



Waste Management and Landfilling in Sweden

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Contents of this presentation

- Swedish policies and instruments in waste management
- Overview of Swedish waste management
- Two case studies: waste management in two regions, focusing on landfills.

Municipal Solid Waste



1994

3,2 Mton (370 kg/capita)

Treatment:

- Recycling 16 %
- Incineration 42 %
- Biological 3 %
- Landfilling 39 %
- Hazardous waste <0,5 %

2006

4,5 Mton (494 kg/capita)

Treatment:

- Recycling 37 %
- Incineration 47 %
- Biological 10 %
- Landfilling 5 %
- Hazardous waste 0,9 %

Legislation - history

- Environmental law 1968
 - Permission required for waste treatment and disposal
- Governmental Bill 1974:
 - "waste is a resource"
 - responsibilities for municipalities and state
 - e.g. municipalities responsible for collection of newsprint

Legislation - today

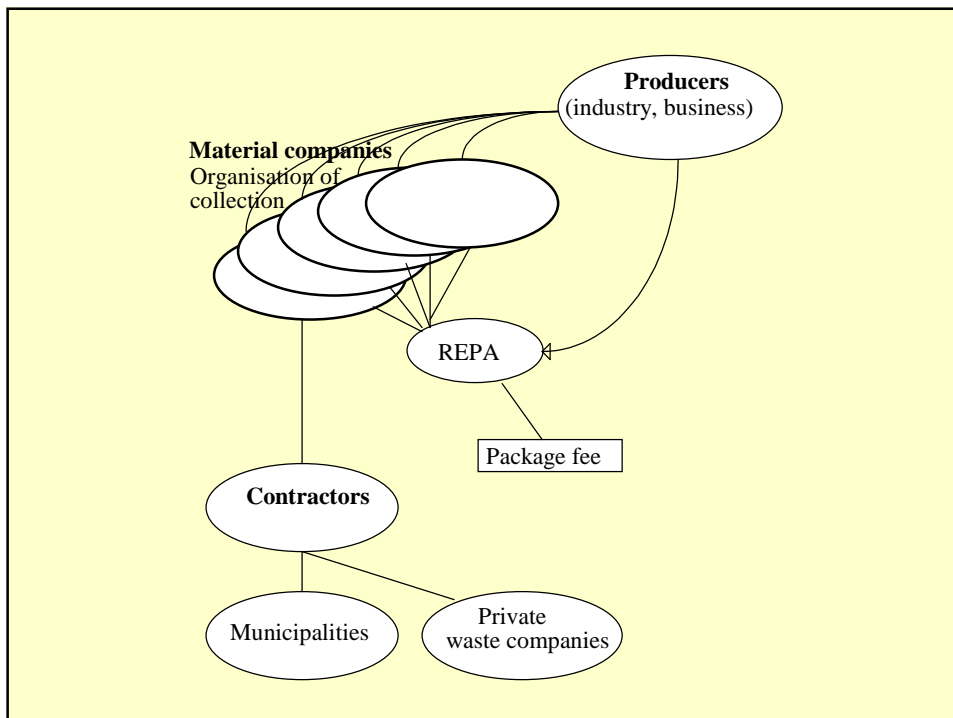
- Environmental Code
 - framework for waste management (the framework directive)
 - the former Environmental Law is transferred to the Environmental Code



- Producers responsibility (started 1994):
 - packages
 - newsprint
 - tyres
 - vehicles
 - electric and electronic equipment (2002)

Producer's responsibility

- Producer : Responsibility for manufacturer, producer, importer or similar to establish and operate a system for management of their products when they are discarded
- the producers have to develop and operate an own collection and recycling system
- recycling goals are set for the waste, e.g. % of waste that must be material recycled
- financed by fees on the sold product
- the waste generator "has to" bring the actual waste to the producers collection system (but no penalty if not)



Taxes and bans:

- Landfill tax from 2000
 - 2000: ~27 €/ton
 - 2003: ~40 €/ton
 - 2006: ~50 €/ton
 - Several industrial wastes are excluded
- Incineration tax from 2007
 - 360 €/ton fossil carbon in waste (about 40 €/ton domestic waste)
- Landfill ban for "sorted combustible waste" from 2002
- Landfill ban for "organic waste" from 2005
 - it is possible to apply for exemption

