

International best practice' Middle-Large Scale Biogas-Plant- technology planning, II

国际最佳实践技术设计-大中型沼气厂设计培训会议

Lessons learned from design failures and biogas plants disasters

从设计失误和沼气厂事故所得到的经验

Torsten Fischer and Dr. Katharina Backes

Krieg & Fischer Ingenieure GmbH

Bertha-von-Suttner-Straße 9, D-37085 Göttingen, Germany

Tel.: ++49 551 900 363-0, Fax: ++49 551 900 363-29

Fischer@KriegFischer.de

www.KriegFischer.de

Beijing, May 16, 2010

Examples for accidents on biogas plants

沼气厂事故问题实例

Torsten Fischer's daily business is to write expert opinions for courts, insurances and banks.

From his vast experiences Mr. Fischer has collected 3 examples where biogas plants did not work. All 3 examples are cases from last year.

Torsten Fischer先生每天忙于写一些报告，保险以及银行的经济问题。从他的大量经验中我们采用了3个实例，这三个实例都是去年当中沼气厂内出现的事故问题。

Experience of an insurance company

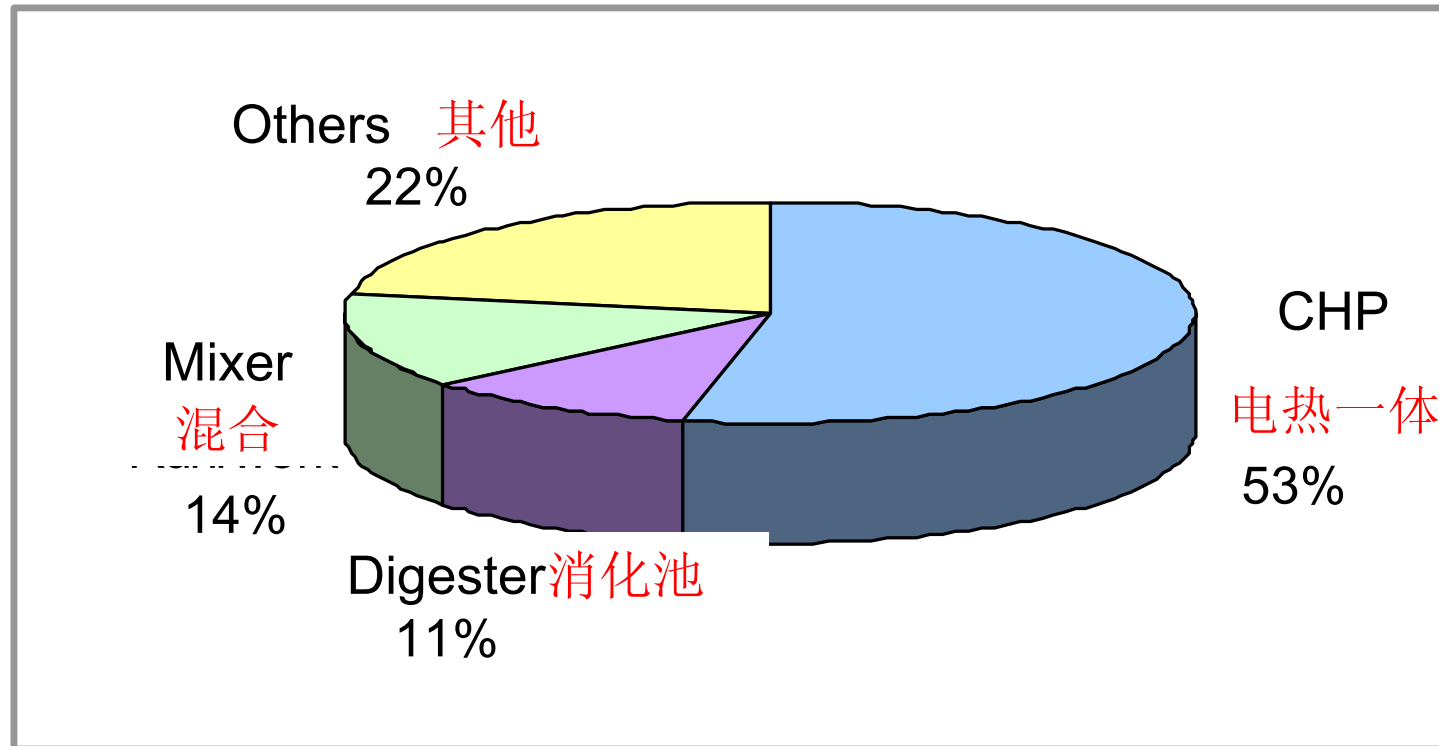
保险公司的经验

Damages at different parts of the plant
- payments related to different plant parts

