



# **Regulations on Sustainability for Construction Materials**

**Dipl.-Ing. Carsten Rieck**



# **Kiwa MPA Bautest GmbH**

**Kiwa =**

**Keurings Instituut voor Waterleiding  
Artikelen N.V. (founded 1948) =**

**Dutch testing institute for drinking  
water products**



# Kiwa MPA Bautest GmbH

## International:

- Certification (CE, COMO etc.)
- Testing
- Training

over 1000 employees





# Kiwa MPA Bautest GmbH

**In Germany:**

**priority on testing  
construction materials**

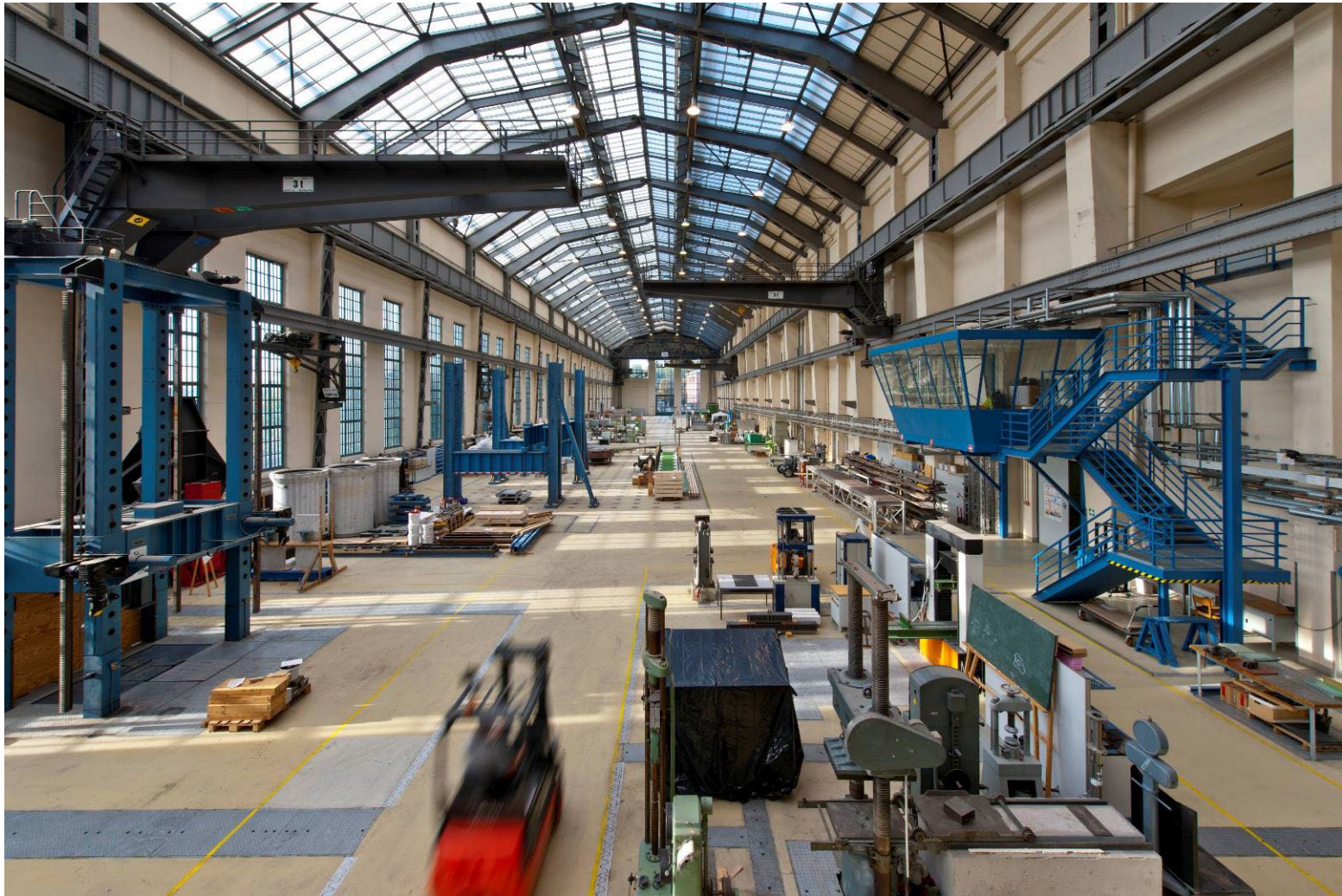
- **Testing**
- **Inspection**
- **Certification**
- **Consulting**
- **Building testing**

