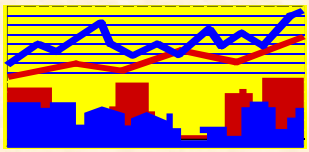

Wall Cavity Sampling Strategies

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Wall Cavity Sampling Rationale

- **Why was that sample collected?**
  - **In that location?**
  - **With that sampler?**
  - **Analyzed using that lab method?**
  - **Interpreted using those criteria?**

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Wall Cavity Sampling Rationale

- **Why was the wall cavity sample collected?**
- **To identify locations for possible remediation**
  - **To assess Building-Related Contamination**
  - **NOT to assess Occupant Exposure**

"The use of *wall* cavity air samples should never be used in an attempt to determine exposure to occupants."

[AIHA: Recognition, Evaluation and Control of Indoor Mold (2008)] (REC Section 10.2.3)

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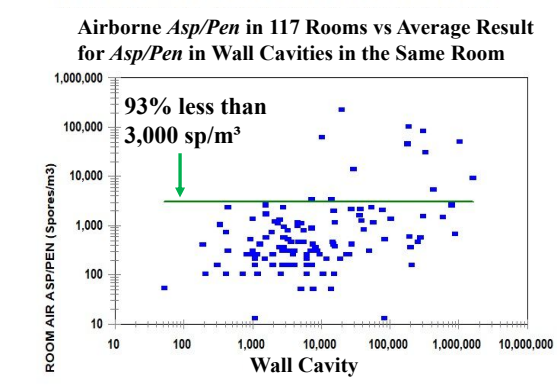
Occupant Exposure from Wall Cavities



Coefficient of Correlation = 0.07
There was no correlation between *Asp/Pen* concentrations in wall cavities and the indoor air in the same room

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Methods for Identifying Locations to Assess for Possible Remediation

- **WALL CAVITY**
  - Current/Past intrusions
  - Qual & quant inform.
  - Only "sampling" method
- **MOISTURE METER**
  - Current water intrusions
  - Limited information about contaminants
- **THERMAL IMAGING**
  - Current water intrusions
  - Limited information about contaminants
  - Difficult to interpret
- **BORESCOPE IMAGING**
  - Current and Past intrusions
  - Qualitative information about contaminants
  - Prone to false results
- **DESTRUCTIVE TESTING**
  - Good Forensic Method
  - Prone to false negatives as a "sampling" method
  - Detection requires sampling
  - "Time and expense" limitations

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Wall Cavity Sampling Rationale

- **Why was the sample collected in that location?**
- ***What's the question the sample is intended to answer?***
- **House with 118 windows**
- **Window reportedly leaked during rain**
- **Surface mold on wall next to bathtub**

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Wall Cavity Sampling Rationale

- **Why was the sample collected with that sampler?**
  - **WallChek probe**
  - **Slit-impaction cassette**

  - **Inner Wall probe**
  - **Slit-impaction cassette**

  - **PCM Filter Cassette**
  - **Beveled Tip Probe**

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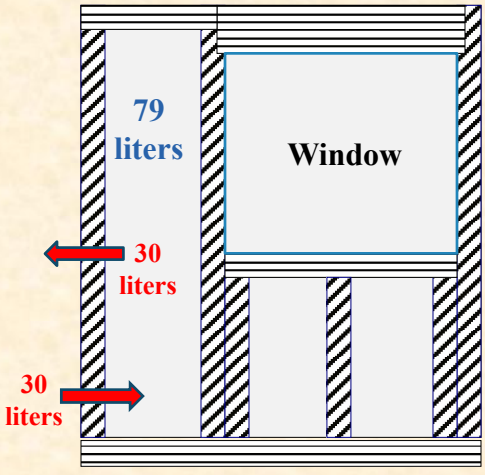
Perimeter Stud Bay v Sample Volume

AOC: Air-O-Cell **FC: PCM Filter Cassette**



- **AOC, 2-min, 30 L (38%)**
- **1,000 sp/m³ beginning**
- **620 sp/m³ ending,**
- **Sample Avg = 810 sp/m³**

- **FC, 2 lpm, 1.5 min (4%)**
- **1,000 sp/m³ beginning**
- **945 sp/m³ ending**
- **Sample Avg = 980 sp/m³**

