

Uncertainties related to determination of aftercare duration and financial obligations for closure and aftercare



Heijo Scharff

DAKOFA Seminar,
5th March 2015, Copenhagen, Denmark

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European policies



- 2005: Thematic strategy for a resource efficient Europe
- 2008: Raw materials initiative
- 2012: 7th Environmental Action Programme to 2020 'Living well, within the limits of our planet'
- These policies all aim at more resource efficiency and a 'circular economy'
- Many policymakers believe this can or should be achieved by means of landfill reduction
- The 7th EAP contains a target 'to virtually eliminate landfilling by 2020'



Primary goal



- EU WFD: 'The first objective of any waste policy should be to minimise the negative effects of the generation and management of waste on human health and the environment'
- EU LFD: '.. by way of stringent operational and technical requirements on the waste and landfills, to provide for measures, procedures and guidance to prevent or reduce as far as possible negative effects on the environment, ..., as well as any resulting risk to human health, from landfilling of waste, during the whole life-cycle of the landfill.'



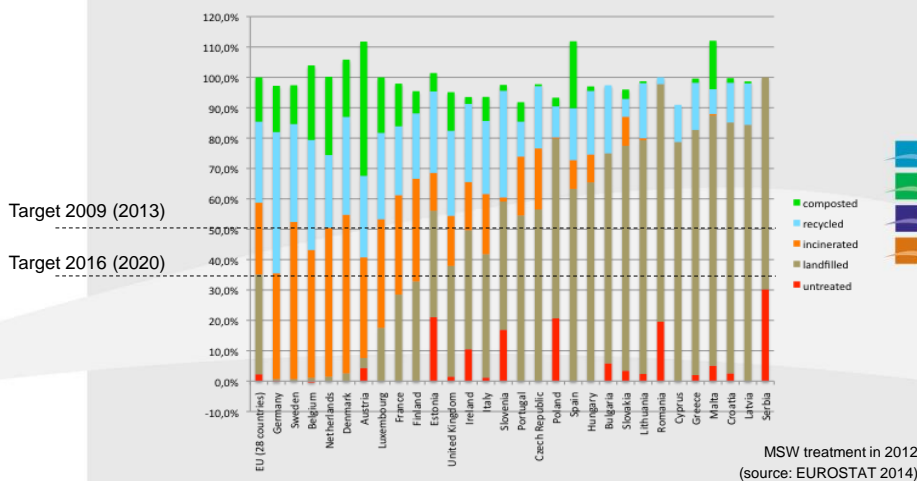
Revision of EU landfill directive



- It was envisaged to revise several EU waste regulations
- The new Commission has however withdrawn the so-called circular economy package in December 2014
- The Commission has announced they will soon make a new more ambitious proposal with respect to eco-design, producer responsibility and resource efficiency
- Whatever will happen, there will be more strict landfill reduction targets
- DK and NL will not be affected very much, they have already reduced landfill to a large extent

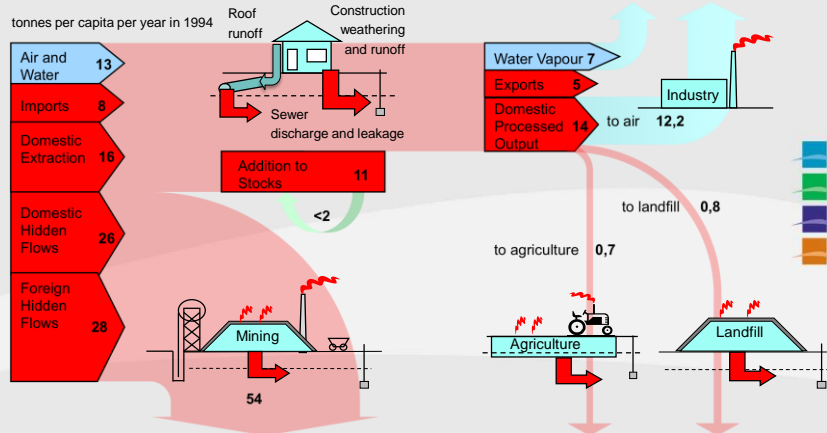


Biodegradable waste reduction targets



Material flow analysis

Sources: Adriaanse A, Bringezu S, Hammond A, et al. (1997) Resource Flows: the Material Basis of Industrial Economies, World Resources Institute, Washington DC, USA.
Matthews E, Amann C, Bringezu S, et al. (2000) The weight of nations: material outflows from industrial economies, World Resources Institute, Washington DC, USA.



