

"LFG projects between Old Europe (Germany) and the Old Eastern Bloc (L., R. and B.)"

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"LFG projects between Old Europe (Germany) and the Old Eastern Bloc (L., R. and B.)"

16th Intern. Waste Management and Landfill Symposium Sardinia 2017, Oct 2nd - Oct. 6th

Wolfgang H. Stachowitz
DAS - IB GmbH

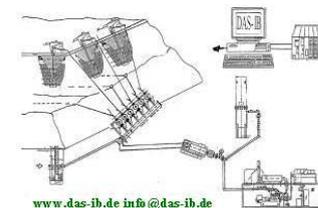
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Biogas, sludge gas and landfill gas technology:

- Consulting, planning, project management
- Training of system operators
- Expert i.a. in accordance with § 29a of the Federal Immission Control Act; and Qualified Person reg. the Ordinance on Industrial Safety and independent expert

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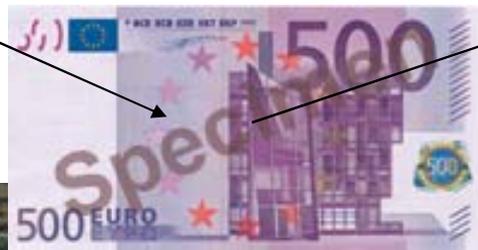
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Emissions of methane: The story of environment and money ..

Methane + O₂ =

+ CO₂



GWP: 28

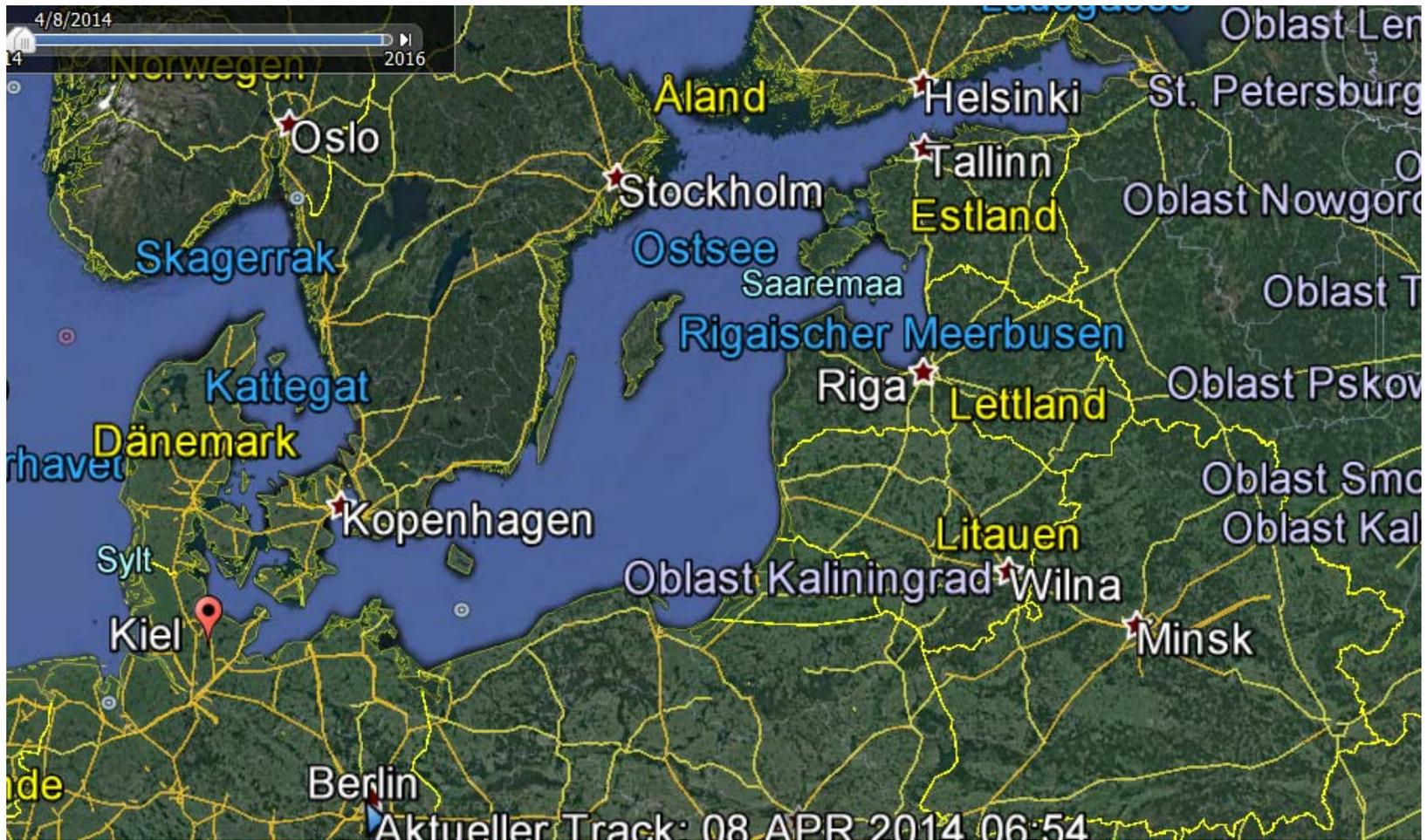


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Overview of the area our projects

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Do you know the area of these Landfill site?



believe this?':
it terror attack

men that did not happen.



