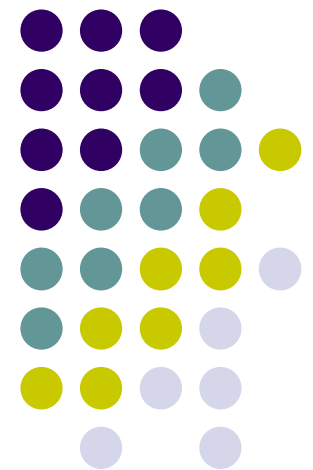


Biological Contamination Concerns at Solid Waste and Recycling Facilities





General Occupational Hazards

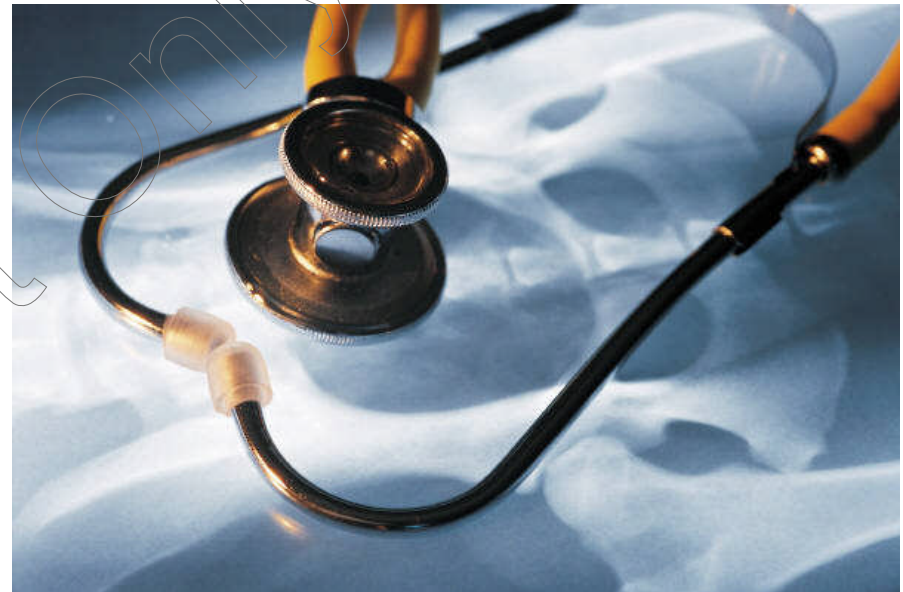
- Silica Dust Exposure
- Volatile Organic Chemicals
- Ergonomic
- Eye & Skin Irritants
- Noise
- Heat and Cold Stress
- Vehicular Hazards
- Landfill Gases
- Lacerations / Punctures



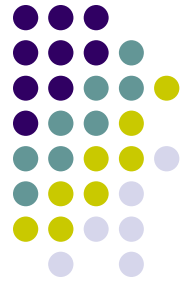
Health Problems Associated with General Hazards



- Pulmonary Disease
- Central Nervous System Dysfunction
- Mucous Membrane and Skin Disorders
- Musculoskeletal Disorders



Biological Hazards – Municipal Solid Waste



- Fungal
 - Mold spores
 - Mycotoxins
- Bacterial
 - Fecal coliform
 - Endotoxin
 - Thermophilic actinomycetes
- Organic Toxic Dust Syndrome (OTDS)

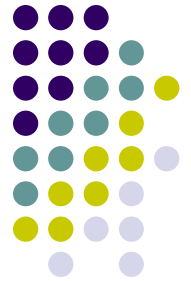


Biological Hazards – Recycled Waste



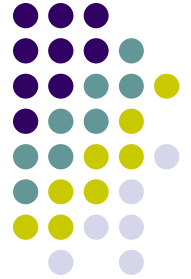
- Fungal
 - Mold spores
 - Mycotoxins
- Bacterial
 - Fecal coliform
 - Endotoxin
 - Thermophilic actinomycetes
- Organic Toxic Dust Syndrome (OTDS)

Microorganisms in Bulk Waste Samples



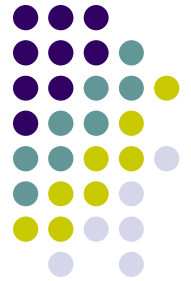
Type of Waste	Bacterial (cfu/g)		Fungi (cfu/g)	Reference
	Total	Gram-negative		
Domestic	10^8 to 10^9	10^8 to 10^9		Gaube et al. (1986)
Unsorted	10^7 to 10^8	10^4 fecal coliforms	10^4 <i>Aspergillus fumigatus</i>	Mansdorf et al. (1982)

