

Dermal Sampling for Beryllium: Overview of the Issue and Related Standardization Activities in the U.S. and Europe

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Why Might Dermal Sampling Be Necessary?

- One typically doesn't need dermal sampling when:
 - Wearing a plastic suit
 - Skin is otherwise protected from exposure (e.g., by use of a glovebox)
 - Airborne beryllium can be sufficiently controlled by ventilation
- Otherwise, if there is airborne beryllium, some of it could get on the skin
- But if beryllium is mainly an inhalation risk, does dermal exposure really matter?
 - Studies indicate it is not an ingestion risk, but could it be absorbed through the skin?
 - And, if it can, is that a worry?



Studies Related to Dermal Exposures

- Dermatitis from skin exposure to soluble Be salts dates back to the 1940s, but is rare when poorly soluble Be forms are involved
- Kreiss et al. (2007): control of inhalation exposures alone not necessarily enough to prevent BeS among new workers
- Tinkle et al. (2003) showed that synthetic beads of $\leq 1 \mu\text{m}$ diameter could move from skin surface into the dermis
- Tinkle study also showed that when BeO particles were placed on surface of mice, subsequent dermal application of a Be salt resulted in immune reaction
- So, perhaps, a case could be made that there are instances when dermal sampling could be of some value ... BUT ...

(See Kreiss, Day, and Schuler, "Beryllium: A Modern Industrial Hazard", *Annu. Rev. Public Health*, 2007, 28:259-77, and references contained therein)



Reasons We Haven't Been Doing Dermal Sampling

- To the best of my knowledge, there is no clear link in humans between dermal exposure and BeS/CBD
- There is no regulatory driver
- Budgets are limited and sampling has to be focused on where the need/benefit is clear
- Sampling standards are lacking
- Analytically, the ability to differentiate between forms of Be is limited
 - It is easy to differentiate readily soluble (via leach test) from not-so-soluble
 - Among the less soluble forms, a clear way to differentiate has not yet been established except via XRD or other techniques that few labs have available
- If we were to find beryllium in a dermal sample, what would we do with that information?
- *More in Gary Whitney's presentation*



Dermal Sampling Methods

- **Removal Methods**
 - Wet wipe
 - Tape stripping
 - Hand wash/rinse
- **Interception Methods**
 - Patch sampling
 - Whole suit
 - Glove
- **In-Situ Methods**



(Photo by A. L. Sussell, NIOSH)

(This slide and next came from surface sampling PDC given in 2011)



DermaL Sampling Methods (as of 2011)

- Further described in ISO/TR 14294, “Workplace atmospheres – Measurement of dermal exposure – Principles and methods”
 - Key contributors to ISO/TR 14294 included Greg Day (then of NIOSH) and Derk Brouwer (TNL, The Netherlands)
- Wet wiping: cotton fabric wipes, smear tabs
- Patch sampling examples:
 - NIOSH 3600, Maneb (Patch)
 - NIOSH 9205, Captan and Thiophenate-Methyl on Dermal Patch
- Tape stripping
- Skin rinsate examples:
 - NIOSH 3601, Maneb (Hand wash)
 - NIOSH 9202, Captan and Thiophenate-Methyl in Handrinse
- In-Situ methods using clothing as collection medium
 - Video imaging, light probe, infrared spectroscopy
- Most of these methods have not been validated



Newest ASTM Standard

- ASTM D7822, Standard Practice for Dermal Wipe Sampling for the Subsequent Determination of Metals and Metalloids
- Developed by task group including Mike McCawley, Geoff Braybrooke, Mike Brisson, and others
- Draws from NIOSH 9105, Lead in Dust Wipes, which has a dermal sampling section
- Is being used by U.S. Army Public Health Command in a current study



Dermal Sampling for Nanoparticles

- **European Commission Mandate M/461 (Feb. 2010), Mandate Addressed to CEN, CENELEC, and ETSI for Standardization Activities Regarding Nanotechnologies and Nanomaterials**
 - CEN = Comité Européen de Normalisation or European Committee for Standardization
 - CENELEC = European Committee for Electrotechnical Standardization
 - ETSI = European Telecommunications Standards Institute
- **Included request for protocols for evaluating effects of dermal exposure to nanoparticles and nanoscale entities**
- **Research now being finished – led by Derk Brouwer, TNO**
- **Technical specification to be developed in 2015 as a joint ISO/CEN project**
 - Title: Workplace exposure – Guidance document for the assessment of dermal exposure to nano-objects and their agglomerates and aggregates
 - U.S. will have input through ISO working group led by Rosalie Tibaldi, Chair of AIHA Dermal Project Team (*our next roundtable speaker*)
- **Not specific to beryllium, but raises level of interest for dermal sampling in general, and presumably would include Be nanoparticles**



Questions?

You can ask now or wait until all three roundtable speakers are finished, as there will be a panel discussion afterward

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