

Interpreting Indoor Concentrations of Airborne Mold

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AIHCE

Mold Exposure Assessment & Evaluation

PO 104

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Some Factors Affecting “Interpretation”

- **Reasonable sample sizes are possible**
- **Sample results are consistent with incident history**
- **Could combine indoor data from multiple sources**
- **Could assess concentrations as high, moderate or low**

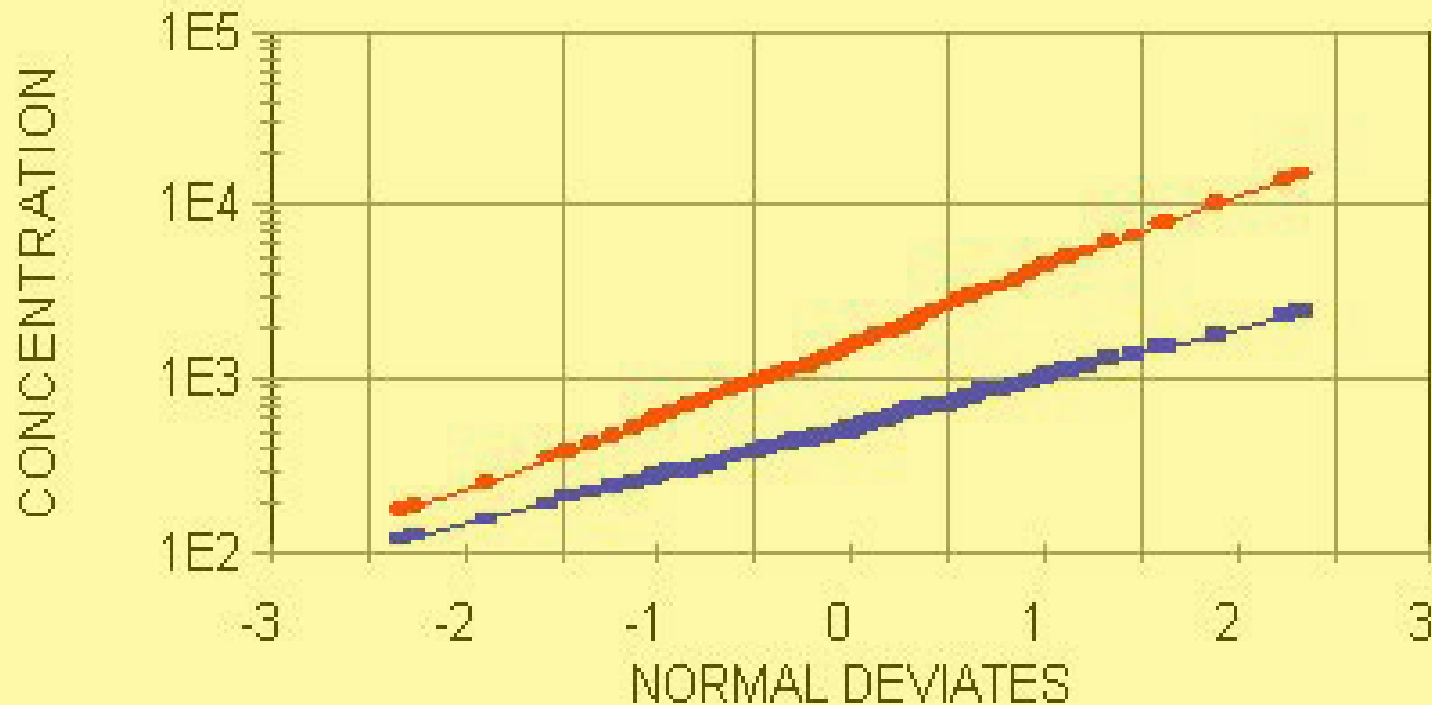
ARE REASONABLE SAMPLE SIZES POSSIBLE?

Can the CV be reduced?