工厂不同部分的损害
不同部分的赔偿



Krieg & Fischer Ingenieure GmbH



Marsh
GmbH

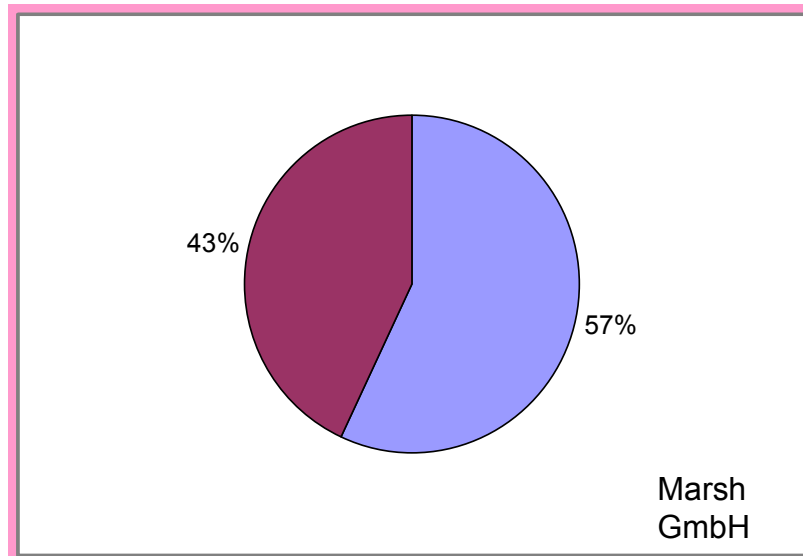
Additional damages - Digester Tanks-

其他损坏
消化池

Part of financial Losses in Digester Damages 消化池损坏的部分经济损耗

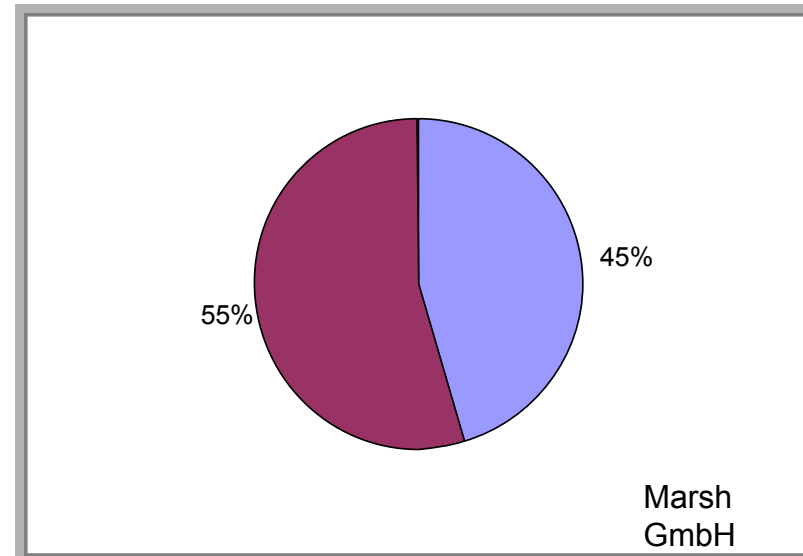
Contracts up to 2005

2005年之前的合同



Contracts starting 2005

2005年开始的合同



■ Damages caused by

Biological Breakdowns 生物降解引起的损害

■ Material Damage 原料破损

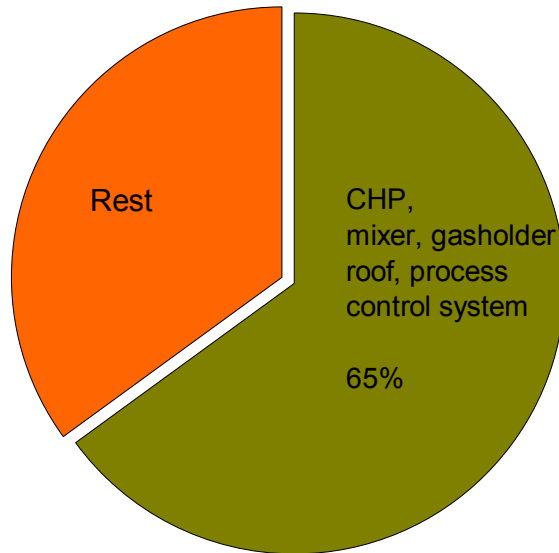
Insurance of the digester biology becomes more important.

消化池的保险越来越重要

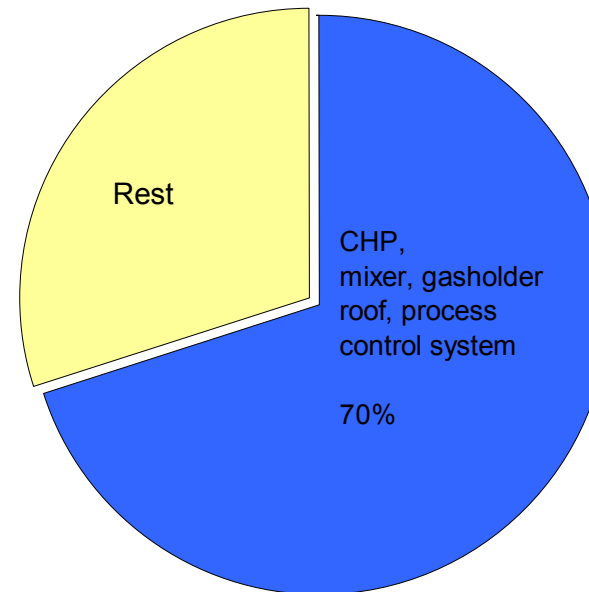
Experience of Gothaer Insurance Company

Gothaer保险公司的经验

Frequency of damages



Payment of damages



- more than 50% of all damages cause payments of less than € 10,000
超过50%的破损得到了不到10,000欧的赔偿
- payments of damages above € 50,000 are paid at 5% of all damages
5%的破损得到了超过50,000欧的赔偿