- Implementation of EU directive on landfilling
 - requirements on
 - location
 - design and performance
 - operation
 - control of waste
 - closing of landfilling
 - special requirement: top sealing to reduce leachate production to
 - < 50 liters/m²,year (non-hazardous waste)
 - < 5 liters/m²,year (hazardous waste)

- Implementation of EU directive on incineration of waste
 - requirements on emissions and control of emissions
 - in general small problems for Swedish facilities

- Governmental Bill 2003:
 - Goal: 35 % of biowaste shall be treated by composting and digestion 2010.

Municipal Solid Waste Management today



- **Shared responsibility**
 - Producer's responsibility: packages, newsprint, tyres, WEEE, vehicles
 - Municipality:
 - the rest of the domestic waste and similar wastes,
 - biowaste
 - (and producer's responsibility waste that is not brought to the producer's collection system)

Several collection systems:

- collection centrals
- collection stations
- collection at houses
- deposit system



Collection "centrals"

- One for about 10 000 - 25 000 inhabitants
- "Collection centrals" in municipality for:
 - bulky waste: often separated into combustible and non-combustible, scrap, etc.
 - WEEE
 - garden waste
 - hazardous waste
 - scrap from households



Collection "Stations"

- One collection point per 1000 - 1500 inhabitants
- For producer's-responsibility-materials
 - paper packages
 - plastic packages
 - metal packages
 - glass packages (often separated into white glass and colored glass)
 - newsprint



- Deposit system for beverage packages
 - Aluminium cans (~0,05 €/can)
 - PET bottles (0,1 and 0,4 €/bottle)



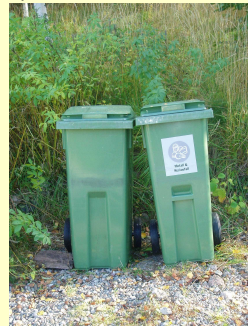
- **Environmental stations for domestic hazardous waste**

- located at petrol stations, paint shops, super markets, collection centrals



- **Rest waste is collected at house**

- one fraction: rest waste
- two fractions
 - biodegradable waste to composting or anaerobic digestion
 - rest waste (normally to incineration)



Municipal solid waste - recycling

	Obtained recycling	Recycling goals
Newsprint	84%	75%
Office paper	66%	50%
Glass packages	92%	70%
Paper packages, including corrugated cardboard	72%	40%
Plastic packages	28%	30%
Metal packages	66%	70%
WEEE	13,4 kg/capita	-
Domestic scrap	16,5 kg/capita	-

Municipal waste - incineration

- 29 incineration facilities
- 2,1 Mtons domestic waste plus 2,0 Mtons industrial wastes
- 11,5 TWh energy is generated
 - 10,3 TWh to district heating
 - 1,2 TWh to electricity



Biological treatment

- 110 municipalities (of 290) has separate collection of biowaste from households
- Also garden waste, some industrial wastes

- Anaerobic digestion:
 - 284 000 tons total, of which 45 000 tons from households
 - 181 000 MWh biogas (0,18 TWh)
 - 273 000 tons digestate - fertiliser to agriculture



- Composting
 - 452 000 tons total, of which 248 000 tons biowaste from households, and 107 000 tons park- and garden wastes



Landfilling

- Number of landfills are decreasing
 - 2006: 160 landfills (municipal waste)
 - 1994: 300 landfills
 - 1976: 1600 landfills
- Leachate: 8 - 12 millions m³.
 - 90 % is collected and treated before discharge
- Landfill gas
 - 0,28 TWh gas is recovered as energy (at 60 sites)

- Secondary activities at landfills
 - 40 % of the received waste is sorted out for recovery:
 - waste derived fuel
 - materials: scrap, corrugated cardboard, wood,
 - construction material: inert wastes