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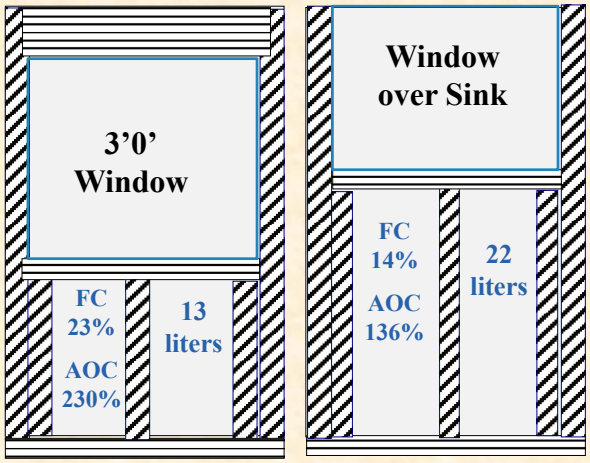
Stud Bay Under Window and Behind Sink Base



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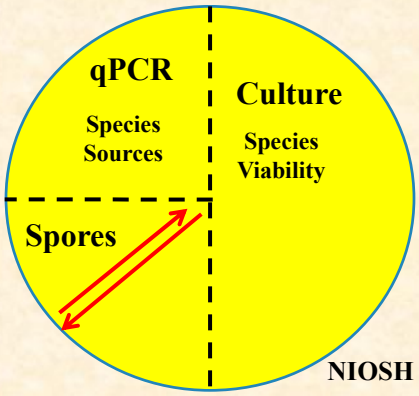
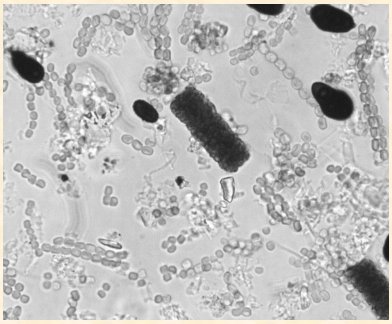
Wall Cavity Sampling Rationale

- **Why was the sample analyzed using that method?**

Filter Analysis: ¼ Microscopy, ¼ qPCR, ½ Culture





Filter Cassette: Low airflow rate, clean background

NIOSH 7400 count method for spores

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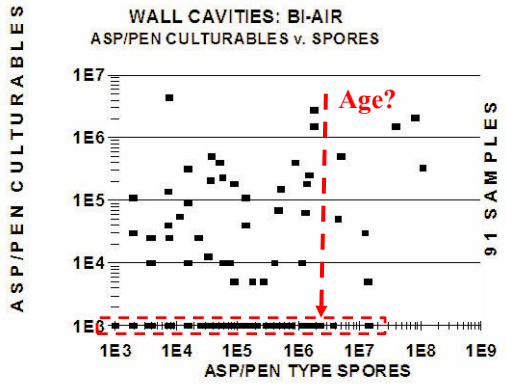
Culturables v Total Spores

Spores or qPCR are better indicators
No false negatives



Incident Age: Ratio of Culturable to Total spores

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Quiescent v Aggressive Sampling

Average of 6 replicate samples from a test wall

	QUIESCENT	AGGRESSIVE	
SAMPLER	Spores/m³	Spores/m³	Ratio
AOC, WallChek	94	11,317	120
AOC, Inner Wall	977	8,383	9
Allergenco-D, IW	11	25,183	2,290

If the objective is to detect mold when it is present, then use the most sensitive method

Aggressive Sampling Resulted in Better Detection

Dry wall cavity v Wet wall cavity ?