Experience of Gothaer Insurance Company

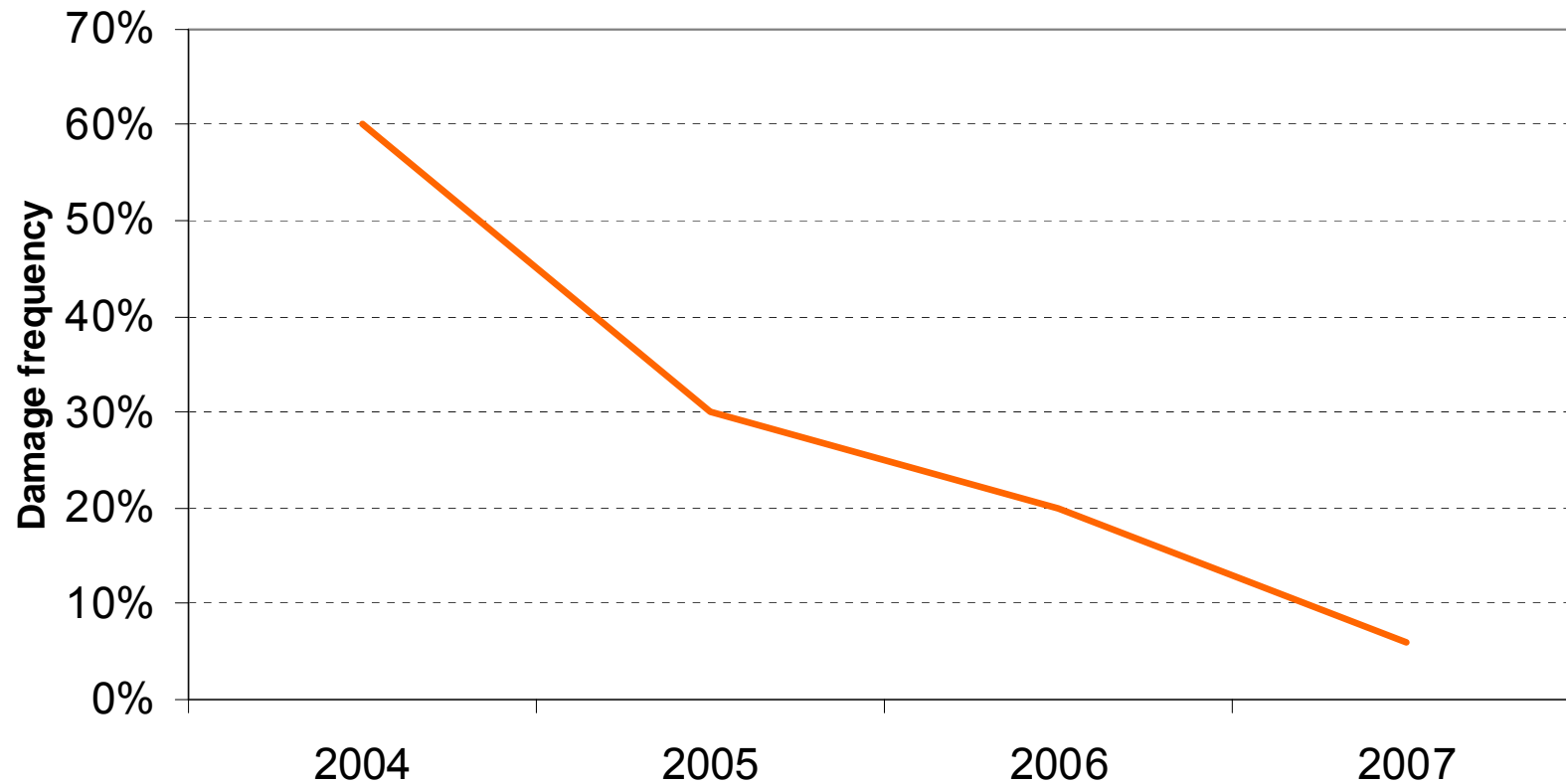
Gothaer 保险公司的经验



- different quality of the plants 工厂的不同质量
 - plant construction 建厂
 - operation 运行
- about 80% of the insurance contracts are damage-free (lots of new plants still have warranty)
大约80%的保险合同是不包括破损部分的（很多新工厂都有保证书）

Experience of Gothaer Insurance Company

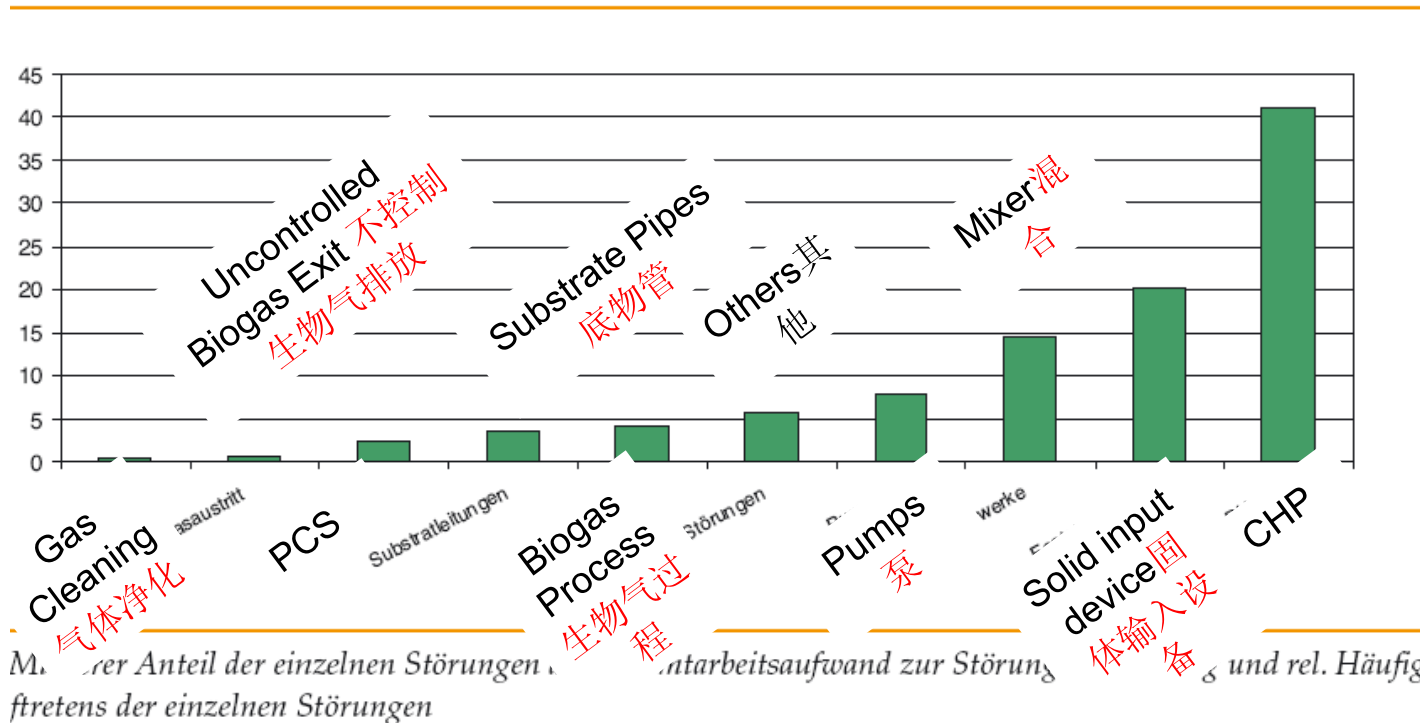
Gothaer 保险公司的经验



Number of Damages increase disproportionate
to Age of Plant 损坏情况随年份不均匀提高

Study published by Federal Government of Germany 德国联邦政府的研究

Part of the total amount of work compared to trouble shooting [%]



