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NIOSH and AIHA Developments on Including Closed Face Cassette Wall Deposits

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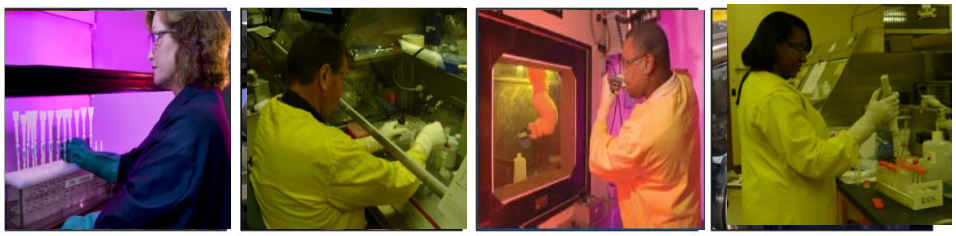

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Outline

- **History of the wall deposits issue**
- **Recent studies**
- **NIOSH, OSHA, ASTM, ISO methods**
- **Recent action by NIOSH**
- **Status within AIHA**
- **The possible dilemma for DOE**
- **Options for addressing the issue**

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History of the Wall Deposits Issue (up to ~1990)

- **Early days: Impingers and particle counting via microscope**
- **1940s: MCE filters on open faced cassettes**
  - No walls - filter catch considered to be “the sample”
- **Closed-face cassettes in use >50 years**
  - Developed by Millipore in 1956 for clean room sampling
  - Filter catch was still considered to be “the sample”

(www.opinionforum.com)

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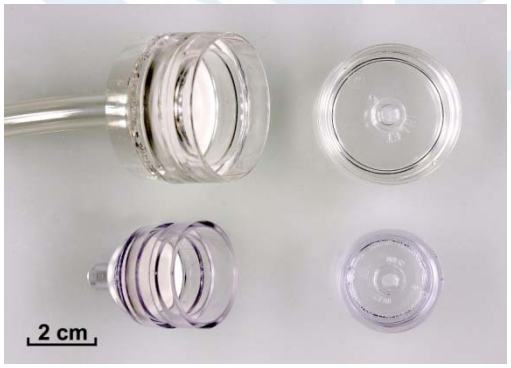
History of the Wall Deposits Issue – 1990s

- **Issue raised in early 1990s**
  - Demange et al., *Ann Occup Hyg,* **34**, 399 (1990)
  - Puskar et al., *Am Ind Hyg Assoc J*, **52**, 280 (1991)
  - Kenny et al., *Ann Occup Hyg*, **41**, 135 (1997): CFC filter catch under-represents larger particles
- **Development of particle-size sampling conventions (ISO 7708, mid-1990s) drew attention to sampling efficiencies of CFC and other samplers**
  - Particles above 20 μm not efficiently sampled by CFC
  - For inhalable sampling, median cut point is 10 μm



(From presentation by Brisson, Ashley, and Jahn, Pittcon 2006)

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More Recent Studies

- **Ashley et al., *J Anal At Spectrom,* 16, 1147 (2001)**
  - For Cd, Fe, Pb, Zn (n=10 each), showed 25% to 33% of particulate was on surfaces other than filter
- **Harper and Demange, *JOEH*, 4, D81-D86 (2007)**
  - Demonstrated that particulate deposits on interior CFC walls in a wide variety of settings
  - Pharmaceutical industry began including wall deposits ~20 years ago
- **Lee et al., *Aerosol Science and Technology*, 43, 1042-1050 (2009)**
  - For Pb-containing particles of 0.5-20 mm AED, no significant differences in size distribution between wall deposits and filter catch

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NIOSH Manual of Analytical Methods

- **Specific methods do not call for addressing CFC wall deposits**
  - Method 0500, Particles Not Otherwise Regulated
  - Substance-specific methods such as NIOSH 7300
- **However, NMAM Preamble (Chapter O, part 7) discusses it conceptually**
- **Since not in specific methods, it has been largely ignored at most DOE sites**