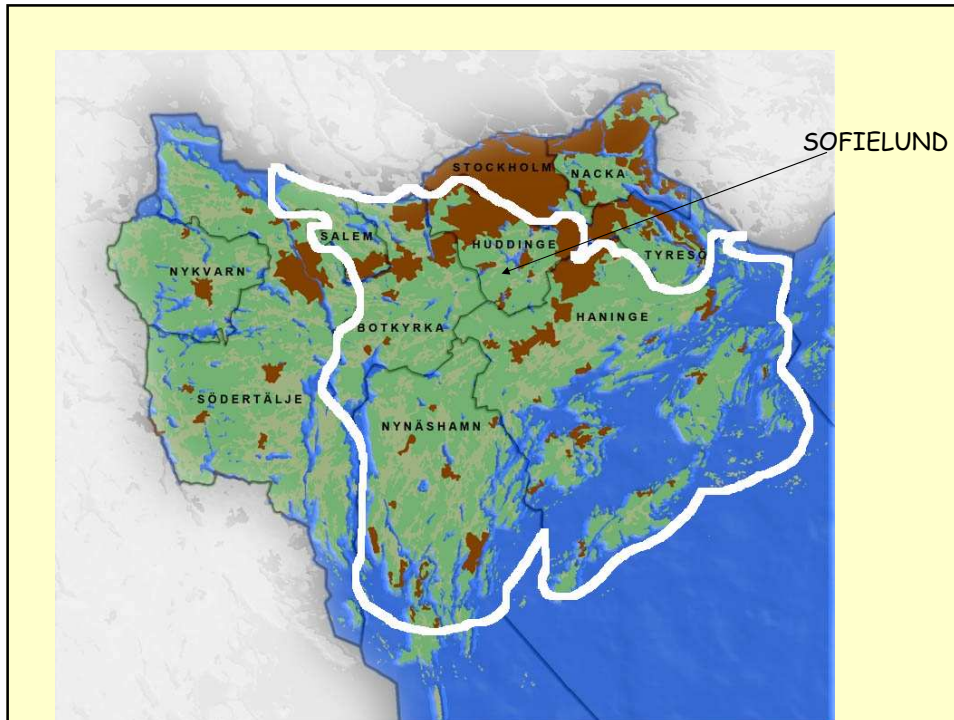


Case 1




SRV - Återvinning

- Waste Management company owned by five municipalities south of Stockholm.
- Waste from 282 000 inhabitants
- Waste Management Site "Sofielund"



Sofielund



- Started 1938, then one municipality (waste from 10.000 inhabitants)
- Three landfill areas
 - Landfill 1: 1938 - 1977. Now closed and final covered
 - Landfill 2: 1977 - 2004. Now during closure and covering
 - Landfill 3: 2005 -

Sofielund: activities

- Reception and repacking of hazardous waste (domestic H.W. and from small business)
- Sorting (all wastes)
- Composting
- Anaerobic digestion
- Landfilling

Sofielund: material balance

	Received tons	To recovery, tons	Landfilled, tons
Municipal solid waste	75 000	65 000	10 000
Construction and demolition waste	27 000	18 000	9 000
Ash and slag	66 000	41 000	3 500
Sludge	200	0	200
Industrial process wastes	35 000	7 500	28 000
Industrial common wastes	110 000	60 000	50 000
Special wastes	600	500	100
Hazardous wastes	43 000	33 000	10 000
Inert waste for cover and construction	30 000	30 000	
SUM	386 800	255 000	110 800

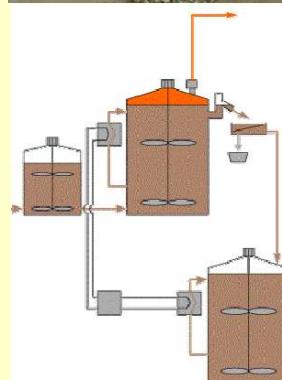
Sorting of waste: bulky domestic waste and industrial waste