Efficiency of recycling

- The many additives in plastics, do not allow recycling for the same purpose, unless each product is separately collected
- At each recycling step fibres of paper and textile get shorter: they cannot or only partly be recycled for the same purpose
- Not all metals can be recovered from metal mixtures: metal oxides cause losses, some fractions are simply too small
- Residues arise: dirtied, substandard and non-reusable materials
- Waste water is produced: dissolved material and contaminants
- A 100% recycling society is thermodynamically impossible

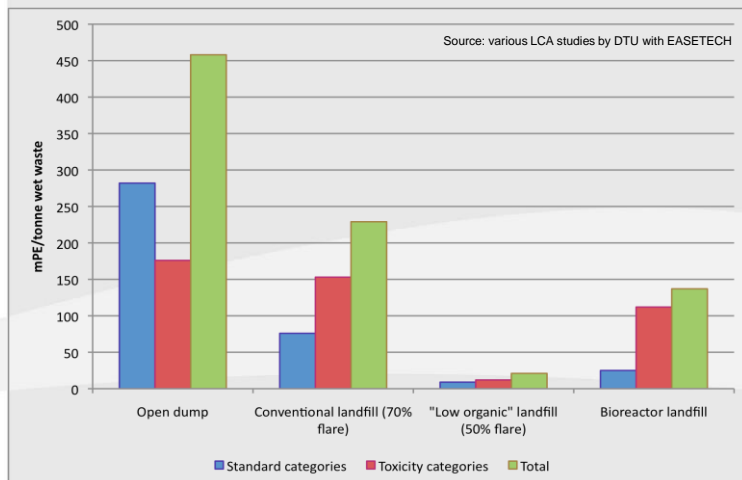


Environmental pressure

- In February 2013 the European Environment Agency published a report 'Environmental pressures from European consumption and production'
- Agriculture, electricity industry, transport services and basic manufacturing industries (refinery, chemical, non-metallic mineral products, metals) dominate (75%) within Europe
- The European Environment Agency identified two main directions for improvement:
 - reducing the pressure-intensities through technology improvements;
 - and shifting consumption patterns



Landfill impact assessment



Impact assessment

- If the open dump or the conventional (MSW) landfill is the starting-point, landfill impact can be significantly reduced
- Disposal is not mentioned by the European Environment Agency as an important environmental impact
- With respect to environmental protection, a 'modern low-organic waste' landfill may not be our prime concern
- It is not very helpful for human health and the environment in general to regulate landfill very strictly and the major material only flows lightly



The future of landfill

- Policies to reduce landfill should be supported
- But recycling operations produce residues
- For some residues landfill will be the only sensible option
- Hazardous compounds need to be removed from the cycle
- There will continue to be a role for landfill as a sink, temporary storage or mine of raw materials in future integrated waste management systems
- Landfill operators will however need to accept:
 - that their role is a lot smaller than currently the case;
 - and that dispersion from landfills needs to be minimised