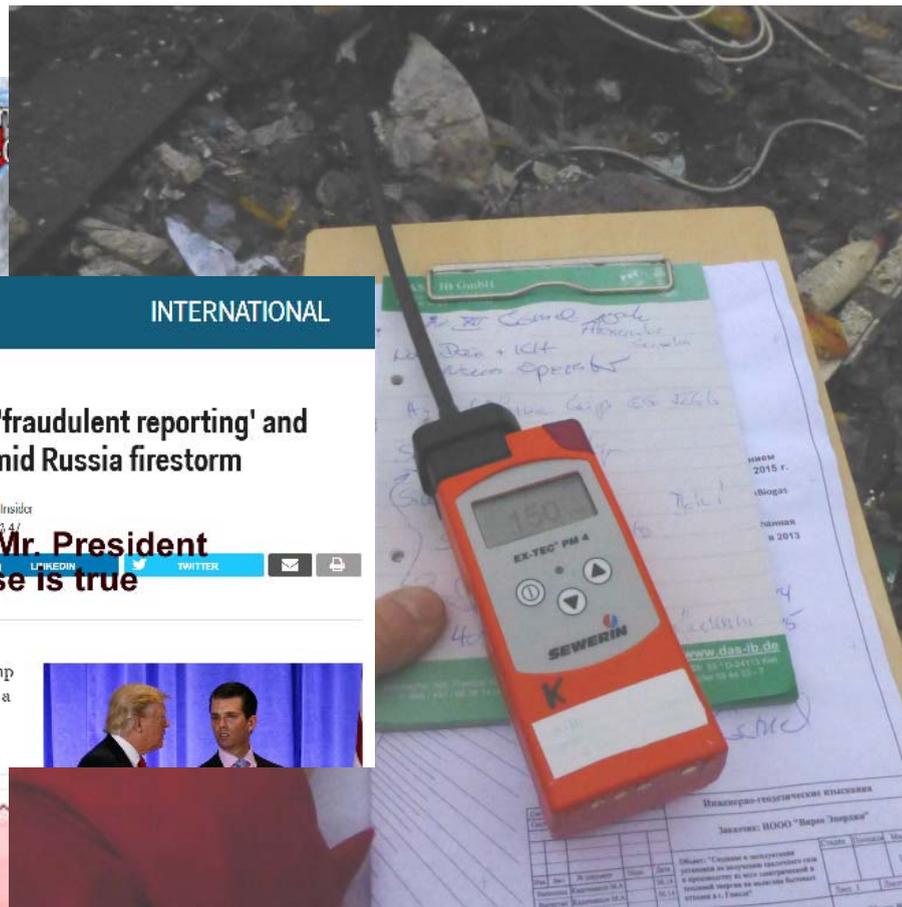
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Landfill G. or H.

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What do we do on site?



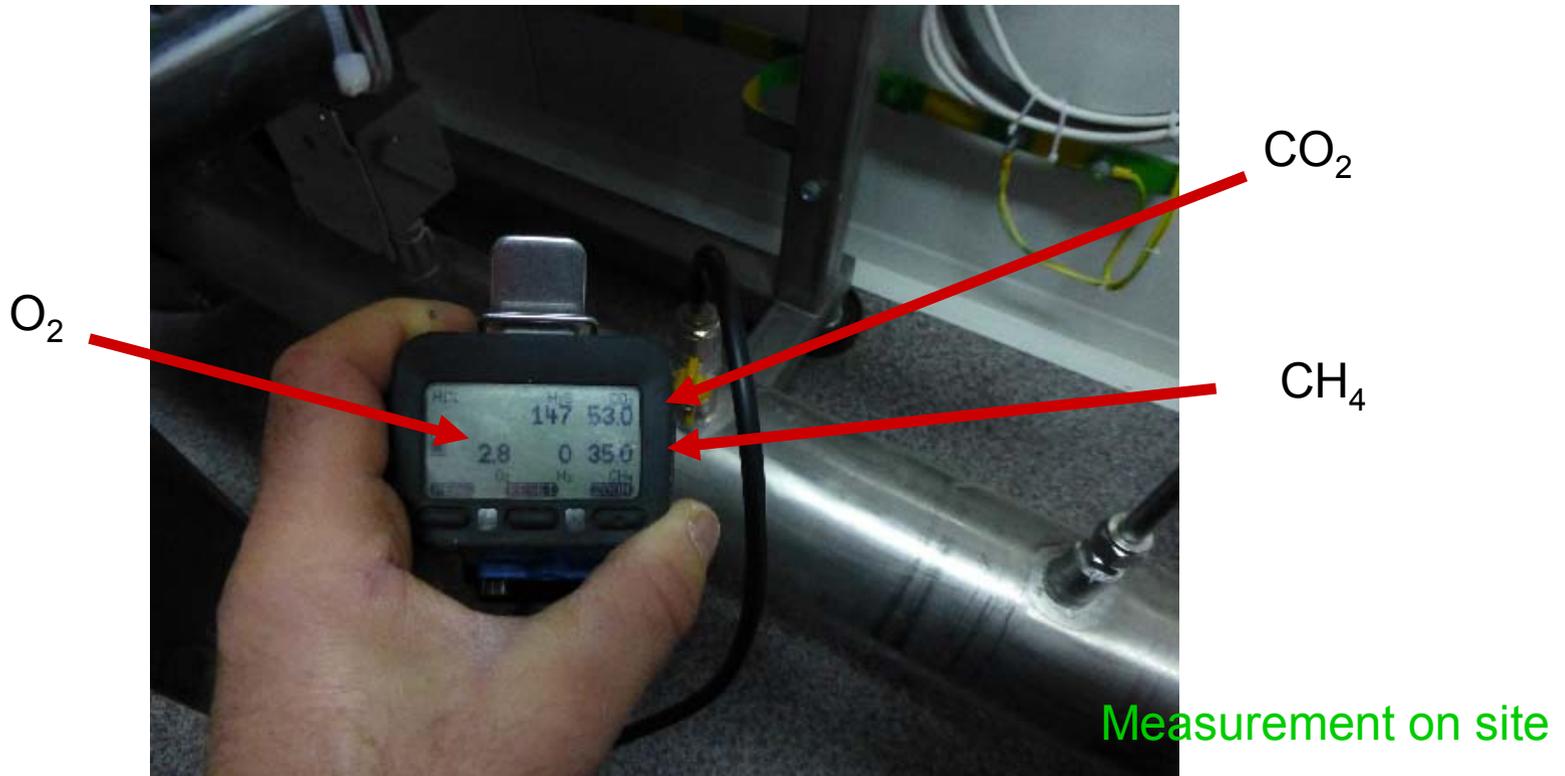
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Landfills V. and O.:

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Regarding the request for LFG prognosis and possible LFG utilisation:



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Regarding the request for LFG prognosis and possible LFG utilisation:

It could also be stated on site that operation less than 18 or 24 month

methane content dropped from > 50 vol.-% to > 30 vol.-%
and CO₂ from approx. 30 vol. % to > 60 vol. %.

This means that the process of composting started due to:
aeration
over suction

CH₄ (from the landfill) + 2 O₂ (from the air) transfer to CO₂ + 2 H₂O +
energy

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Regarding the request for LFG prognosis and possible LFG utilisation:

Furthermore:

The temperature of the landfill gas was so low ..

.. the air is in wintertime so cold that the temperature of the landfill gas even decreased instead of increasing (getting higher):

approx. 10°C instead of 30°C to 40°C.

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Landfills V. and O.:

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Regarding the request for LFG prognosis and possible LFG utilisation:



The installed technique looks (first view) always proper and fine

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Second view:

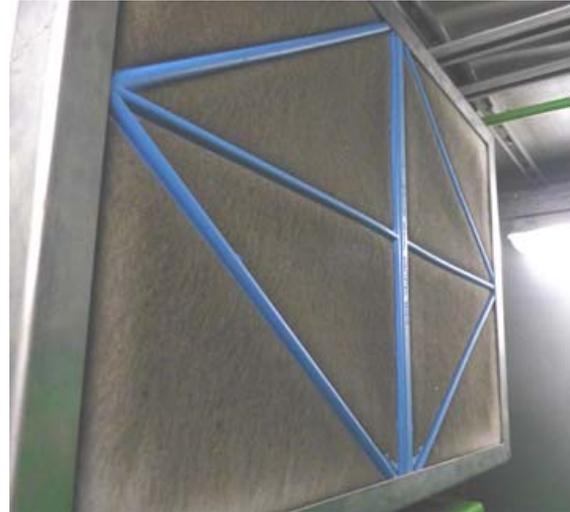


Emission (Vol %) in a manifold station



Screws are missing

Weight of pipes on a bellow expansion joint



Air filter in engine container

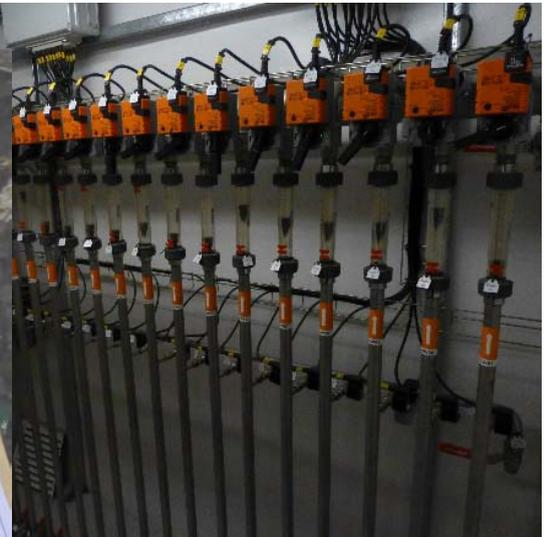
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Landfill N.:

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.... an old landfill with an existing poor extraction system. It would not have been useful to analyse it.
However, there is a new site near by.



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Landfill N.:

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However, there is a new site near by.



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Landfill G. or H.

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At min. another 1 MW_{el} engine is possible to install and to operate - but with a new and better extraction system

But taken into account the high H₂S content from the site.

Currently, no engine is installed at the site.

The landfill is not fully covered.

The equipment and gas booster are not sufficient.



ter emerges high H₂S

d at the site.

d).

uch as CHPs

The gas extraction system need a upgrade.

