OPTIMISATION OF GAS COLLECTION SYSTEMS
LANDFILLS, HAZARDOUS WASTE AND ABANDONED

WASTE DISPOSAL SITES

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Thirteenth International Waste Management and Landfill Symposium in Sardinia from 3-7 October 2011

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Biogas, sludge gas and landfill gas technology:
- Consulting, planning, project management
- Training of system operators
- Independent Expert activities

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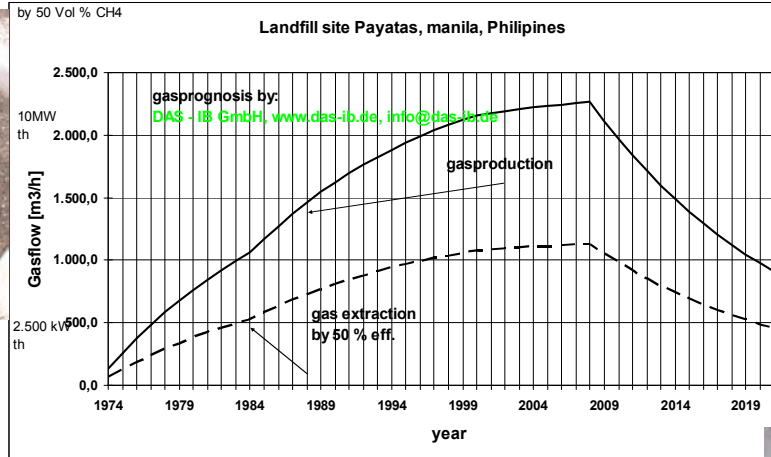**www.das-ib.de**
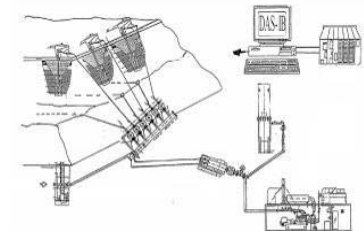
1. Introduction

Reasons (aims) for optimisation measures:

- **Decreasing gas quantities and, as a result, reduced generation of electric energy, or oversized CHP - units**

- **Emission reduction in the sense of the regulation for waste disposal sites and of environmental protection**

- **Stipulated measurement and monitoring measures in accordance with regulation for waste disposal sites**

- **Reduction of the aftercare through optimised avoidance of emissions**

- **CDM - projects**

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1. Introduction

by 50 Vol % CH4

Landfill site Payatas, manila, Philipines

gasprognosis by:
DAS - IB GmbH, www.das-ib.de, info@das-ib.de

gasproduction

gas extraction
by 50 % eff.

10MW th

2.500 kW th

Gasflow [m3/h]

year

**Stachowitz W.H. ,
15 Years of experience in the field of LFG disposal ..
Sardinia 2001, 8th International …**

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1. Introduction

Fires at landfills

(les décharges en feu)

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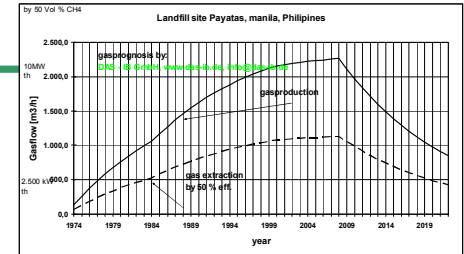**DAS - IB GmbH**

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1. Introduction

People on landfills

(Humains sur les décharges)

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1. Introduction

animals on landfills

(animaux sur les décharges)

Watchdogs, cows, donkeys, storks etc.

