Waste management and health

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Environment
Work environment

Solid waste handling in developing countries
Routes of exposures in nearby residents

"Nearby"
Approximately 1 km (air) and 2 km (water)

Routes of exposure for the general population:
- Contaminated municipal water
- Contaminated agricultural products
"Toxic effects" – but also....

- Air pollution due to transportation of waste
- Hazards due to transportation of waste
- Noise, odours....
- Other industrial activities in the area
- Socioeconomic inequity
Population health and waste management

- Incineration
  Epidemiological studies
  - A specific site
  - Multi-site investigations
- Landfill
- Ongoing
- Former
- "Normal" waste
- Hazardous waste
In England and Wales—
Within buffer zones (2 km)
• 80% of the population
• Less affluent
• Younger population
• Urbanization

HOW TO STUDY:

• Identification of sites
• Buffer zones (1-2 km)
• Localized population
• Link to health registry
An overview of findings from epidemiological studies (WHO report 2007) (reflect yesterday’s exposure situation!)

Cancer in adults "Inadequate"
Childhood cancer "Inadequate"
Congenital malformations "Suggestive"/ "unconvincing"
Reduced birth weight "Suggestive"/"unconvincing"

Not convincing causal associations
It is difficult to disentangle co-exposures and socioeconomic disparities

NOTE: ”Lack of evidence” does not equal ”no effect”
From the WHO 2007 document…

"there is a great lack of data concerning wastes that are illegally disposed of. …

Because a variety of illegal disposal practices exist (burning, dumping, etc…) and because it is very difficult to estimate the amounts of waste that are disposed of illegally, determining emissions and exposure levels is virtually impossible.”
What to do in a specific case?

Population health and waste management:

- Information on technology, process, actions taken
- Exposure assessment
- Risk assessment*
- Environmental monitoring program

Report of a WHO workshop
Rome, Italy, 29-30 March 2007

*Epidemiological studies generally not recommended
Human risk assessment in a specific situation

- **Sources**
  - air
  - water
  - soil
  - diet

- **Uptake**
  - pulmonary
  - gastro-intestinal
  - dermal

- **Dose-effect relationships based on known data**
Occupational hazards in waste management
Work accidents (notified) per 1000 gainfully employed men in 2005

More than twice as common as the average
Work-related diseases (notified) per 1000 gainfully employed men in
"When it comes to health and safety, the refuse collection sector in Denmark evidently and as recognized by its actors demonstrates two ‘realities’. There is a theoretical ‘reality’, addressed in objectives, declarations, quality policies, norms, and regulations; and there is an actual reality demonstrated by the way in which the job is being performed in most municipalities.”

Ole Busck. Marketization of refuse collection in Denmark: social and environmental quality jeopardized
*Waste Management Research* 2007; 25; 384
# Recycling and work environment

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<thead>
<tr>
<th>Most favoured option</th>
<th>Prevention</th>
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<td>Least favoured option</td>
<td>Disposal by landfill</td>
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Table A4. The waste management hierarchy
Recycling of electronics

PBDEs
- persistent
- bioaccumulation
- endocrine disrupters
Electronics dismantling and occupational exposure to PBDEs

BDE-183 in serum (pmol/g l.w.)

Median and max is given in the figure.  \(<Q\) = median below limit of quantification
Workplace changes.....

2000
Doubled amount of goods processed

- Better ventilation
- Less storage indoors
- Better house-keeping
- Shredder outdoors, not indoors
...resulted in less exposure  Thuresson et al 2006

Electronics dismantling
before and after workplace dust reductions

<table>
<thead>
<tr>
<th>BDE47</th>
<th>BDE154</th>
<th>BDE153</th>
<th>BDE183</th>
<th>BDE209</th>
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<tr>
<td>110</td>
<td>47</td>
<td>19</td>
<td>19</td>
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Male referents 2000

pmol/g L. W.
Fluorescent lamps - hi-tech enterprise for mercury recycling

And an obvious risk for excessive mercury exposure during manual handling at intermediary "hot-spots" in the recycling chain!
Recycling and work environment

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| Least favoured option | Disposal by landfill |

…..a long way to go
Waste management in developing countries

Our experience:

A bilateral research cooperation between UNAN-Managua, Nicaragua and OEM. Lund, within a multidisciplinary environmental program, supported by SIDA/SAREC

PhD students: Dr D Hernandez Romiro and Dr S Cuadra.
Approximately 1000 persons worked at the waste disposal site, of which 50% were under age 18.
Children aged 6-15, working and sometimes also living at the waste disposal site and referent children from a nearby area.

- **Chemical exposures**
  - Heavy metals (Pb, Cd, Hg)
  - PCB, pentachlorphenol
  - DDT and other persistent pesticides
  - PBDE

- **Air pollution and respiratory problems**

- **Injuries**

*SN Cuadra, licenciate thesis, available at www.ymed.lu.se*
Lead exposure from the waste disposal site and from uncontrolled lead recycling.

- 103 Child workers
- 102 referents from nearby area
- 34 referents from distant area
- Swedish children

Box plots showing B-Pb concentration (μg/l) with male and female groups.
The child workers had a very high risk of being injured (absence from school or work >1 day)

- **Injury**
  - Any kind: 5.1 (3.2-8.1)
  - Non-work related injury: 1.3 (0.8-2.3)

**Incidence rate/1000 person-days**

- **Child workers**
  - Work related: 2.19
  - Non work related: 0.8

- **Referents**
  - Work related: 0.6
  - Non work related: 0.6