**over 350 employees  
(employees in 2005: 7)**





# Testing Hall in Berlin: 180 m long





# Structure

1. Introduction

2. Regulations on Sustainability

3. Example for an EPD

4. Examples of Durable Constructions



# Structure

## 1. Introduction

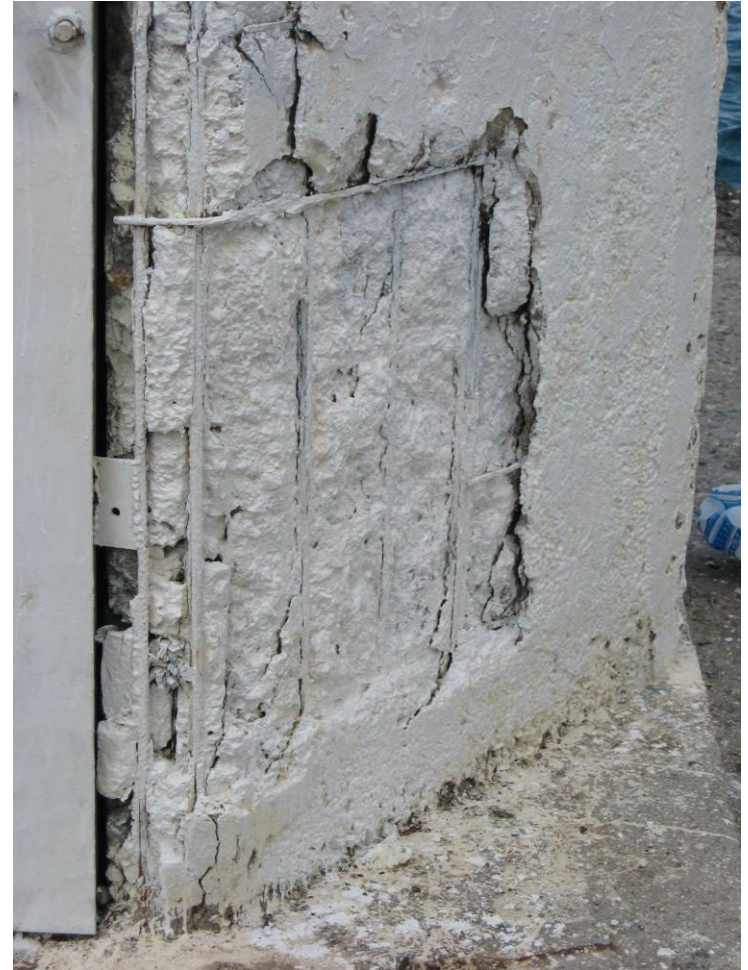
## 2. Regulations on Sustainability

## 3. Example for an EPD

## 4. Examples of Durable Constructions



# Introduction: Sustainable Repair?



# Introduction: Sustainable Insulation?



thermal insulation  
composite system

vs.

fence



# Introduction: Sustainable Insulation?



**Which was first?**



# Introduction

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**Sustainability of constructions is important as**

- **Strength**
- **Usability**
- **Fire protection**
- **...**

**because construction works need resources and energy.**



# Structure

1. Introduction

**2. Regulations on Sustainability**

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# Regulations on Sustainability

## To assess sustainability, you need a system:

EN 15643-1:2010, *Sustainability of construction works - Sustainability assessment of buildings - Part 1: **General framework***

EN 15643-2, *Sustainability of construction works - Assessment of buildings - Part 2: Framework for the assessment of **environmental performance***

prEN 15643-3, *Sustainability of construction works - Assessment of buildings - Part 3: Framework for the assessment of **social performance***