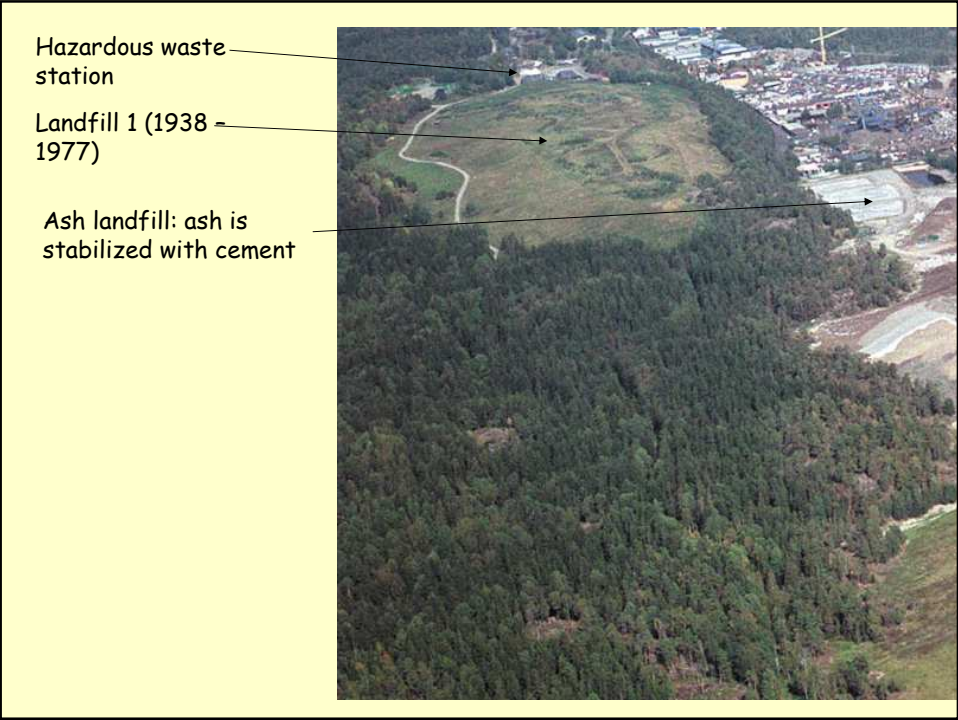
- Metals
- Wood
- Combustible
- Noncombustible (<10 % TOC)
- Shredding of wood and combustible waste

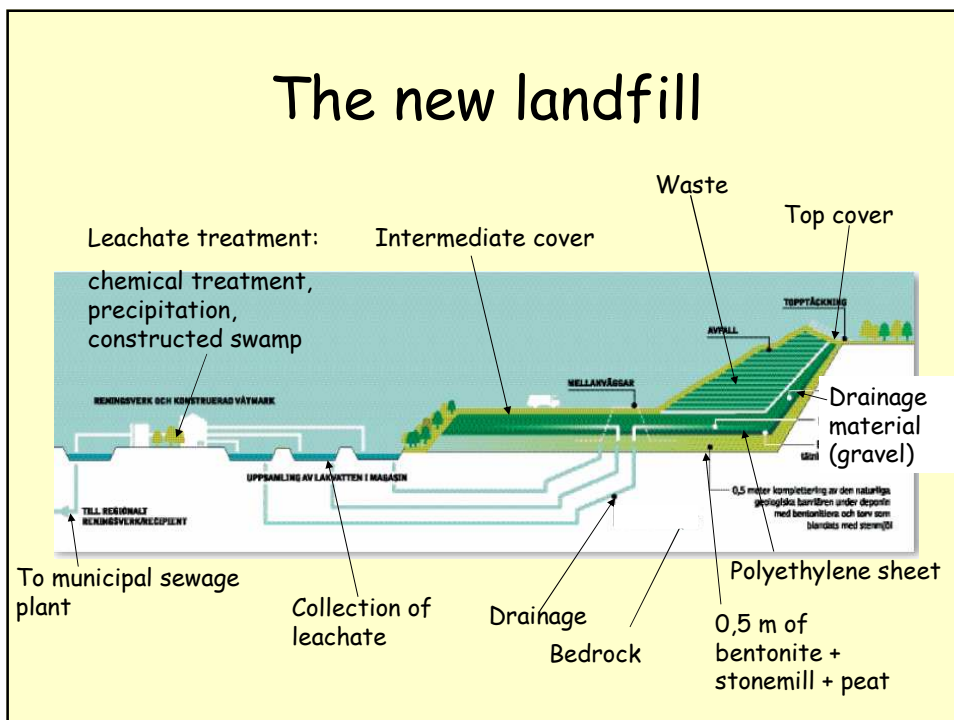
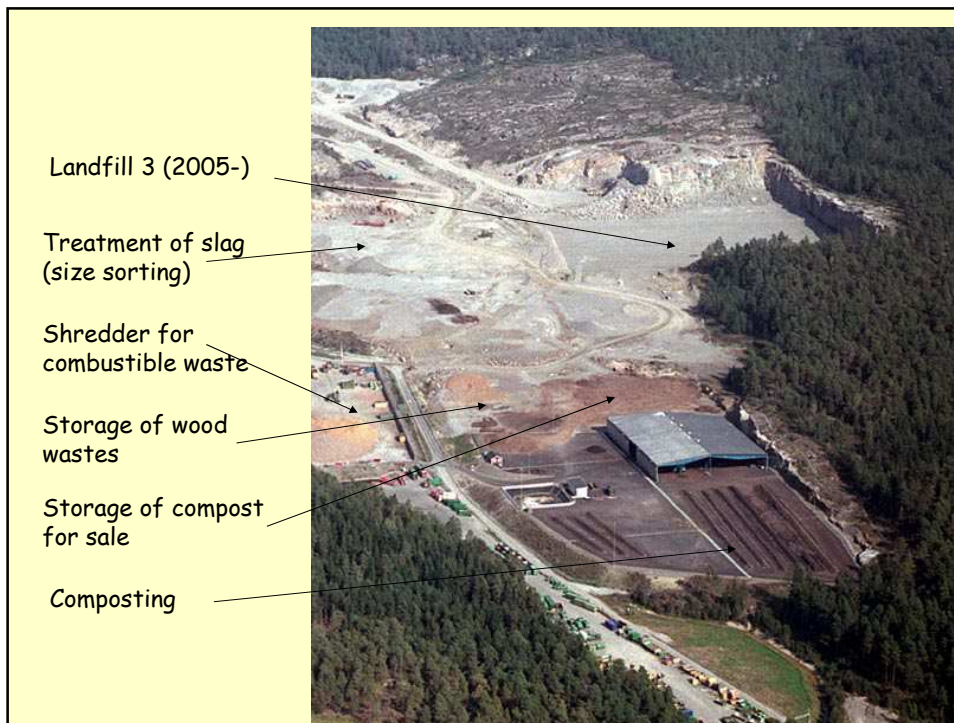


