

Bottom ash and fly ash disposal



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Overview MSWI residues in NL

year	MSW incinerated ktonne	APC residues ktonne	Fly ash ktonne	Bottom ash ktonne
1999	4.800	40	90	1.354
2000	4.982	45	83	1.009
2001	4.855	39	78	1.191
2002	5.087	41	82	776
2003	5.107	38	82	820
2004	5.291	40	83	1.464
2005	5.503	44	83	909
2006	5.542	48	89	990
2007	5.788	51	88	1.254
Total	46.955	386	758	9.767
		0,8%	1,6%	20,8%



Overview MSWI residues in NL

	Disposal			Recovery		
	2005	2006	2007	2005	2006	2007
Spray drier salts	14	18	21	16	15	14
Filter cake	9	10	10			
Sludge	2	2	2	1	1	1
Gypsum			1	2	2	2
Fly ash	33	40	38	50	49	50
Bottom ash				909	990	1.254
Total	58	70	72	978	1.057	1.321
				94%	94%	95%



Fly ash and APC residue options

- Disposal in big bags on landfills (until 16 July 2009)
- Pre-treatment and production of monolithic waste
- Disposal in underground storage (not allowed in NL)
- Recovery:
 - Salt separation in MSWI and reuse of salts
 - Fly ash: cement replacement or filler in asphalt production
 - Fly ash and APC residues can be 'recovered' in salt mines



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Landfill: big bags



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Landfill: monolithic waste



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Recovery: asphalt



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MSWI bottom ash in projects

Application	1986-1993	1994-1998	1999-2004
Embankments	72%	46%	51%
Foundation	19%	40%	24%
Landfill	0%	12%	24%
Road base	7%	0%	0%
Unknown	2%	2%	1%
Total	100%	100%	100%



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Embankment motorway A5



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Embankment: ash placement



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Embankment: road profile



Embankment: top liner



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Embankment: top liner



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Embankment: liner protection



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Foundation: support layer



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Foundation: 'ash-phalt' plant



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Foundation: 'ash-phalt' cover



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Landfill: ash storage



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Landfill: cover soil removed



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Landfill: support layer



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Landfill: gas drainage



Bottom ash leaching characteristics

Parameter	Unit	Composition	Leaching L/S 10
Arsenic	mg/kg	8.32	0.01
Cadmium	mg/kg	2.88	0.00
Chromium	mg/kg	176.33	0.02
Copper	mg/kg	3,917.00	2.41
Molybdenum	mg/kg	10.32	0.68
Lead	mg/kg	112.00	0.03
Nickel	mg/kg	1617.00	0.05
Antimony	mg/kg	109.50	0.25
Zinc	mg/kg	2,550.00	0.04
Sulphate	mg/kg	12,117.00	3,770.00
Chloride	mg/kg	8,517.00	8,250.00
Bromide	mg/kg	5.00	3.53
pH	-	11.10	
EC	mS/cm	12.50	
DS	%	80.50	
N-Kj	mg/kg		71.40
N-NH4	mg/kg		22.70



Conditions for application

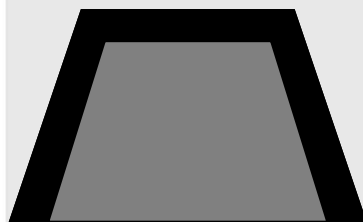
- Soil quality decree: isolated construction material
- 0.5 m above the highest groundwater level: no contact
- Combination liner: sand/bentonite + hdpe membrane
- Application of certified materials and quality control
- Monitoring and maintenance during life time of the project



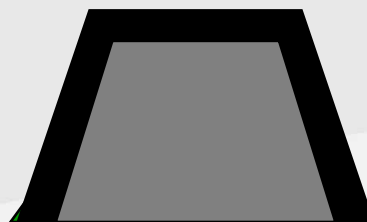
Applications

RECOVERY

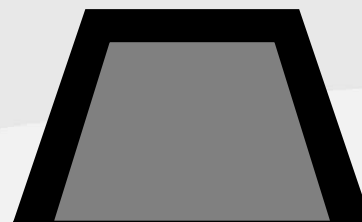
DISPOSAL



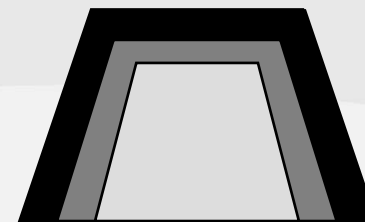
Embankment



Road base



Foundation



Landfill



Environmental impact

- All applications are covered: risk is limited to spreading of contaminants with groundwater
- Many contaminants: relatively strong binding in soil
- Contamination above accepted level can be expected for As, Cu, Sb, Mb, Cl, SO₄ and NH₄
- Accepted level means that more than 95% of the ecosystem does not show any negative effect



Conclusions fly ash and APC residue

- The materials can not be landfilled without pretreatment
- No compliance with leaching limits for salts
- Separation in the MSWI and reuse of salts seems possible, but is not available: it needs to be developed
- Solutions:
 - monolithic waste
 - underground storage
 - (site specific derogation from WAC)



Conclusions bottom ash

- Environmental risk of bottom ash application is low:
only a few meters dispersion in 20 years
- Environmental risk of bottom ash decreases from embankment
to road base to foundation to landfill
- Landfill entails the lowest risk because landfills have:
 - leachate drainage, collection and treatment
 - stricter requirements and quality control of liners
 - monitoring and aftercare that is effectively enforced



Quote

- The European Commission in connection to proposals for new waste legislation has stated that:

"the guiding principle for waste legislation is protection of the environment and human health"



Questions

- If protection of the environment is the guiding principle, then why not promote landfill of bottom ash instead of 'recovery'?
- Should we continue to administer labels 'recovery' and 'disposal'?
- Or should we consider the real environmental impact?



**Thank you very much
for your attention**

