Sicherheit von Biogasanlagen, 21. Oktober 2015, Paris

German Biogas Association
Association Allemande du Biogaz
Asociación Alemana de Biogás

Fachverband Biogas e.V.

Safety of biogas plants during construction and operation

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Agenda

- German Biogas Association
- Current status of safety of biogas plants
- Building requirements
- Obligations of operators an manufacturers
- Lessons learnt

Structure of the German Biogas Association

over 400 honorary experts

Steering Committee

7 members, elected by all members
for a 4-year-period

Board of Trustees

Elected honorary spokesmen of regional groups, working groups and advisory boards

Advisory Boards, Working Groups

Advisory boards of plant operators, companies, the legal profession, funders; Working groups for the areas permissions, safety, feeding-in of biogas, environment, heat, waste and fertiliser law

Headquarters in Freising

23 employees, organised in 10 departments

Berlin Office

5 employees

Regional offices (North, South, East, West and Editorial Office Biogas Journal

5 employees

23 Regional groups in Germany

4,800 Members

Operators of biogas plants

Providers of feedstock

Research Institutions

Interested private individuals

Public authorities

Lawyers

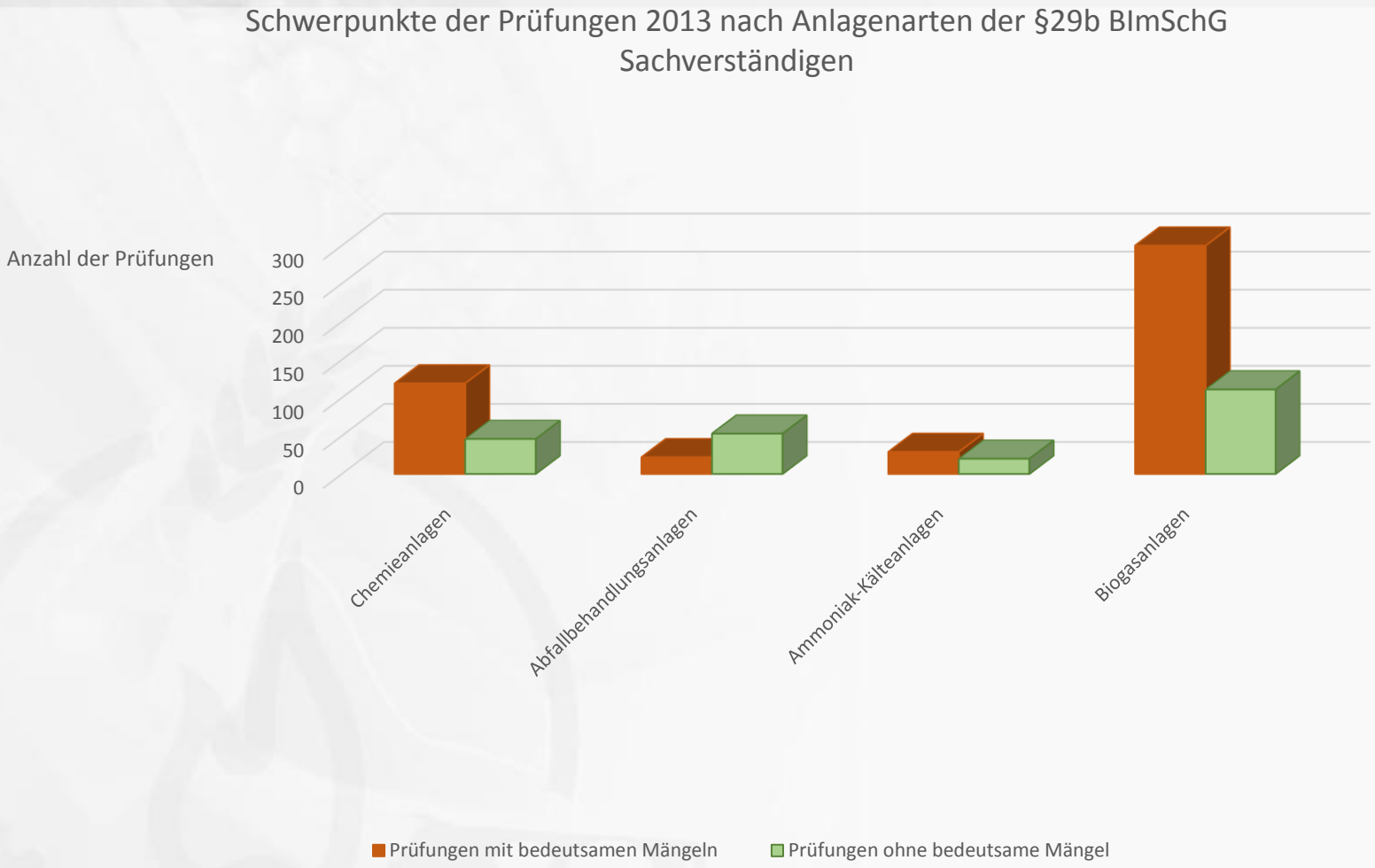
Companies and manufacturers

Corporate finance

Planners, advisers, laboratories

Member of the European Biogas Association (EBA)