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1. Introduction

Aims (reasons) of the optimisation measures:

- **Operation of CHP – units**

- **Getting CO2 – credits / Flaring**

- **Emission reduction**

- **According to regulation for waste disposal sites**

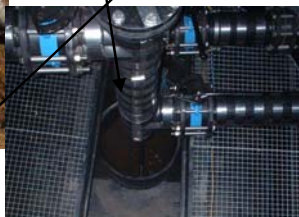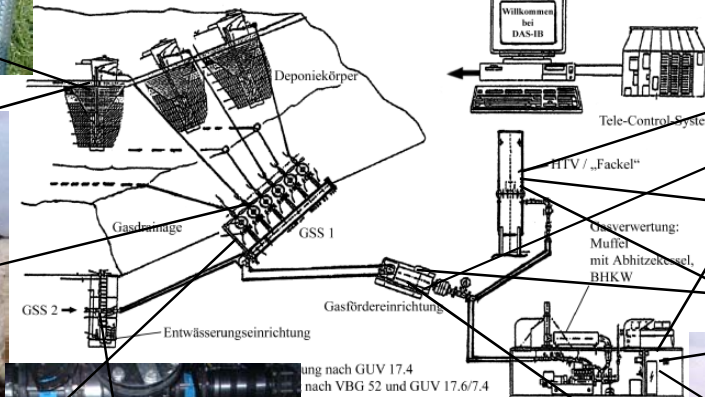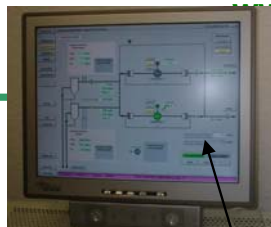- **Reduction of the aftercare period**

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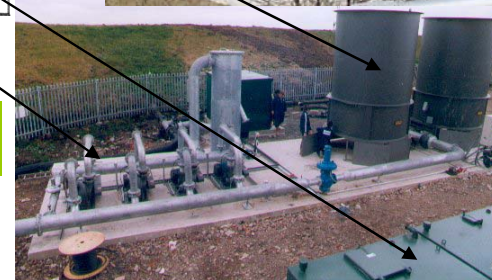
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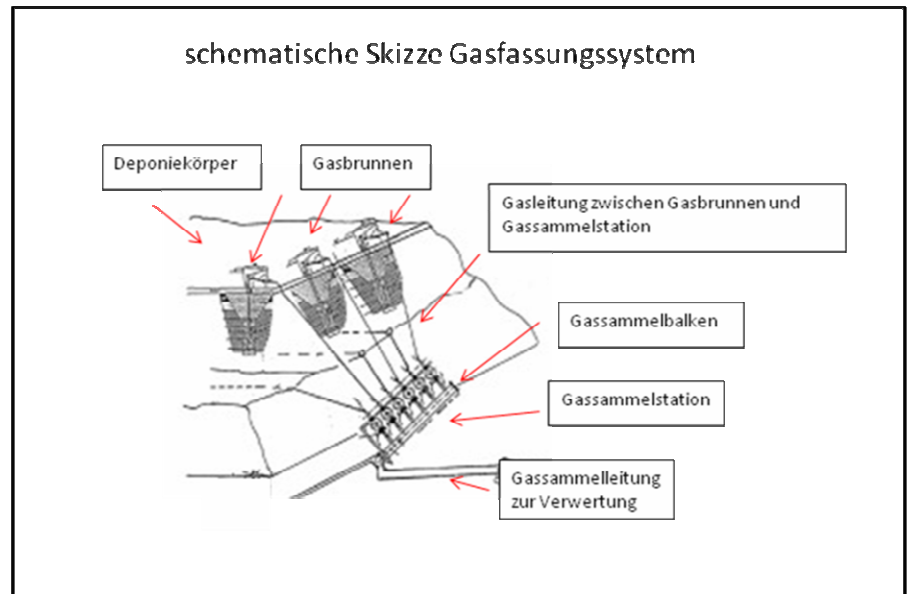
1. Introduction

The big EASY

**Stachowitz W.H. ,
15 Years of experience in the field of LFG disposal ..
Sardinia 2001, 8th International …**

2. Optimisation

Procedure measurement campaign

1.   **Measurement gas well**

2.   **Measurement gas manifold station**

3.   **Measurement all gas pipes**

First step:
on-site evaluation

Ill. 1: Schematic drawing gas collection [DAS-IB GmbH, 2010]