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OSHA Methods

- **Has included wall deposits in gravimetric sampling since its inception (1970)**
- **Began addressing wall deposits in other methods as early as 1976**
- **Found rinsing interior walls to be inadequate**
- **Found that single wiping was adequate**
- **LLNL has been following OSHA ID-125G, including wiping of interior walls, since at least 2006**
- **More info: Hendricks et al., *JOEH*, 6, 732-734 (2009)**

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ASTM International and ISO Methods

- **ASTM International D22.04, in 2008, began putting guidance on wall deposits into methods**
  - D7439 (ICP-MS)
  - D7035 (ICP-ES)
- **Parallel ISO methods also have this guidance**
  - ISO 30011 (ICP-MS)
  - ISO 15202-1 (ICP-ES)
- **Guidance is in non-mandatory appendices**

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NIOSH's January 2012 Recommendation

Web reference: cdc.gov/niosh/docs/2003-154/cassetteguidance.html

- **"NIOSH considers that all particles entering the sampler should be included as part of the sample whether they deposit on the filter or on the inside surfaces of the sampler."**
- **" … during sample preparation and analysis, procedures should be used to account for material adhering to the internal walls of sampling cassettes."**
- **Provides a list of affected methods and a list of methods that may be affected (pending further evaluation)**
  - *Includes 7300, 7301, 7303 for elements by ICP-ES*

(thephilipcenter.org)

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Status Within AIHA

- **NIOSH (Kevin Ashley) briefed Analytical Accreditation Board (AAB) on this recommendation in February**
- **AAB has requested a review by the Sampling and Laboratory Analysis Committee (SLAC) of the January 2012 document**
- **SLAC reviewed this issue in 2007 and made two recommendations, basically deferring to promulgators of standard methods:**
  - Modifications by method owners would be more valid than ad hoc adoption of extraction/wiping procedures by individual laboratories, or a general charge to all laboratories to adopt such procedures
  - Appropriate parties involved in any studies and method modifications would likely be the current method developers and owners

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Possible Outcomes from SLAC Review

- **Some possible outcomes from SLAC review:**
  - No action (let 2007 recommendations stand as they are)
  - SLAC may consider NIOSH recommendation to be equivalent to a method change that would be enforceable, perhaps *immediately*, in site assessments
  - SLAC may say Policy Manual revision is required to enforce accounting for wall deposits
  - SLAC may say that NIOSH needs to revise the ~30 individual methods
- **Could require action by DOE sites to remain in compliance with 10 CFR 851 requirements for accredited analyses**

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Current AIHA-LAP Policy Manual Guidance

Module 2A, General Management System Requirements

- **2A.5.4.1 "Standard methods, procedures, and modifications of standard methods and procedures may be acceptable if the laboratory has verified acceptable method performance …"**
- **Site assessors will look at method being used by the lab**
  - Example: NIOSH 7300 "as is" or "modified NIOSH 7300"
  - If "modified", performance data will be expected
- ***Reminder:* AIHA-LAP LLC is not the only available accrediting body, but is the one most used by DOE IH labs**

ilac-MRA

AIHA Laboratory Accreditation Programs, LLC

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Bottom Line Right Now

- **For labs following OSHA ID-125G, accounting for wall deposits is an enforceable requirement within AIHA-LAP LLC policy**
- **NIOSH recommendation, at this point, is exactly that (pending SLAC review)**
  - Could become enforceable if NIOSH revises the actual methods
- **Guidance in ASTM and ISO methods is non-mandatory and thus not enforceable from an AIHA standpoint**
  - Future editions of ASTM standards might move guidance to normative text

(sh3.com)

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Potential Dilemma for DOE

- **The whole idea is to ensure that sampling results accurately reflect what workers are exposed to**
  - Better exposure assessment – more conservatism – better worker protection
- **BUT:**
  - Costs would be higher (estimates vary; data not available)
  - Given tight budgets, higher per-sample costs could lead to fewer samples being collected, which could be *less* protective
- **AND:**
  - Off-site commercial labs have balked at dealing with wall deposits (due to cost) unless it is made mandatory
  - Field personnel could do it before sending sample to lab
    - Example: open cassette, wipe inner walls, put wipe and filter together in a new container to send to lab
    - But that would increase risk of error in the results