Current status of safety of biogas plants



Quelle: Dr. Ziegenfuß (KAS), eigene Darstellung

Current status of safety of biogas plants

Examples of defiencies (extract)

- Missing statics of the gas storage
- components are not frostproof
- missing lightning protection
- Over-/underpressure protection was constructed without podest
- Design of the Gas storage was deficient
- Flare was inoperable
- Operating instructions were missing
- Inspection report was missing
- No backup power supply

Quelle: Josef Ziegler, § 29b BImSchG Sachverständiger

Quelle: Dr. Ziegenfuß (KAS), 2015

Current status of safety of biogas plants

Examples of defiencies (extract)

- Process control engineering partly not functional, e.g. flame detector, leak probe, overfill protection, emergency stop

- Explosion protection document not up to date or was missing


Bildquelle: http://www.de.implico.com

- Many deficiencies regarding the documentation
  - Emergency response plan, ground plans for fire brigade use, fire safety regulations, plans of evacuation routes are missing
  - Documentation incomplete (flowcharts, list of hazard materials, plans)
  - Concept for the prevention of incidents was missing
  - Deficient documentation of safety managment system

Quelle: Dr. Ziegenfuß (KAS), 2015

Current status of safety of biogas plants

Quelle: Josef Ziegler, § 29a BImSchG Sachverständiger

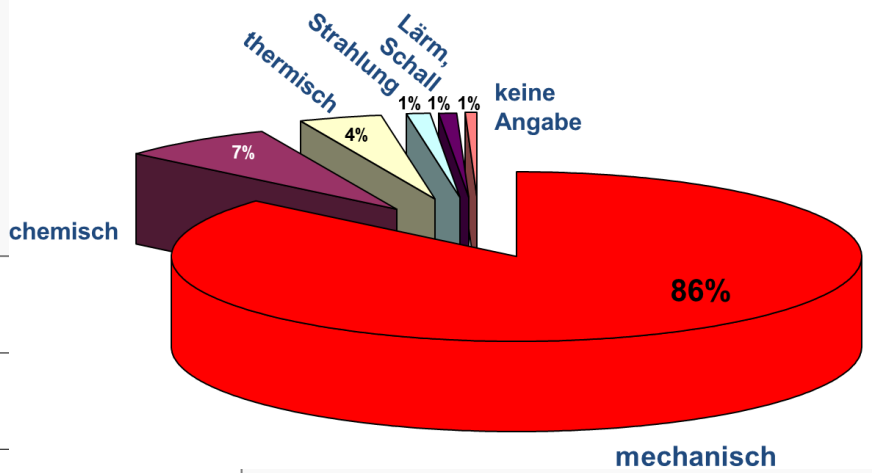
Current status of safety of biogas plants