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2. Optimisation

1. Measurement campaign at the gas well

- Pressure p in mbar

- CH_4 – concentration in vol.-%

- CO_2 – concentration in vol.-%

- O_2 – concentration in vol.-%

- The flow rate (if possible) in m³/h (or m / s)

- H_2S – concentration in ppm (or vol.-%)

- Depth of the well or water build-up/shearing-off (light-plummet measurement)

- Landfill gas temperature T in C°

- If required, bellow position at the gas well

- Meteorological basic conditions

III.2 Measurement at the wellhead [DAS-IB GmbH, 2009]

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2. Optimisation

Plastic tubes instead of HDPE – pipes

(Tuyaux en plastique au lieu des Tuyaux HDPE-)

2. Optimisation

Measurement at gas wells:

(Les mesures dans les puits de gaz:)

p, F, T,

Q: CH4, CO2, O2, H2S, …

Measurement on surface:

(Mesure en surface:)

"VOC"

Volatile organic compounds

(Les composés organiques volatils)

2. Optimisation

2.2. Implementation and on-site evaluation

2. Measurement campaign in the gas manifold stations

- Pressure p in mbar

- CH_4 – concentration in vol.-%

- CO_2 – concentration in vol.-%

- O_2 – concentration in vol.-%

- The flow rate (if possible) in m³/h (or m / s)

- H_2S – concentration in ppm (or vol.-%)

- Landfill gas temperature T in C°

- Damper position at the individual line of the respective gas well

- Meteorological basic conditions

Ill. 3 Measurement in the gas collection
station [DAS-IB GmbH, 2009]

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2. Optimisation

2.2. Implementation and on-site evaluation

3. Measurement campaign at the each pipe of manifold station and gas well

- Pressure p in mbar

- CH_4 – concentration in vol.-%

- CO_2 – concentration in vol.-%

- O_2 – concentration in vol.-%

- Flow rate in m³/h (or m / s)

- H_2S – concentration in ppm (or vol.-%)

- Landfill gas temperature T in C°

- Damper position at the gas collecting main

- Meteorological basic conditions

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2. Optimisation

2.3 Evaluation analytical optimisation

2.3.1 Landfill gas composition (CH_4, CO_2, O_2, H_2S)

Determination of the current landfill gas composition and evaluation, for example in phases according to Farquar

2.3.2 Flow rate (landfill gas quantity)

Determination of the current landfill gas quantities and evaluation,

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2. Optimisation

Measurement at manifold station:

(Mesure à la station de collecte du gaz:)

p, F, T, Q: CH4, Co2, O2, H2S, …

Plus samples for a laboratory:

(Plus des échantillons pour le laboratoire:)
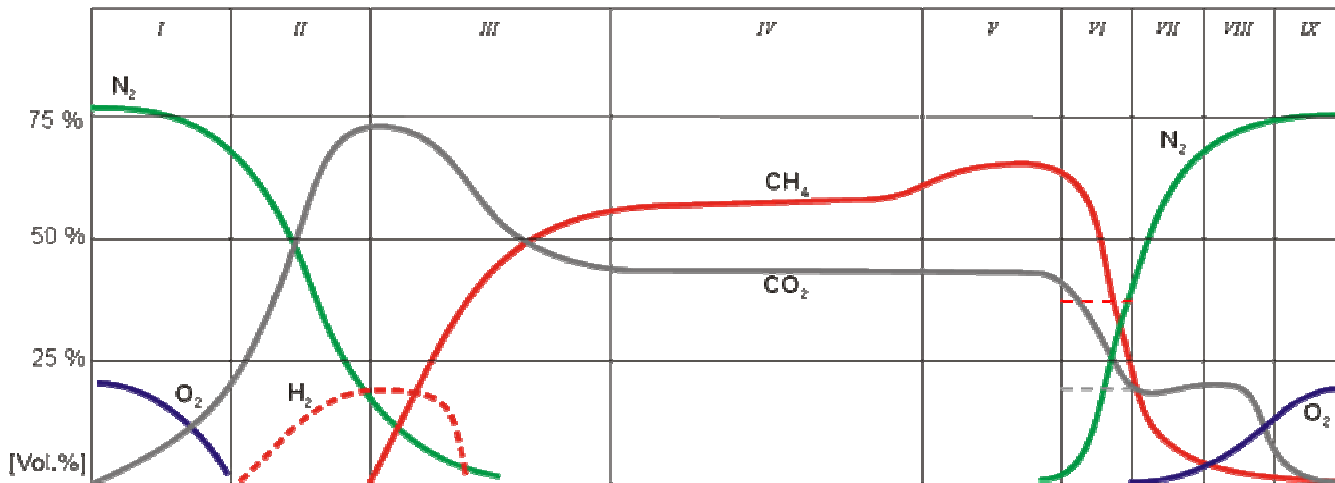
F, Cl, S, Si, CO, NH3 etc.