Concentrations of Bioaerosols



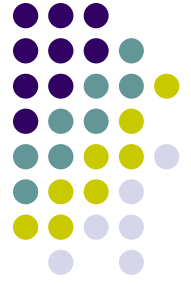
Plant	Task	Bacteria (cfu/M ³)				Fungi (cfu/M ³)
		Total	Gram-negative	Fecal strep	Thermophilic actinomycetes	
Transfer station	Conveyor	lod - 10 ⁶	lod - 2x10 ⁵	lod - 10 ⁴	lod - 10 ⁵	10 ² - 3x10 ⁶
Landfill	Bulldozer cab	9x10 ¹ - 9x10 ⁶	lod - 2x10 ⁴	lod - 10 ⁴	lod - 10 ⁵	10 ² - 3x10 ⁵
	Dump site	5x10 ¹ - 2x10 ⁴	lod - 6x10 ¹	lod - 4x10 ²	lod - 10 ²	5x10 ² - 6x10 ³

Bioaerosol Exposures for Paper Sorting



Task	Bacteria (cfu/M ³)		Fungi (cfu/M ³)	Endotoxin (ng/M ³)
	Total	Gram-negative		
Loader in tipping hall	2,000 to 80,000	3,000 to 20,000	5,000 to 9,000	0.1 to 1
Manual sorting	2,000 to 5,000	900 to 5,000	400 to 20,000	0.1 to 6
Maculation	600 to 3,000	Up to 2,000	Up to 3,000	0.6 to 1
Balers	3,000 to 10,000	Up to 5,000	1,000 to 10,000	0.1 to 3

Contamination on Hands and Clothing



- One study found bacterial contamination of:
 - Streptococci
 - Enterobacter
 - Coliforms
- While another study found no contamination on hands and clothing



