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EU Landfill Gas Control Guidance document



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European legal framework



- Directive 1999/31/EC of 26 April 1999 on the landfill of waste
- This Directive is not directly binding for landfill operators
- It is an instruction to member states and competent authorities to include specific aspects in a landfill permit
- Landfill gas control:

Consideration (16) “Whereas measures should be taken to reduce the production of methane gas from landfills, inter alia, in order to reduce global warming, through the **reduction of the landfill of biodegradable waste** and the requirements to introduce **landfill gas control**;”



European legal framework



- Specific requirements LFG control in Annex I Section 4. Gas control:
 - 4.1 Appropriate measures shall be taken in order to control the accumulation and migration of landfill gas (Annex III).
 - 4.2 Landfill gas shall be collected from all landfills receiving biodegradable waste and the landfill gas must be treated and used. If the gas collected cannot be used to produce energy, it must be flared.
 - 4.3 The collection, treatment and use of landfill gas under paragraph 4.2 shall be carried on in a manner which minimises damage to or deterioration of the environment and risk to human health.
- Requirements on monitoring in Annex III
- Member States complained that these requirements were too vague



European LFG control guidance



- The guidance document was drafted by a working group installed by DG ENV (March 2010), consulted with Member States and approved following a Technical Adaptation Committee meeting (December 2013)
- The purpose of the document is:
 - To help competent authorities improve methane collection through the enforcement of the Landfill Directive requirements
 - To provide clarity on landfill gas control requirements within the context of all of the Landfill Directive technical and regulatory requirements
 - To set out the most important criteria in ensuring effective collection, treatment and use of landfill gas



European LFG control guidance



- Generic requirements on landfill gas control measures:
 - Landfill gas extraction should start as soon as possible following waste disposal
 - A phasing plan should facilitate collection and minimise the release of LFG
 - The active tipping area should be minimised
 - LFG should be collected from the operational area (temporary/sacrificial)
 - Temporary and permanent caps and gas collection should be installed asap
 - The recovered landfill gas is either utilised or oxidised
 - The efficiency of recovery and composition of gas are monitored



European LFG control guidance



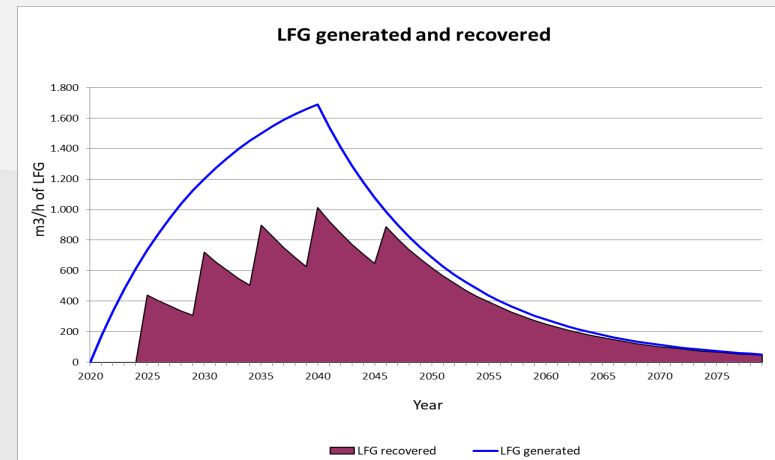
- Landfill gas must be collected from landfills receiving biodegradable waste unless the landfill operator can prove to the competent authority that it is not necessary to do so
- It has to be demonstrated that the landfill does not produce more than negligible quantities of landfill gas
- The test for negligible quantities of landfill gas is whether an active methane treatment method can be sustained at the landfill
- Technically that is though! There are flares on the market that burn on $1 \text{ m}^3 \text{ CH}_4$ per hour with 15% methane in the gas



