Pesticide residues and staff protection:

a cooperative effort between medical professionals, industrial hygienists and museum staff

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Please Note:
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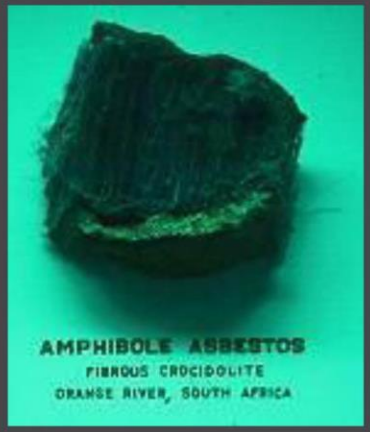
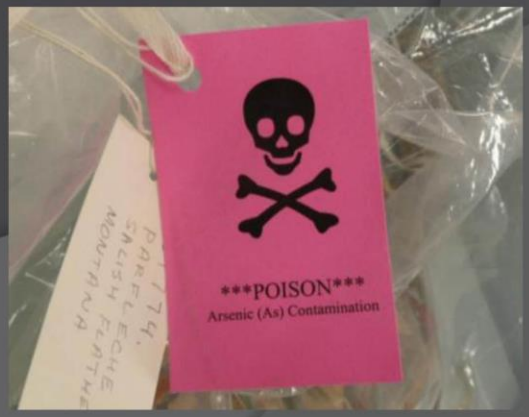
As was common practice in the 19th and 20th centuries, residual pesticides were applied to collections in efforts to protect the collections from, primarily, arthropod and rodent damage. A number of Field Museum conservators over the last 25 years contributed to a history of pesticide usage at the museum, particularly the Anthropology collections. Safety procedures were developed by the Museum collections and conservation staff and the Museum occupational health and safety officer, and relied heavily on procedures used in other institutions with similar collections. Tests and evaluations by conservators, industrial hygienists and medical professionals over the last 12 years have led to a better understanding of what pesticides are likely to be found, where pesticide hazards are likely to be found, what exposure levels have been detected in staff and facilities, and what improvements in staff procedures can further reduce risk. The program was a cooperative effort between medical professionals and museum staff, who provided information on pesticide history, collection handling and personal protection procedures, results of all prior testing, and access to observe staff work environment and procedures. Medical professionals developed and implemented the test programs, provided and interpreted results, and prepared recommendations on improvements in facilities and work practice. Communication during test development, implementation and sharing of results was critical to the effectiveness of the program and the comfort level of staff both during testing and in the results.

Health and Safety Hazards in collections work?

- Physical Hazards
- - Ex: noise, cold, tools, old buildings,
- construction, ladders, fieldwork, etc.
- Toxic Materials
- - Inherent: asbestos, toxic plants
- heavy metal pigments
- - Acquired: pesticides, preservatives





Wipe Sample Results for Lead, Arsenic, Mercury, and Organochlorine and Organophosphate pesticides screen, November 2001

Sample location	Pb µg/ft²	As µg/ft²	Hg µg/ft²	Organo-chlorine µg/100cm²	Organo-phosphate µg/100cm²
Room A1. ground level, floor	66.3	3.96	1.16	ND	ND
Room A1. ground level, shelf	78.8	2.96	6.2	-	-
Room A2. ground level, floor	99.7	12.2	2.29	ND	ND
Room C. ground level, floor west end	45.0	1.08	0.292	ND	ND
Room C. ground level, floor	75.3	3.83	0.476	ND	ND
Room C. ground level, shelf	92.9	2.24	-	-	-
Room C. mezzanine level, shelf	37.6	1.25	4.31	-	-
Room D. ground level, floor	21.6	1.22	2.38	ND	ND
Room D. ground level, shelf	41.3	9.06	8.53	-	-
Room D. mezzanine level, shelf	7.95	0.661	0.740	-	-
Room E. ground level, floor	75.3	3.83	0.476	ND	ND
Room E. ground level, shelf	41.2	2.47	-	-	-
Room E. mezzanine level, floor	108.0	7.52	-	-	-
Room E. mezzanine level, shelf	55.1	6.27	-	-	-

HUD Guidelines for Pb dust on horizontal surfaces is <40µg/ft²

Target levels for As on surfaces not established. Should not exceed background levels.

For Field Museum area this is 1.5-10µg/ft²

Target levels for Hg on surfaces not established. Typical guide is <90µg/ft²

The Ratterman Group (Certified Industrial Hygienists)

Air Sampling Results for Arsenic and Lead, November 2001

Sample	Location/Activity	Arsenic 8-hr TWA µg/m^3	Lead 8-hr TWA µg/m^3
1	Room A, vacuuming shelves, moving objects	<0.416	0.520
2	Room B, moving objects	<0.416	<0.520
3	Room C, object inventory, picking up objects	<0.416	<0.521
4	Room D, cleaning room, object inventory	<0.417	0.5251
5	Room E, object inventory	<0.417	<0.520

OSHA and ACGIH 8-hr TWA for arsenic is 10µg/m^3
OSHA and ACGIH 8-hr TWA for lead is 50µg/m^3

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Conclusions:

- Arsenic and Mercury detected but below accepted target levels.
- Lead exceeded acceptable levels on surfaces, but not from air inhalation.
- No organochlorines or -phosphates detected.