Ratio of GM's = 3

CONTROL AND CONTAMINANT DISTRIBUTIONS

GSD = 2.0 and GSD = 2.8

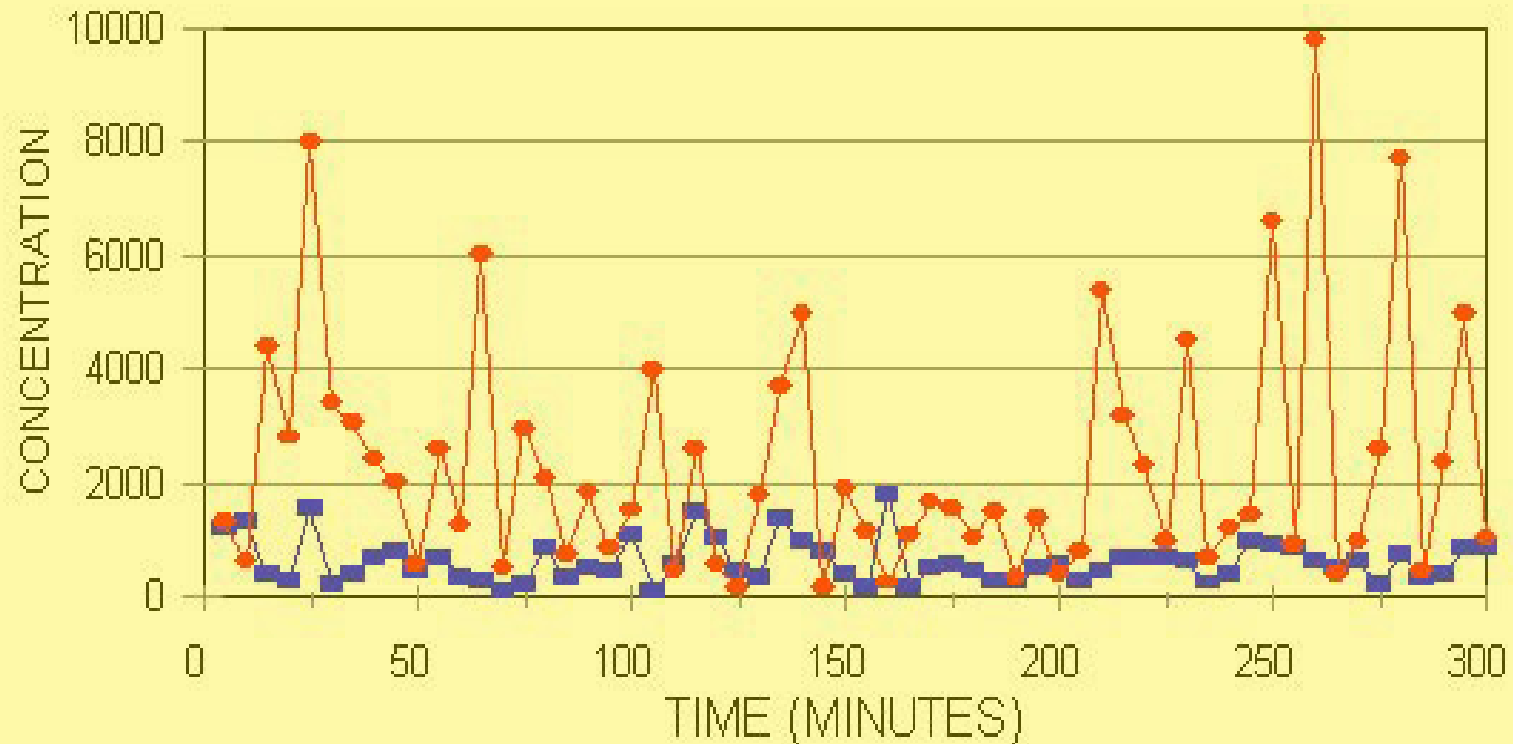


GM's = 550 & 1,560 s/m³

Random Number Generator

5-MINUTE SAMPLE TIMES

N = 60: CV = 92 % and 60 %



% < 1,000 s/m³ Control = 83% & Contaminant = 32%

