Planning for Environmental Concerns in Disaster Debris Management

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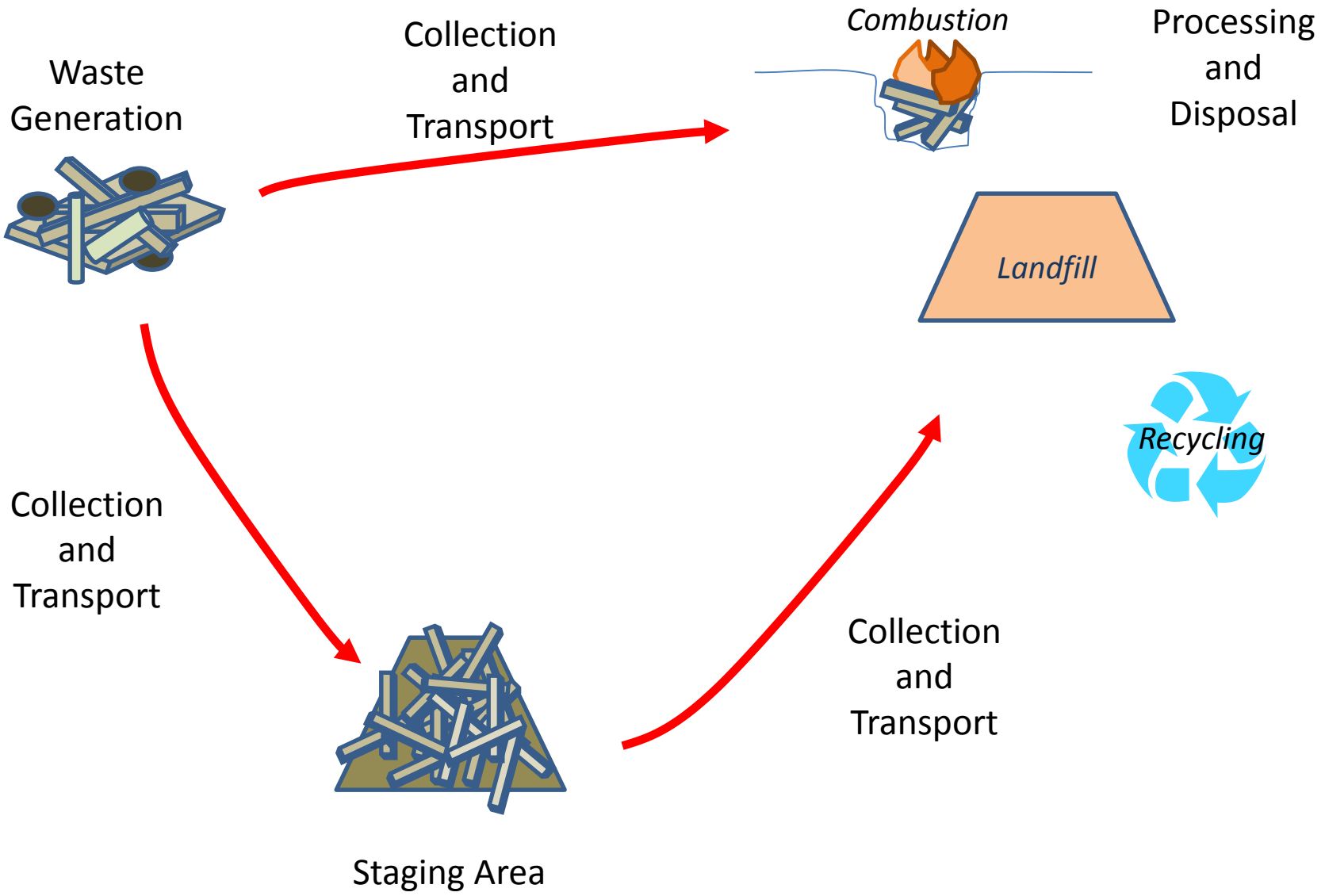
Topics

- Types of environmental concerns
- Problem waste streams
- Planning

Types of Concerns

- Risks at the collection point
- Staging and processing areas
- Disposal facilities
  - Impacts on groundwater and surface water
  - Gas emissions
  - Fires


Waste Generation
Collection and Transport
Combustion
Processing and Disposal
Landfill
Recycling
Collection and Transport
Collection and Transport
Staging Area

The Collection Point

- Where feasible, wastes are placed at the edge of the right-of-way for collection.
- In some cases where, the structures must first be demolished prior to removal.
- Issue with respect to waste management:
  - Chemical discharge associated with storage at the generation point
  - Human exposure to pollutants at the collection points
  - Mixing of wastes that impacts future disposal and recycling strategies

Staging Areas

- Wastes are often taken to staging areas prior to transport to final disposal.
- Waste processing (size reduction) may be performed.
- Issue with respect to waste management:
  - Discharge to the environment during processing and storage
  - Exposure to workers
  - Exposure to residents dropping off debris
  - Exposure of local residents to airborne pollutants
  - Fires from stockpiled materials

