Waste management, Land Reclamation

- Waste management – landfills, incineration plants, recyclation, noise
- Reclamation of landfills, mines and contaminated lands

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Waste management

• anything unused, unproductive, or not properly utilized
• anything left over or superfluous
• rejected as useless or worthless

Minimize waste, („no-waste technology“ is utopic)

Necessary condition (requirement) for further effective waste handling
SEPARATION → at the source x central
The Most Common Types of Waste

• **Household waste** means waste from households as well as other waste, which, because of its nature or composition, is similar to waste from households.

• **Municipal waste** means all waste from a city/town/village (households + public bins, waste from streets, waste from green areas maintenance... **NOT INDUSTRIAL**).

• **Hazardous waste** must have one or more of the properties listed in **LoW**.

• **LoW** – List of Wastes (formerly named the European Waste Catalogue) The European Waste Catalogue (EWC) classifies waste materials and categorises them according to what they are and how they were produced. 

Municipal Waste

• Miscellaneous, varies in time and space
• In the CR every year 300÷500 kg/person (1 kg person/day)
• in Europe approx. 400 kg per person/year, and increasing…

Properties: (important for landfilling)

• Bulk density approx. 300 kg.m\(^{-3}\) (after compaction on a landfill approx. 500÷700 kg.m\(^{-3}\))
• Total amount of waste is rapidly increasing, the composition is changing (particularly light and bulky materials – paper, plastics, packing)
Waste management

Increasing amount of waste – consequence of rising living standard
(→ waste is more dangerous than 100 years ago)

...we are responsible for the waste!
## Source of Waste (CR)

<table>
<thead>
<tr>
<th>Source</th>
<th>[%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricult. and Forestry</td>
<td>6,3</td>
</tr>
<tr>
<td>Mining</td>
<td>0,3</td>
</tr>
<tr>
<td>Industrial waste</td>
<td>44,6</td>
</tr>
<tr>
<td>Energetic waste (*)</td>
<td>19,8</td>
</tr>
<tr>
<td>Municipal waste</td>
<td>6,1</td>
</tr>
<tr>
<td>Other</td>
<td>22,9</td>
</tr>
</tbody>
</table>

(*!) not energies (heat, light, vibration,...)
## Municipal Waste in Prague

<table>
<thead>
<tr>
<th>Year</th>
<th>MW [t]</th>
<th>Waste disposed [t]</th>
<th>Recycling [t]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>total</td>
<td>landfill</td>
</tr>
<tr>
<td>1998</td>
<td>232 000</td>
<td>224 000</td>
<td>94 000</td>
</tr>
<tr>
<td>1999</td>
<td>240 300</td>
<td>224 500</td>
<td>31 000</td>
</tr>
<tr>
<td>2000</td>
<td>250 700</td>
<td>226 000</td>
<td>59 000</td>
</tr>
<tr>
<td>2001</td>
<td>256 950</td>
<td>228 200</td>
<td>31 900</td>
</tr>
<tr>
<td>2002</td>
<td>281 800</td>
<td>244 500</td>
<td>31 900</td>
</tr>
<tr>
<td>2008</td>
<td>268 790</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>270 123</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>272 134</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>264 206</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>264 206</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>259 138</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Observations:**
- **1998 to 2000:** The total waste disposed increased from 224 000 to 228 200.
- **2001 to 2002:** The total waste disposed increased further to 244 500.
- **2008 to 2013:** The total waste disposed shows a decreasing trend from 268 790 to 259 138.

Note: The data suggests a general trend of decreasing waste disposal with some fluctuations.
Waste cannot be obeyed, can be stored, modified or reused. All we can speed up or slow down its return to biosphere, but we cannot get rid of it completely!

- landfills (deposition, storing)
- incineration (modification, energy resource)
- recycling (modification, definitive solution is postponed)
- biological waste – (modification, composting)
Landfilling

**PROS:**
- the cheapest
- „the safest“ = most known
- verified technologies

**CONS:**
- long waste activity after storing
- is not a definite solution, we leave it for the future generation(s)
- takes up place, decreases the value of the area

→ we are making an effort to reduce, disposing just earth friendly materials (similar constitution) – but still 62% of HOUSE.W ends up at landfills….**TOO HIGH**
WHAT IS A LANDFILL?