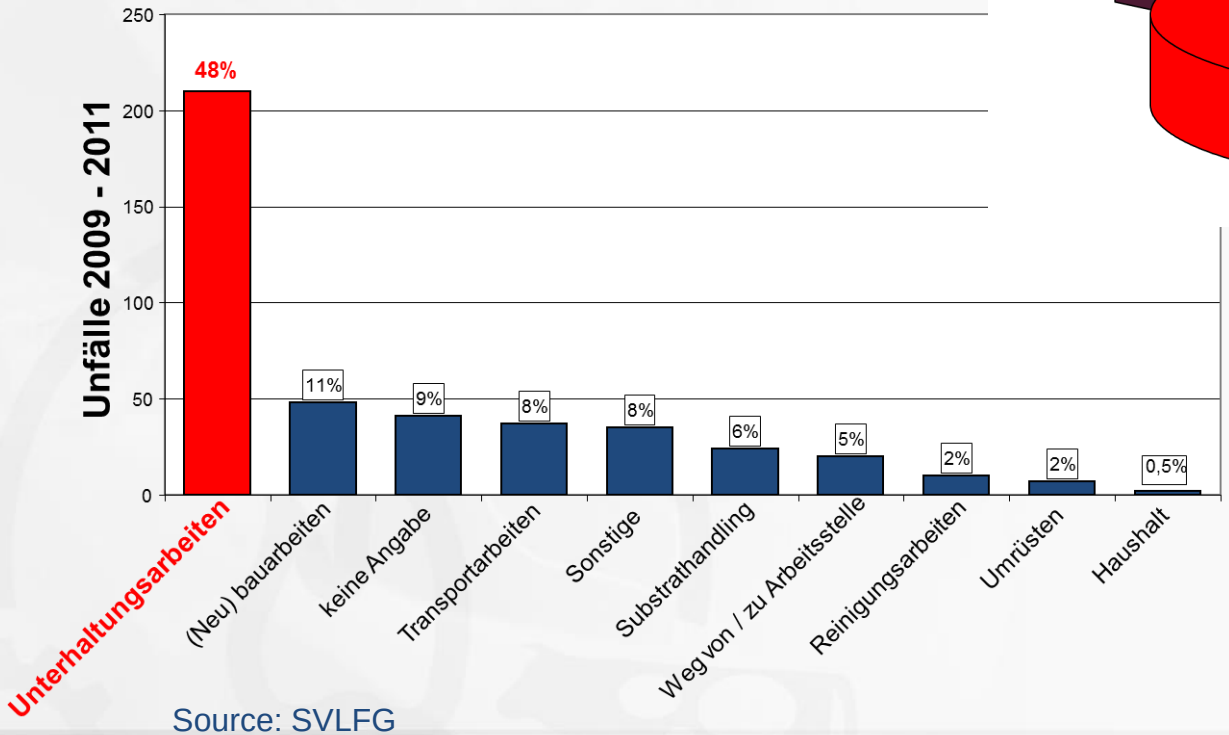
17.03.15 – Memmingen – fire in chp building

16.06.15 – Arnstorf – substrate leakage

12.03.15 – Weißenburg – explosion - maintenance

Current status of safety of biogas plants





Source: SVLFG

Reasons for deficiencies during construction an operation

- Important information of the plant are not handed out to the plant operator
  - Flow chart
  - Process control matrix
  - …
- Wrong design of plant components
  - Over-/underpressure valve
  - flares
  - …
- Deficient concrete quality
  - Crack formation
  - settlements
- …

Reasons for deficiencies during construction an operation

- Many plant operators are overchallenged
  - Industrial standards are claimed, plant operators are not familiar with these requirements.
- Plant operators have not sufficient knwoledge to scrutinize/to challenge the work of manufacturers.
- Lack of communication between manufacturers and operators
  - Mangelhafte Kommunikation führt zu Missverständnissen in der Aufgabenverteilung bzw. zu mangelhaftem Verantwortungsbewusstsein des Betreibers.
  - Deficient communication leads to missunderstadndings regarding task allocation and to an insufficient sense of responsibility
- …

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Building requirements

- Overground built parts of the biogas plant need a safe foundation and have to be protected against damages. The stability has to be ensured.