# Regulations on Sustainability

Most important regulations to assess the sustainability of **construction materials** are:

EN ISO 14025:2010, *Environmental labels and declarations - Type III environmental declarations - **Principles and procedures***

ISO 21930:2007, *Sustainability in building construction - **Environmental declaration** of building products*

EN 15804:2012-04, Sustainability of construction works - Environmental product declarations - **Core rules** for the product category of construction products



# Regulations on Sustainability

## Also important:

EN 15978, *Sustainability of construction works - Assessment of environmental performance of buildings - **Calculation method***

CEN/TR 15941, *Sustainability of construction works - Environmental product declarations - Methodology for **selection and use of generic data***

EN 15942, *Sustainability of construction works - Environmental product declarations – **Communication formats: business to business***



# Regulations on Sustainability

## EN 15804:

provides core product category rules (PCR) for construction products

provides a structure to ensure that all Environmental Product Declarations (EPD) of construction products are derived, verified and presented in a harmonised way



# Regulations on Sustainability

## EN 15804:

ensures that EPDs communicates verifiable, accurate, non-misleading environmental information for products and their applications

supports scientifically based, fair choices and stimulating continuous environmental improvement

deals with a limited number of quantifiable predetermined parameters



# Regulations on Sustainability

## **EN 15804:**

⇒ **type III environmental declaration (EPD)**

providing quantified environmental data using predetermined parameters and, where relevant, additional environmental information

⇒ Assess the sustainability of constructions

⇒ identify constructions, which cause less stress to the environment and the user



# Regulations on Sustainability

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**Comparisons** between construction products are carried out in the context of their **application in the building**, over the whole **life cycle** (or over selected **life cycle stages**).



# Regulations on Sustainability

## 3 Types of EPD with respect to life cycle stages covered:

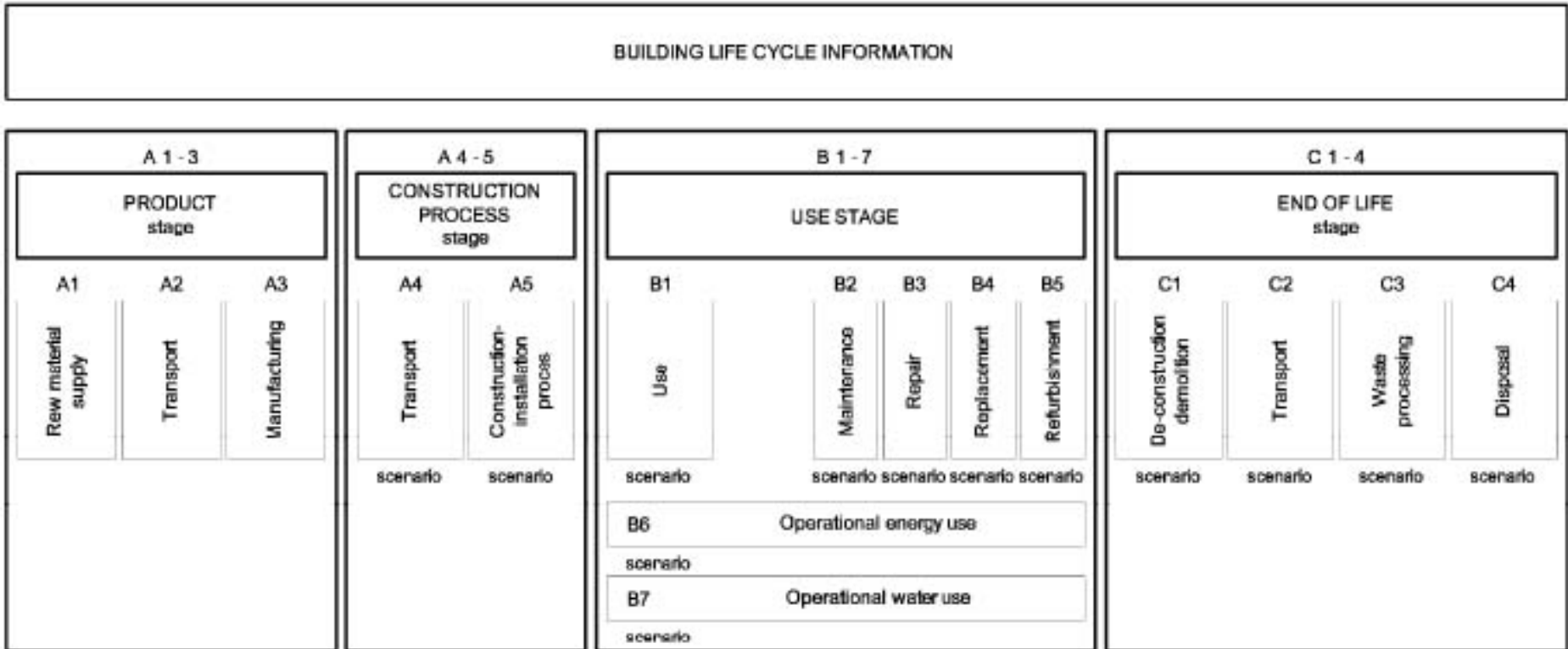
1. “cradle to gate” (product stage only):  
raw material supply, transport, manufacturing and associated processes
2. “cradle to gate with options” (product stage and selected further life cycle stages)  
No. 1 plus other selected optional modules, e.g. end-of-life information modules