Disposal Areas

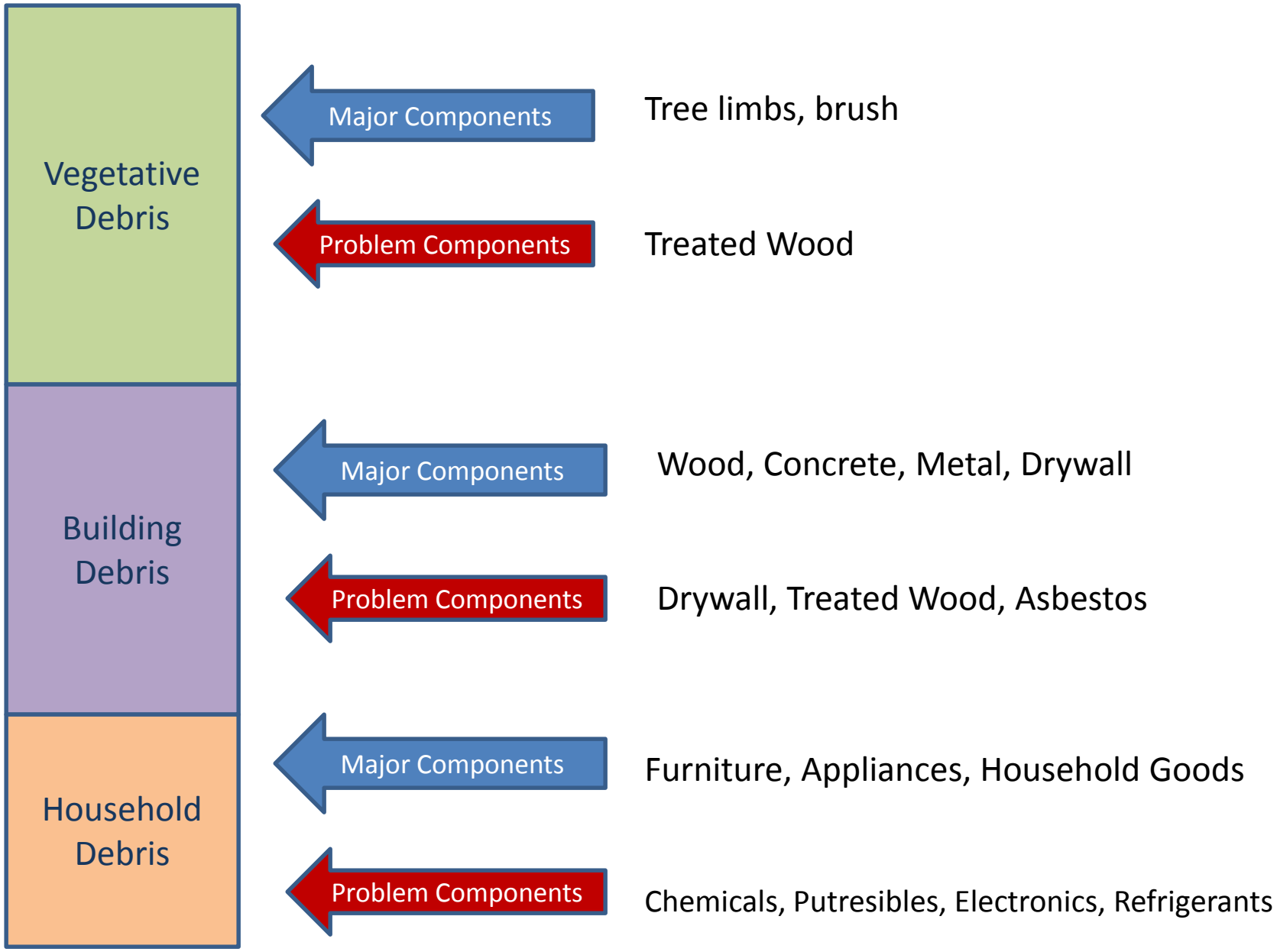
- Disposal is typically through grinding (with subsequent reuse or land application), combustion, and landfilling.
- Processing often takes place at the disposal site.
- Issue with respect to waste management:
  - Water and gas emissions from the landfill to the environment.
  - Exposure to workers.
  - Exposure of local residents to airborne pollutants during processing.
  - Fires.