- Gas-carrying parts have to be protected against chemical and wheather caused influences. In exposed areas they have to be protecetd against mechanical influences and damages (e.g. collision protection)

- Electrically conductive parts have to be connected with each other and with the earth wire (equipotential bonding).

Bildquelle: ARGE Biogas Safety First!

Bildquelle: ARGE Biogas Safety First!

Building requirements

- Control stands and control panels of agitators, pumps and purging devices have to be built overgound, if not possible: forced ventilation. Sufficient ventilation has to be guaranteed.

- Insulation of digesters has to be at minimum normally inflammable, e.g. B 2 DIN 4102.

Quelle: Technische Information 4
„Sicherheitsregeln für Biogasanlagen“

Building requirements

- Gas storages have to be gastight, pressure-resistant and resistant to aggressive media. Materials have to fullfill the following requirements
  - Tear strength min. 500 N/5 cm or
  - Longitudinal strength 250 N/5 cm
  - Gas permeability regarding methane < 1000 cm^3/m^2 x d x bar
  - Temperature-resistance for special usage (mesophiler, thermophiler Vergärungsprozess)
  - Gas tigthness has to be proven before commissioning

Quelle: Technische Information 4
„Sicherheitsregeln für Biogasanlagen“

Building requirements

- Between gas storages and other buildings/plants (height < 7.5m) or thoroughfares the protective distance has to be 6m (horizontal).

- Buildings with h > 7,5m (gas storage or other buildings):

$$0{,}4 \times H_1 + 3m$$

- In case of two buildings with a height < 7.5 m (gas storage or other buildings):

$$0{,}4 \times H1 + 0{,}4 \times H2$$

Quelle: Technische Information 4
„Sicherheitsregeln für Biogasanlagen“

Building requirements

- Between gas storages and chp-buildings the protective distance has to be 6 m
- The protective distance can be reduced through fire barriers or earth deposits.

Quelle: Technische Information 4
„Sicherheitsregeln für Biogasanlagen“

Building requirements

Concrete for foundation

Bildquelle: http://www.lsz-bw.de

- Exposition class: XC4, XA1
- Concrete grade: C25/30
- Cement/water ratio ≤ 0,60
- No protective measures necessary
- Control class 2
- Concrete protection of the reinforcement 40 mm

Quelle „Gärfuttersilos, Güllebehälter, Biogasanlagen“
W. Rothenbacher, W. Hemrich, H. Zimmermann, (BetonMarketing Deutschland)

Building requirements

Concrete for digester with outside insulation

- Exposition class XC4 (inside), XC1 (outside), XA3
- Concrete grade : C35/45
- Cement/water ratio ≤ 0,45
- protective measure necessary
- Control class 2
- Concrete protection of the reinforcement 40 mm

HS cement is recommended.

Bildquelle: Directindustry.de

Quelle „Gärfuttersilos, Güllebehälter, Biogasanlagen“
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Obligations of manufacturers and operators

- Statutory basis:
  - EU Machinery Directive (old: 2006/42/EG new: 95/16/EG) = Product Safety Act (ProdSG) in Germany
- Manufacturer has to forward all information, which are necessary for a safe plant operation, to the plant operator :
  - Operation instruction and hazard analysis for the product (biogas plant or components)
  - Declaration of incorporation (z.B. ATEX / Ex-Zone)
  - European Conformity (CE)
  - Maintenance instruction
- **Watch out!:** operators can also become manufacturers,:
  - Modifications of the machine, regarding
    - Power, scope
    - function
    - Safety engineering
    - Own production of machines!

Obligations of manufacturers and operators

BetrSichV

- Contractors must have technical knowledge
- Operator and contractors have to inform each other about the risks/hazards of their works.
- If a hazard cannot be barred, the employers have to create a risk assessment.
- If there are exceptional hazards, a coordinator has to be consulted.