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Wall Cavity Sampling Rationale

- **Why was the sample interpreted using that method?**
- **Methods for interpreting data**
  - **Reference Method**
    - **Wall Cavity v Outdoor Air (Both with an AOC)**
  - **Control Method**
    - **Contaminated v Uncontaminated (WC, Window)**
  - **Database Method [Logistics Regression]**
    - **Current v Previous Wall Cavity Samples**
    - **Extension of Control Method**

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Table from Typical Mold Report

Room Name/Location	Levels of Mold
Master Closet (Airborne)	Elevated – Pen/Asp 1,920 sp/m^3
Mud Room/Laundry Room (Airborne)	No Elevations
Mud Room/Laundry Room, West wall	Elevated – Cladosporium 3,540 sp/m^3 Elevated – Pen/Asp 43,700 sp/m^3
2nd Floor Bedroom #1 Closet (Airborne)	No Elevations
2nd Floor Bedroom #1 Closet, North wall	Elevated – Pen/Asp 156,000 sp/m^3
2nd Floor Game Room (Airborne)	No Elevations
2nd Floor Game Room, North wall	Elevated – Pen/Asp 718,000 sp/m^3
Kitchen (Airborne)	No Elevations
Kitchen, South wall	Elevated – Pen/Asp 1,650,000 sp/m^3

- **Mixed air and wall cavity samples included in the same table.**
- **Typically, not even labeled airborne or wall cavity.**

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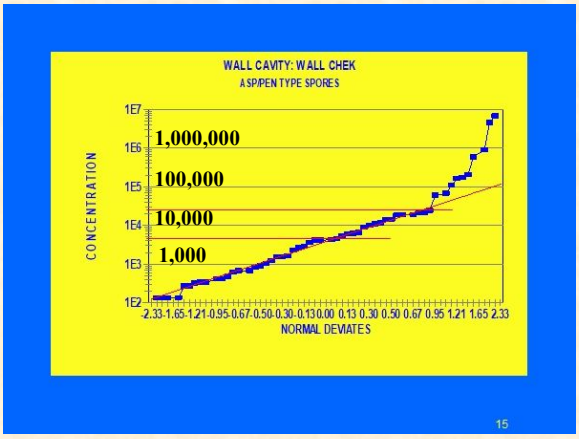
Background Mold in Wall Cavities
Moderate Climate



Background: *Asp/Pen* up to about 25,000 spores/m³

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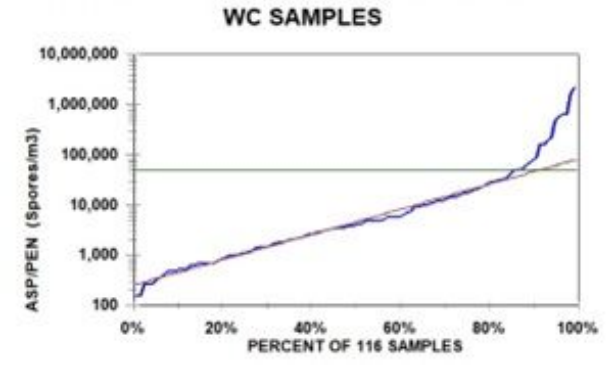
Background Mold in Wall Cavities
Hot, Humid, Subtropical Climate

Houses not subject to water intrusion incidents



Background: *Asp/Pen* up to about 75,000 spores/m³

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Wall Cavities Just Subject to Infiltration of Humid Air

- In 392 wall cavity samples collected in houses NOT subject to water intrusion incidents
  - 92% of the spores detected were *Asp/Pen* spores
    - Xerophilic (dry-loving, low water activity) species
  - 6% were *Cladosporium* spores
  - 2% were Other

Characteristic:
- A lack of fungal diversity
- A "monoculture" of primarily xerophilic *Aspergillus* with some *Penicillium*

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Detection of Mold Spores in Water Damaged Wall Cavities

Percent of 113 wall cavity samples in which a mold spore type was detected in a water damaged wall

MOLD SPORE	Percent of Samples	Range (Sp/m³)
Asp/Pen-like	96%	80-8,000,000
*Cladosporium**	60%	70-40,000
Stachybotrys	36%	30-35,000
Chaetomium	28%	30-5,500
Ulocladium	15%	30-300

**Penicillium* and *Cladosporium* may be prevalent in previously wet wall cavities that have dried out

Characteristic: A variety of hydrophilic (wet-loving) indicator molds detected

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Hidden Mold That Is Subject to Remediation

- AIHA: Recognition, Evaluation and Control of Indoor Mold (2008)
- [Section 17.5.1]
  - "Hidden mold is defined as concealed VISIBLE COLONIZING GROWTH of filamentous fungi on building materials or contents that is within the building enclosure"
- Hidden mold subject to remediation is:
  - Concealed [Wall cavity or interstitial spaces]
  - Growing [Not just germinated]
  - Visible [Confirmed by inspection]