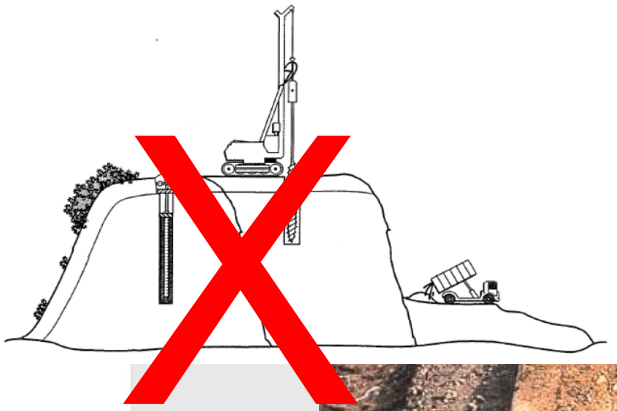
European LFG control guidance



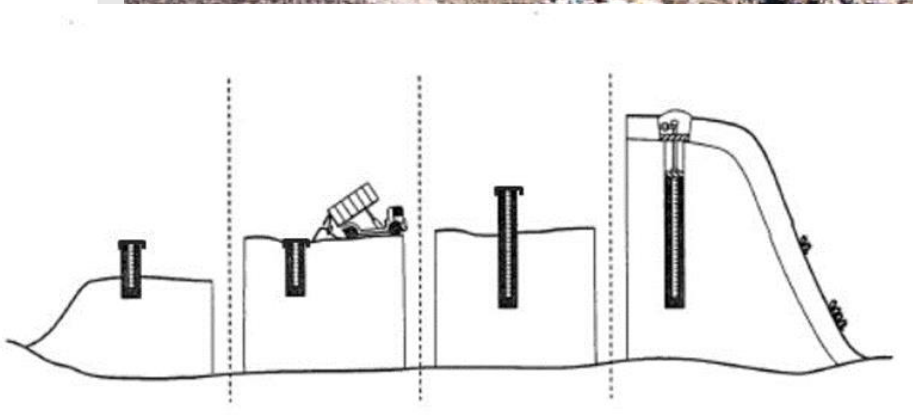
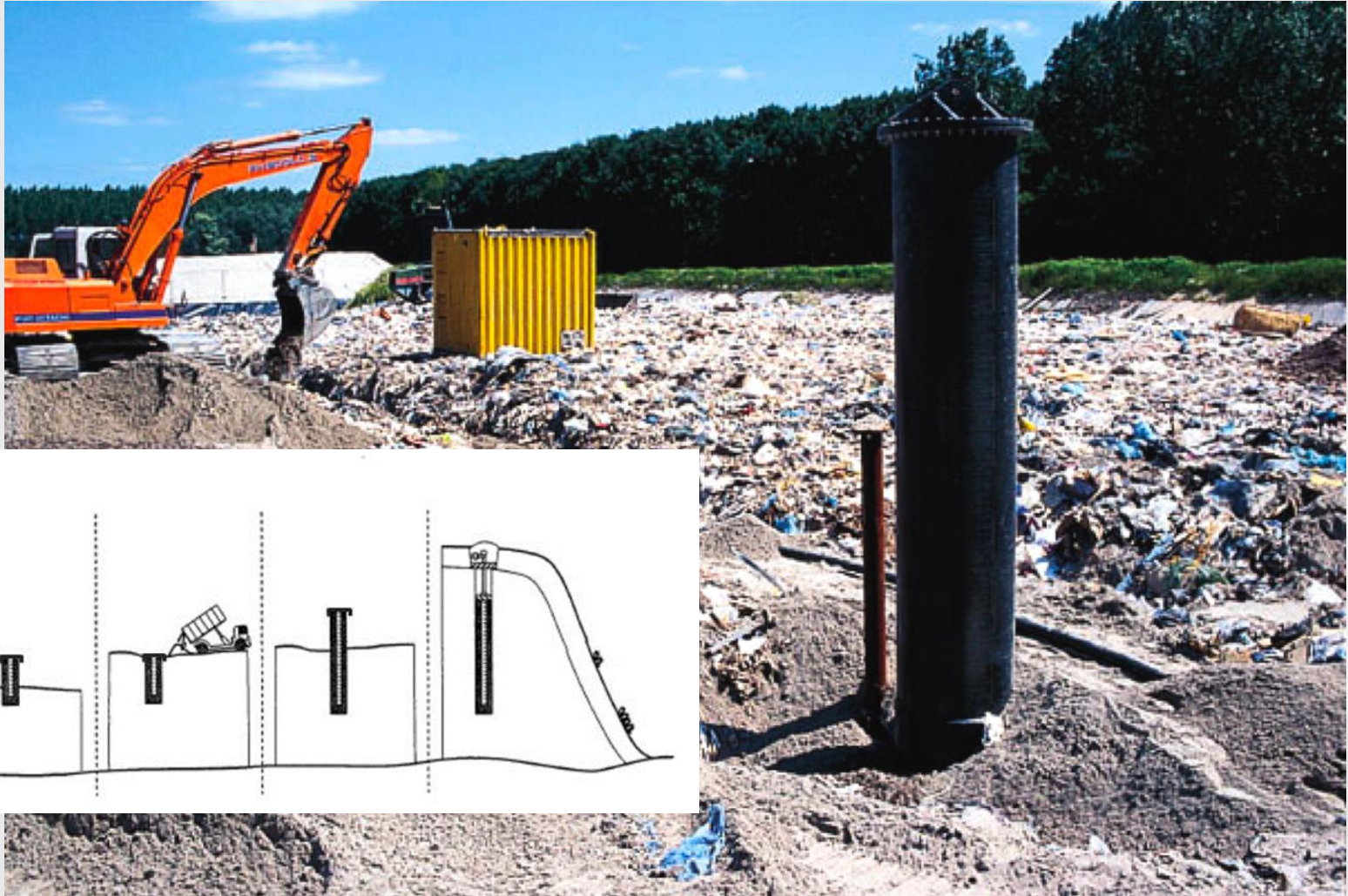
- Landfill gas generation declines over time: lower volume and methane %
- Landfill operators must ensure that the maximum amount of landfill gas is oxidised over the whole lifecycle of the landfill
- They have to follow a hierarchy of treatment techniques over the life of the landfill:
 - High temperature flaring
 - Low calorific flaring
 - Other techniques for oxidation of methane
- Passive methane oxidation should be considered, but insufficiently addressed
- Aeration is not specifically mentioned