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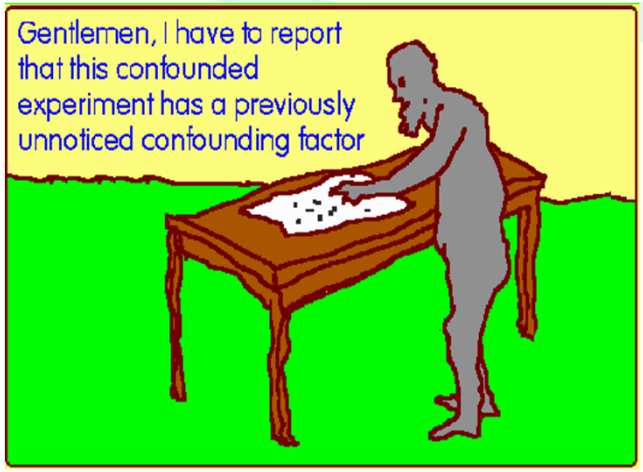
Lest We Forget … Confounding Factors

- **Push by ACGIH toward size-specific TLVs**
  - Beryllium in 2009 (inhalable)
- **10 CFR 851 is tied to the 2005 TLVs, not to changes made afterward**
- **Could cause the "right answer" to vary depending on contaminant(s) of interest**



(animatedsoftware.com)

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But Let Us Suppose …

- **That we have decided to account for wall deposits in at least some cases, either**
  - Because accrediting bodies like AIHA-LAP LLC adopt that as policy, or
  - Because “owners” of the standard methods make it a requirement, or
  - Because DOE makes it a requirement through regulation or policy
- **Let us now consider the options for doing so …**

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Accounting for Wall Deposits in CFCs – Options

- **Wet-wipe interior walls (OSHA)**
  - Would add to bulk material to be digested or extracted; possible analytical issues
- **Rinse interior walls into digestion vessel**
  - OSHA found this inadequate
- **Digest or extract sample within body of sampler**
  - Used in some French standard methods
  - Would avoid unnecessary sample handling by field or lab
- **Use a digestible insert**
- **Use a different sampler less affected by wall deposits**
  - IOM generally less affected by static that can attract particulate to walls
  - Costly and may not be appropriate for many contaminants