Components of Disaster Debris

- Building debris
- Household debris
- Vegetative debris
- Problem waste streams

This will be the focus of the presentation



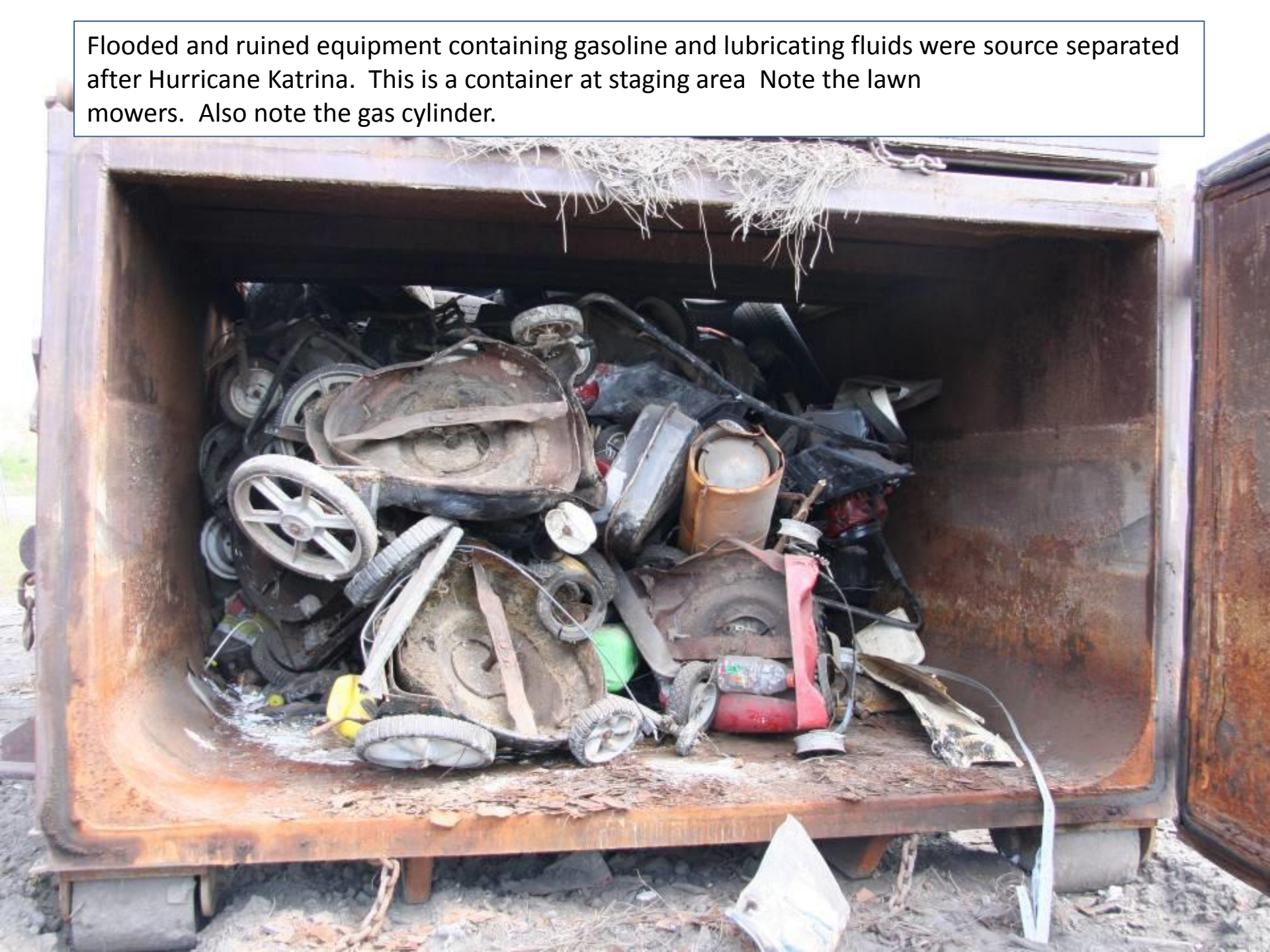

Vegetative Debris
Major Components
Tree limbs, brush
Problem Components
Treated Wood
Building Debris
Major Components
Wood, Concrete, Metal, Drywall
Problem Components
Drywall, Treated Wood, Asbestos
Household Debris
Major Components
Furniture, Appliances, Household Goods
Problem Components
Chemicals, Putresibles, Electronics, Refrigerants

Household Hazardous Waste

- Paints
- Chemicals
- Fuels
- Pesticides

This bag contains a gasoline container. The container was bagged and placed on the curb for pickup by a separate hazardous waste collector.

Flooded and ruined equipment containing gasoline and lubricating fluids were source separated after Hurricane Katrina. This is a container at staging area Note the lawn mowers. Also note the gas cylinder.



This photo shows a plastic lined roll-off box at a hurricane debris disposal site. Items such as propane tanks, lawn mowers and fuel containers were placed in here.

Appliances

- Refrigerators
  - Concerns of CFCs
  - Putrescible wastes

Appliances are discarded like other household products when damaged. They are also disposed after extended power outages because of the rotting food wastes. They are simply taped up and placed on the right-of-way.


Refrigerator damaged
after flooding

A commercial refrigeration unit after that suffered a prolonged power outage.

Contents of commercial refrigeration unit

Refrigerators at disposal and staging areas are removed where possible. Refrigerants should be removed prior to disposal

Unloading refrigerators at New Orleans refrigerator management site after hurricane Katrina.

Example of food waste in discarded freezer unit

Removing refrigerants from the discarded appliances.

The spoiled food waste taken to a lined MSW landfill.

The appliances were then rinsed with a disinfectant solution prior to baling and recycling.

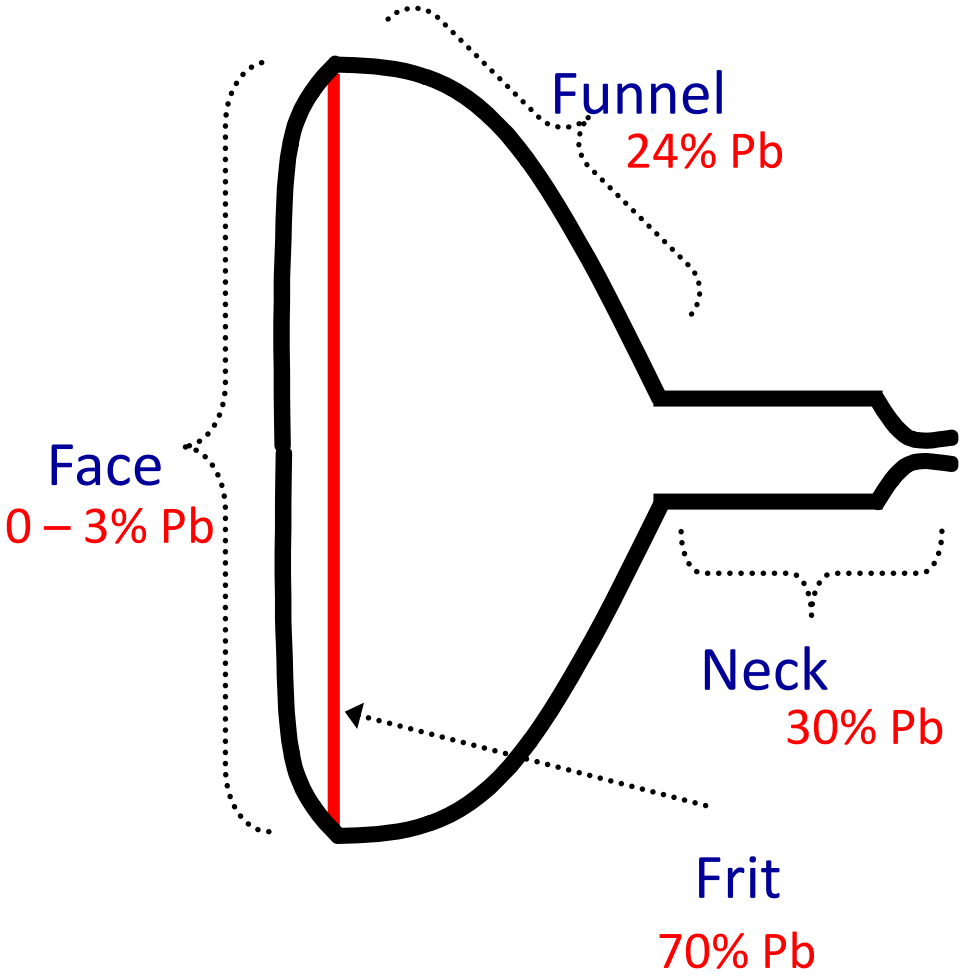
Removing spoiled food from the discarded appliances.

