INVESTIGATION OF DUST MIGRATION CAUSED FROM THE TRANSPORTATION OF SAMPLES

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INTRODUCTION

- Aerosols sampled from industrial facilities are often transported to a lab for gravimetric/chemical analyses after placing protective covers on the samplers. Most often, only the sampling media (filter or capsule) is tested for the analyte, but any aerosol content transferred to the cover of the sampler or the surface of the filter container is not accounted for.
- Therefore, the purpose of this study is to investigate the effect of wood/metal particle migration caused from the transportation of samples from the site of collection to the site of analyses with 4 commonly used commercial samplers.

Fig. 1. Commonly used Dust Samplers

METHODS – SAMPLE GENERATION

- Wood Dust: The 4 samplers shown in Fig. 1 sampled birch wood dust from a dust generating chamber at 2 LPM, where a sander equipped with a P120-grit sandpaper performed sanding of a wooden log. Polyvinylchloride (PVC) filters/capsules with 5 µm pore size were utilized for gravimetric analysis according to NIOSH 0500 and 0501 methods. Four mass levels of wood dust (0.5, 1, 2, and 3.5 mg) were collected.
- Welding Fumes: The 4 samplers in Fig.1 sampled metal analytes (Cu & Mn) from fumes generated by the welding action of a robotic arm in an enclosed welding chamber at 2 LPM. Mixed Cellulose Ester (MCE) membrane filters/capsules with 0.8 µm pore size were chosen as the filter medium for its utility in wet chemical analysis.

METHODS – LAND & AIR TRANSPORT/ANALYSIS

- The samples (128 wood dust and 117 welding fume) were divided evenly into 2 groups for Air and Land Transport.
  - Air Transport: The sample box was shipped to Florida, USA and returned by a priority overnight commercial airfreight.
  - Land Transport: The sample box was driven in a personal vehicle and travelled ~ 600 miles in mostly interstate paved roads with mild turns and easy gradients resulting in about 800 feet difference in elevation between the departure and destination.
- After transportation, all 128 wood dust samples were analyzed gravimetrically in an environmentally controlled weighing room (26 ± 2°C & 50 ± 2 %)
- Welding fumes samples were analyzed chemically via Inductively Coupled Plasma Mass Spectrometry according to a modified NIOSH 9102 method.

RESULTS I- METALS (CU & MN)

Sampler Type	Mn Land Samples			Mn Air Samples		
	A*	B (%)	C	A	B (%)	C
Solu-Sert	16	1.7	12	15	2.4	12
DIS	15	1.4	14	13	0	15
IOM	16	4.4	12	12	1.3	4
CFC	17	3.9	15	11	0.8	9
	Cu Land Samples			Cu Air Samples		
Solu-Sert	14	11.2	12	14	19.3	7
DIS	13	30.8	10	13	33.3	6
IOM	11	12.6	8	10	8.7	2
CFC	14	3.5	11	9	12	5

***A. Total # of Samples; B. Maximum % of dust deposited on sampler cover; C. # of samples w. no particle detected on sampler cover**

- The majority of samples (~80 % for Mn and ~62% for Cu) showed non-detectable amounts of metal components on the sampler covers
- For Mn particles, the maximum percent deposition among both modes of transportation was 4.4 % on IOM samplers
- For Cu particles, the maximum percent deposition was observed in DIS samplers, 30.8% for land and 33.3% for air transport.

RESULTS II- WOOD DUST

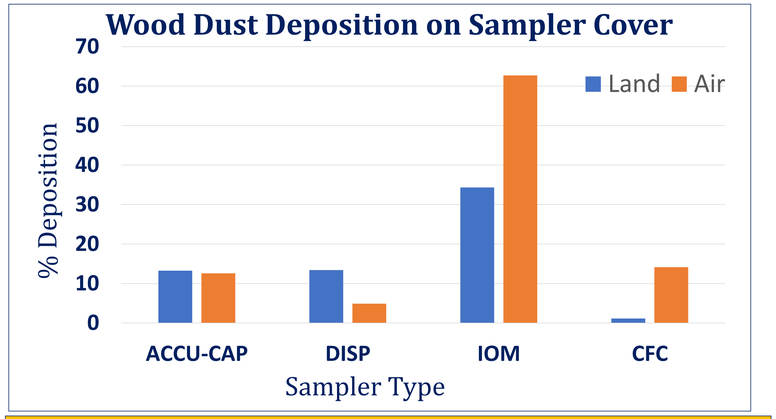

Fig. 2. Dust Deposition Comparison [Land vs. Air]

The median mass for the CFC, Accu-CAP, DIS and IOM was 0.7 mg, 0.6 mg, 1.5 mg, and 3.8 mg, respectively, for the land transported samples and 0.4 mg, 0.9 mg, 1.5 mg, and 1.0 mg, respectively for the air transported samples.

Comparing Transport: Significant differences were observed for IOM/CFC samplers in proportion of dust migrated to sampler covers; no significant differences observed for other samplers.

Comparing Samplers: IOM showed a considerably higher proportion of dust migration compared to the others, regardless of the mode of transport.

CONCLUSION

- Mode of transport affects particles migration within the sampler and the magnitude of the migration varies depending on the type of sampler used & the dust sampled.
- We strongly suggest that practitioners include the cover in the weighing analysis to prevent potential underestimation of hazard due to sample transportation.
- Other commonly used aerosols could be subject of further investigation.

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