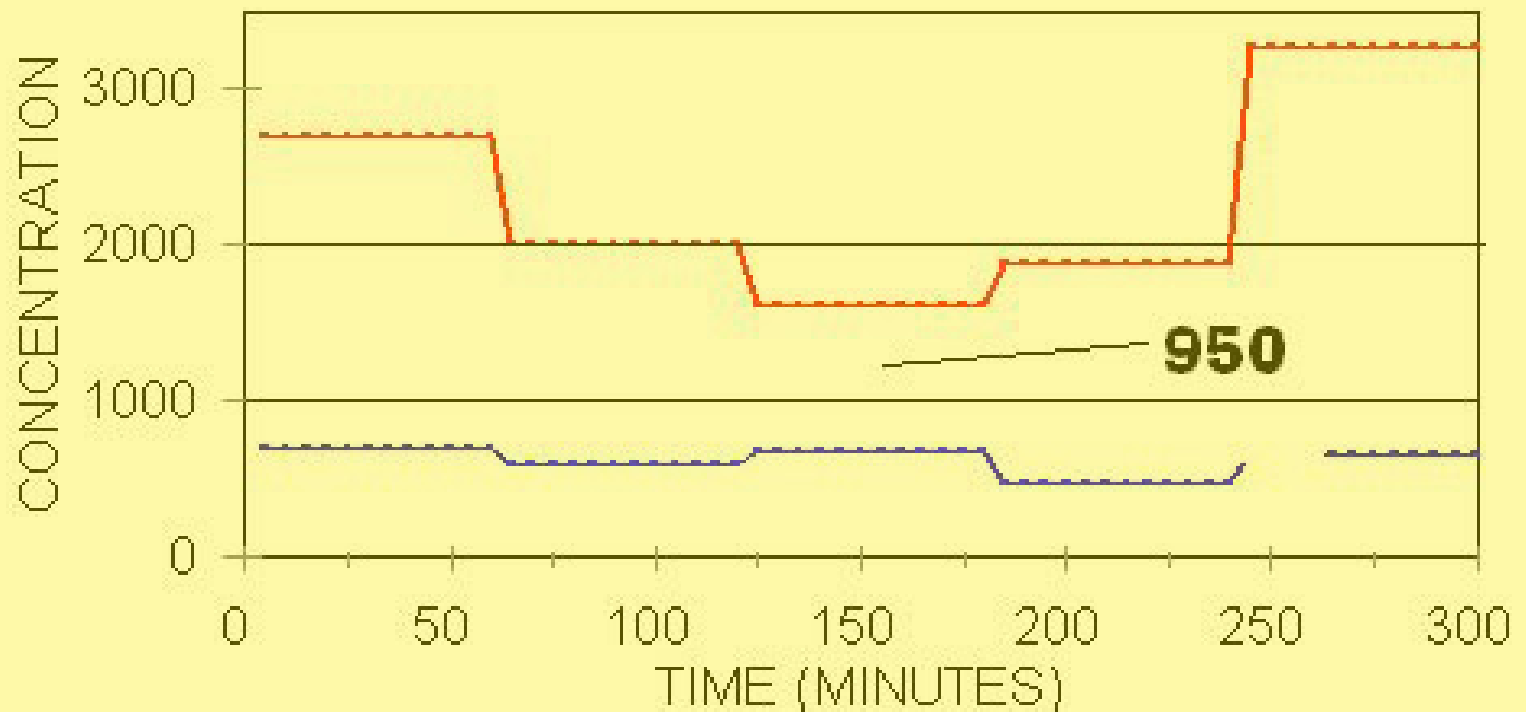
“Grab” Samples

- **High CV's of 60% and 92% require large sample sizes to distinguish between controls and contaminants**
- **Significant chance for false negatives**

Extended Period Samples?