# Regulations on Sustainability

3. “cradle to grave” (whole life cycle of a product according to the system boundary):  
product stage, installation into the building, use and maintenance, replacements, demolition, waste processing for re-use, recovery, recycling and disposal;  
based on a LCA, i.e. covering all information modules

# Regulations on Sustainability



**Life cycle stages**



# Regulations on Sustainability

## In detail for information module A1:

- Extraction and processing of raw materials
- Reuse of products or materials from a previous product system
- Processing of secondary materials used as input for manufacturing the product
- Generation of electricity, steam and heat from primary energy resources (including extraction, refining and transport)



# Regulations on Sustainability

The **impact assessment** is carried out for the following **impact categories** in the EPD:

1. global warming
2. ozone depletion
3. acidification of land and water
4. eutrophication
5. photochemical ozone creation
6. depletion of abiotic resources (elements)
7. depletion of abiotic resources (fossil)



# Regulations on Sustainability

Also included in the EPD:

1. Ten parameters describing resource use
2. Three parameters describing waste categories
3. Four parameters describing output flows



# Structure

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# Example for an EPD

## UMWELT-PRODUKTDEKLARATION

nach ISO 14025

Deklarationsinhaber	Verein Deutscher Zementwerke e.V.
Herausgeber	Institut Bauen und Umwelt (IBU)
Programmhalter	Institut Bauen und Umwelt (IBU)
Deklarationsnummer	EPD-VDZ-2012111-D
Ausstellungsdatum	16.03.2012
Gültigkeit	15.03.2017

### Zement

Verein Deutscher Zementwerke e.V.

[www.bau-umwelt.com](http://www.bau-umwelt.com)



Institut Bauen  
und Umwelt e.V.



# Example for an EPD

## Structure of the EPD for cement:

1. general information
  2. description of the product
  3. LCA: calculation method
  4. LCA: results
  5. LCA: interpretation
- (9 pages; more information in the confidential project report)

# Example for an EPD

## ANGABE DER SYSTEMGRENZEN (X = IN ÖKOBILANZ ENTHALTEN; MND = MODUL NICHT DEKLARIERT)

Produktionsstadium			Stadium der Errichtung des Bauwerks		Nutzungsstadium							Entsorgungsstadium				Gutschriften und Lasten außerhalb der Systemgrenze
Rohstoffversorgung	Transport	Herstellung	Transport zur Baustelle	Einbau ins Gebäude	Nutzung / Anwendung	Instandhaltung	Reparatur	Ersatz <sup>1)</sup>	Erneuerung <sup>1)</sup>	Energieeinsatz für das Betreiben des Gebäudes	Wassereinsatz für das Betreiben des Gebäudes	Rückbau / Abriss	Transport	Abfallbehandlung	Deponierung	Wiederverwendungs-, Rückgewinnungs- oder Recyclingpotenzial
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

