Beryllium Aggressive Air Sampling

BHSC April 7, 2011

Panel Discussion

Panelists

- Kent Kerr, PE, NNSA / KCSO
- James Wyckoff, Ph.D. Statistician, Honeywell FM&T
- Eric Wenger, CIH, Burns & McDonnell
- Paulette Detillier, CEO Era Environmental & Safety
- Hollie Medlin, CSP, Burns & McDonnell
- Myrl Wear, PE, Facilities Engineering Services
- Dan Ham, Senior Engineer, Honeywell FM&T

Facility Release

- RFI: both surface and AAS –or- only AAS?
- KCP need may predate 850 revision
- Wipe Sampling –or- Air Sampling?
  - Wipe Sample Results can vary 500% based on:
    - + Surface
    - + Wipe media
    - + Residue
    - + Human Factors
  - Wipe Samples do not infer safe surfaces or air
  - Some surface not safe to wipe
- Air Sampling offers TLV comparability
- Be 1° inhalation hazard – drives air sampling

Aggressive Air Sampling

- Possible measure of relative potential for air levels of concern
- Forcefully resuspends legacy dust accumulated on facility surfaces for sampling
- Blind to disproportionate deposits
- Includes surfaces not normally available for routine cleaning/sampling
  - Above 8′
  - Power cable trays
  - Bus ducts
  - Light fixtures

KCP AAS Demo

- Modeled after EPA AAS for asbestos
- A room with a little < 1 µg Be/100 cm^2
- Required some expensive prep

  - power
  - neg air
  - isolation wall
  - decon line chamber
- Opportunity for getting a correlation between surface levels and TLV
- Required some modification of EPA Method
- Team: B&M, Ph.D. Statistician, Recognized SMEs from Complex

Containment Area B4 Fans, etc.