Case Study 1:

实例1:

Fire Damage CHP-Container

CHP容器的火灾损害

Case Study 1:
Fire Damage CHP-Container
实例1: CHP容器的火灾损害



Construction: 2007
Input: Energy Crops
CHP: 191 kWe
建于2007年，输入：能量
作物，CHP:191 KWe

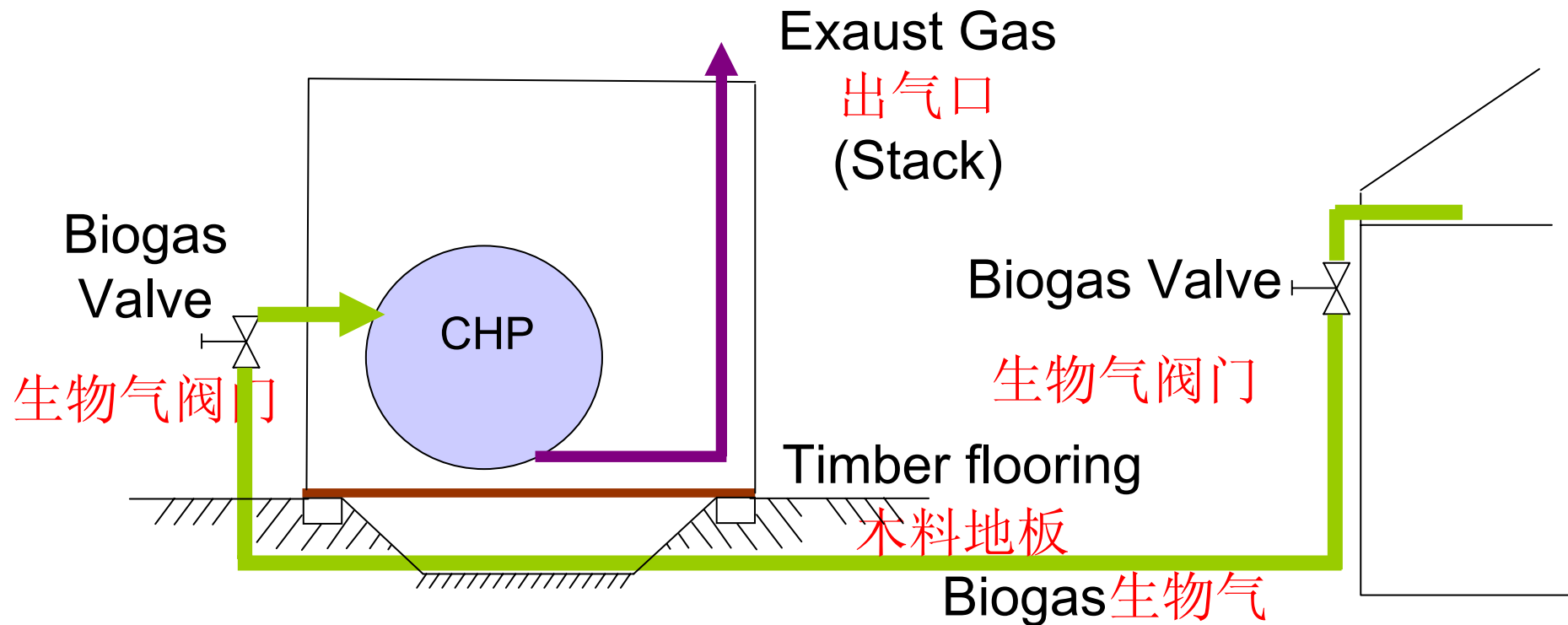
Case Study 1:
Fire Damage CHP-Container
实例1: CHP容器的火灾损害



The CHP-container had a
timber flooring.