1) Die Stadien Ersatz (B4) und Erneuerung (B5) sind auf Produktebene i.d.R. nicht relevant da sie sich normativ auf die künftigen Aufwendungen im Lebenszyklus des Gebäudes beziehen. Aus Gründen der Übersichtlichkeit wurden diese beiden Stadien aus den nachfolgenden Tabellen gestrichen. Wird eine Deklaration der beiden Stadien dennoch durchgeführt, so sind die Ergebnisse einzufügen.

## ERGEBNISSE DER ÖKOBILANZ UMWELTAUSWIRKUNGEN: 1 t Zement

Parameter	Einheit	Produktion
		A1 - A3
Globales Erwärmungspotenzial	[kg CO <sub>2</sub> -Äq.]	691,7 <sup>1)</sup>
Abbau Potential der stratosphärischen Ozonschicht	[kg CFC11-Äq.]	1,50E-05
Versauerungspotenzial von Boden und Wasser	[kg SO <sub>2</sub> -Äq.]	0,83
Eutrophierungspotenzial	[kg PO <sub>4</sub> <sup>3-</sup> -Äq.]	0,12
Bildungspotenzial für troposphärisches Ozon	[kg Ethen Äq.]	0,10
Potenzial für den abiotischen Abbau nicht fossiler Ressourcen	[kg Sb Äq.]	1,30E-3
Potenzial für den abiotischen Abbau fossiler Brennstoffe	[MJ]	1901,4



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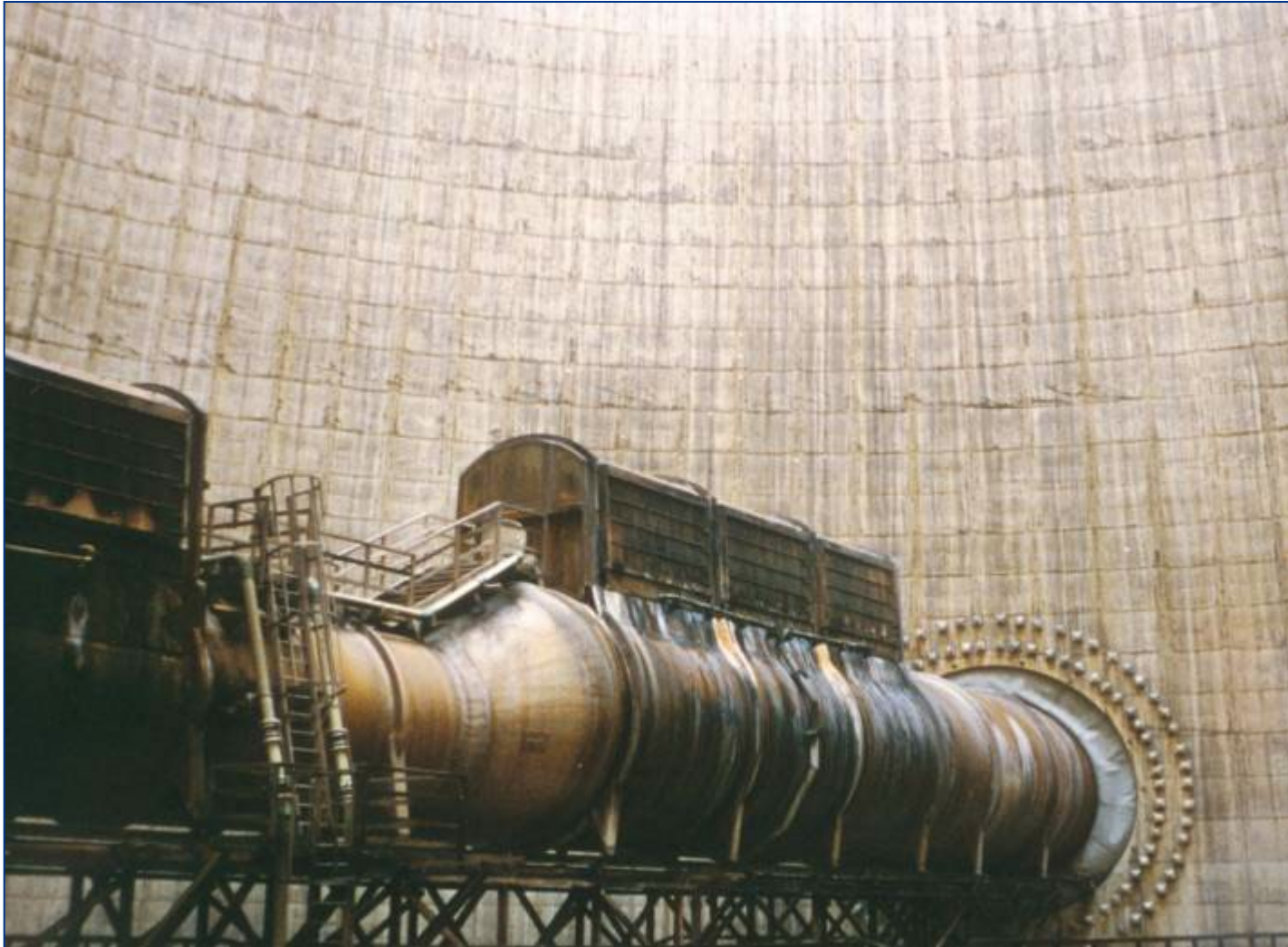
**4. Examples of Durable Constructions**