HEVI-DUTY

DECON LINE CHAMBERS

// DESIGNATED AREA //
// DESIGNATED AREA //

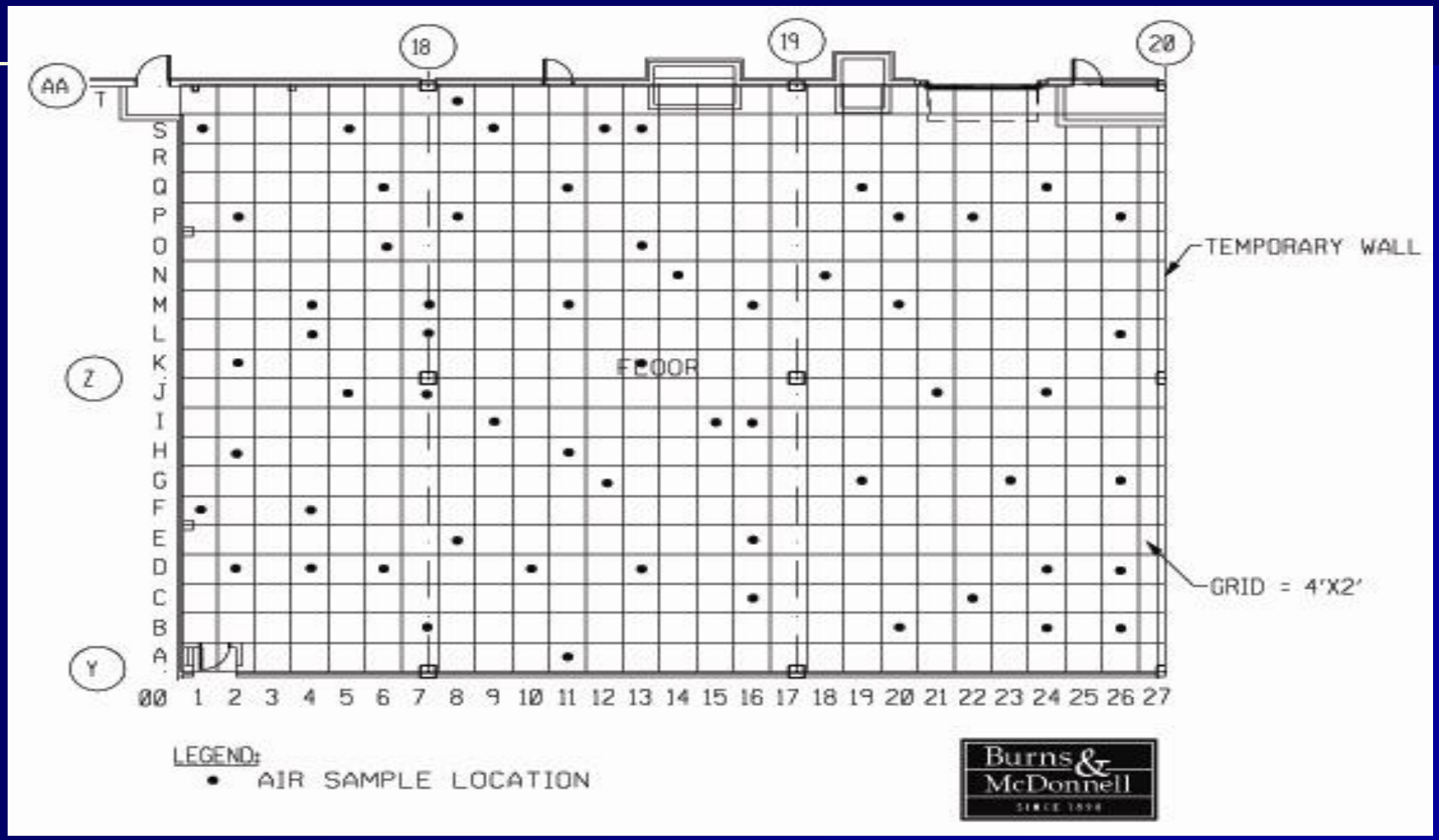
Sampling & Analysis Plan

- Reviewed by team,
- Project null hypothesis = 0.01 $\mu g/m^3$,
  TLV = 0.05 $\mu g/m^3$ Be in air (I),
- Demonstrate <5% will exceed 0.01$\mu g/m^3$
- Minimum sample volume 2 m^3.

Sampling Strategy

- Complete sampling in <24 hours,
- Use common IH sampling pumps,
- 59 area air samples needed to achieve statistical significance if all N.D.,
- Floor divided into 4′x4′ marked grids,
- Random sample location,
- Added 10% for potential errors,
- Added 10 samples for biased placement.

Sampler Positions, Random



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Sampling Strategy (Cont.)

- 1st Sampling Event: air results from 'as is' conditions of ND-0.85 µg/100cm2,
- Be-Cu particle of interest 10 µm AED, with 4.6 fpm V_t,
- Added 3 index metals in case ND for Be: Calcium, Copper, Iron,
- *A priori* disqualifications.

AAS Procedures

- Negative air reduced to limit 'scrubbing',
- Started pumps prior to fans/aggressive air
- 32 axial fans (30-in dia.),
- Hurricane-force air disturbance of all surfaces (two-five,1-hp leaf blowers)
- PPE: at least 1,000 APF,
- Sulfuric acid and hydrogen peroxide digestion,
- Be analysis by OSHA ID-125, ICP/MS, included cassette wipe.