Electronic Waste

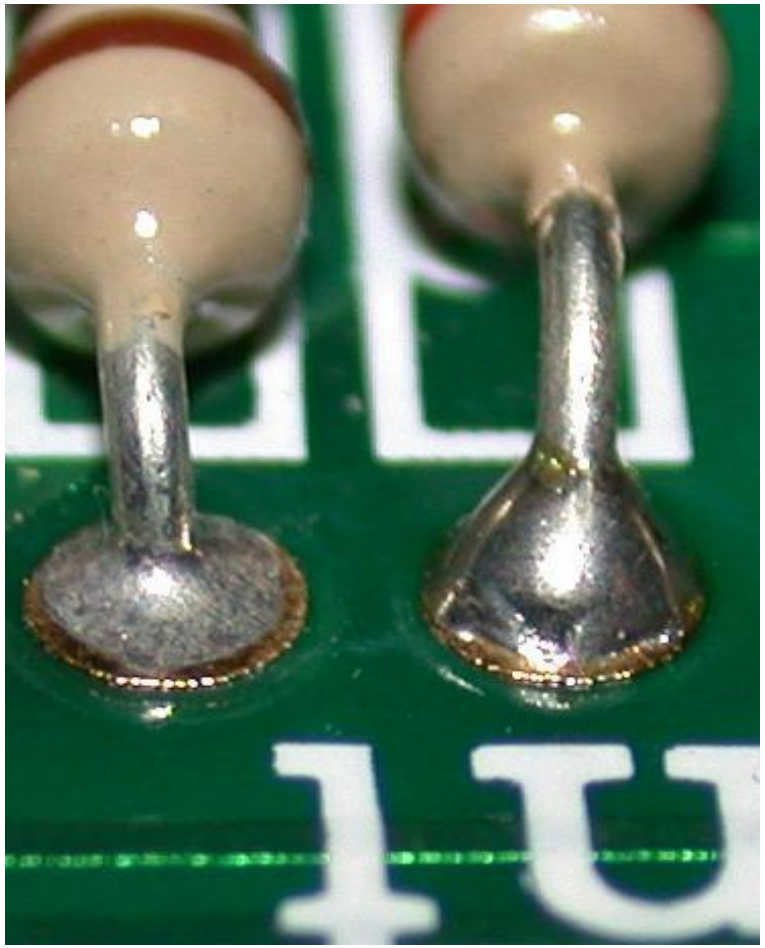
- Electronic devices contain a variety of potentially toxic elements
  - Metals (lead, mercury, cadmium,…)
  - Organic chemicals (PCBs, brominated flame retardants)
- Many devices meet the definition of hazardous waste
  - Color CRTS are recognized as hazardous wastes by the US EPA
  - Other devices which contain printed wire boards also frequently meet the criteria for hazardous waste

Lead is Primary Concern from Regulatory Perspective (TC Limit for Lead = 5 mg/L)