Obligations of manufacturers and operators

BetrSichV

- The employer/operator has to implement maintenance measures. The work equipment has to be save. Information of manufacturers have to be taken into account.
- Maintenance measures have to be implemented on the basis of a risk assessment.
- Maintenance measures have to be done by expert, ordered and instructed employees or by extern experts.

Obligations of manufacturers and operators

First and recurring safety-inspections of work equipment/facilities

- Inspection of the explosion protection every 6 years
- Extra inspection of devices , protection systems and appliances after RL 94/9/EG every 3 years
- Additional expections of vents, gas detection devices and inertisation devices every year

Obligations of manufacturers and operators

- Substitution of hazards after TRGS 600

-> This implies the reduction of…

Extra inspection: Diversification of the substrates

Hazardous attributes

- CMR-substance -> no CMR-substance
- Very toxic-> toxic -> harmful -> no attributes

Exposition potential

- High amounts-> small amounts
- fluid -> paste
- dusty -> grained -> coated products
- Open system-> closed system

additives, which are acute toxic (Kat. 1, 2, 3), carcinogenic, mutagen, keimzellmutagen and toxic for reproduction(jeweils Kat. 1A und 1B) have to be substituted if there are technical alternatives.

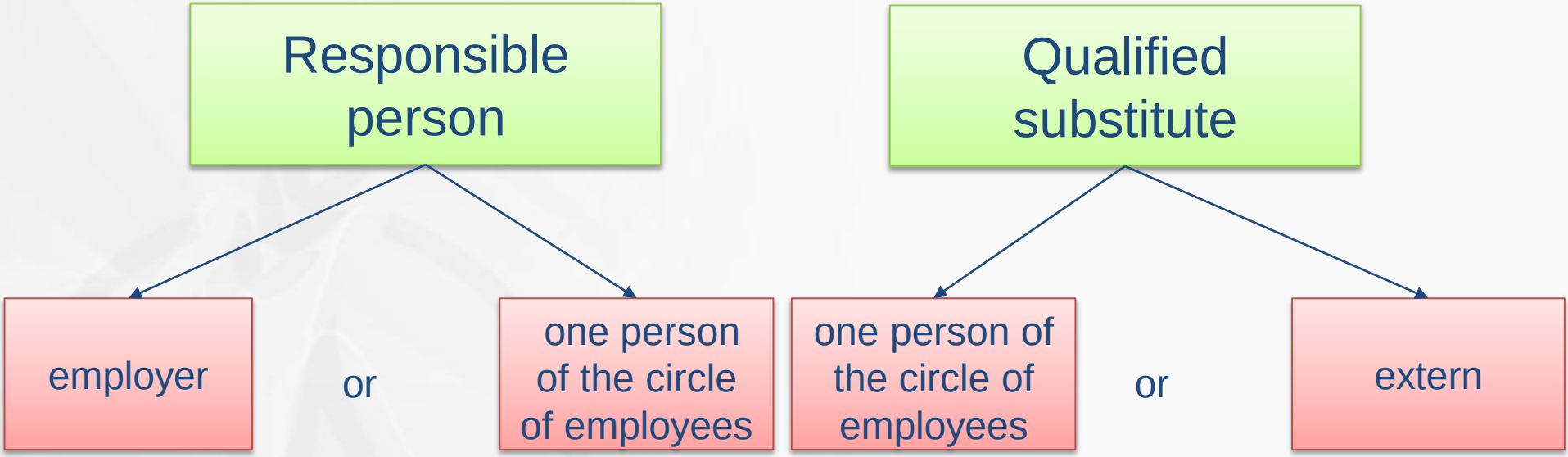
Obligations of manufacturers and operators

Dosage of additives

- acute toxic (Kat. 1, 2, 3), carcinogenic, mutagen, keimzellmutagen and toxic for reproduction(jeweils Kat. 1A und 1B) have to be dosed by a closed system,
- Only experts are allowed to implement the dosage
- The safety data sheet has to be available