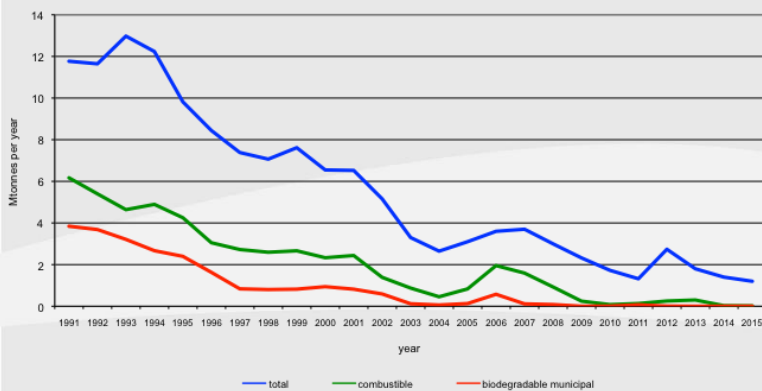


Situation in the Netherlands

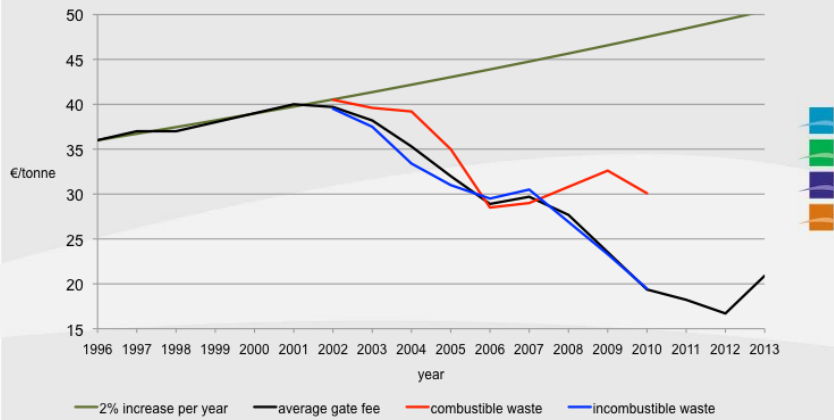
- 16.8 million inhabitants and GDP € 34,000 per capita (2013)
- Total waste production: 61 million tonnes (2013)
- Total landfilled: 1,7 million tonnes or 2.8% (2013)
- Total turnover waste management sector: € 7.0 billion (2012)
- HHW production: 8 million tonnes (2012)
- HHW turnover: € 1.6 billion (2012)
- Average waste levy per capita: HHW € 95 per year, 0.28% GDP
- Total waste costs per capita: € 416 per year, 1.2% GDP



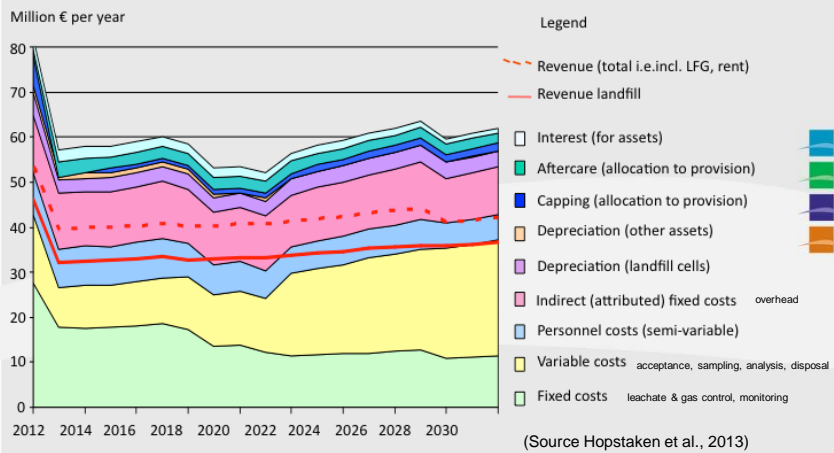
Development of landfill in NL



Development of average NL gate fee



Cost structure of landfill



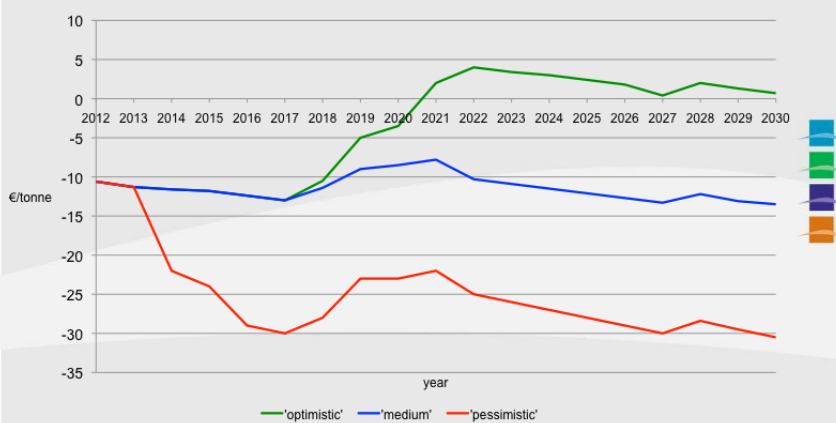
(Source Hopstaken et al., 2013)

Result of landfill operation

Calculated result of Dutch landfill operation in 2013
(derived from Hopstaken et al., 2013)

	€ / 1,7 Mtonne	€/tonne
Fixed costs (monitoring, leachate and gas control)	€ 17.600.000	€ 10,35
Variable costs (acceptance, sampling, disposal, ..)	€ 9.900.000	€ 5,82
Personnel	€ 9.000.000	€ 5,29
Indirect fixed costs (overhead)	€ 11.900.000	€ 7,00
Amortisation of landfill cells	€ 2.900.000	€ 1,71
Amortisation of other assets	€ 1.800.000	€ 1,06
Financial provision for closure and aftercare	€ 2.800.000	€ 1,65
Interest for assets	€ 2.400.000	€ 1,41
Total costs	€ 58.300.000	€ 34,29
Revenues gate fee	€ 33.000.000	€ 19,41
Revenues landfill gas and rent	€ 7.000.000	€ 4,12
Net result	€ (18.300.000)	€ (10,76)