Cathode Ray Tube

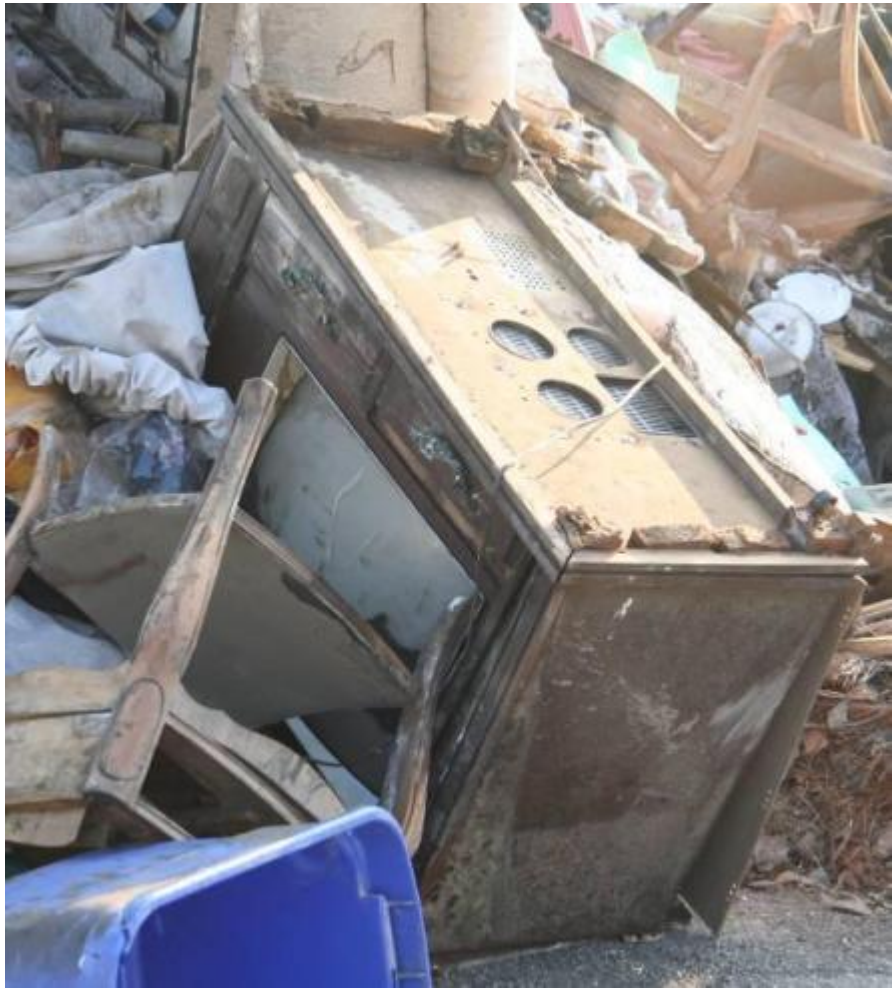


Printed Wiring Boards



Managing Discarded Electronics

- Historically, these devices were handled in the same manner as furniture and other household items
- Waste managers today must consider regulatory implications and environmental concerns



Flood debris in New Orleans.
Note the television.

Electronic devices placed on the right-of-way after a flooding event. They will be collected separate from the rest building debris and household waste.

A personal computer in a scrap metal pile at a disaster debris landfill.

Appliances and electronic devices, along with other household wastes placed on the right-of-way after severe flood damage.

Appliances and electronic devices, along with other household wastes placed on the right-of-way after severe flood damage.

Treated Wood

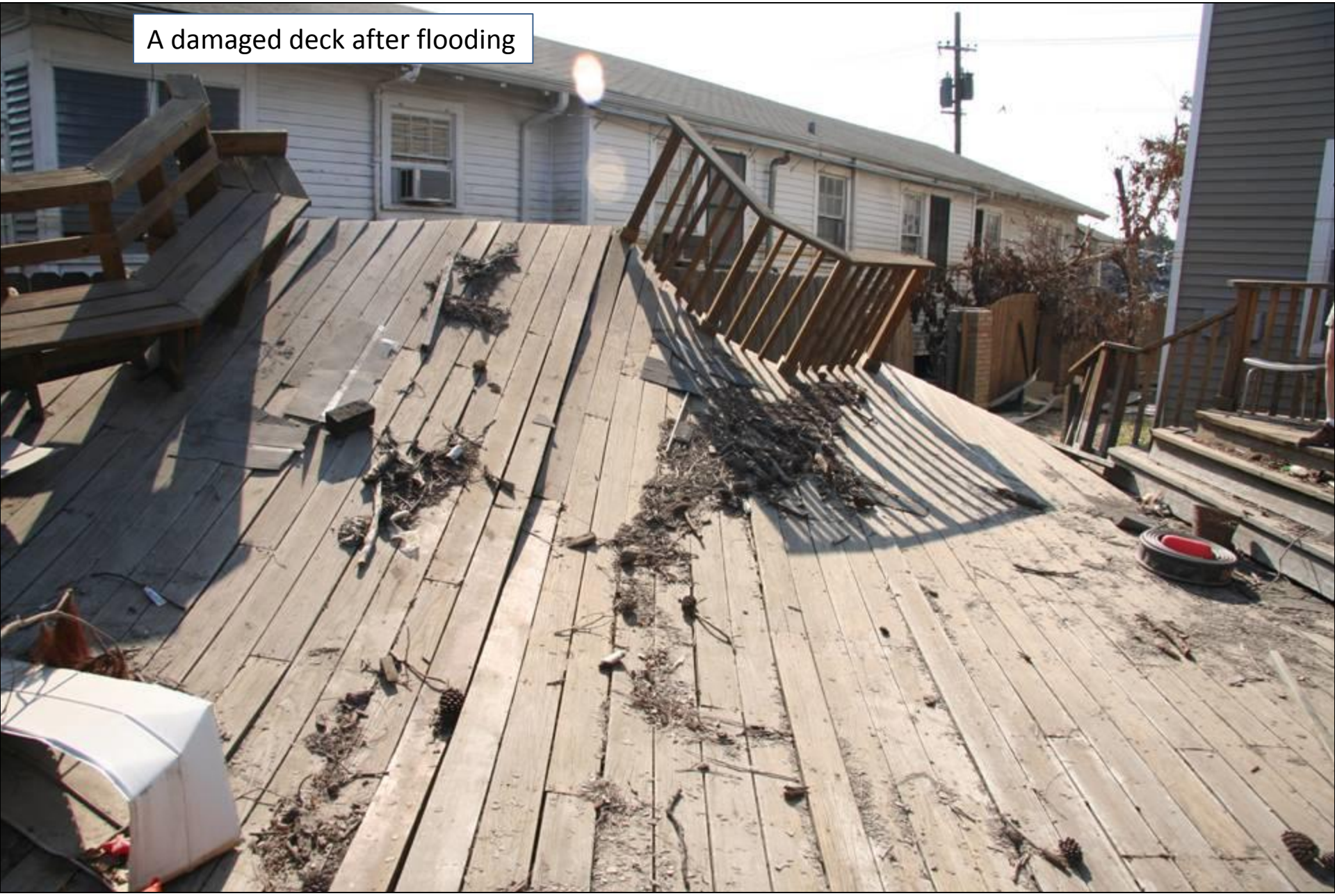
- Pentachlorophenol
  - Telephone poles
- Cresote
  - Railroad ties, telephone poles
- Chromated copper arsenate (CCA)
  - Decks, docks, fences
  - Phased out from residential use
- Copper-based preservatives
  - Decks, docks, fences
  - Phased out from residential use