Recommendations:

- Respirators not required.
- Follow good hygiene, especially washing hands and no eating in work areas.
- Establish housekeeping procedures that include use of HEPA vacuuming storage areas.
- Employees working in contaminated areas must be informed and trained on the health hazards and PPE and procedures.

The Ratterman Group (Certified Industrial Hygienists)

Our procedures included:

Gloves
Lab coats
Hand washing
Food consumption only in designated areas
HEPA vacuuming only

Anthropology Orientation for everyone working in collections areas (discussion).
Written procedures for working in collection areas.
Written procedures for handling arsenic contaminated objects.
Written guidelines for objects containing toxic material.

Isolating storage containers and labeling of all objects that test positive for arsenic, lead, mercury.

Annual Deep Clean of storage and workrooms

Department of Transportation authorization exempting objects transported for loans from Hazardous Materials Regulations provided they are packed as specified.

Mercury Vapor Sampling, May 2004

Three sample types:

- 7 hour Time_Weighted Average (TWA), air pump filter placed in breathing zone
- 15 minute Short-Term Exposure Limit, air pump filter placed in breathing zone
- Wipes on floor and shelves, sample area 100 cm^2.

Conclusions:
All air sample results were <0.02 mg/m^3.
None exceeded OSHA Permissible Exposure Limit (PEL) for mercury vapor of 0.1 mg/m^3.
Wipes indicated minute presence of mercury on shelving and floor, 0.05-1.4 $\mu g/100cm^2$.

Recommendations:
Follow standard personal protection procedures.
Clean shelving and floors with HEPA vacuum cleaners.
Allow container or storage unit to vent for several minutes between opening and accessing objects.

The Ratterman Group (Certified Industrial Hygienists)
The Field Museum Health and Safety Officer

Tests were conducted in 2011 by the University of Illinois Chicago School of Public Health to evaluate the effectiveness of the procedures and personal protective equipment used in the Anthropology Department in protecting staff from arsenic exposure.

Staff urine arsenic levels were all found to be below threshold limits.

Wipe tests were done on surfaces that could be cross contaminated during normal work procedures – desk tops, object housing table tops, computer keyboards and mice, phones, door handles, elevator buttons, sinks, object carts, ID badges.
All arsenic readings were below acceptable threshold limits. The object carts were higher than other areas, and we implemented stricter procedures for vacuuming and wiping them down.

Urine Arsenic Biomonitoring results, February 2011

Volunteer	Arsenic, Organic	Arsenic, Inorganic	Arsenic, Methylated
A	43.4	0.0	23.1
B	6.7	0.0	8.4
C	0.0	0.0	0.0
D	0.0	0.0	0.0
E	13.7	0.0	0.0
F	6.3	0.0	0.0
G	6.6	0.0	0.0
H	13.0	5.5	11.7
I	15.7	0.0	12.9
J	12.5	0.0	6.3

want total Inorganic and Methylated arsenic to be <35µg

The University of Illinois Chicago, Department of Public Health

Arsenic Wipe Sampling Results, April 2011

	Sample location	[As] Day 1 µg/100cm^2	[As] Day 2 µg/100cm^2
1-2	Main lab workstation table top	ND	ND
3	Main lab storage cabinet handle	ND	ND
4-5	Adjacent lab door surface and handle	ND	ND
6	Office workstation table top	ND	ND
7-8	Adjacent lab door and lab door handle	ND	ND
9-12	Lunchroom table, sink, refrigerator door, microwave door	ND	ND
13-14, 27	Transport cart handle, sandbags	ND	ND
15-16	Storage room drawer handle	ND	ND
17, 33-36	Transport cart cover paper	ND	0.052-0.350
18	Exterior elevator buttons	ND	ND
19	Interior elevator buttons	ND	ND
20	Storage elevator phone	ND	ND
21-24, 26	Adjacent lab storage shelves, sandbags, computer station, sink	ND	ND
25	Adjacent lab work station	ND	0.070
28	Object base, object previously tested positive for As	ND	0.064
29	Object container, object previously tested positive for As	ND	0.078
30	ID badge and key lanyard	ND	ND
31	Main lab computer station	ND	ND
32, 37	Sampling blank	ND	ND

ND = not detectable, results below the method reporting limit of 0.050µg/100cm^2

The University of Illinois Chicago, Department of Public Health