60-MINUTE SAMPLE TIMES

N = 5: CV = 29 % and 14 %



Extended Period Samples

- **Good separation between distributions.**
- **CV's reduced to 29% and 14%, even with $n = 5$, requiring fewer samples to be collected.**
- **Chance for false negatives greatly reduced.**

Example Distributions

What are the sample sizes required to differentiate based on the 95 % confidence intervals on the GM?

Sample Size per Similar Exposure Area

Sample Time	Samples / SEA	Total Samples
5 Minutes	16	32
60 Minutes	3	6

Conclusion

Increasing the sample times from 5 minutes to 60 minutes reduced the sample size by a factor of 5

RESULTS CONSISTENT WITH INCIDENT HISTORY?

Five 1-Hour Samples: Bi-Air Filter Cassette

Asp/Pen type spores (s/m³)

50,700		45,300
84,900 CEILING		
20,200		
		15,200

Bathroom ceiling collapsed & then repaired

Three 5-Minute Samples: Air-O-Cell Cassette

50,700 6,700		<i>Asp/Pen type spores</i>
84,900 CEILING		45,300 91,500
20,200 43,500		
		15,200

**Bedrooms as
the source,
not the
bathroom
repairs**

Conclusion

- **1-hour extended period samples were consistent with the incident history**
- **Other examples of 1-hour samples also show consistency**
- **5-minute grab samples were not consistent with the incident history**

**COMBINING
INDOOR DATA FROM
MULTIPLE SOURCES AND
DIFFERENT SAMPLER TYPES**

**Are distributions of INDOOR
airborne spores [relatively] stable?**

Consider two unit areas of drywall

- **Conditioned indoor environments: 72 °f**
- **Same fungal species as contaminants**
- **Water activities (A_w) the same**
- **Subject to similar levels of disturbance**

Boston and Los Angeles: Winter

Would airborne concentrations of spores be about the same in both rooms.

ASSUMPTION: PROBABLY

Would it make any difference if there was snow on the ground in Boston?