CCA-treated wood placed on the right-of-way after hurricane Wilma

Treated Wood: Why the Concern?

- Creosote, PCP and Copper-based wood products are not expected to fail TCLP. CCA treated products are exempted from hazardous waste characterization.
- Since it is common to mulch woody wastes, it is possible that these materials would get mulched along with tree debris. The mulch created would pose a possible health risk if in sufficient quantities.
- Burning treated wood, especially CCA-treated wood, can result in toxic emissions.
- Disposal of CCA treated wood in an unlined landfill could result in future environmental contamination.


Treated wood decking after a storm surge


A damaged deck after flooding


A damaged treated wood fence after a storm.

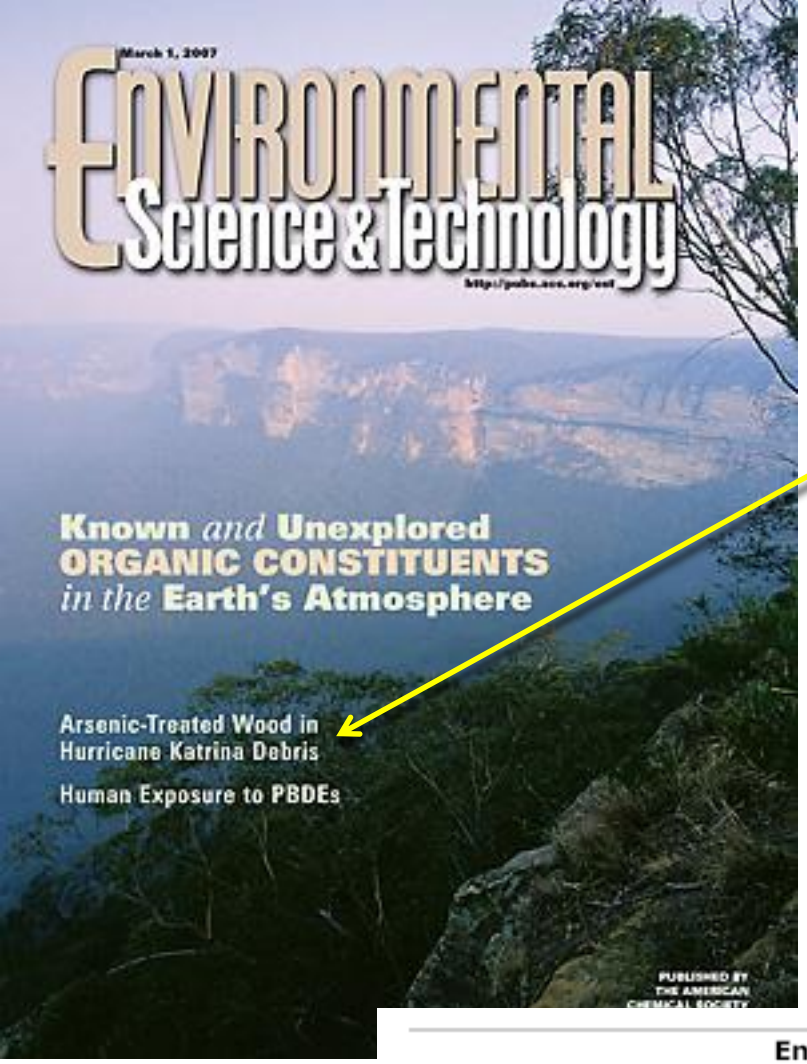
Many utility poles become damaged during high wind events. Note the leaning poles in this photo.

Utility pole cut-off waste


The remnants of a treated wood boardwalk.


The remnants of a treated wood boardwalk.

Treated wood among the debris scattered on the shore after a hurricane.



Research

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Quantities of Arsenic-Treated Wood in Demolition Debris Generated by Hurricane Katrina