Composting and aerobic digestion

- Treated amounts 2006
- Composted
 - Food wastes: 1 050 tons
 - Park- and garden wastes: 7 700 tons
- Anaerobic digestion
 - Food wastes (restaurants): 4 370 tons







Sofielund - Landfilled wastes

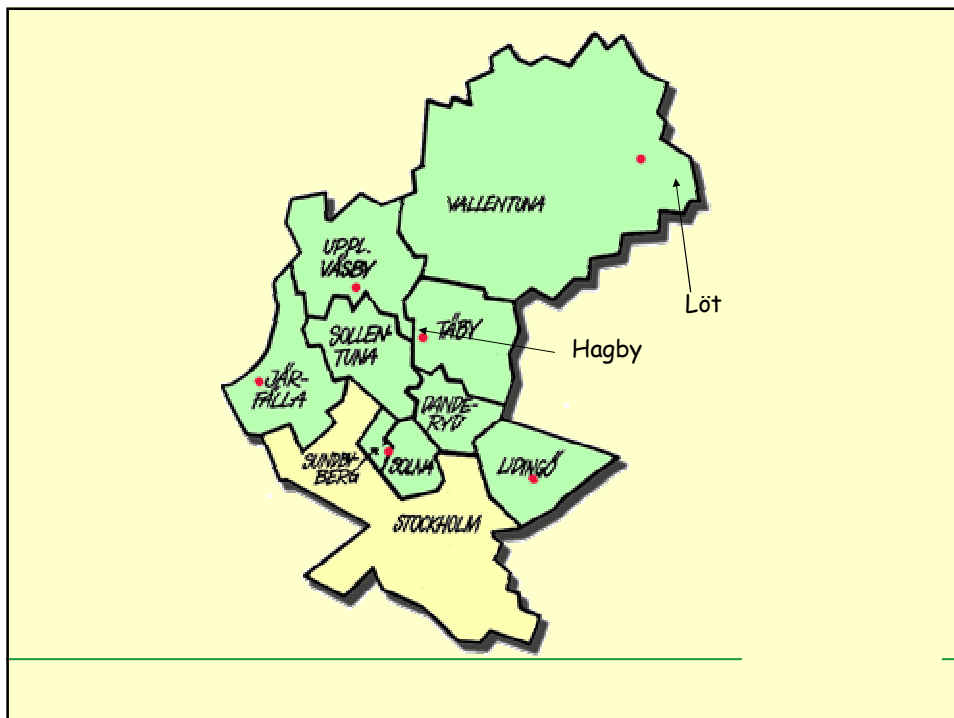
- Total amount of waste received:
386 800 tons
- Landfilled: 110 800 tons
 - Municipal solid waste: 9 800 tons
 - Construction and demolition waste: 8 800 tons
 - Ash and slag: 3 600
 - Shredder wastes (shredding of vehicles): 27 900 tons