CHP容器均有木质地板

Case Study 1:
Fire Damage CHP-Container
实例1: CHP容器的火灾损害



Case Study 1: Fire Damage CHP-Container 实例1: CHP容器的火灾损害



Case Study 1:
Fire Damage CHP-Container
实例1: CHP容器的火灾损害



Krieg & Fischer Ingenieure GmbH



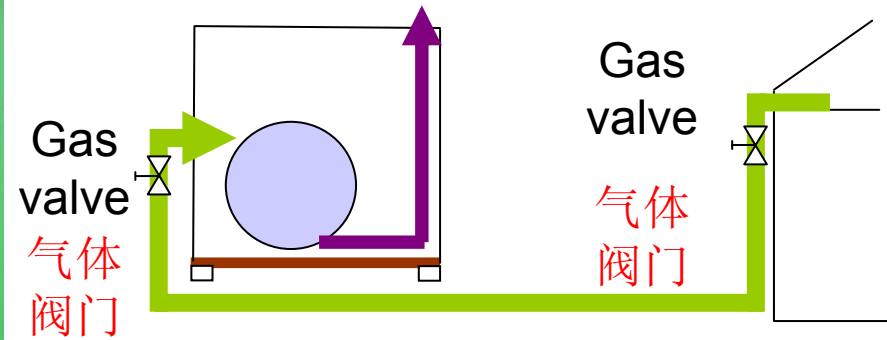
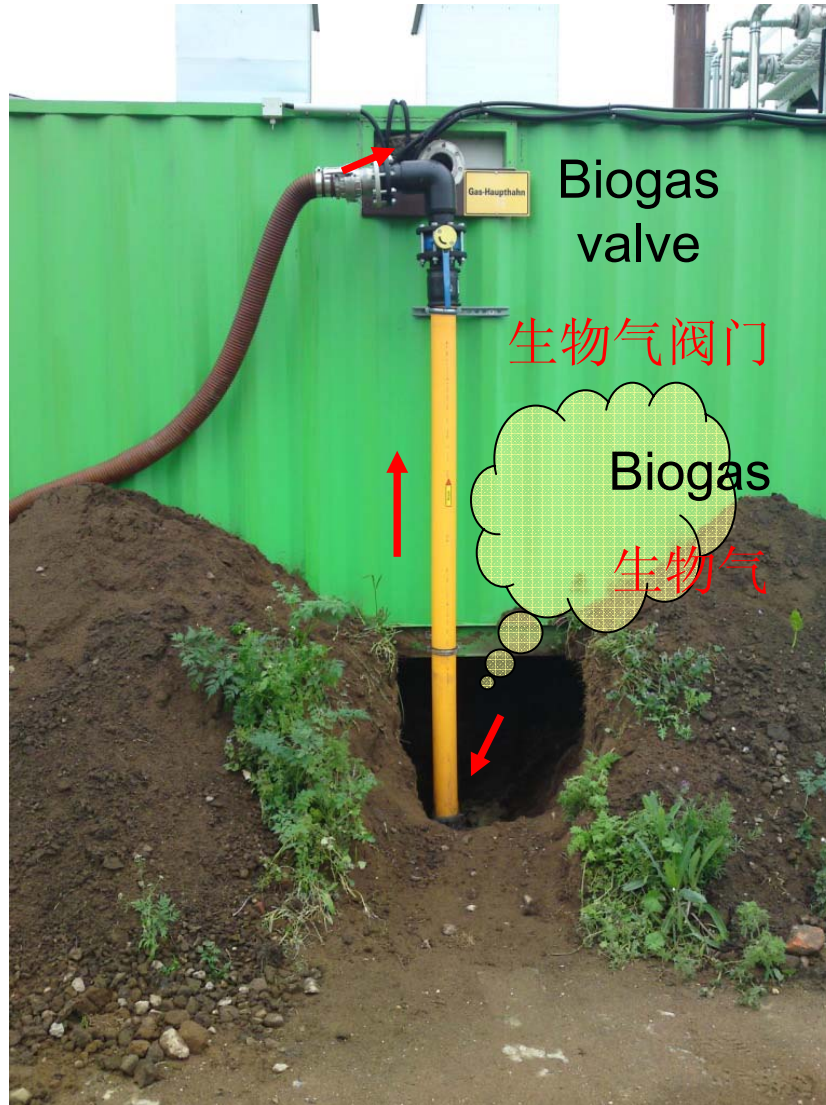
Case Study 1:
Fire Damage CHP-Container
实例1: CHP容器的火灾损害



Case Study 1: Fire Damage CHP-Container 实例1: CHP容器的火灾损害



Case Study 1: Fire Damage CHP-Container 实例1: CHP容器的火灾损害



Case Study 1: Fire Damage CHP-Container 实例1: CHP容器的火灾损害



- Province-specified fire-protection regulations were not paid attention to
没有注重指定地区的防火保护法规
- Technical inadequateness:
技术不适宜（失败）
 - exhaust pipe did not keep the required distance (to the timber flooring and to the cables)
排气管也没有达到所需的距离（到木材地板和管道的距离）
 - exhaust pipe was not insulated against the timber flooring
排气管和木材地板之间不绝缘
 - biogas pipe below the container was not covered with soil
容器管道下的沼气管没有土壤覆盖
- The operator did not detect the reason of the fire
经营者没有找到火灾原因

Case Study 1: Fire Damage CHP-Container 实例1: CHP容器的火灾损害



Conclusions结论

- The damage has been categorized as extensive.
这种损害是广泛存在的
- The CHP-container has not been set up according to the actual regulations (province-specified fire- protection regulations are valid)
CHP容器没有根据实际规定建成（区域指定的消防保护法是有效的）
- No concerns have been expressed by the CHP provider
CHP提供商没有足够的重视
- Will the insurance pay the damage costs?
保险会为损害付赔偿金？

Case Study 1: Fire Damage CHP-Container 实例1: CHP容器的火灾损害



Lessons Learned

得到的经验

- Fire-protection regulations have to be paid attention to
必须注意防火法规
- The exhaust gas pipe has to keep safety distances or/and has to be insulated
废气管须保持安全距离和/或要绝缘
- To avoid accidents the engineering of a biogas plant should be done by a biogas specialist
为了避免意外事故，沼气专家应该负责沼气厂工程设计

Case Study 2:

实例2:

Overfilling of Hydrolysis Tank

水解池过满

Case Study 2: Overfilling of Hydrolysis Tank 实例2： 水解池过满



Krieg & Fischer received an E-Mail from the insurance company: Krieg & Fischer 收到了保险公司的邮件

- Damage of a concrete tank
水泥池的损害
- Which tank was not noticeable from the documentation of the insurance company
保险公司的文件中哪些池没有注意到
- Insurance company asked for an examination of the documentation available on site the biogas plant
保险公司需要检查生物气工厂的现有文件

Case Study 2: Overfilling of Hydrolysis Tank

实例2：水解池过满



Data were only rudimenta I 数据残缺

- No documentation
没有记录
- No flow-sheet
没有流程图
- Site layout was taken from permission documents and obsolete because the concrete tank was erected 2 years later

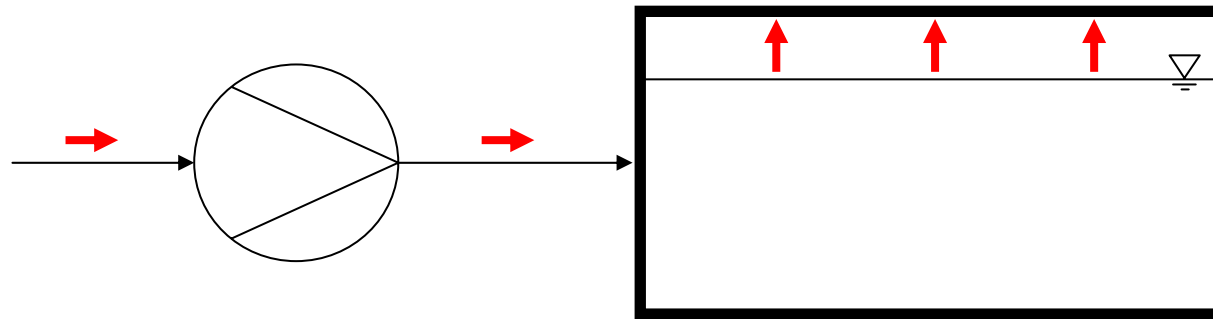
工地布置是有文件的，并且许可文件是过时的，因为建一个水泥池需要2年时间

→ The new tank was not registered by the insurance company.