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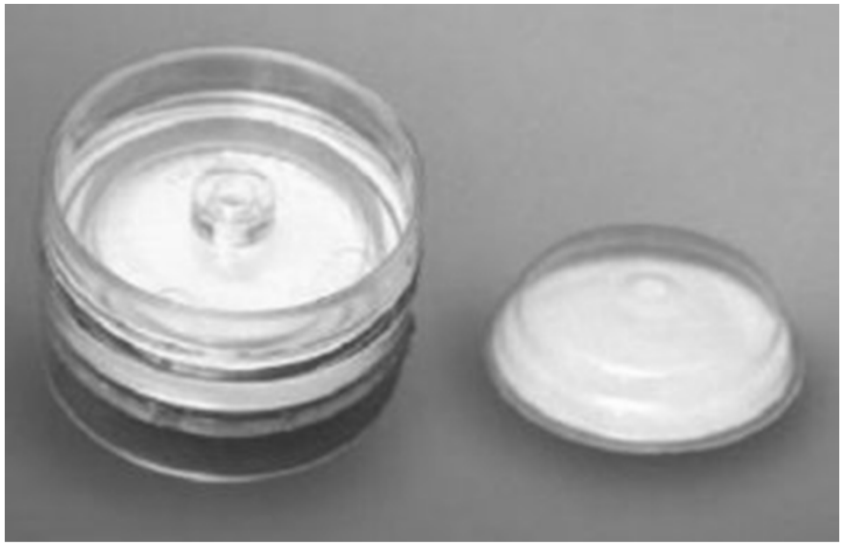
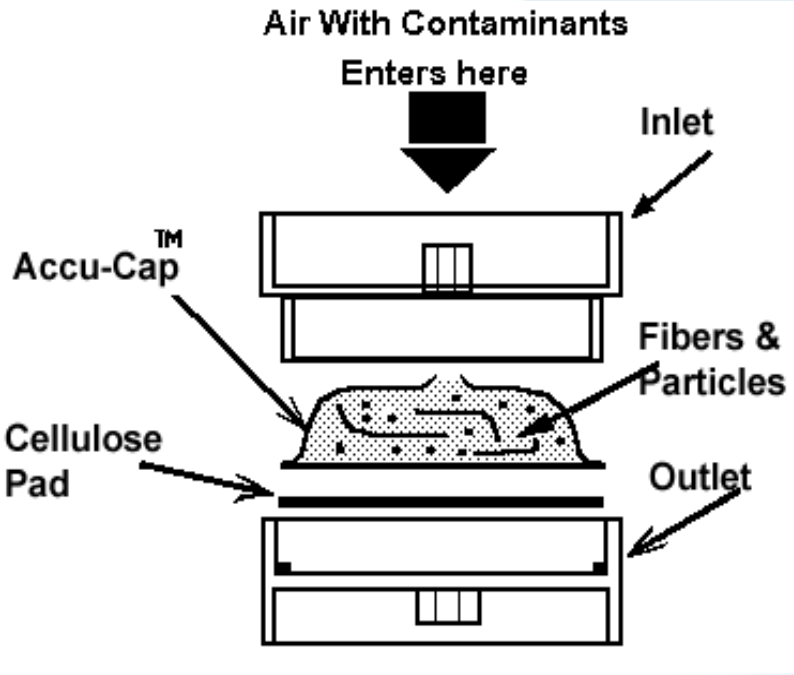
Accu-Caps™

Expected to be available by end of 2012.
Data from pilot study on next slide.



(Courtesy of SKC, Inc.)



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Accu-Caps™ – Interlaboratory Study

Sample matrix	$\bar{X}$, µg Pb	s_x	s_r	s_R	r	R	% Recovery (% RSD)
Lead acetate (low)*	18.2	0.99	1.83	1.83	5.13	5.13	101 (5.0)
Lead acetate (high)*	37.5	1.92	5.73	5.73	16.1	16.1	89.1 (4.7)
Soil (low)	21.6	2.41	1.62	2.75	4.52	7.70	97.7 (10.2)
Soil (high)	49.8	2.62	2.42	3.28	6.76	9.18	91.3 (4.8)
Paint (low)	22.2	0.46	1.67	1.67	4.67	4.67	104 (1.9)
Paint (high)*	49.2	1.31	2.17	2.21	6.08	6.19	95.0 (2.4)

M. Harper and K. Ashley, *JOEH* (in press)

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What About a Correction Factor?

- **Has been advocated by some within DOE, but not by anyone involved in research**
- **Many factors involved in how much deposits on walls versus filter catch**
- **Data below suggest this would be difficult, if not impossible**

Environment	N	Agent	Wall Deposit as % of filter	
			Median	Maximum
Smelter	18	Cu	21	55
Bronze Foundry	6	Cu	19	45
Cuproberyllium	4	Cu	31	40
Pb ore mill	9	Pb	19	35
Solder manufacture	30	Pb	29	74
Battery production	16	Pb	28	66
Bronze Foundry	6	Pb	13	17

(From Harper and Demange, 2007)

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Summary

A variety of decisions are needed:

- **Technical decisions by groups promulgating standard methods**
  - Consensus standards bodies (ASTM, ISO)
  - Governmental agencies (NIOSH, EPA – OSHA already has)
- **Policy decisions by accrediting bodies and/or DOE**
  - Consider proper balance between accurate exposure assessment/worker protection and technical/budget feasibility
- **Implementation decisions at DOE sites based on the technical and policy decisions above**
  - Could be “do nothing” if nothing is required
  - Could result in higher costs or fewer samples – assess which is the “lesser evil”

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THANK YOU!

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