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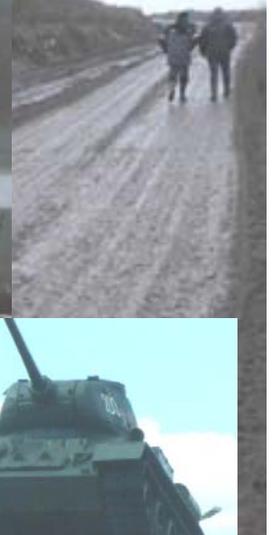
Landfills east and north east

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Weather conditions are different to central Europe ..

Ask Napoleon and German troops in world war II



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Landfills in the 70th West Europe and actual East Europe

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And a landfill is never full filled



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Landfill K. in L.

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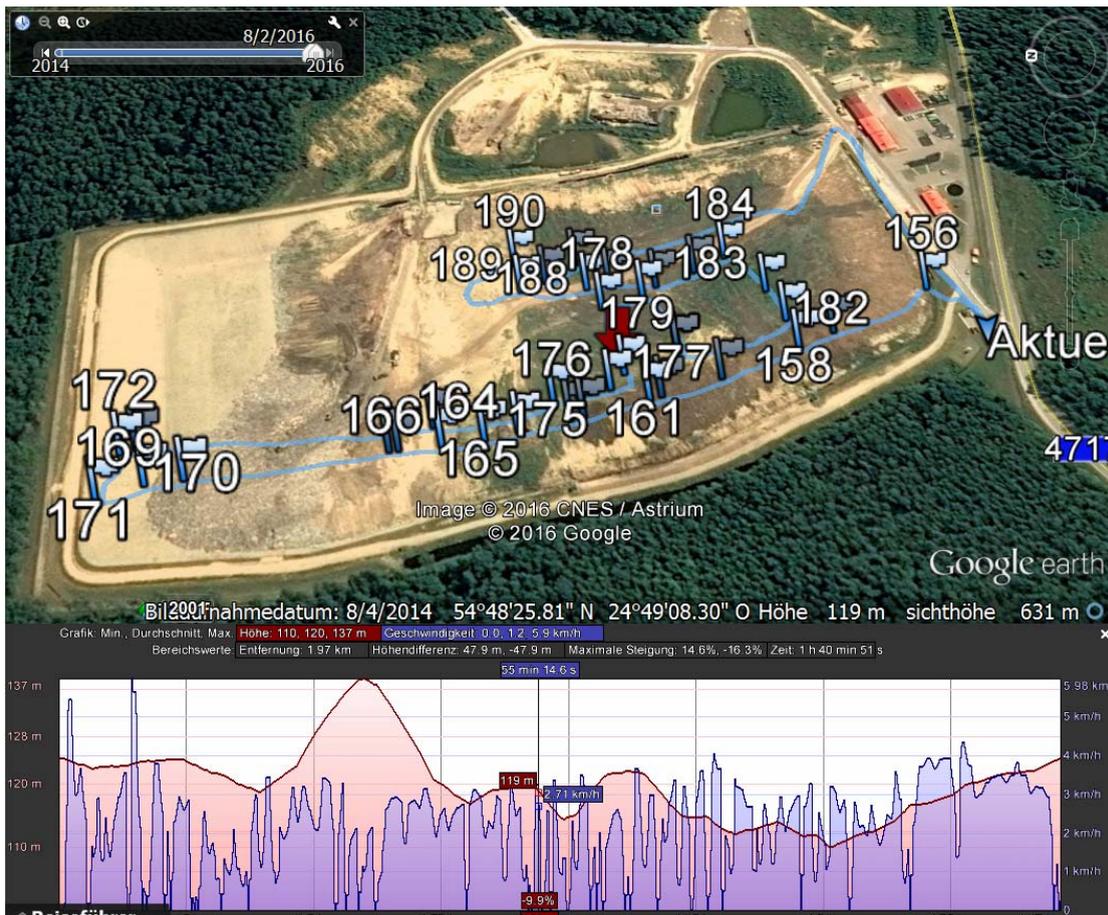
The K. landfill is one of the biggest landfills in L.. The construction of the landfill started in 2006, and its operation started in 2007. The landfill is situated at 2 km south of K. village in the E. district. It is used by eight different districts of the V. region, where around 500,000 people live. The entire surface area of the landfill amounts to approximately 27 ha, and is subdivided into two sections. The first section has been operated since 2013. An estimated amount of approximately 1,4 million tons of waste are stored here. After the first section had been closed, the second section was opened. It is planned to store around 1 million tons of waste.

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Landfill K. in L.

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Landfill K. in L.

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| Waypoint (examples) | Emission over the surface (Sewerin HS 680) in ppm / vol. % of methane | Emissions in a height of approx. 1m, measured in ppm with Sewerin ExTec PM 4 |
|---------------------|---|--|
| 169 (open dump) | > 30 | > 10 |
| From 170 | 660 ppm – 0.1 vol. % | 10 – 20 |
| Until 171 | 240 – 0,1 vol. % | 4 – 20 |
| Until 172 | 200 – 600 | 7 – 30 |



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Landfill K. in L.

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Challenge 2016 ff

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Landfill K. in L.