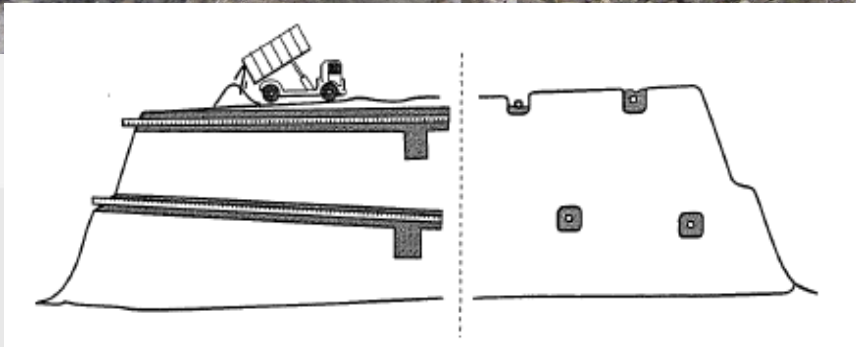
Gaswell construction



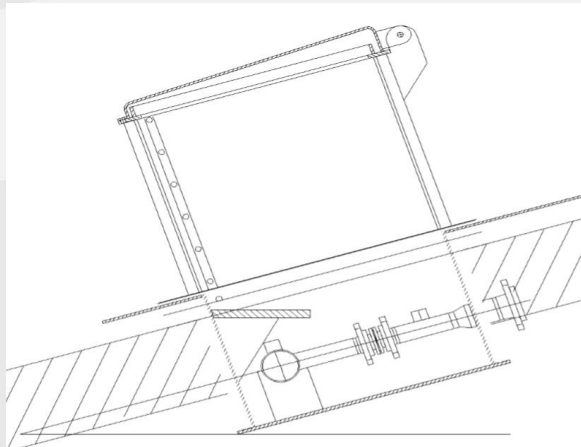
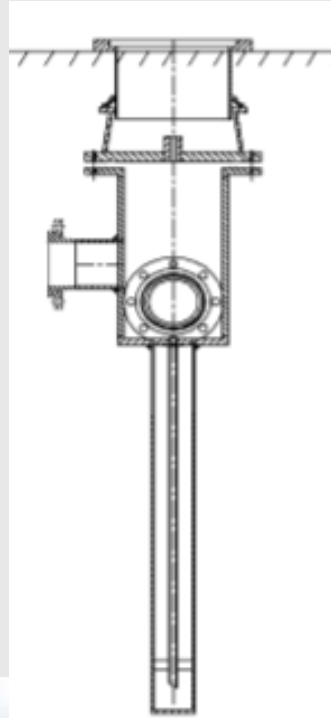
Gaswell construction