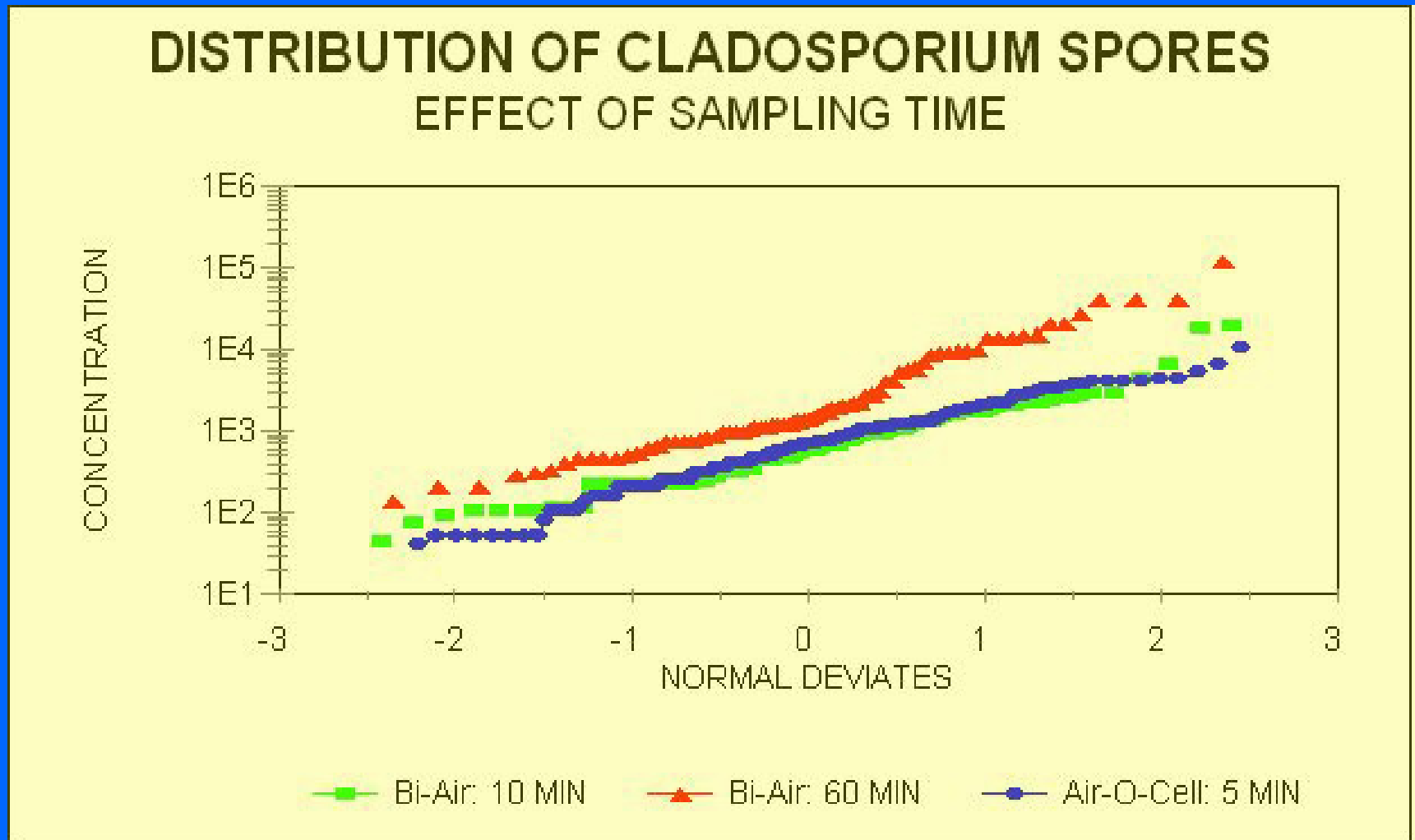
ASSUMPTION: PROBABLY NOT

Airborne distributions: AOC Texas & California

	Asp/Pen (TX)	Asp/Pen (CA)	Total (TX)	Total (CA)
N	9	40	14	51
Min	0	0	176	153
Max	2,672	2,640	7,893	7,311
Avg	613	582	2,501	2,008
GM	262	365	1,555	1,469