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From VIII 2015 to VIII 2016
changes of the slope by
leachate water lagoons on top

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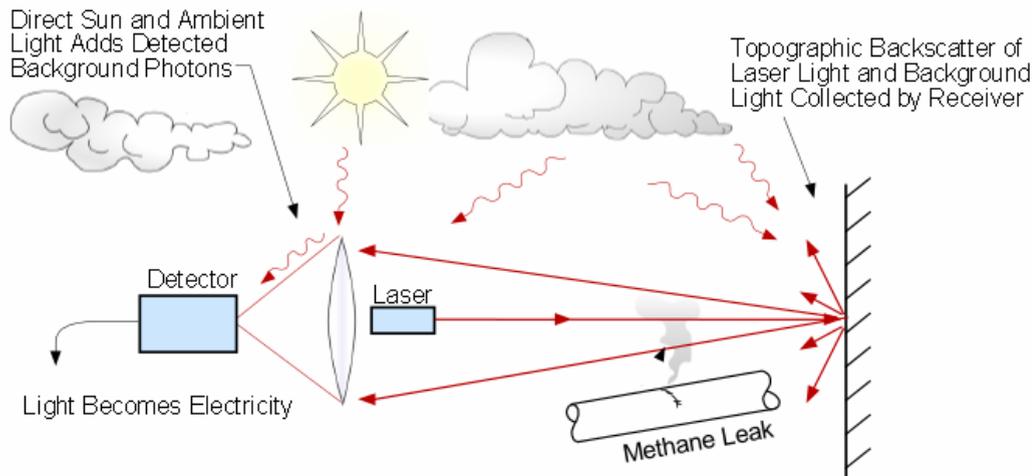
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General about the LASER system we use

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RMLD

(Remote Methane Leak Detector) – Laserabsorptionsspectrometer



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At all the sites, gas leakages can be found at the engines (turbo charger and cylinder):



But we also find out: This is a general aspect all over – the emissions belongs to the work of O&M (not engines and countries)

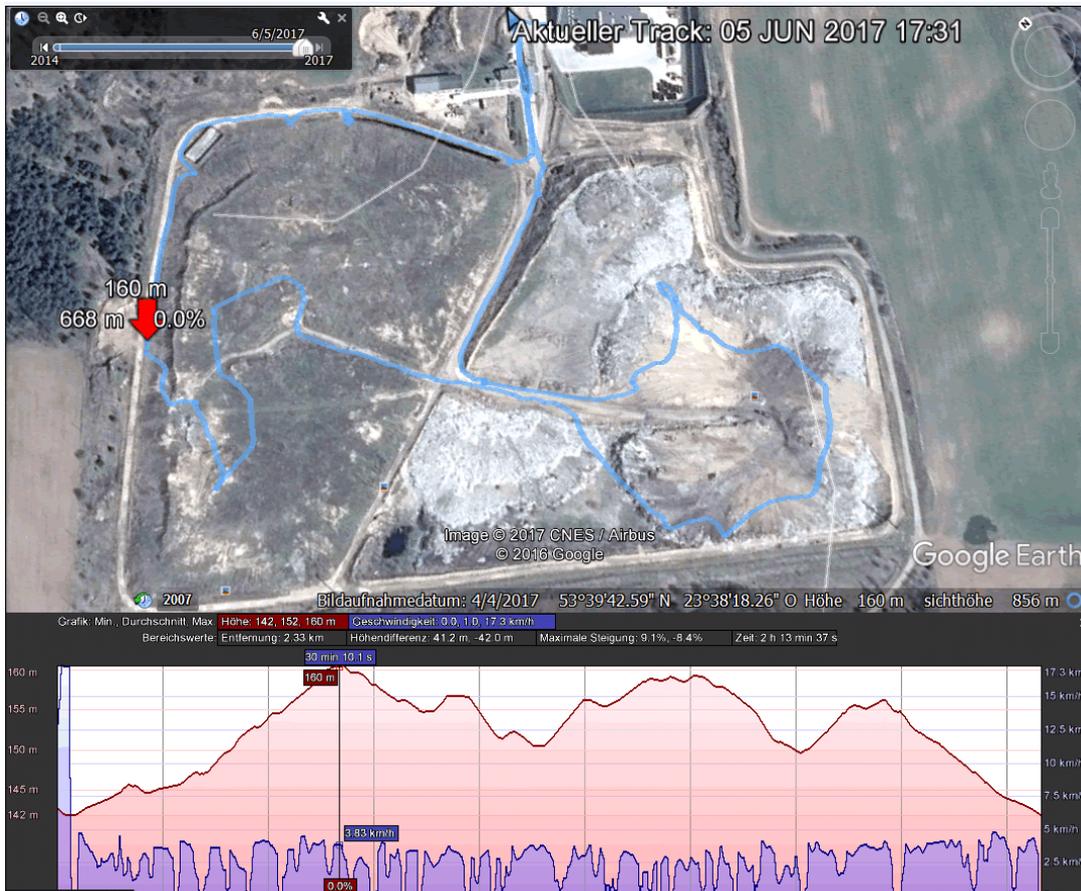
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Landfill G II. or H II.