Gaswell construction



Piping



Compressor and flare



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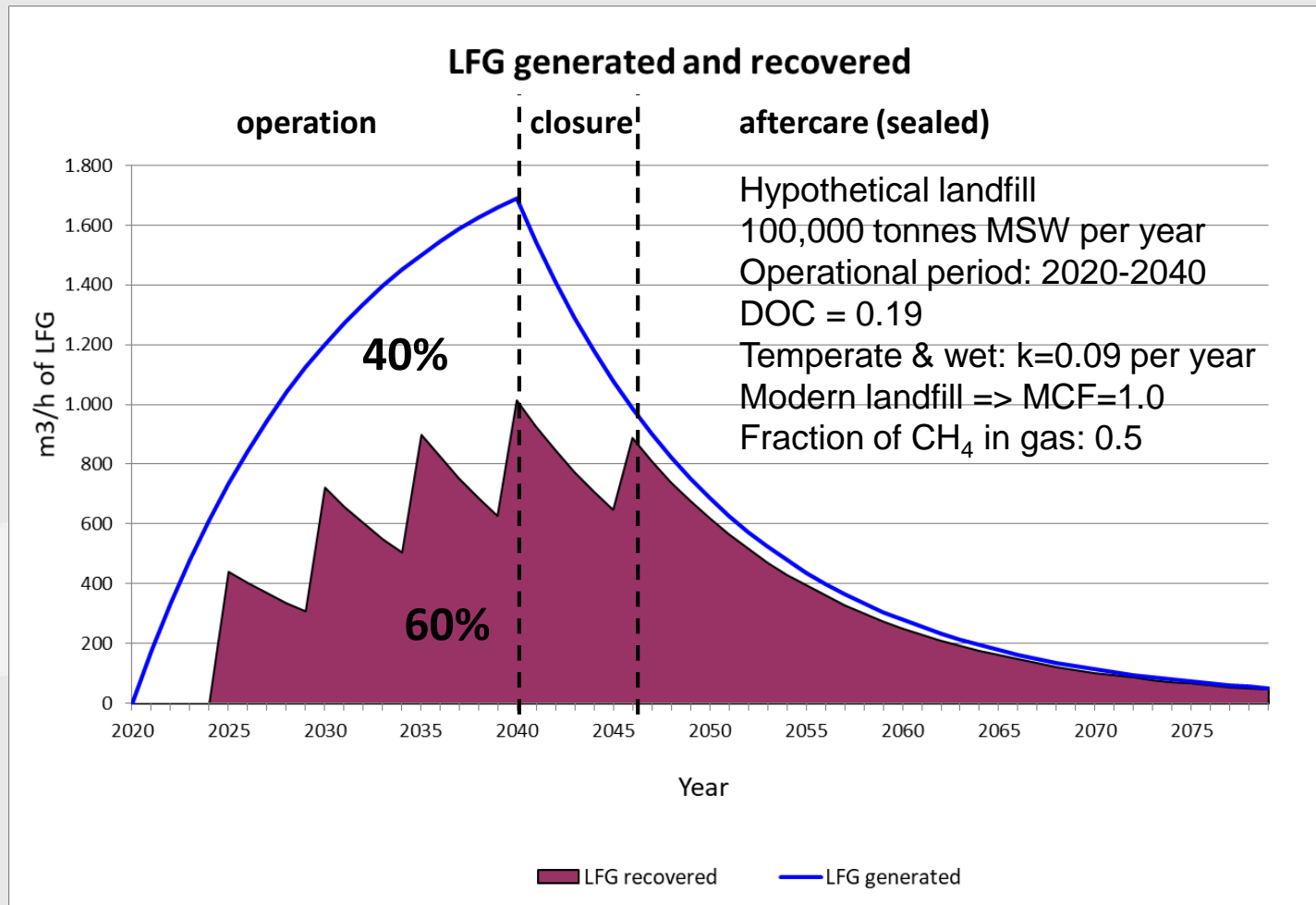
LFG engines