2. Optimisation

Phases according to Farquar:			V:	Long-term phase
I:	Aerobic phase		VI:	Air penetration phase
II:	Acid fermentation		VII:	Methane oxidation phase
III:	Transient methane fermentation		VIII:	Carbon dioxide phase
IV:	Stable methane phase (anaerobic)		IX:	Air phase

Ill. 4   Course of the landfill gas composition depending on the time with long-term model Farquar 1981 and Rettenberger & Mezger 1992.

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2. Optimisation

e.g.   Flow rate (landfill gas quantity)

Determination of the current landfill gas quantities and evaluation, detection of deficits, such as

- Settlements of the body -> Pipes crashed

- - > Condensate build-up ("water pocket")

- Filter section in the gas well reduced (e.g. as a result of settlements)

- No suction pressure

2. Optimisation

e.g. Temperature

Determination of the current temperatures and evaluation, for example

conclusions regarding an inhibited **biology** at temperatures < 30° C or >

45°C or **fires**

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2. Optimisation

e.g. Pressure

Determination of the current pressure conditions and evaluation, for
example the suction performance and detection of deficits analogously to
the flow rate:

- Pipe obstruction (e.g. through incrustation)
- **Condensate build-up ("water in pipe")**
- Pipe sheared and crashed
- Filter section in the gas well reduced (e.g. as a result of deposits)

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2. Optimisation

e.g. Bellows position / technical regulations

Locating of the bellows and determination of their settings / settlement of landfill, and evaluation, for example adjustment possibilities. Where are bellows in the gas system, which of them can be used and in which condition are they?

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2. Optimisation

e.g. Gas well depth / water build-up

Determination of the gas well depth and
water level in site. The comparison with as-
built drawings, for example, can provide
information about the freely usable filter
section. In addition, shearing / damages etc.
can be detected.

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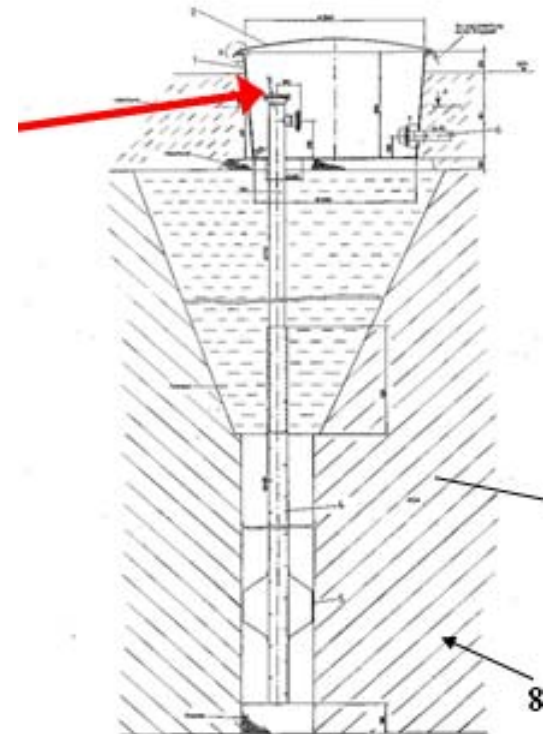
2. Optimisation

e.g. Meteorological basic conditions

Recording of the meteorological data for the assessment of the

conditions existing at the moment of measurement. In particular the air

pressure conditions, wind conditions and rain events need to be taken

into account.