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Calibration of the GPS system: waypoint parking place & weight bridge on site



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There is organic or not ... to be or not be ... indicator

- a) Put a pipe in and measure
- b) Measure over the surface
- c) Have look at the animals and plants
- d) Have experience



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No efficiency - without a good gas extraction system

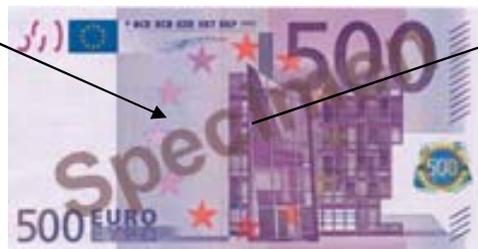
The image contains several technical and photographic elements:

- 3D Perspective:** Shows a landfill with a grid of extraction lines in green and purple.
- Technical Diagrams (A-A):** Two cross-sections of a landfill. The top one is labeled "Klasická filtrace sítěho stádu sál vln sportyho kágu i vlnitv stárym/udámym vlnitv rovkam" and "Filtrace sítěho kágyho stádu, vlnitv kágy, d=53". The bottom one is labeled "Vlnitv kágy sál s vlnitv vlnitv, d=100" and "Asfaltv kágy sál s vlnitv vlnitv, d=100". Both diagrams show a 146.00m length and various filter and well details.
- Photograph:** A drilling rig is shown in operation on a landfill site. The text "At the end of a day we drill" is overlaid in green.
- Well Diagram:** A row of wells is shown in cross-section. The top two rows of wells are highlighted with pink circles. The text "but grabbing is better .. why?" is overlaid in green.

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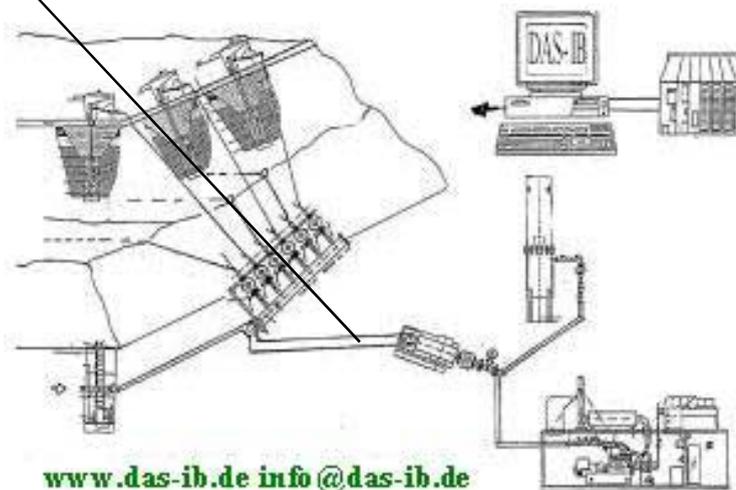
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Methane
(méthane) + O₂ =



+ CO₂

GWP: 28



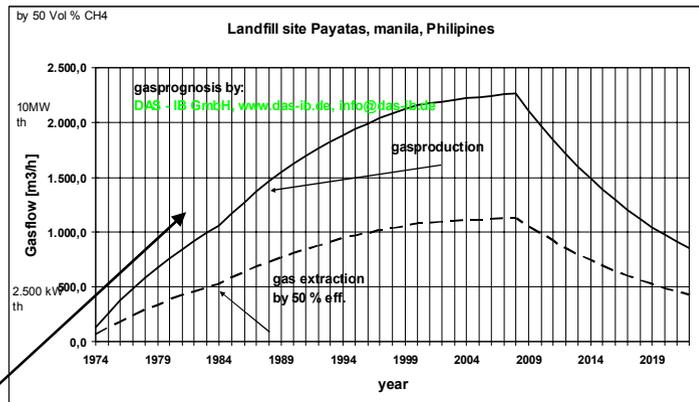
It looks easy – money from waste ... **BUT**

Il semble facile de faire de l'argent à partir des ordures ... **MAIS**...

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No efficiency - without good gas prognoses and equipment on site



See Author **Wolfgang H. Stachowitz**
 15 Years of experience in the field of LFG disposal ..
 Sardinia 2001, 8th International ...



$$Q_{a,t} \left(\frac{m^3}{a} \right) = 1,868 \cdot M \cdot TC \cdot f_{a0} \cdot f_a \cdot f_o \cdot f_s \cdot k \cdot e^{-k \cdot t}$$

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No efficiency - without any measurement on site from ... via manifold station ..



old manifold station vs. new manifold station.

Ring – pipe around the site with bypass instead of
“good” & “poor” gas system

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No efficiency - without the right local solutions



Manifold station on the brink of the landfill
with dewatering (to the condensate shaft) and purge connections

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No efficiency - without the right local solutions



Measurement at manifold station:

ρ , F , T , Q : CH_4 , CO_2 , O_2 , H_2S , ...