新建的池没有在保险公司中注册

Case Study 2: Overfilling of Hydrolysis Tank

实例2: 水解池过满



Screw
pump
螺丝泵

Concrete tank
混凝土池

Case Study 2:
Overfilling of Hydrolysis Tank
实例2: 水解池过满



- Construction:
2005/2006
- Input: Energy crops
- CHP: 536 kW_e

建造于2005、2006。
输入：能量作物

Case Study 2: Overfilling of Hydrolysis Tank

实例2: 水解池过满



Krieg & Fischer Ingenieure GmbH



Case Study 2: Overfilling of Hydrolysis Tank 实例2: 水解池过满



Case Study 2: Overfilling of Hydrolysis Tank

实例2: 水解池过满



Case Study 2: Overfilling of Hydrolysis Tank

实例2: 水解池过满



Case Study 2: Overfilling of Hydrolysis Tank 实例2：水解池过满



- No documentation of the plant
工厂没有记录
- No process flow sheet
没有工艺流程图
- Hydrolysis tank had been enhanced and equipped with a cover by the operator
水解池带盖子
- No structural calculation of the tank
池子没有进行结构计算
- No safety-regulated documentation
没有安全规章

Will the insurance company pay for a damaged tank they do not know about?

保险公司会为没有记录的损坏池赔偿吗？

Case Study 2: Overfilling of Hydrolysis Tank 实例2：水解池过满



Lessons Learned

经验

- A precise documentation is important
需要一个详细的文件
- Safety devices have to be installed
需要安装安全设备
- The engineering of a biogas plant should be done by a biogas specialist
沼气专家应该负责生物气工厂的设计

Case Study 3:

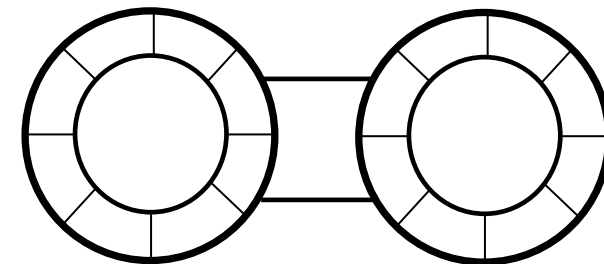
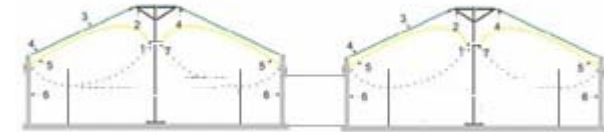
Rupture of a Gas Holder Roof

实例3：池顶气体储存池的破裂

Case Study 3:
Rupture of a Gas Holder Roof
实例3：池顶气体储存池的破裂



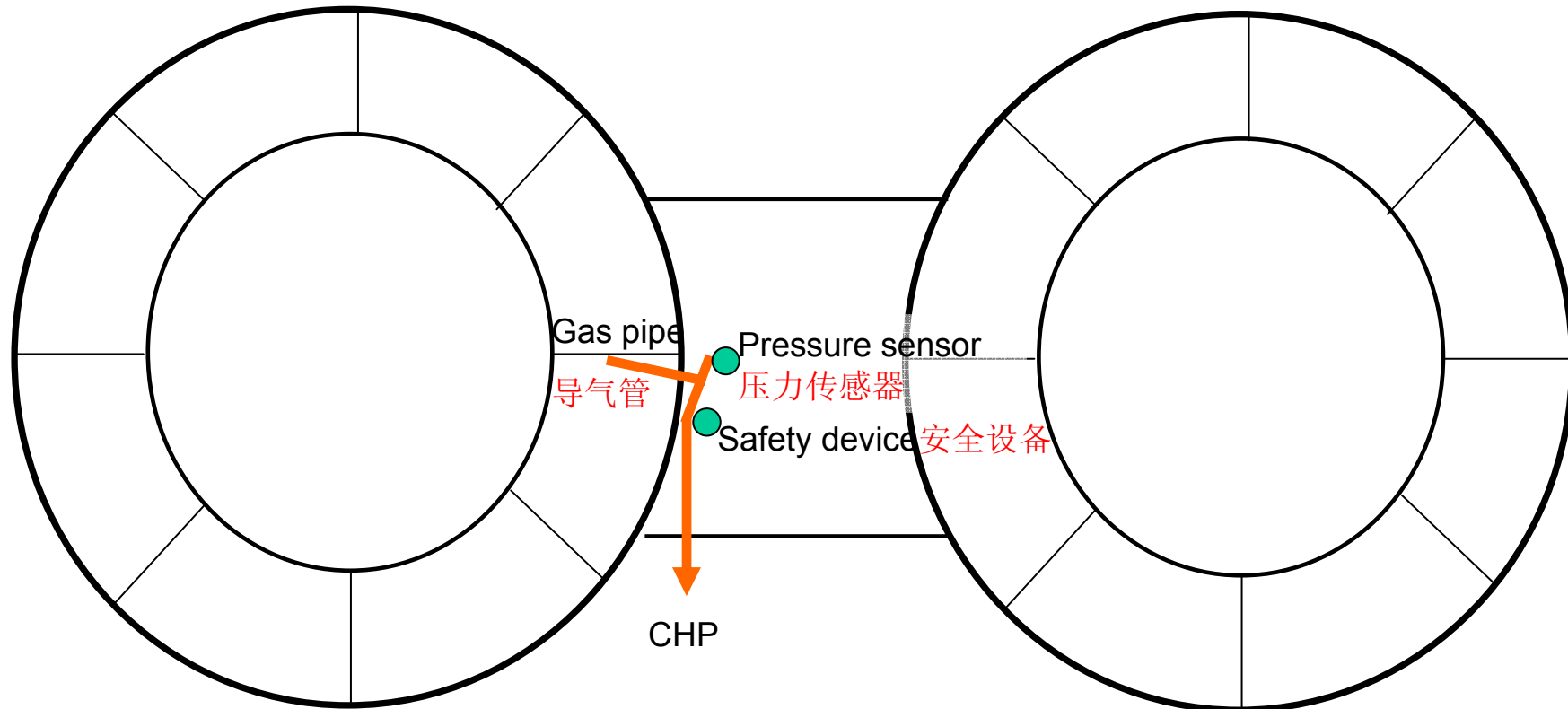
Construction: 2005
Input: manure, energy
crops, cereals
建造于2005年
输入：肥料，作物，谷类