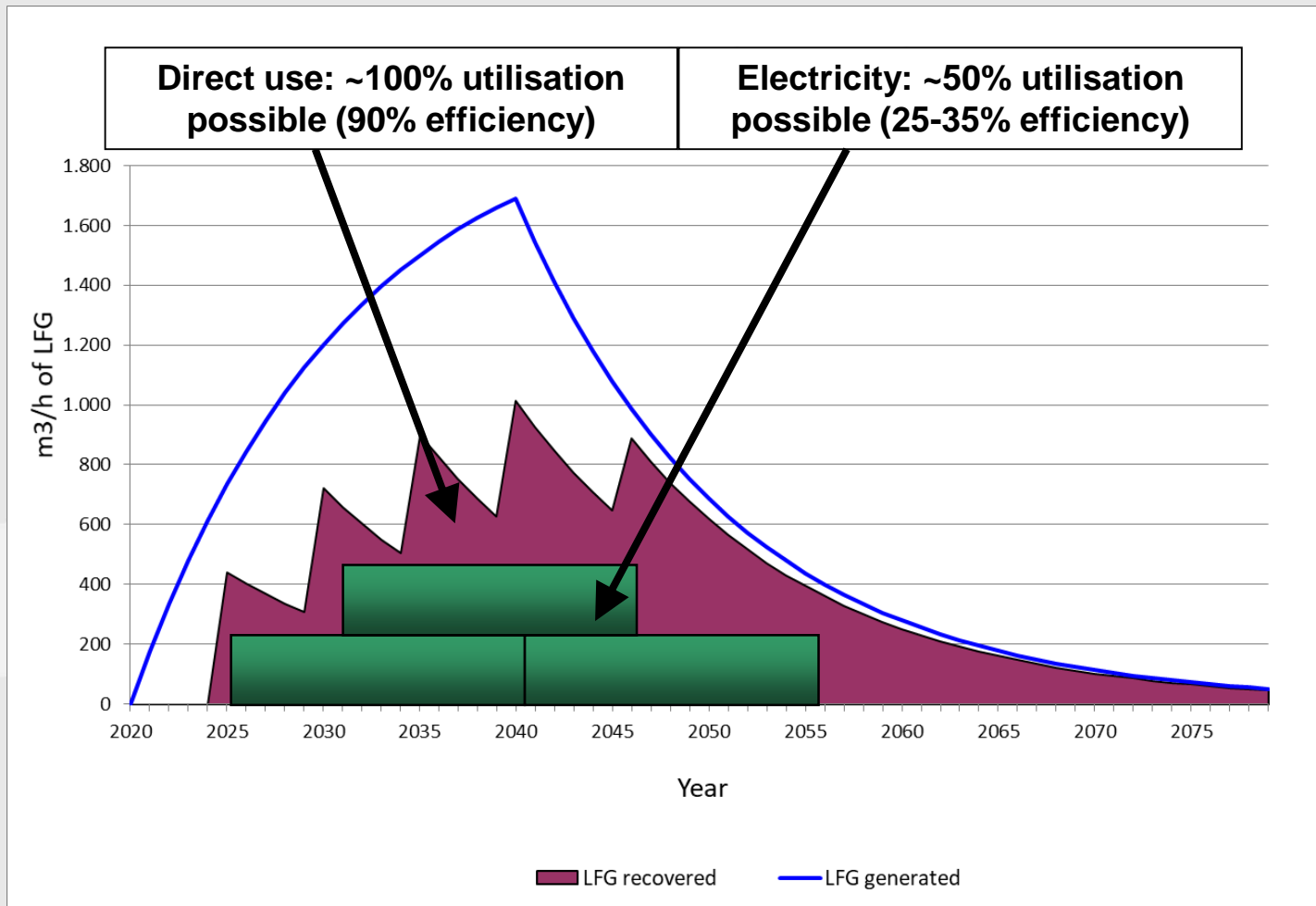
Landfill gas boilers



Landfill gas generation and recovery

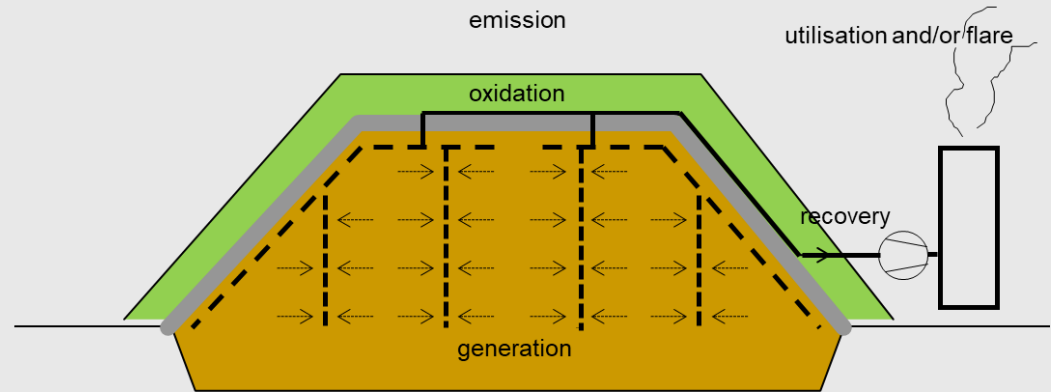


Landfill gas utilisation



Emission =

$$(generation - recovery) - oxidation$$



no gas control	generation	1 kg CH ₄ =>	25,00 kg CO ₂ eq.
	oxidation	0,1 kg CH ₄ =>	-2,50 kg CO ₂ eq.
	net emission	0,9 kg CH ₄ =>	22,50 kg CO ₂ eq.
recovery and energy production	generation	1 kg CH ₄ =>	25,00 kg CO ₂ eq.
	recovery	0,6 kg CH ₄ =>	0,00 kg CO ₂ eq.
	utilisation	50%	
	electricity	5,3 MJe =	-0,39 kg CO ₂ eq.
	heat	6,8 MJth =	-0,41 kg CO ₂ eq.
	not captured	0,4 kg CH ₄ =>	10,00 kg CO ₂ eq.
	oxidation	0,1 kg CH ₄ =>	-2,50 kg CO ₂ eq.
net emission		6,70 kg CO ₂ eq.	
recovery and flare	generation	1 kg CH ₄ =>	25,00 kg CO ₂ eq.
	recovery&flare	0,7 kg CH ₄ =>	0,00 kg CO ₂ eq.
	not captured	0,3 kg CH ₄ =>	7,50 kg CO ₂ eq.
	oxidation	0,1 kg CH ₄ =>	-2,50 kg CO ₂ eq.
	net emission		5,00 kg CO ₂ eq.



Consequences for COCOON?

- The intention of the articles on landfill gas control in the EU landfill directive have been clarified and specified in a guidance document
- The guidance document states goals rather than means
- Technical details should be specified in national guidance documents
- Not much need to improve or extend
- Two aspects for future EU landfill management legislation remain:
 - Landfill aeration as gas control measure is not yet included
 - Microbial methane oxidation is insufficiently addressed



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Thank you very much for your attention...



European LFG control guidance



- 'Whole landfill methane emission measurement methods that are affordable, sufficiently accurate and sufficiently reliable to stand up in a court case are currently not available'
- Technical Adaptation Committee of the European Commission decided against emission limit values (ELV's) for landfill gas
- Landfill is an activity under the IPPC protocol => IED
- The IED does not include ELV's for carbon dioxide and methane
- This means that permits need to require BAT
- BAT is described in technical guidance documents



Best Available Techniques (in the EU)

- 1984: Directive 84/360/EEC: best available techniques not entailing excessive costs (BATNEEC)
- 1996: IPPC Directive 96/61/EC: Best Available Techniques to the integrated control of pollution to air, water and soil
- 2010: Directive 2010/75/EU (Industrial Emissions Directive):
 - "best" means most effective in achieving a high general level of protection ..
 - "available" means .. under economically and technically viable conditions, taking into consideration the costs and advantages, .. as long as they are reasonably accessible to the operator;
 - "techniques" includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned