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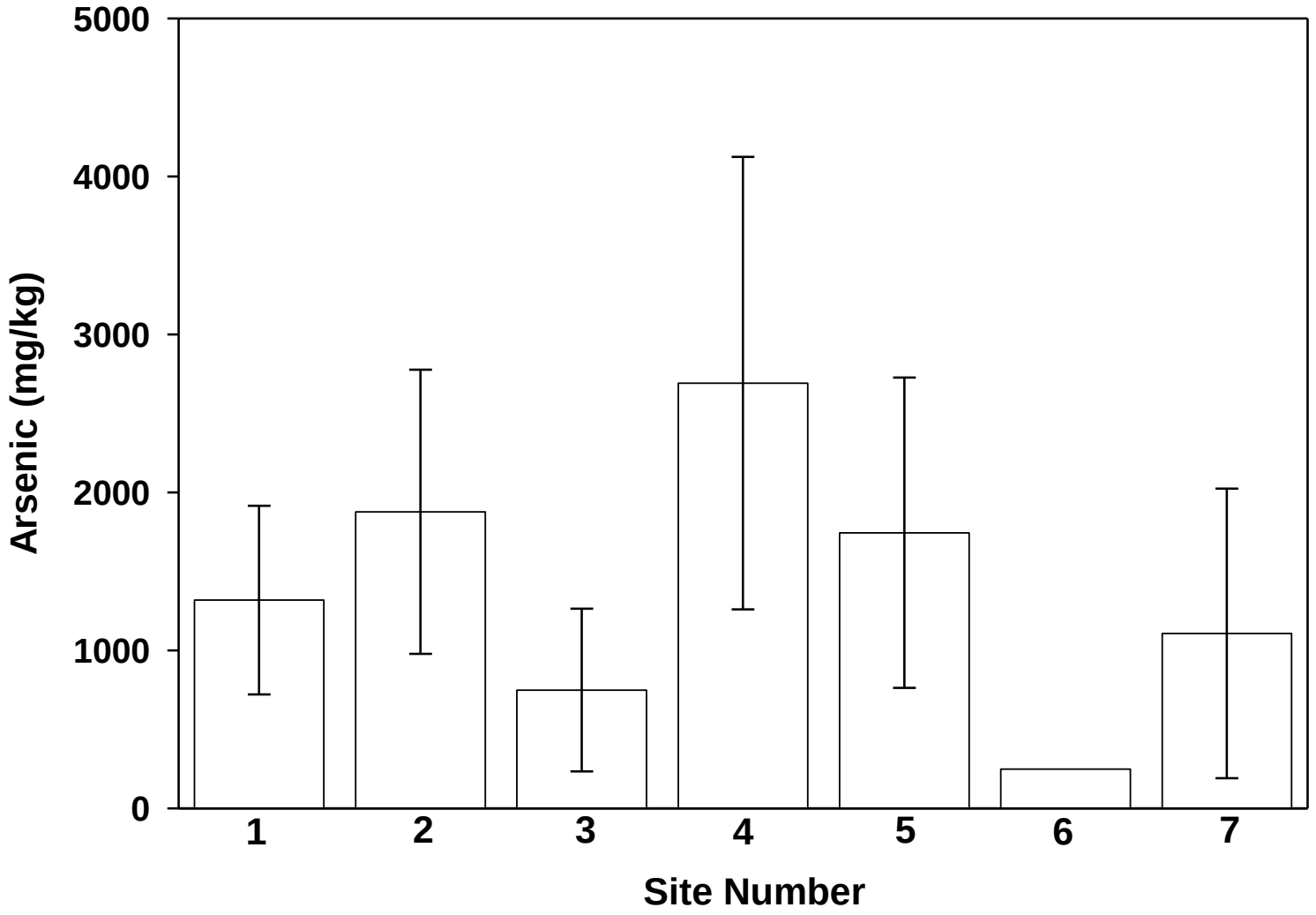
Environmental Science & Technology Online News
http://pubs.acs.org/subscribe/journals/esthag-w/2007/jan/science/ee_katrina.html

Science News –January 24, 2007

Arsenic in Hurricane Katrina wood debris

Treated lumber from houses and other structures destroyed by the hurricane poses a hazardous waste disposal problem.



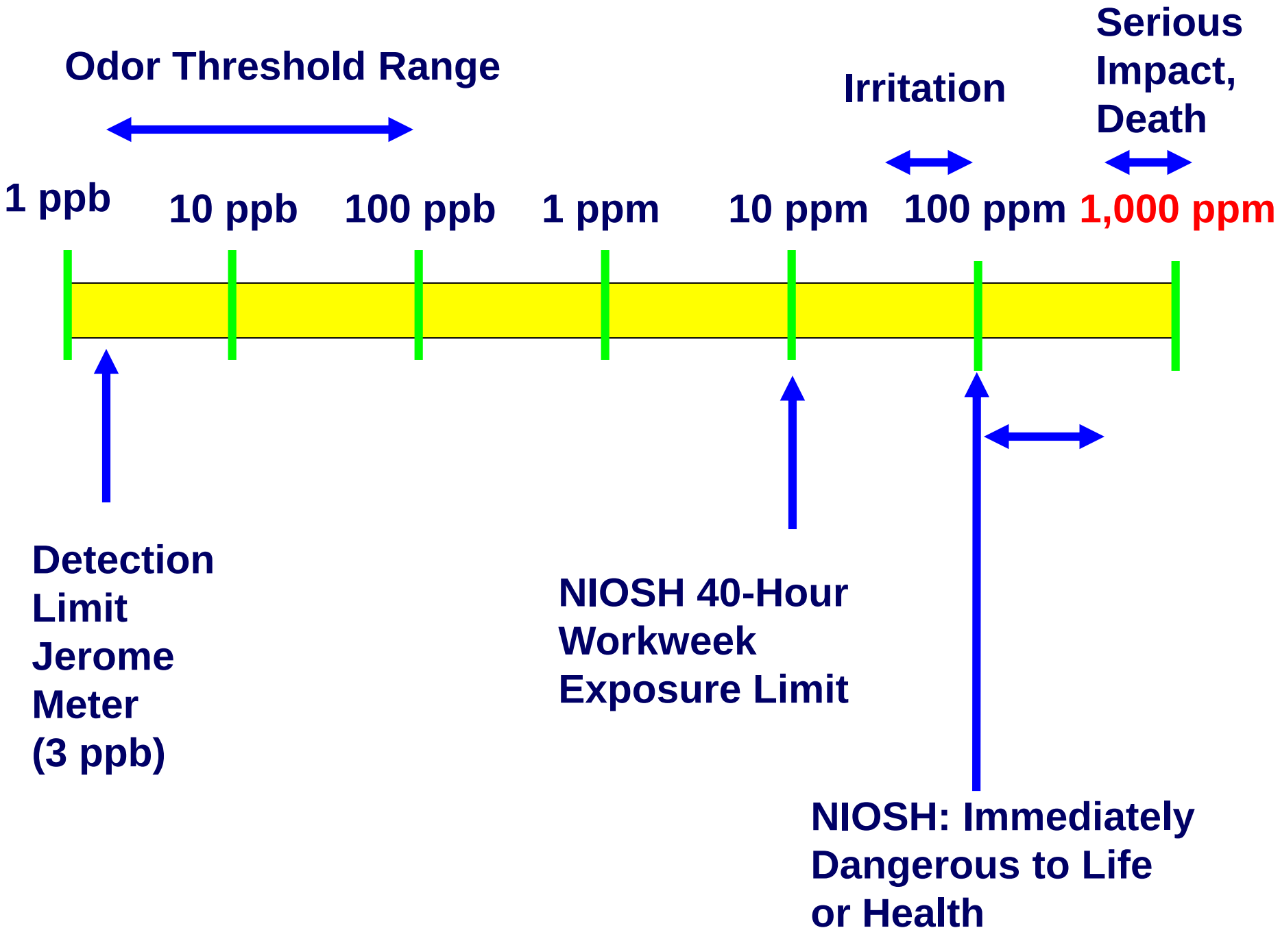
Average As concentrations from the samples tested as CCA at seven sites (Total As estimated as 1740 metric ton from debris generated in Louisiana and Mississippi)