TX: PE Services

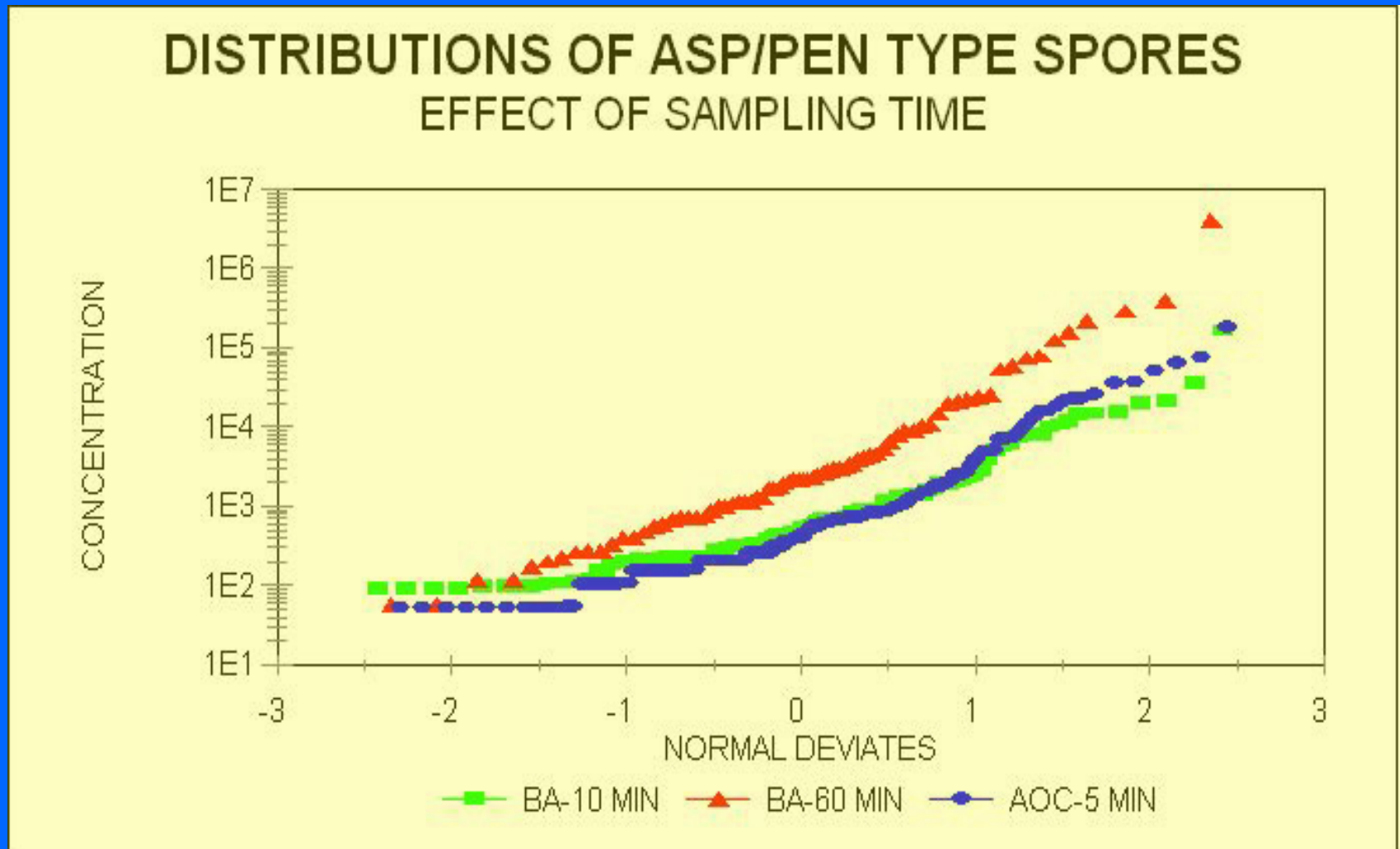
Indoor Distributions: Two Samplers



Distributions of *Cladosporium* spores

SAMPLER	AIR-O-CELL	BI-AIR:10
Samples	167	109
Maximum	10,720	19,838
GM	607	582
Average	1,139	1,219
95th %-tile	4,595	3,635
GSD	3.4	3.0

Indoor Distributions: Two Samplers



Distributions of *Asp/Pen* spores

SAMPLER	AIR-O-CELL	BI-AIR:10
Samples	143	122
Maximum	181,644	163,962
GM	585	674
Average	5,039	3,549
95th %-tile	11,743	7,999
GSD	6.2	4.5

Conclusion

- **Airborne distributions of INDOOR spores may be relatively stable;**
- **Assessing distributions may allow data from multiple INDOOR sources to be combined;**
- **Improving the consultant's ability to interpret airborne data**

**ASSESSING
CONCENTRATIONS AS
HIGH, MODERATE OR LOW**

Distributions of indoor mold concentrations from 55 houses

CUM %	Asp/Pen	Asp	A. ver	Pen
16 %	133	23	10	67
50 %	365	98	33	216
75 %	723	258	75	478
84 %	1,005	411	111	700
95 %	1,932	1,040	241	1,494
99 %	3,866	2,787	550	3,343

Distributions of indoor mold concentrations from 55 houses

CUM %	Asp/Pen	Asp + Pen
16 %	133	90
50 %	365	314
75 %	723	736
84 %	1,005	1,111
95 %	1,932	2,534
99 %	3,866	6,130

Summary

- **Extended Period Samples**
 - **Reduce the CV**
 - **Reasonable sample sizes**
 - **Results more consistent with incident history**
 - **Capture peak concentrations**
- **Distributions rather than concentrations**
 - **Combine data from multiple sources?**
 - **Assess data as high, moderate or low**