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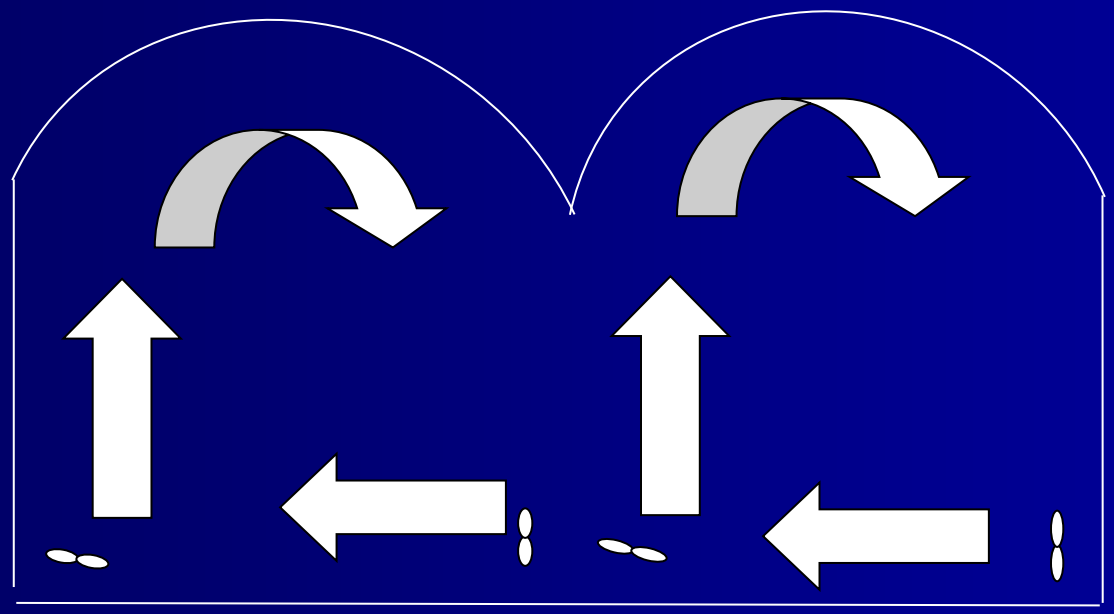
Fan Arrangement to Maintain Suspension During Sampling



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Inside containment – Aggressive Air Disturbance

Inside containment checking pumps

Challenges

- "As is' resulted in a veritable dust storm causing sample overloading issues,
- Round 2 air sampling went well (after 'pre-cleaning' of Round 1),
- Large number of samples and pumps.

Be Air Results

Round 1 (n=31); Round 2 (n=62)
Null = 0.01 µg/m³; TLV = 0.05 µg/m³

Agent	Mean (µg/m³)	SD (µg/m³)	CV	95% UC of 95%ile
Be (R1)	0.0088 (Log-normal)	0.0009	0.097	0.0107
Be (R2)	0.0013 (Normal)	0.0004	0.288	0.0020

Index Air Results

Round 1 (n=31); Round 2 (n=62)

TLV: Ca=NA; Cu=1,000ug/m3; Fe=NA

Agent	Mean ($\mu g/m^3$)	SD ($\mu g/m^3$)	CV
Ca (R1)	2033	181	0.089
Ca (R2)	297	52	0.176
Cu (R1)	14.1	1.62	0.114
Cu (R2)	2.5	0.54	0.213
Fe (R1)	748	94.7	0.127
Fe (R2)	30.3	0.216	144.8

Wipe Results

Pre-moistened Ghost Wipes™; ASTM D6966-2008

- Area (Biased)

Round 1:

<0.0071 (LOD) to 0.0800 μg/100 cm^2

Round 2:

<0.0071 (LOD) to 0.0089 μg/100 cm^2

- Equipment (Biased)

< 0.2 μg/cm^2 (DOE equip. release criterion)

Technical Aspects of AAS

- Used two types of pumps:
  - Medium-high flow
  - Medium-low flow
- Shipping/Receiving
- Calibration Equipment
- Calibration Methods

AA-001
AA-006
AA-055
AA-041
12-G
AA-043
AA-001

Sampling Pumps

SKC XR-5000

SKC Leland Legacy™

Technical Aspects:

- Strengths
  - XR5000 Performance
  - Grid system
  - 'Camera' tripod
  - Gross pump decon
  - Background samples
  - PAPR use
- Weaknesses
  - Particulate overloading
  - Heat Stress (PPE)
  - Noise
  - Congestion in containment
  - Sampling train air restriction