Plus samples for a laboratory:

F , Cl , S , Si , CO , NH_3 , H_2S etc.



dewatering

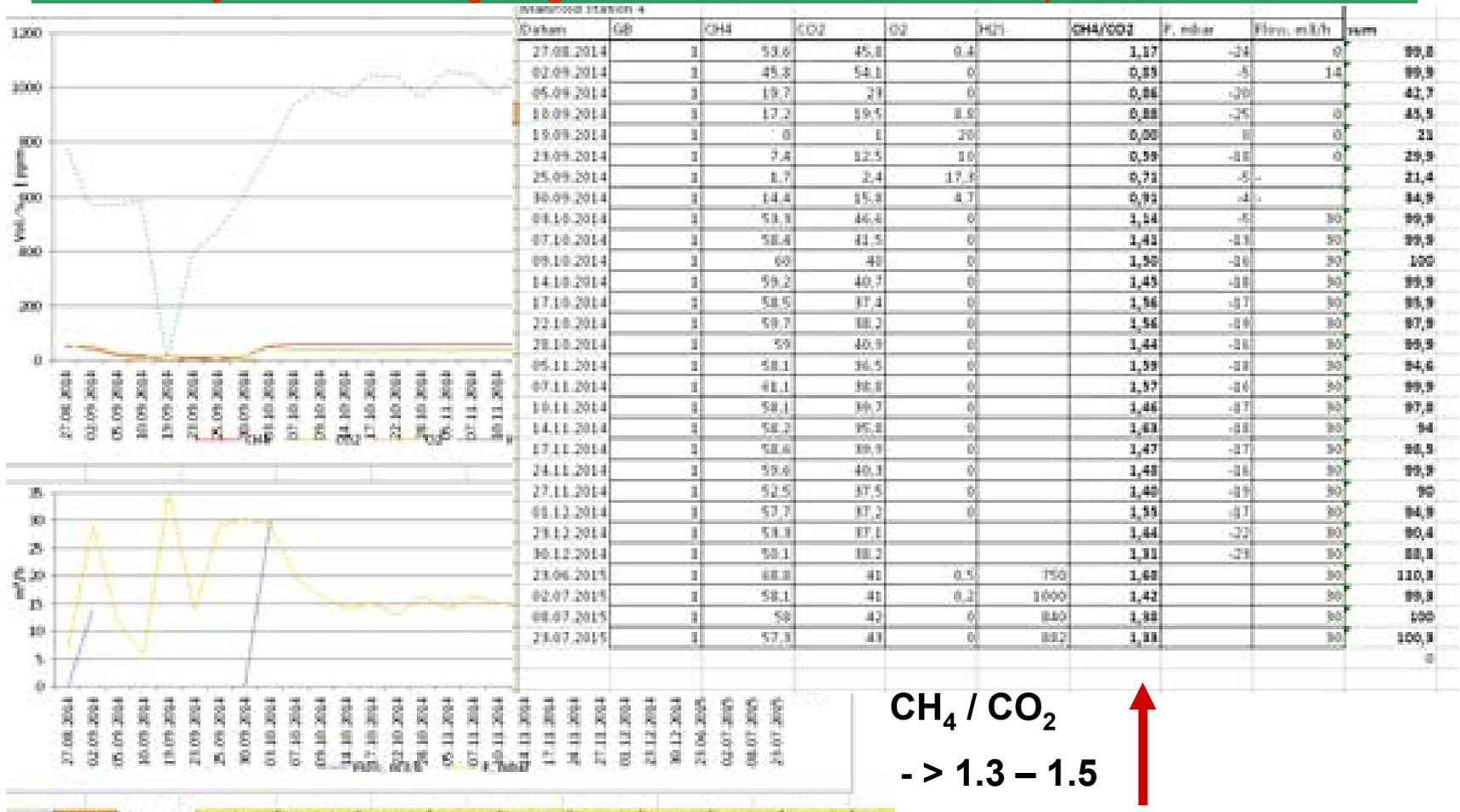


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No efficiency - without the right figures of measurement and interpretation



CH₄ / CO₂
- > 1.3 - 1.5



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No efficiency - without knowing of the raw gas

Raw gas analyses / inspections



| | | | |
|-------------------------------|-------|--------|---------------------|
| Methan | Vol-% | 27,6 | DIN 51872-5*;KI |
| Kohlendioxid | Vol-% | 5,6 | DIN 51872-5*;KI |
| Sauerstoff | Vol-% | 26,1 | DIN 51872-5*;KI |
| Stickstoff | Vol-% | < 0,5 | DIN 51872-5*;KI |
| Wasserstoff | Vol-% | < 0,5 | DIN 51872-5*;KI |
| Kohlenmonoxid | Vol-% | < 0,5 | DIN 51872-5*;KI |
| NebenkompONENTEN | | | |
| Schwefelwasserstoff | mg/m³ | 2190 | Sewerm;KI |
| Ammoniak (NH3) | mg/m³ | > 76,0 | Sewerm;KI |
| Siliciumkomponenten | | | |
| Hexamethyldisiloxan | mg/m³ | 0,7 | E VDI 3860 Bl. 2;KI |
| Hexamethylcyclotrisiloxan | mg/m³ | < 0,4 | E VDI 3860 Bl. 2;KI |
| Octamethyltrisiloxan | mg/m³ | < 0,1 | E VDI 3860 Bl. 2;KI |
| Octamethylcyclotetra- siloxan | mg/m³ | 1,5 | E VDI 3860 Bl. 2;KI |
| Decamethyltetrasiloxan | mg/m³ | < 0,1 | E VDI 3860 Bl. 2;KI |
| Decamethylcyclopenta- siloxan | mg/m³ | 0,5 | E VDI 3860 Bl. 2;KI |
| Summe Siloxane | mg/m³ | 2,7 | E VDI 3860 Bl. 2;KI |
| Summe Siloxane als Si | mg/m³ | 1,0 | E VDI 3860 Bl. 2;KI |
| Summenparameter | | | |
| Chlor gesamt | mg/m³ | < 1 | E VDI 3860-2;KI |
| Fluor gesamt | mg/m³ | < 1 | E VDI 3880-2;KI |
| Schwefel gesamt | mg/m³ | 1600 | E VDI 3860-2;KI |

Handwritten notes on the table:
 - A bracket groups the first six rows.
 - An 'X' is written next to the Ammoniak row.
 - '2 end of measurement div.' is written next to the Ammoniak row.
 - '5.355' and '> 186' are written next to the Schwefelwasserstoff row.
 - '2,44' is written next to the Summe Siloxane row.
 - '3512' is written at the bottom right.
 - A checkmark is next to the Chlor gesamt row.