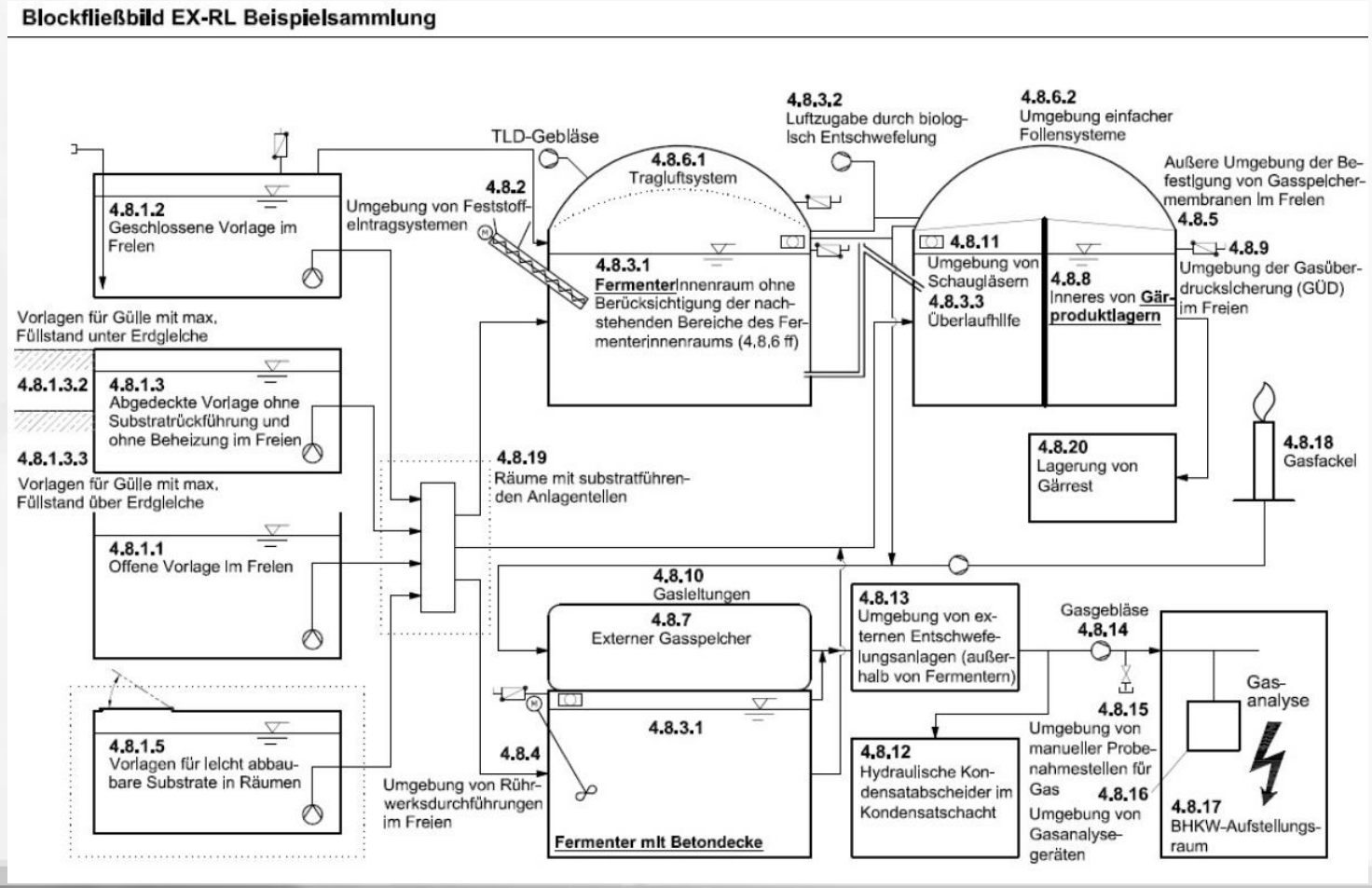
Quelle: NEST; Dirk Pachurka, BG ETEM

Obligations of manufacturers and operators



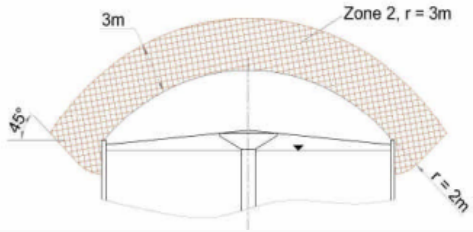
Obligations of manufacturers and operators

An explosion protection document and an explosion-protection-zone plan have to be implemented into the risk assessment after GefStoffV.



Obligations of manufacturers and operators

- Implementation is obligatory

Nr,	Beispiel	Merkmale/Bemerkungen/ Voraussetzungen/Hinweise	Schutzmaßnahmen nach TRBS Teil 2	Festlegung der Zonen (Zündquellenvermei-dung TRBS 2152 Teil 3)	Schutzmaßnahmen nach TRBS 2152 Teil 4
(Sp.1)	(Sp.2)	(Sp.3)	(Sp. 4)	(Sp. 5)	(Sp. 6)
		kungen wird zeitlich überwie-gendes Aufkonzentrieren verhindert.			
4.8.6.2	**Umgebung einfacher Foliensysteme**	a) Die technische Dichtheit wird erstmalig und wiederkehrend, z.B. Ortung mit Gaskamera und Kontrolle mit schaumbildenden Mitteln oder geeignetem Gasspürgerät, überwacht.	2.4.3.3 2.4.3.5	Keine Zone	Keine
		b) wie a), jedoch ohne wiederkehrende Kontrolle	2.4.3.3	Zone 2: 3m um Folie und 2m nach unten mit 45° siehe Bild, … 	Keine

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Further Activities of the German Biogas Association

- Latest tools and pamphlets
  - A-001 safe working in digesters
  - A-002 briefing for subcontractors
  - A-003 checklist for safe operation of the biogas plant
  - A-004 requirements regarding the organisation
  - A-005 concretisation of the TRGS 529 additives
  - A-006 guideline for an emergency power system
  - …


Arbeitshilfe A-005
zum Umgang mit Zuschlags- und Hilfsstoffen auf Biogasanlagen

- Safetytour across Germany (regional groups of operators) until the end of 2015