- Other process wastes: 143 tons
- Other industrial wastes: 50 500 tons
 - Rest waste (after sorting): (28 800)
 - mixed waste: (15 600)
 - Combustible waste: (6 100)
- Special waste (manure, sludge from car washing): 83 tons
- Sorting residues from the site: 11 600 tons

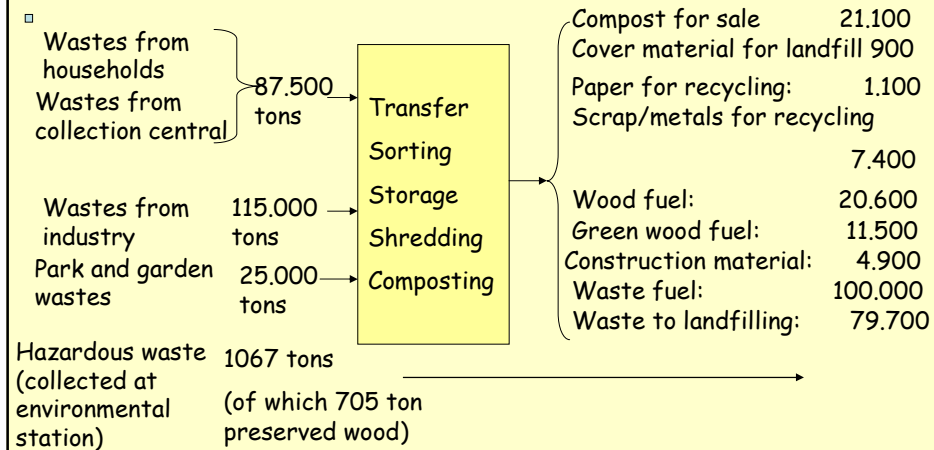
Case 2. SÖRAB



- SÖRAB is a regional waste disposal company in the north of the County of Stockholm owned by ten municipalities
- Domestic waste from 422 000 inhabitants
- Two major waste facilities
 - Hagby: closed-down landfill. In operation 1948 - 1995. Today transfer station, composting, domestic hazardous waste, etc
 - Löt: new landfill 1995 -, also sorting, composting, hazardous waste, etc.