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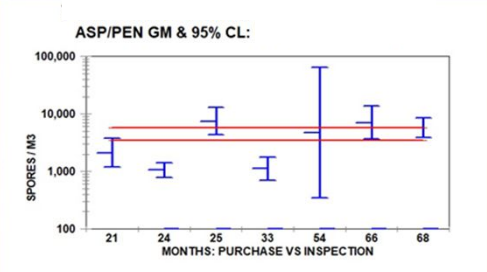
Variation of *Asp/Pen* Concentrations with Time-of-Growth in Three Houses



The median *Asp/Pen* concentrations in wall cavities did not increase during a period of 5.7 years (68 months)

Borescope image of one of the wall cavities

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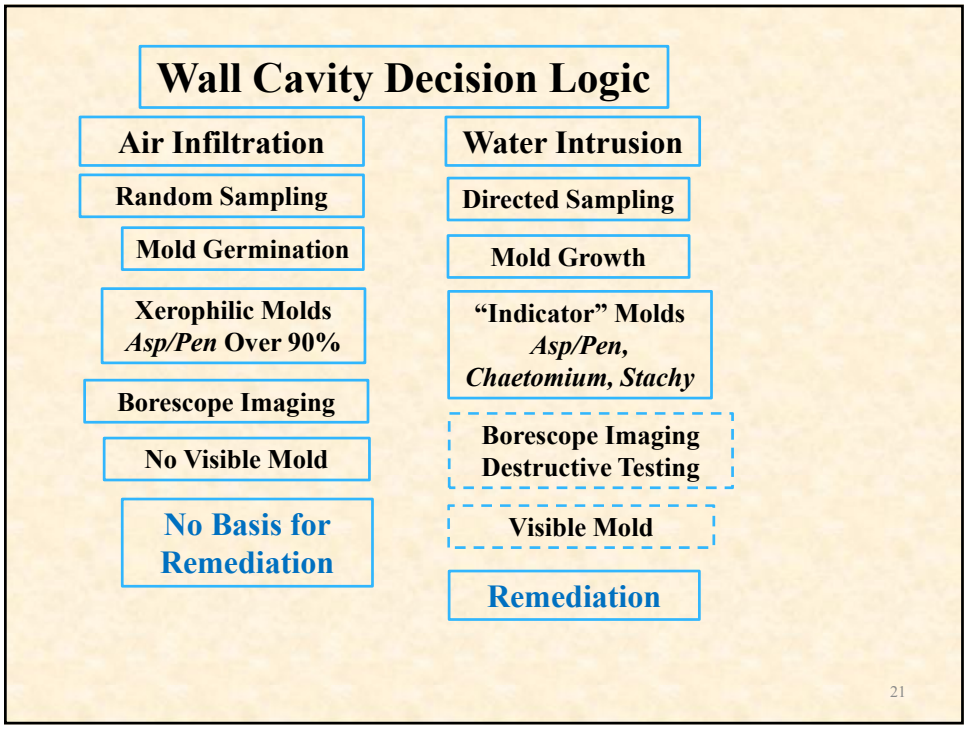

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AIHA: Recognition, Evaluation and Control of Indoor Mold (2008)

- The AIHA position on wall cavity sampling
  - [Section 10.2.3] "[*Sampling wall cavities*] remains a controversial area of practice, with some investigators discouraging its use…"
  - [Section 11.2] "Because of the uncertainty of this method, interpretation of wall cavity samples is not discussed further."
- Comment: As it is currently taught in many mold courses and commonly practiced in the field, AIHA's guidance on wall cavity sampling is probably appropriate.

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Not An Uncommon Method
"Wall Proximity Air Sample"

Sample nearest electrical outlet or light switch

What's the question this sample is intended to answer?

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My Opinion on Wall Cavity Sampling

- **Wall cavity sampling is one of the most useful mold sampling methods when used correctly.**
- **BUT it is also one of the most misunderstood and misused of the mold sampling methods.**
  - **I can't recall reviewing a mold report as an expert in which I thought it was properly applied. Samples were either not Collected correctly, Reported correctly, or Interpreted correctly.**
- **It can be, and should be, taught better in the initial mold sampling courses.**

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