Technical Aspects:
Planning/Lessons Learned

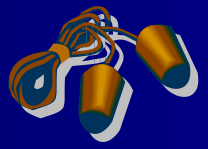
- Time consideration for sample return for equipment clearance
- Pump flow
- Fewer samples, statistical confidence
- Decon method
- Pre-cleaning/debris removal
- Training of support crew
- Noise considerations

IH Practice for AAS Demo

- Assured adequate protection for personnel stirring up dust
- Area Access Control
- Differences in potential exposure - ground crew vs. manlift crew
- Decon process
- Logistical challenges – crew coordination

Worker Protection

- Tyvac Coverall (inner & outer)
- Full Face Powered Air Purifying Respirator(PAPR)
- Equipped with HEPA filters
- Gloves
- Ear Plugs



Work Practices

- HEPA vacuums were used.
- 2 floor workers – 2 lift workers
- High-speed leaf blowers - disturb dust
- All surface above and below air swept
- Floor fans keep stirred
- Dust remaining suspended for sampling
- Personal air monitoring: for 1 floor and 1 lift worker

HURRICANE STRENGTH LEAF BLOWER

Worker Exit Procedure

Step 1: Enter Equipment Rm:

Doff Outer Suit/Gloves

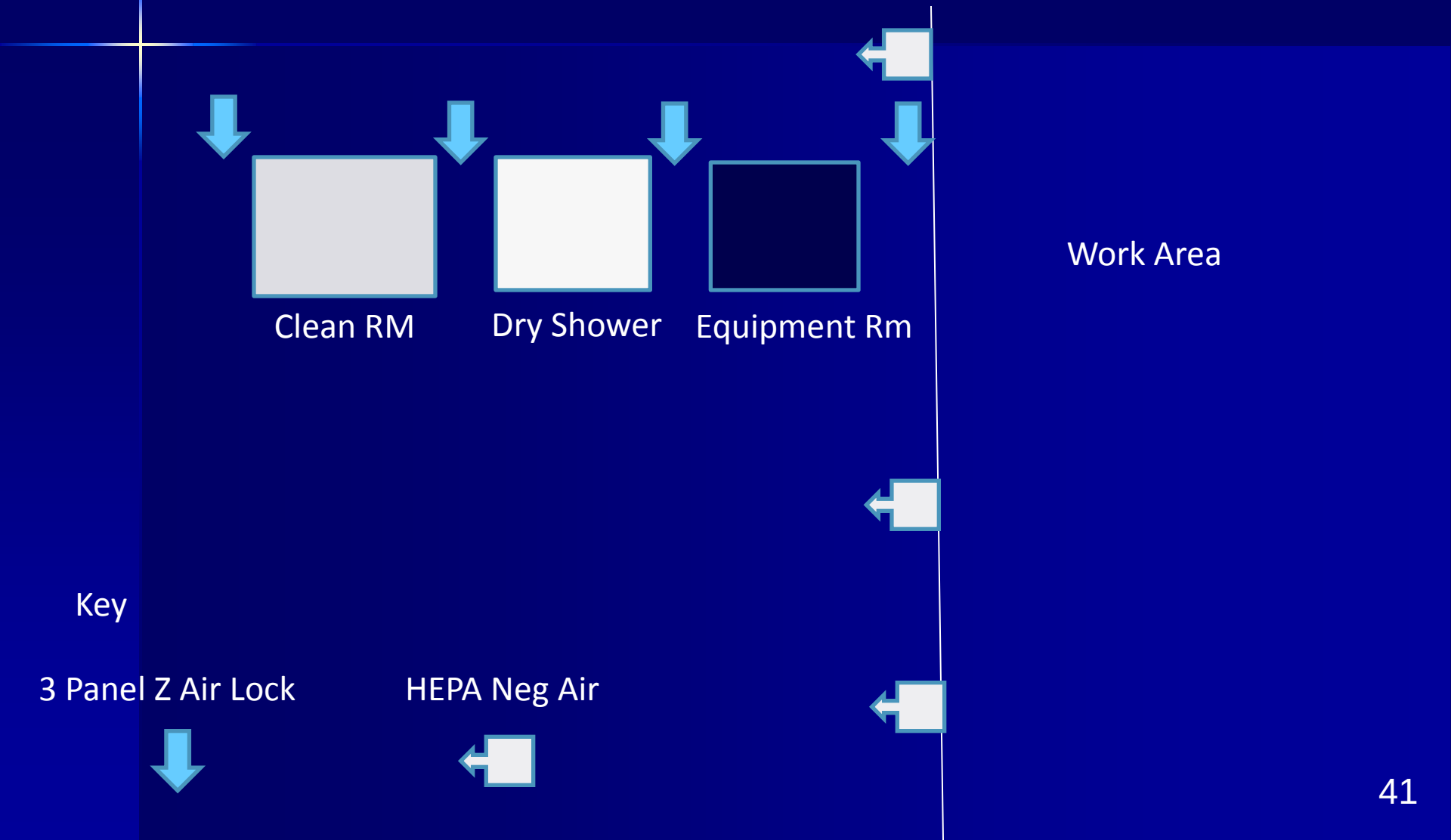
Step 2: Dry Decontamination Rm

Doff Inner Suit
Wet Wipe Hands
Remove Respirator
Seal Respirator HEPA Filters, Wet Wipe Respirator

Step 3: Clean Rm

Store Respirator
Exit / Sign Entrance Exit Log

Decontamination Chamber



Observed Differences BeAAS vs. Asbestos AAS

- BeAAS more aggressive in resuspension
- 1st sampling event dust storm – atypical for AsbAAS
- Cleaning effort for 2nd sampling event less aggressive
- Recommended improvements

KCP Experiences – Cleaning and Testing Areas

- 2 KCP characterizations 3.2 M ft^2
- HEPA/wet cleaning/pressure wash