- ISO TC 255 „Standardization of Biogas“: 2 work groups in operation (Terms/Definitions und Gasfackeln)

Further Activities of the German Biogas Association

- **pamphlet DWA M 377:**
  Biogas – storage systems - draft (Juli 2015)

- **Pamphlet for the requirements of gasflares until** 2016 => Input for ISO-TC 255

- **Pamphlet for the requirements of the piping:** in progress

- **Technical Safety Management System (TSM) Biogas:**
  pilot phase with 2 succesfull inspections

Further Activities of the German Biogas Association

Explosion protection

- Collection of examples
- DGUV R 113-001
- Explanation by GBA

trainings

- Qualification of operators
- Schulungsverbund
- Criteria for speakers and institutes
- DVGW / G1030

Gas storages

- 2 pamphlets(DWA/DVGW) in progressStatik
  - Leakproofness (Permeability, leakages…)

Umsetzung der AISV-Empfehlungen für 29a SVs

- A-003 checklist for safe operation of the biogas plant

StörfallV

- A-004 requirements regarding the organisation
- Protective distance

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Lessons learnt

- The safety of biogas plants is significantly influenced during the planning and construction
- Independent expertise should be involved during the planning of the plant
- The manufacturers of biogas plants must adhere to the planning requirements (distances, concrete quality,…) and hand out the documentation to the operators.
- Operators often have insufficient knowledge. The mandatory participation in a training course can lessen that.
- Experts should help operators with the documentation
- The German Biogas Association supports the operators with pamphlets etc.

Thank you for your attention!