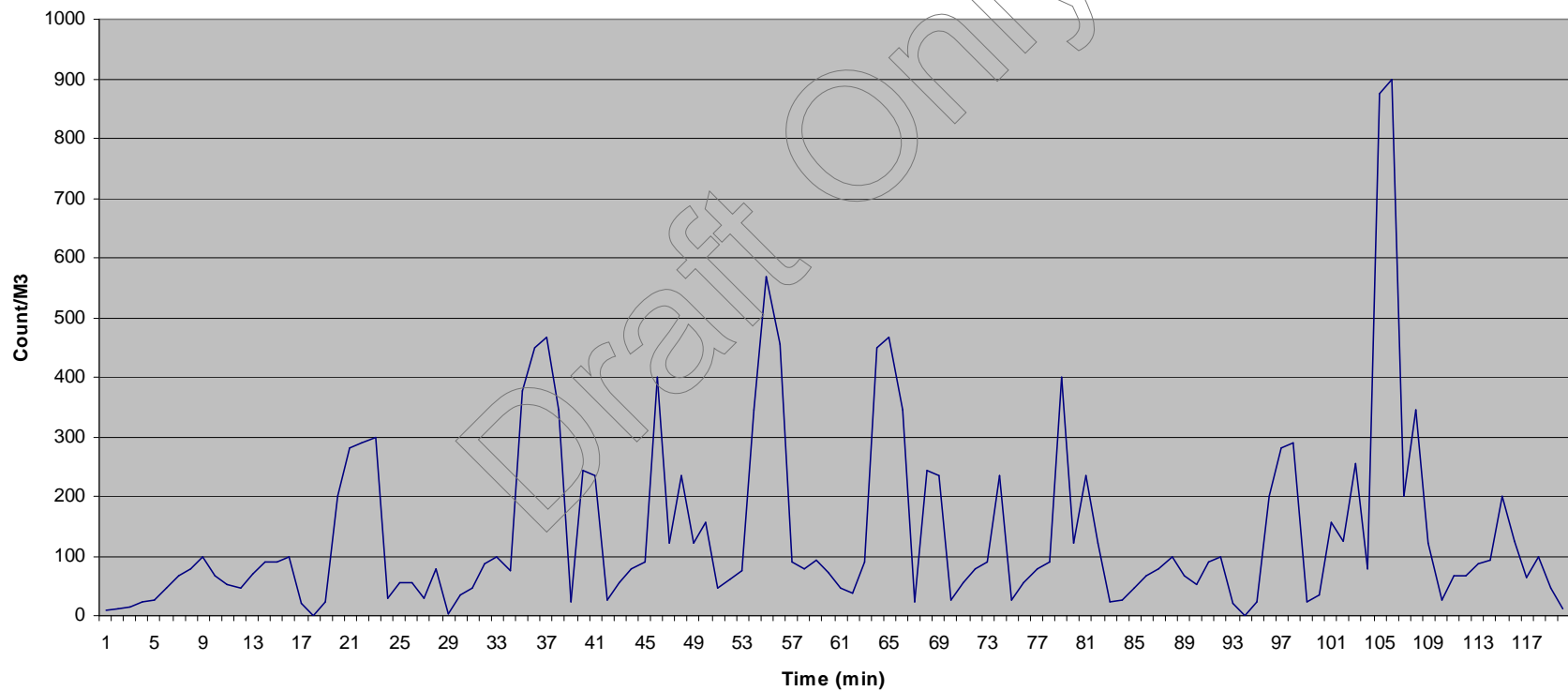
Measuring Exposure

- Because there are no exposure standards, the sampling strategy should be designed to answer very specific questions!
- Data interpretation should be considered when developing the sampling strategy.
- The sampling strategy and questions must be determined before samples are collected!

Measuring Exposure cont.



Fungal Spore Count Over Time



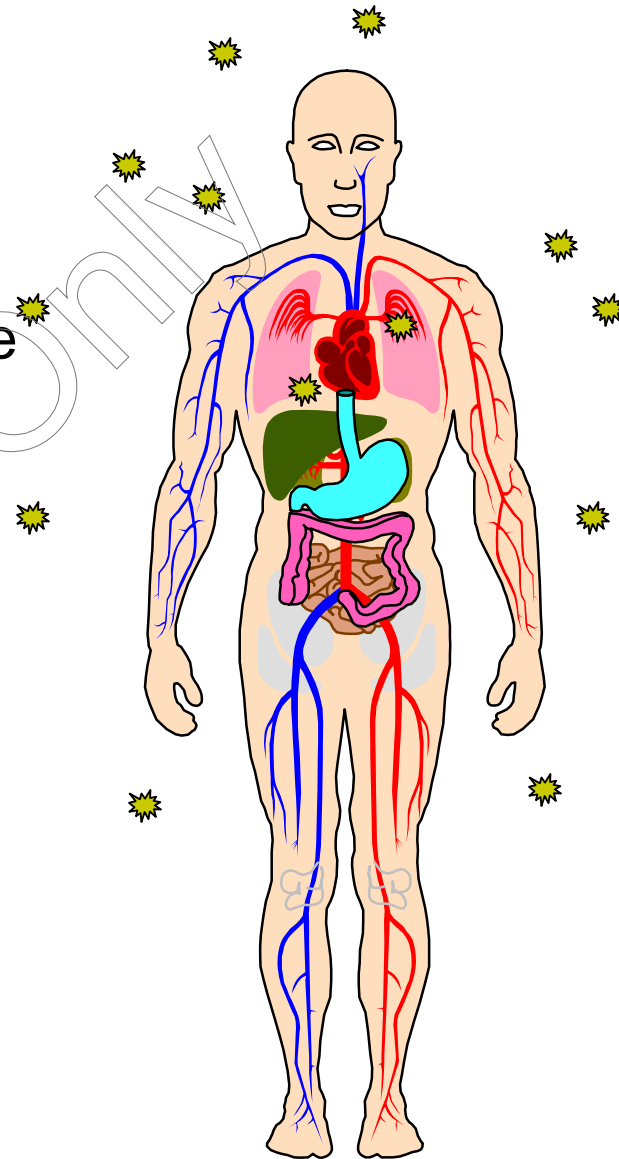


Measuring Exposure cont.

- Limitations
 - Costly.
 - Difficult to accurately determine representative exposure concentrations.
 - Bioaerosol source dissemination is influenced by disturbance of contaminated materials, air velocity, time of day, and humidity levels.
 - Bulk samples do not accurately reflect past, future or current bioaerosol exposures.

Health

- Health Effects and Biological Contaminants
 - Exposure is the amount of the contaminant in the air
 - Dose is the amount of contaminant (or its metabolite) at a target organ
 - Health effect is a measurable target organ dysfunction





Health Complaints

- Asthma
- Chronic bronchitis
- Hypersensitivity pneumonitis
- Cough and Sneezing
- Gastrointestinal problems
- Irritation of the eyes
- Irritation of the mucous membranes
- ODTS-like symptoms





Exposure Control

- Daily soil cover
- Station clean up
- Control biological degradation processes
 - Covered waste receptacles
- Air filtration on cabs
- Personal protective equipment
- Personal hygiene