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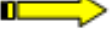**www.das-ib.de**

2. Optimisation

different climate conditions on landfill sites

(différents Conditions climatiques sur la décharge)

So you do need a good gasprognoses – tests on sites – pumping trails – etc. etc.

3. Summary

➡ Basic data of the landfill (operator, dimensions, short description, location, infrastructure)

➡ Deposited amount of waste, deposition mode (packed bed, compaction),
Waste composition see form at http://www.das-ib.de/english/gasprognosis.htm - > gas prognosis

➡ Landfill gas analysis, where required, with the components (CH4, CO2, Cl, Fl, S, silicon, where appropriate)

➡ **Floor plan of the landfill with height specifications (e.g.: 1:2000) and regional map, infrastructure, (streets, energy supply)**

➡ Floor plan with plot numbers + list of the neighbouring proprietors

➡ **Specifications regarding the connection distances to the next medium-voltage line, or even power grid / EU (electric utility) specifications about the capacity of the line**

➡ **Specifications about the possible point of interconnection (contact the power grid company (EU for details!) to be able to assess the possible grid connection costs. Delivery and energy supply**

➡ **Specifications regarding the local pay of skilled personnel (engineer, electrician, machine operator) Specifications regarding possible feed-in revenues (ct/kWh) outside Germany)**

➡ **Planning documents for upstream plant components (installation plan of the technical components at the landfill; buildings etc.) Which type of machines are required (size) to reach the landfill? Are there any crafts available on location: drilling excavation, pipelines etc.**

➡ Information about possible heat users (distance to the installation place of the gas utilisation plant, heat requirements, heat spread)

➡ Information about the current annual electric energy consumption and costs (demand rate, price per kWh).

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3. Summary

Please note all landfill sites are different

• Weather conditions

• size, high, input,

• etc.

Chaque décharge est un cas particulier

•Conditions climatiques

•Dimension, hauteur, input

•   etc.

Mobile flare systems for pumping trails to find out the different between theory (gas prognoses) and real gas flow and methane content
Les systèmes mobiles du pompage de gaz pour connaitre la différence entre la théorie (les prévisions de gaz) et le débit réel de gaz et de teneur en méthane

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Deponieangaben zur Erstellung einer Gasprognose:

Specification of landfill conditions for predicting landfill gas generation:

Standort der Deponie (Name, Adresse, Land etc.): Location of the landfill site (name, address, country ....):	
Einbaubeginn (Verfüllung): Start of landfill operation:	
Einbauende: End of landfill operation:	
Einbaumenge pro Jahr: Landfill waste p. a. (tonnes/a) [m^3/a]:	

Zusammensetzung des eingelagerten Mülls (Müllsorten in % oder t): Composition of landfilled waste (type of residues in % or t):	
Hausmüll: MSW (municipal solid waste):	
Sperrmüll: Bulky refuse:	
Bauschutt: Rubble, demolition waste:	
Organischer Müll: Organic waste:	
Hausmüllähnlicher Gewerbeabfall: Ordinary industrial residues (similar to MSW):	
Produktspezifischer Gewerbeabfall: Industrial residues from production processes:	
Klärschlamm & Straßenkehricht: Sewage sludge & road sweepings:	
Sonstiges Abfälle: Other waste: _____	

Basisabdichtung: Landfill bottom liner:	? Ja ? Yes	? Nein: ? No:	
Oberflächenabdichtung: Surface sealing/Landfill cap:	? Ja ? Yes	? Nein: ? No:	

Dünnschichteinbau (ab wann): Thin layer compaction (since ....):	

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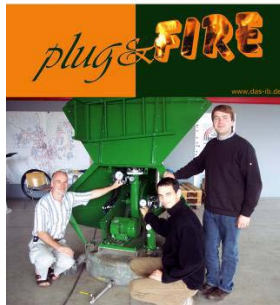
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4. Take care

Any questions left?

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