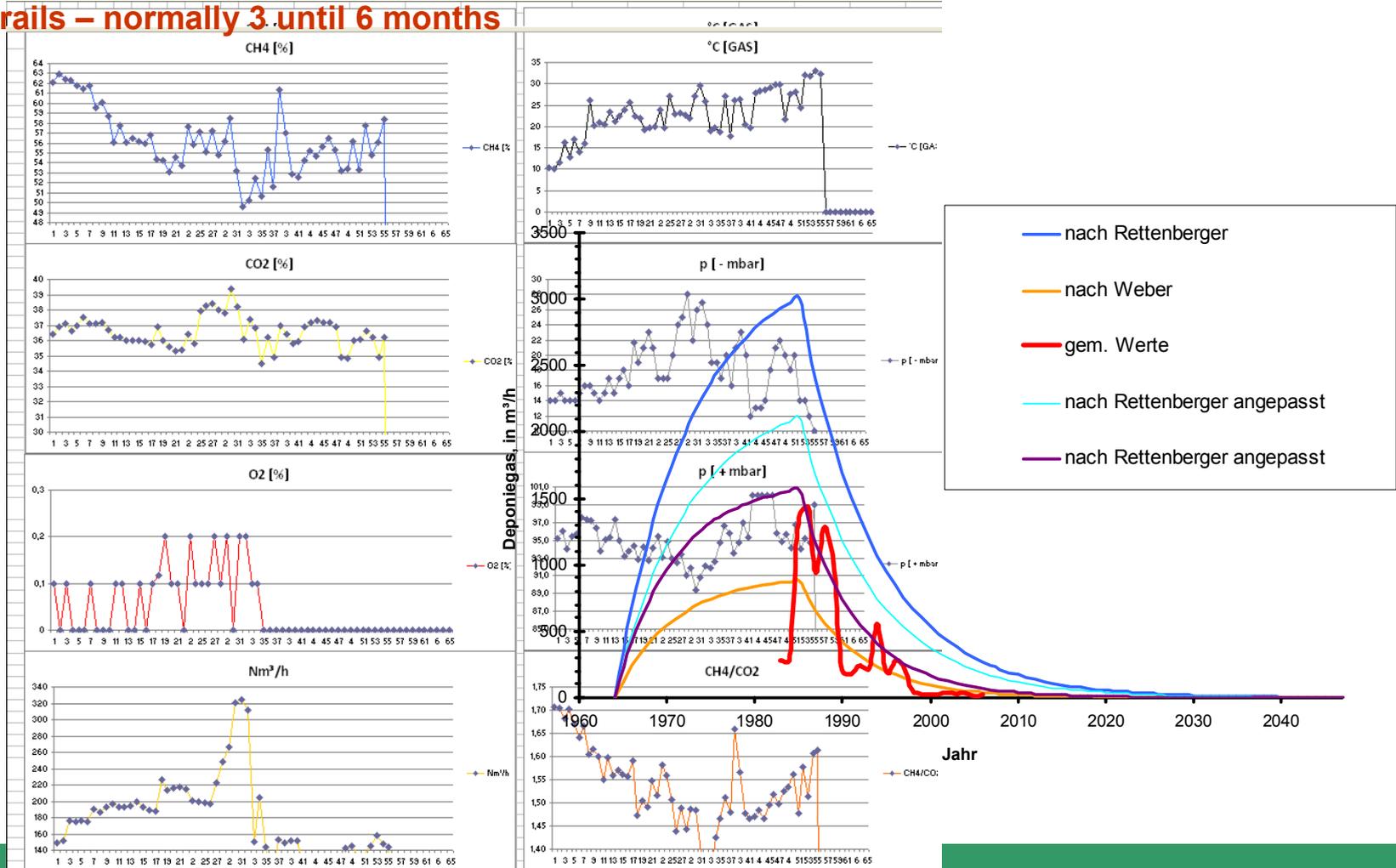
--- = Statistischer Bestimmtheitsgrad n.b. = nicht bestimmbar * = nicht akkreditiert FV = Fremdvergabe

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No efficiency - without knowing of the right gas flow – so make realistic pumping trails – normally 3.until 6 months



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Conclusions:

No efficiency - without a good gas extraction system

No efficiency - without good workers and measurement devices



No efficiency - without the right local conditions

No efficiency - without the right figures of measurement and interpretation

No efficiency - without knowing of the raw gas

No efficiency - without knowing of the right gas flow – so make realistic pumping trails – normally 3 until 6 months

Be on site in summer and winter time !

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Any questions left?



Knowledge is key and is available when you know where to find it:

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Or we see us at your site or here e.g. next break