Gypsum Drywall

- Gypsum → sulfate → hydrogen sulfide
- When gypsum is disposed in landfills, the biologically reducing conditions can result in the production of hydrogen sulfide.
- Disaster debris may contain a large than normal amount of drywall because of drywall removal activities.

H_2S Generation at C&D Landfills

- The rate at which hydrogen sulfide is generated depends on
  - moisture
  - organic matter
  - dissolved oxygen
  - pH
  - temperature


Odor Threshold Range
Irritation
Serious Impact, Death
1 ppb
10 ppb
100 ppb
1 ppm
10 ppm
100 ppm
1,000 ppm
Detection Limit Jerome Meter (3 ppb)
NIOSH 40-Hour Workweek Exposure Limit
NIOSH: Immediately Dangerous to Life or Health

Disaster debris is piled on the right-of-way for pickup. This photo is building materials supply business. New sheets of gypsum drywall were damaged as a result of the storm.


Debris piled on right-of-way
Wendy's

Drywall is one of the components that must be removed from flood damaged buildings, even if the structure is salvaged. Thus some disaster debris sites will have a larger than normal (compared to most building debris) amount of drywall. The fact that it is wet only adds to possible future H_2S generation.


In flooded houses that can be salvaged, drywall must be removed.
HOUSE CLEAN-UP
&
DRYWALL
REMOVAL
(504) 554-0681


Drywall and carpet removed
from flood damaged house

Inside of building after drywall has been removed

Asbestos

- Rules for asbestos management during demolition are well documented.
- Buildings that required demolition often are not in suitable shape to undergo asbestos inspection or abatement.
- Largest risk is presented if materials were to be ground and become airborne.

Management Strategies

- Decide waste separation plan from the beginning.
- Identify appropriate disposal/recycling outlets for each type of material from the beginning.
- Develop guidelines for separation, packaging, transport and disposition.
- Factor recycling potential where possible.

Strategies for Collection

- Identify targets for separate collection
- Typical:
  - Tree debris
  - Building debris
  - Household debris
  - Hazardous chemicals
  - Appliances
- Other possibilities:
  - Electronics (practiced after Katrina)
  - Drywall ??
  - Treated wood ??

Fires

- Fires have been documented in stockpiles and landfills of woody debris following storm cleanup.
- These fires inevitably result from too large of a debris pile building up too quickly without adequate cover on the side slopes.
- When wind enters the file, it fuels aerobic microbial activity, which in turn leads to temperature increases and chemical reactions, which finally lead to spontaneous combustion.
- Plans for avoiding these situations should be developed as part of debris management plans.

Environmental and Health Concerns

- For waste processing (grinding), avoid processing materials with possible airborne health impacts (asbestos, treated wood).
- Better up-front segregation of problem components will reduce limitation of future processing.

Environmental and Health Concerns

- If woody debris is to be mulched for future land application use or use a boiler fuel, the presence of treated wood should be minimized.

Environmental and Health Concerns

- When woody debris is combusted using air curtain incinerators, treated wood should be segregated out.

Arsenic in CCA-treated wood will volatilize and can lead to severe heath problems if a human is exposed. The arsenic and chromium in the ash will also be present at possibly risk concentrations.

Environmental and Health Concerns

- Choices should be made ahead of time regarding the type of landfill that wastes should be disposed in.
- CCA-treated wood might be better off in a lined landfill.
- Large amounts of drywall can cause future odor problems and possible health issues. Appropriate disposal facilities should be selected.

Summary and Conclusions

- Historic practice in dealing with disaster debris has been to manage most of the waste components together, often by burning or in unlined landfills.
- Emerging science suggests that some components of the waste stream might be better off is managed in a different fashion.
- Plans must be developed up front for managing these types of materials.

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