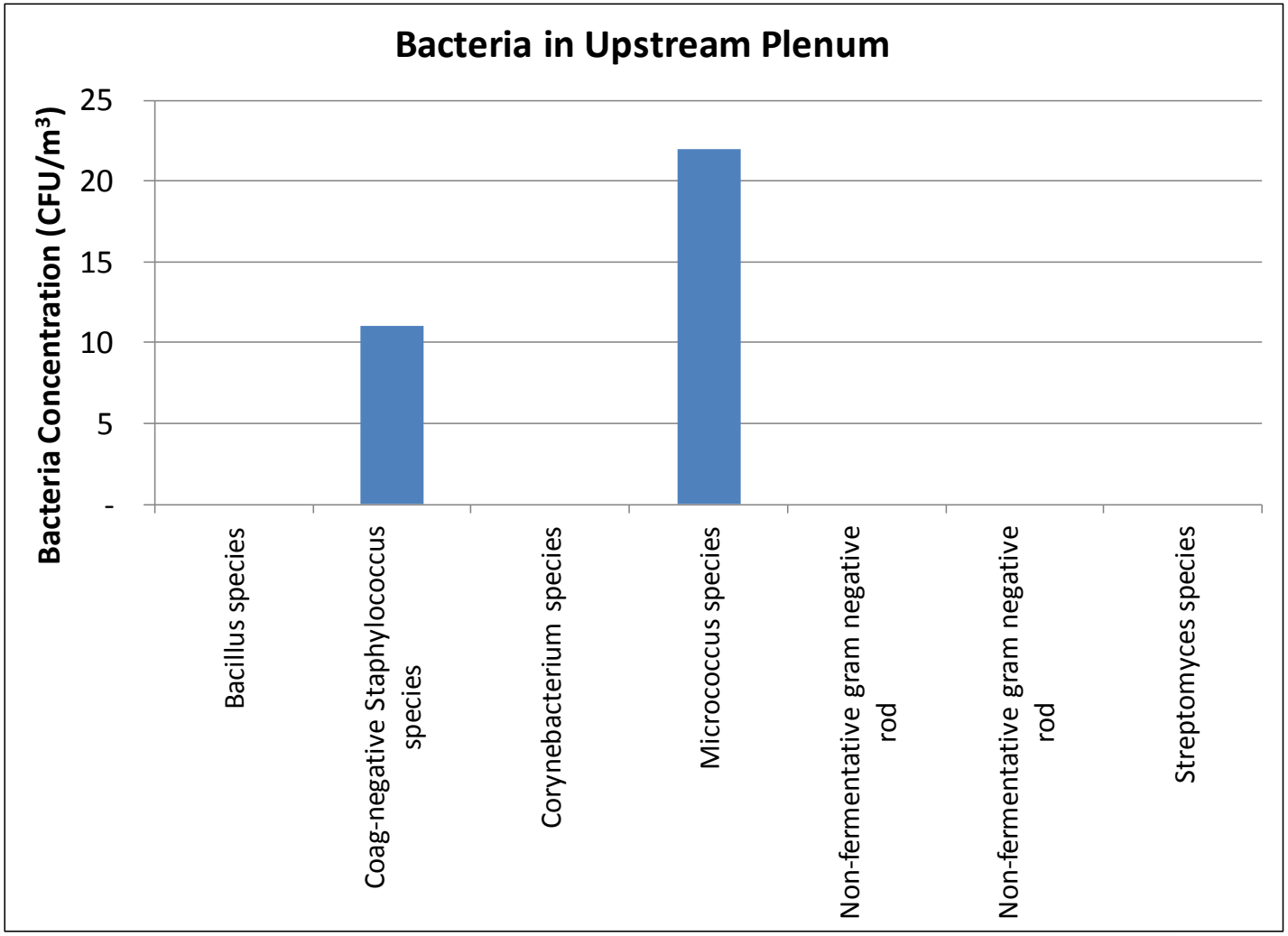
Five were present: ascospores, basidiospores, Cladosporium, hyphal elements, Penicillium/Aspergillus group.

Results – Viable Fungi



Five were present: Acremonium species, Cladosporium species, Non-sporulating colonies, Penicillium species (mixed) , Rhodotorula species

Results – Bacteria



Two were present: Coag-negative Staphylococcus species, Micrococcus species

Conclusions

- Little data exists characterizing hotel room toilet exhaust.
- Data from this presentation characterizes a collective hotel room toilet exhaust airstream over a 24 hour period in terms of airborne chemical presence, non-viable and viable fungi presence, and bacteria presence.
- This data can provide further familiarity with the types and concentrations of contaminants present in such airstreams to assist with recirculation designs of these airstreams.
- Further work is planned to compare the contaminant data upstream and downstream of the filtration system to the concentrations in outdoor air at the same site.

Questions?

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