- Biased methanol wipe sampling failed to verify cleanliness to debated limits
- KCP protocol random-bias sampling including surfaces > 8′

KCP considerations RE: Area Surface Cleanliness

- Wipe sampling results from widely varying surfaces not feasible for final cleanup and release
- Discussions with GSA – AAS may be more acceptable basis for release
- Xµg/100cm2 BeO dust ≠ Xµg/100cm2 CuBe in sticky matrix
- AAS inherently discriminates for principle health concern, i.e. resuspendability
- AAS is bias blind – gets "hot spots" and untouchable dust reservoirs
- AAS is directly comparable with TLV

AAS Drawbacks

- Not adequately proved-in for use as area release criterion (neither is wipe sampling)
- AAS Demo project was expensive – possible ways to make more affordable
- Susceptible to some of the same variables as wipe sampling:
  - Surface
  - Residue
- Remaining sticky residues could pose dermal exposure potential (would wipe sampling eliminate this uncertainty?)

Summary Comparison Wipe and AAS

	Wipe Sampling	**Aggressive Air Sampling**
Variables	Surface, Residue, Media, Human Factors	Surface, Residue
Bias sensitive	Yes	No
Drawbacks	Not proved, Expensive, Without solvent may leave sticky dermal exposure potential	Not proved, Expensive, may leave sticky dermal exposure potential
Compares with health-based standard	No	Yes

Apparent Choices for KCP Facilities Release

- 10 CFR 770 Transfer w/ disclosure and indemnification
- Clean in advance –or- provide $ allowance for buyer to clean?
- How to estimate cost of cleaning? AAS? Wipe? Encapsulate? Combo?
- What if buyer chooses to demolish?
- KCP move starts fall 2012; all out fall 2014.
- What method provides more convincing argument? Convince us? Convince buyer?