A secure landfill is a carefully engineered depression in the ground (or built on top of the ground, resembling a football stadium) into which wastes are put. The aim is to avoid any hydraulic [water-related] connection between the wastes and the surrounding environment, particularly groundwater.
Landscape reclamation / restoration

Reconverting disturbed lands to its former or productive uses

**WHY?** → Potential source of pollution (soil erosion, heavy metals, organic pollution, odour etc.)

→ Aesthetical, economical and ecological reasons

Reclamation plan must be made before any disturbing project is undertaken - landscape is a nonrenewable resource!!!
LANDFILL RECLAMATION

• after a landfill is full (and covered) its surface should either look similar to neighbouring environment

• or should be used for something else:
  • biological reclamation: agriculture, forestry, recreation (park, golf course)..
  • technical reclamation: construction !!! (if it is close to larger urban complexes)

Major issues:
- Subsidence – ground settling (up to 30% in 30 yr)
- leachate control
- Topsoil quality
- Keep plants in good conditions (cap protection, stormwater management)
we can use energy from incinerators

reduces the amount of waste (volume 1/10, weight 1/3)

atmosphere pollution

50 x more expensive than landfilling

complicated technology

Burning is happening at high temperatures – commonly up to 1200 °C

Sometimes gas has to be added – some materials are less burnable

Separation is useful prior combustion

Ash and dust from incinerators is toxic – concentrated has to be treated as hazardous waste
RECYCLING

PROS:
✓ saves primary natural sources
✓ postponing final solution

CONS:
✓ needs separation
✓ often high demands of energy

Label – made from materials that can be recycled

Label – is made from recycled material

paper
glass
plastics
wood
 Constr. materials
It is decomposition of organic matter to the basic substances under aerobic conditions

- composting needs
  - $O_2$
  - heat (50÷60 °C)
  - moisture
  - ratio between C:N = 30:1

PROS:
- uses energetic potential of waste
- Gain quality material – improving soil properties, decreasing necessary amount of fertilizers

CONS:
- smell in neighbouring areas
- Specific conditions for composting – must be sustained
- expensive

COMPOSTING

uses energetic potential of waste
Gain quality material – improving soil properties, decreasing necessary amount of fertilizers

- smell in neighbouring areas
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Disposing Hazardous Waste

• at least **stop** transport and spreading of Hazardous W., when we don‘t know how to handle it (seal the waste in concrete, glass, bitumen…)

• or **reduce** toxicity and store it somewhere

There is a hope (**NAIVE ?**) that the future generation will sort it out (better technologies, methods…)}
Conclusion

Ideal waste management activities would be:

- Waste which doesn’t need to be produced – let it not be produced = **REDUCE**
  
  ↓

- **REUSE** all waste which can be reused
  
  ↓

- Separate and **RECYCLE**

- Not recyclable:
  1) Composting
  2) Incineration (both reduce the volume and produce energy)
  3) Landfill
Wastes are often toxic
Sources of toxic compounds – Contamination transport

industry
agriculture
civilization
natural processes
Sources of toxic compounds

• **Point source**
  landfills, local sources of contamination on factory premises, petrol station, military areas, fertilizer depositories

• **Non-point source**
  Agriculture – application of pesticides and fertilizes (and toxic compouds such as heavy metals naturally present in it)
  Industry – pollution of air by exhausts (factories, incineration plants => rain and dry dust atmospheric depositions)

• **Combined**
  civilization activities – river pollution from point and non-point sources
  natural processes – volcano eruptiony (Hg-mercury), discharge of earth gases (Ra-radon)
Major contaminants in air, water, food

- **PCBs**
  industrial chemical, banned, cancer
- **Pesticides**
  Residues in most of the food, many carcinogenic
  Dioxins
  From combustion process, accumulate in animal fat, skin rashes, cancer, reproduction

**Heavy metals**
Accumulate in soft tissues, drinking water, food, construction materials, neurological problems, Alzheimer,

**Asbestos**
Construction material, release fibres, cancer

**Fuels and additives**

**Pharmaceutics**
...
“Energetic waste”

Wasted energy created by human, that negatively impact the environment

• **noise** (traffic, construction, mining...)
• heat (industrial cooling, cities)
• light (advertisements, street lamps, ski slopes ...)
• electromagnetic emissions (cell phones, TV towers)
Noise from transportation

1) reduce the source = tech. state of the machines (engine, covers)
   = contact of tire and road (road surface, rails, tires)
   = human behavior (schedule, horns)
   = move noise out of inhabited areas

2) decrease noise level = absorb (mobile) noise barriers, green belts
Examples...

Line structures to mitigate line sources (traffic)

Source: Dep. of railroad constructions, FSv
The goal is to **absorb** the noise, not to **reflect**!

→ Heavy, massive structures with coarse surface

(concrete barriers with bush or trees)

**membranes** (steel, glass) are not preferred reflection + resonance
Summary

✓ Land Reclamation x Revitalization
✓ Possibilities of new landuse
✓ Handling of waste
✓ Energetic waste – sources, consequences
✓ Mitigation measures – prevention x technical measures

Further reading, references

- [http://www.howstuffworks.com/landfill.htm](http://www.howstuffworks.com/landfill.htm)
Thank you

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