Case Study 3:
Rupture of a Gas Holder Roof
实例3：池顶气体储存池的破裂



Case Study 3: Rupture of a Gas Holder Roof 实例3: 池顶气体储存池的破裂



Case Study 3: Rupture of a Gas Holder Roof

实例3：池顶气体储存池的破裂

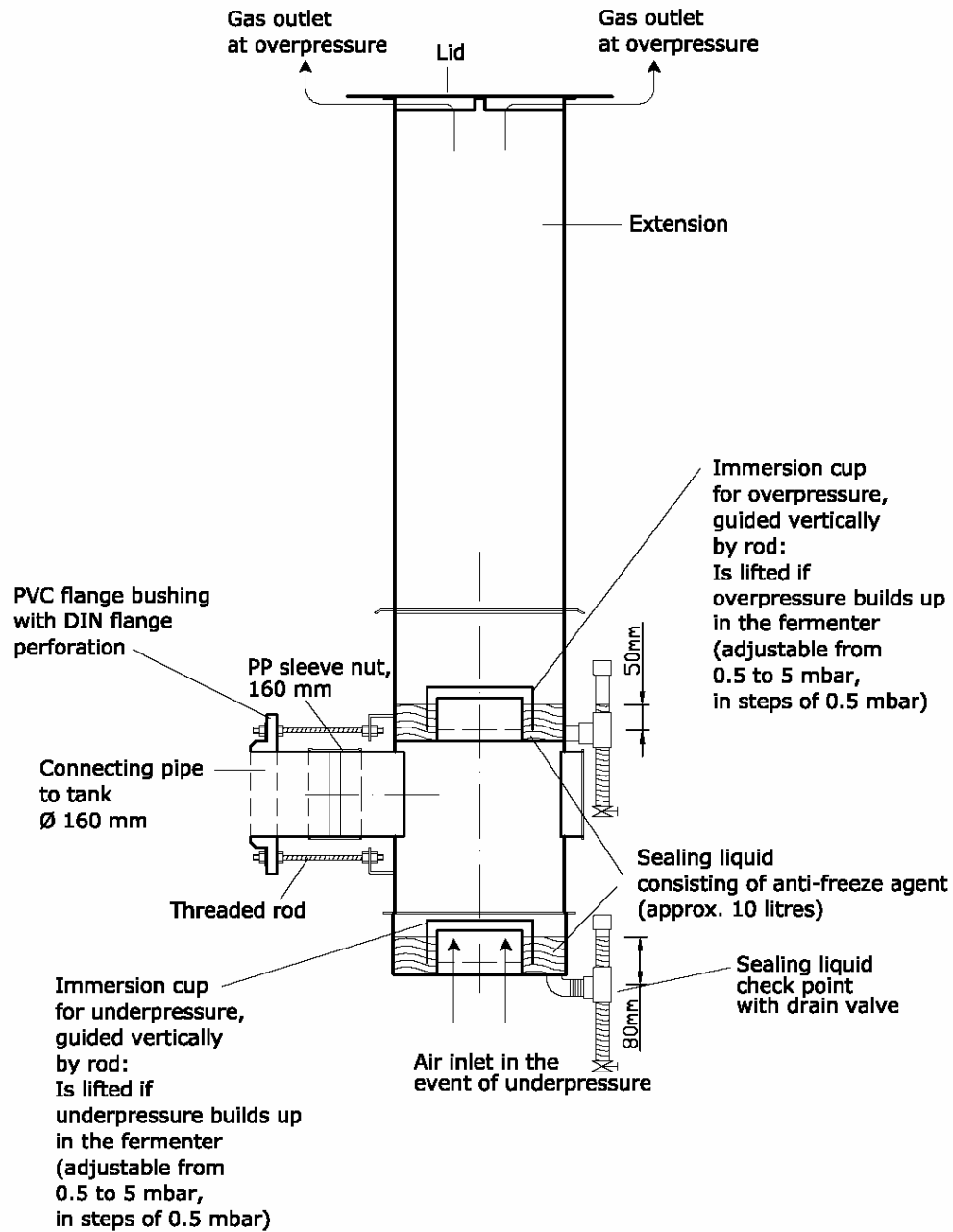


Krieg & Fischer Ingenieure GmbH



Case Study 3:
Rupture of a Gas Holder Roof
实例3: 池顶气体储存池的破裂





Principle of MT overpressure / vacuum valve with extension

MT过压理论/真空阀门

Case Study 3: Rupture of a Gas Holder Roof

实例3：池顶气体储存池的破裂



Case Study 3: Rupture of a Gas Holder Roof

实例3：池顶气体储存池的破裂



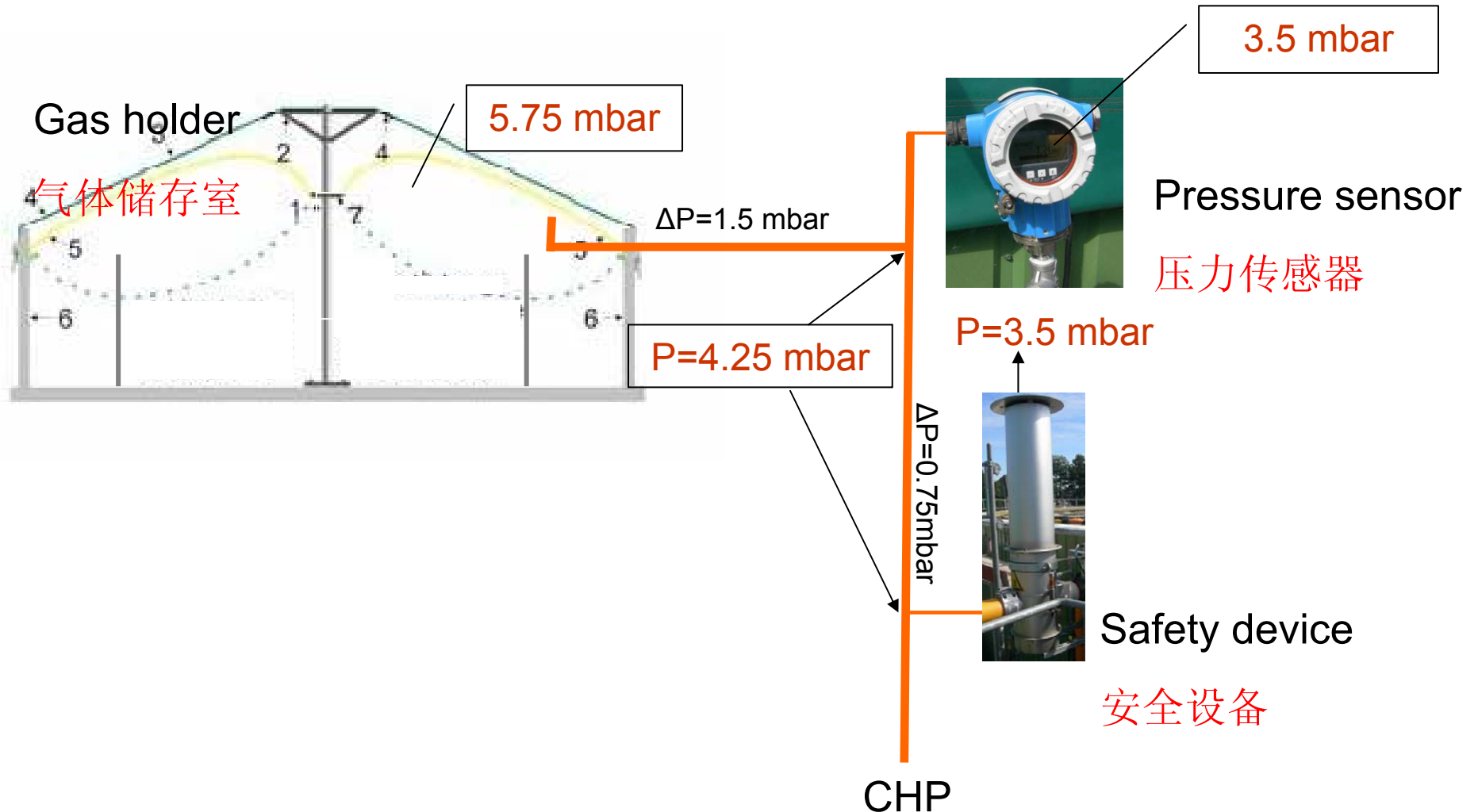
Krieg & Fischer Ingenieure GmbH



Case Study 3: Rupture of a Gas Holder Roof 实例3：池顶气体储存池的破裂



Case Study 3: Rupture of a Gas Holder Roof 实例3: 池顶气体储存池的破裂



Case Study 3: Rupture of a Gas Holder Roof

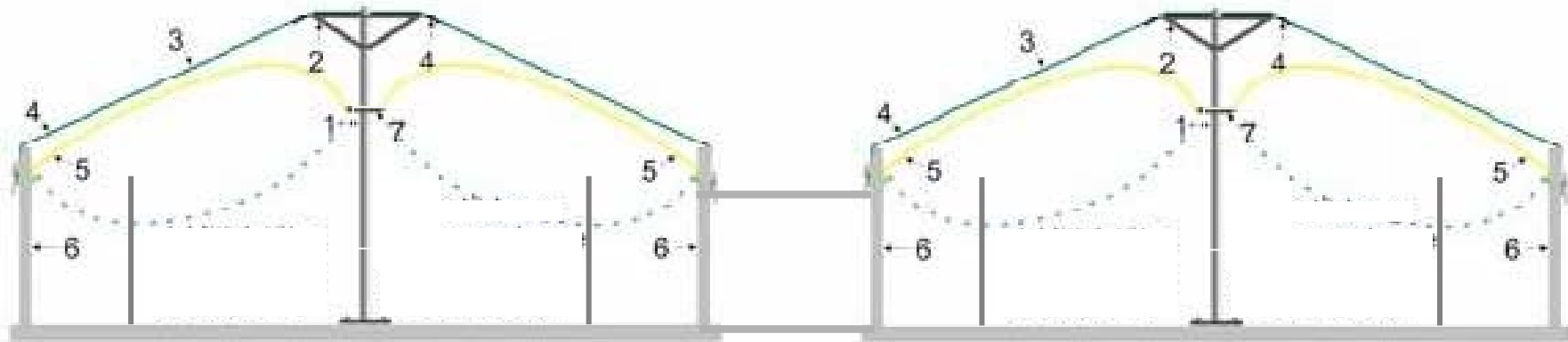
实例3：池顶气体储存池的破裂



Krieg & Fischer Ingenieure GmbH



Case Study 3: Rupture of a Gas Holder Roof 实例3：池顶气体储存池的破裂



2 digesters identical in construction

2个同样的正在建的消化池

Case Study 3: Rupture of a Gas Holder Roof 实例3: 池顶气体储存池的破裂



Case Study 3: Rupture of a Gas Holder Roof

实例3: 池顶气体储存池的破裂



Lessons Learned

经验

- The engineer has to understand the system
工程师必须清楚流程
- The position of measurement systems is important
检测系统的位置很重要
- In gas pipes reductions of the dimension and bends cause pressure reductions
导气管尺寸的减少并引起了压力的降低
- The engineering of a biogas plant should be done by a biogas specialist
沼气工程师应该负责沼气的工程设计



Krieg & Fischer Ingenieure GmbH

International best practice' Middle-Large Scale Biogas-Plant- technology planning, II

Lessons learned from design failures and biogas plants disasters

国际最佳实践工程设计 – 大中型沼气厂设计培训
从设计失误和沼气厂事故中学到的经验

Torsten Fischer and Dr. Katharina Backes

Krieg & Fischer Ingenieure GmbH

Bertha-von-Suttner-Straße 9, D-37085 Göttingen, Germany

Tel.: ++49 551 900 363-0, Fax: ++49 551 900 363-29

Fischer@KriegFischer.de

www.KriegFischer.de

Beijing, May 16, 2010