Result per tonne landfilled



(Source Hopstaken et al., 2013)

Result of landfill operation

- Many Dutch landfill operators claim they do not recognise this financial assessment
- But the same landfill operators have confidentially given the researchers access to their financial accounts
- When asked more firmly the landfill operators do admit that other activities compensate for low landfill income and to 'eating into' their financial provisions for closure and capping
- (Not into the financial provision for aftercare, by law the competent authorities impose an annual aftercare levy based on the amount of waste landfilled and manage the provision)



Risks for closure and aftercare

- Due to landfill reduction it takes longer before the landfill volume is completely filled and the provision has to be used
- Reducing financial provisions for closure and capping could be justified: the period the provision generates interest is longer
- But there is more uncertainty it will be sufficient in the end
- In addition more and more waste management companies are privatised and there is an increasing risk that landfill companies will go bankrupt
- Although in NL the financial provision for aftercare by law is with the competent authority there is a similar risk



Risks for closure and aftercare

Province	Provisions per 1.1.2012	Provisions required at closure
Zuid-Holland	€ 22.255.000	€ 38.078.000
Noord-Holland	€ 21.965.393	€ 59.098.851
Friesland	€ 5.214.636	€ 6.352.923
Groningen	€ 6.287.711	€ 7.649.552
Utrecht	€ 2.593.372	€ 7.225.037
Drenthe	€ 4.929.120	€ 110.052.800
Zeeland	€ 5.834.000	€ 11.000.000
Flevoland	€ 72.000	€ 41.240.000
Noord-Brabant	€ 12.866.195	€ 109.917.000
Gelderland	€ 9.306.760	€ 33.211.527
Overijssel	€ 10.711.534	€ 52.582.046
Limburg	€ 13.065.221	€ 40.816.190
Total	€ 115.100.942	€ 517.223.926



Risks for closure and aftercare

- The final sum of money required for aftercare is determined after closure when the operator has installed the surface sealing and responsibility for aftercare is transferred to the competent authority
- Recently a competent authority decreased the discount factor from 3.06% to 1.99% which increased the provision from € 38 to € 60 million euro for two landfills while one was closed
- Fortunately in NL we do not have to worry about the length of aftercare: it is not foreseen to end (often for 30 years only)

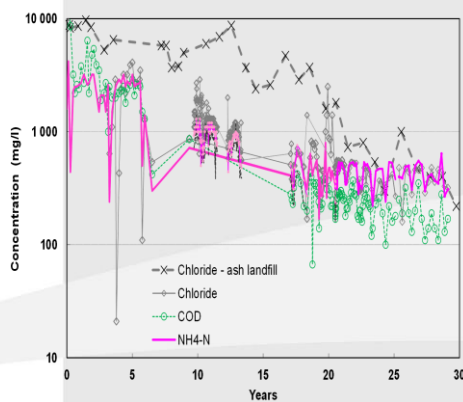


Aftercare time frame

- Autonomous degradation in landfills is slow
- Flushing of contaminants may require liquid/solid ratios significantly higher than 1, probably 3 to 5
- On a 24 m high landfill, with a waste density of 1 tonne/m³ and a net annual infiltration of 0.3 m/year, it will take 400 years to reach L/S=5
- Independent of the completion approach, it is likely to take centuries before desired concentration levels are reached
- Capping reduces infiltration and will extend that even further



Aftercare time frame



Source: P. Beaven, K. Knox, J.R. Gronow, O. Hjelm, D. Greedy, H. Scharff (2014) A new economic instrument for financing accelerated landfill aftercare, Waste Management 34, 1191–1198

Parameters	Required value C_R [mg/l]	Initial concentration C_0 [mg/l]	Period required until C_R is reached [a]
COD	200		
Domestic waste landfill		1200 – 3800	75 – 120
MBP landfill		450 – 2000	35 – 100
Landfill with ashes from WIP		15 – 600	0 – 50
Construction waste landfill		100 – 250	0 – 10
N_{tot}	70		
Domestic waste landfill		400 – 800	110 – 160
MBP landfill		150 – 250	45 – 80
Landfill with ashes from WIP		4 – 200	0 – 65
Construction waste landfill		20 – 200	0 – 65
Cl	100		
Domestic waste landfill		1000 – 2100	110 – 150
MBP landfill		420 – 980	70 – 110
Landfill with ashes from WIP		290 – 12000	50 – 230
Construction waste landfill		100 – 600	0 – 90
AOX	500 µg/l		
Domestic waste landfill		1000 – 2800	25 – 55
MBP landfill		200 – 1500	0 – 35
Landfill with ashes from WIP		0 – 130	0
Construction waste landfill		0 – 20	0