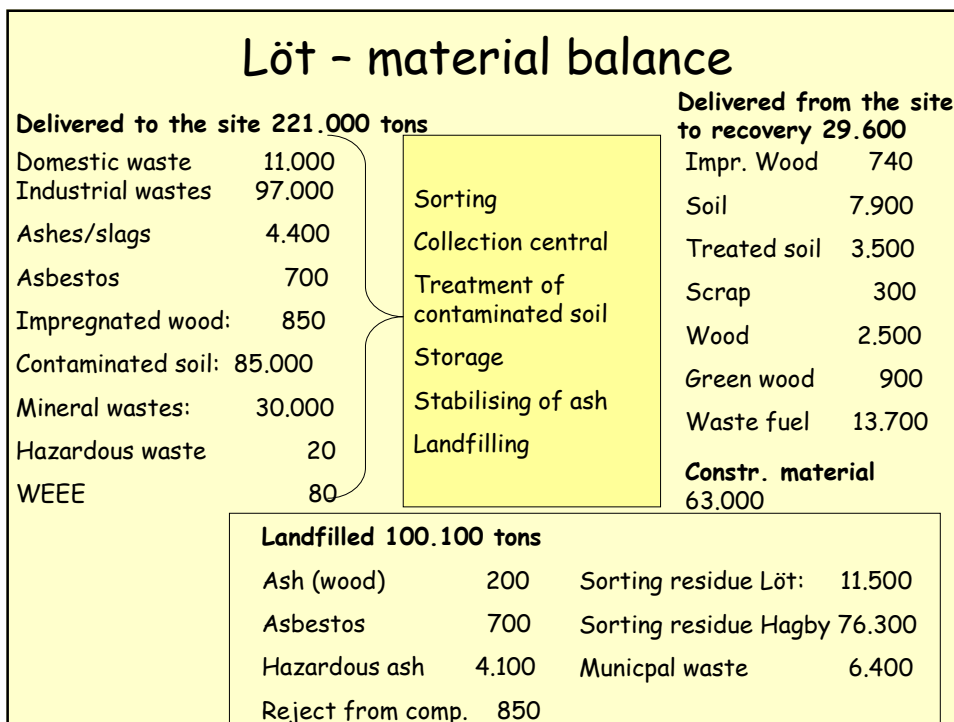
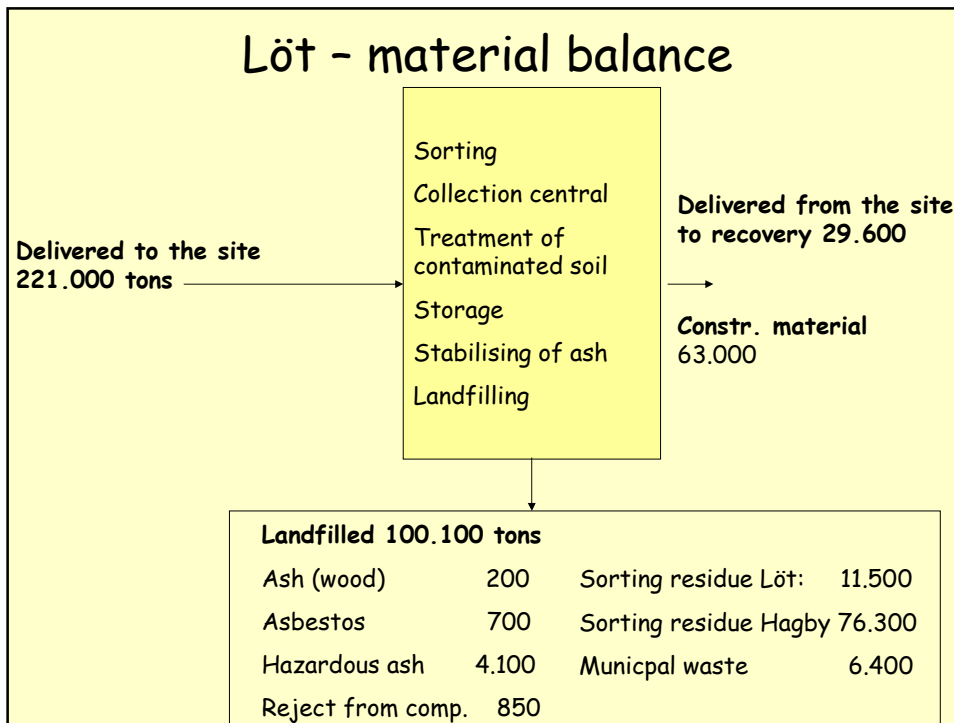


Hagby - material balance



Hagby - leachate and gas

- Leachate and gas is still generated
- Gas: 821.000 m³ - heating
- Leachate: 64.000 m³ to treatment (nitrogen reduction and chemical treatment) and discharge to municipal sewage



Löt - gas and leachate

- Gas 615.000 Nm³: heating, electricity and torching
- Leachate 46.000 m³ from the site
- Leachate treatment: biological treatment (aeration), peat filter, constructed wetland. Then discharge to municipal sewage

Concluding remarks

- Landfill sites are "Waste Management Sites"
- Landfilling is often a "minor" activity.
- These activities are essential for the recovery and recycling of waste