Source: K.U. Heyer, K. Hupe, R. Stegmann, A. Wiland (2007) Landfill aftercare – options for action, duration, costs and quantitative criteria regarding the release from aftercare, Sardinia 2007



Aftercare time frame

- In conclusion the threat to HHE is likely to continue for much longer than considered in landfill legislation
- Unless something is done about it actively
- It seems clear that especially for MSW landfills reduction of DOC (or COD), nitrogen and chloride is likely to be necessary
- Technologies to achieve this are available
- The question is: why are they not applied more often?
- Fact 1: active stabilisation requires money to be spent now
- Fact 2: aftercare represents money to be spent in the future



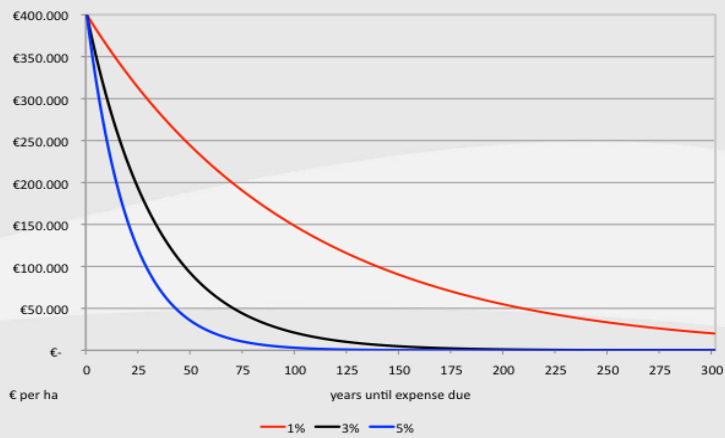
Discounting

- Discounting: determining the net present value of a future expense by means of a discount factor (interest rate (or return on an investment) minus inflation)
- There is long debate about the correct discount factor
- In the seventies discount rates of 10-12% were common
- In the nineties the US Government reduced it to 7%
- Currently some propose <1% for periods of many centuries
- Example: surface sealing in the Netherlands
Expense: € 400,000 per hectare
Discount rates: 1%, 3% and 5%



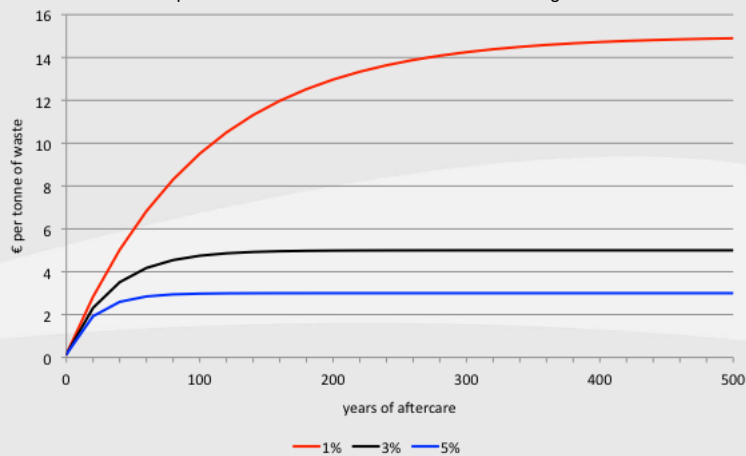
Discounting

Net present value of the cost of surface sealing in relation to time and discount factor



Discounting

Aftercare provision in relation to discount factor and length of aftercare



Messages and questions



- There is uncertainty about the length of aftercare
- There is uncertainty about the discount factor for determining the financial provision
- There is uncertainty that the provisions currently being accumulated will suffice in the future
- In addition in a declining market there is uncertainty that landfill operators can and will uphold their financial obligations
- How can we be sure that there will be enough money to carry out aftercare as long as it is needed?



Messages and questions

- Discounting provides a financial incentive to postpone activities into the future and not deal with them now
- Sustainable development demands that every generation deals with their own environmental issues and consequently does not postpone solving them into the future
- Can the waste management industry and research community contribute to this dilemma? Or will we leave it to the regulator?



AFVALZORG

**Thank you very much
for your attention**