# In Germany for over 25 years...



**... the flue gases are discharged via the cooling tower.**





# Most important attack on concrete

**sulphuric acid**





# Anticorrosive Coating of the Inner Shell





# Testing facilities for acid-resistance





# Testing the acid-resistance

- **Sulphuric acid pH 3.5**
- **12 weeks storage**
- **Loss of mass**
- **Damage depth**  
**by polarising microscopy**

# Mortar-specimen after 2.5 months acid-storage, pH 2.5



**Mortar-specimen**

- Portland Cement
- Fly Ash
- Microsilica

**Mortar-specimen**

- Portland Cement

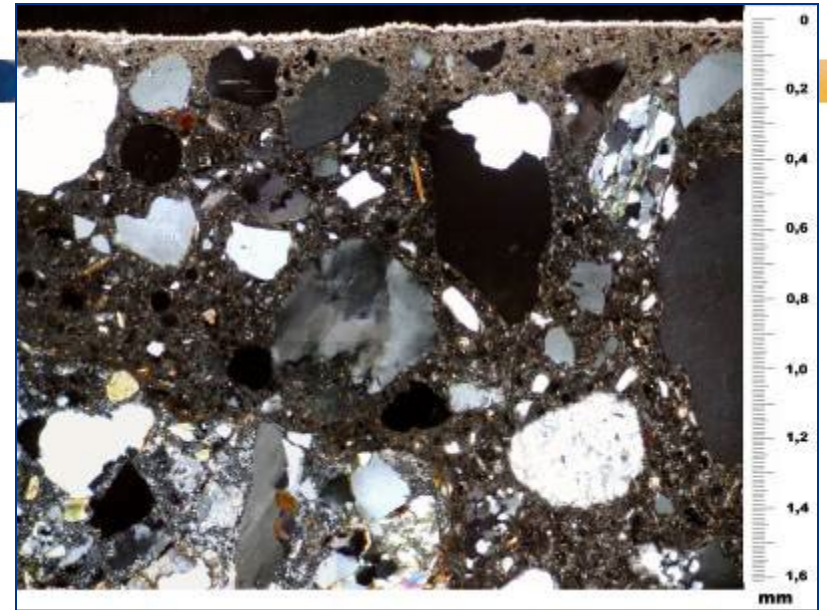
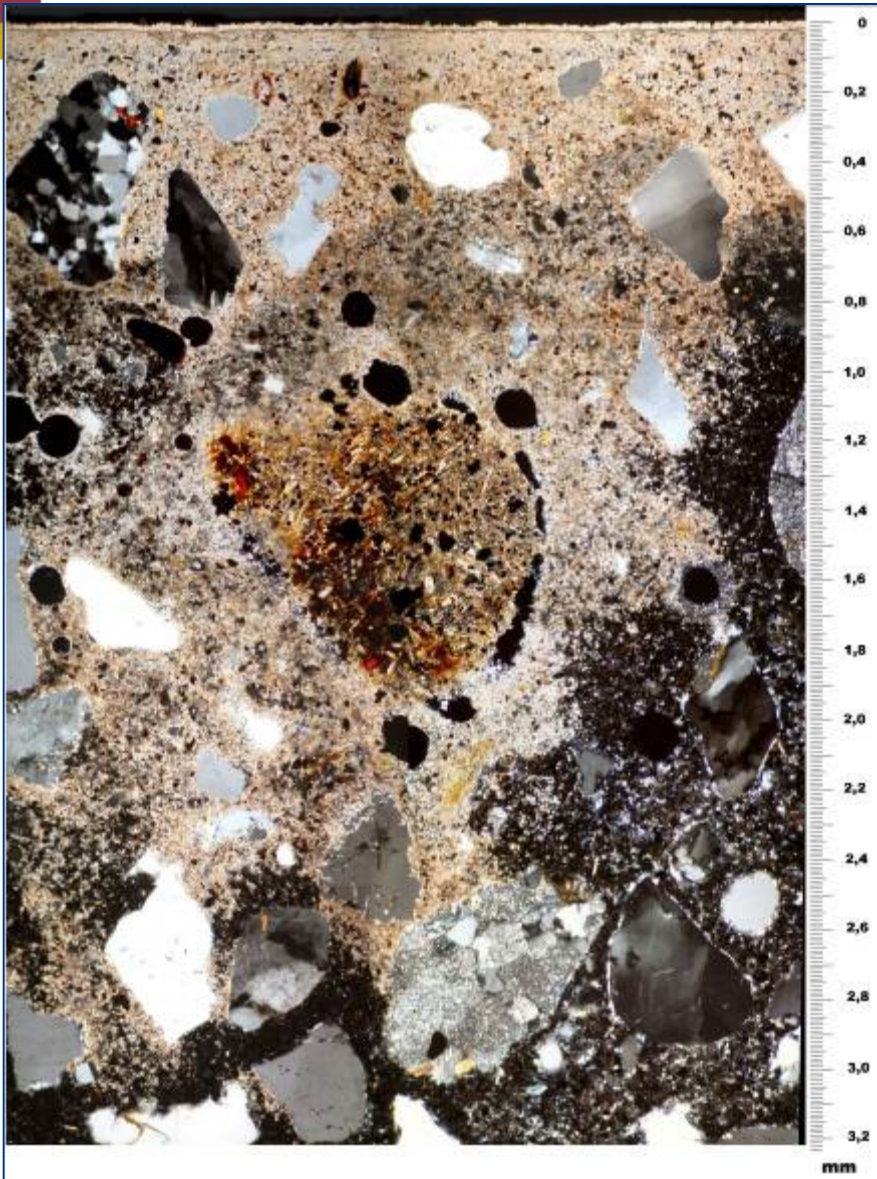
The same loss of mass!



# Damage depth by polished section



# Damage depth by polarising microscopy



**Concrete with  
increased acid  
resistance**

**Ordinary concrete**



# Maximum damage depths

**Concrete with increased acid resistance: 0.25 mm**

**Ordinary concrete: 5 mm**

**Resistance is about 20 times higher!**

**Sustainability is much better.**



## The Beginning in 1999

The highest cooling tower  
in the world (200 m)  
in Niederaußem

concrete conception:  
Technical University Berlin / Kiwa

Expected damage depths after  
over 10 years of service.

**Concrete with increased acid resistance:  
Consultant Kiwa (cooling tower and pre-cast segments)**

**Niederaußem, Neurath, Westfalen (RWE)**

**Boxberg (Vattenfall)**

**Datteln (E.ON)**

**Lünen (Trianel)**







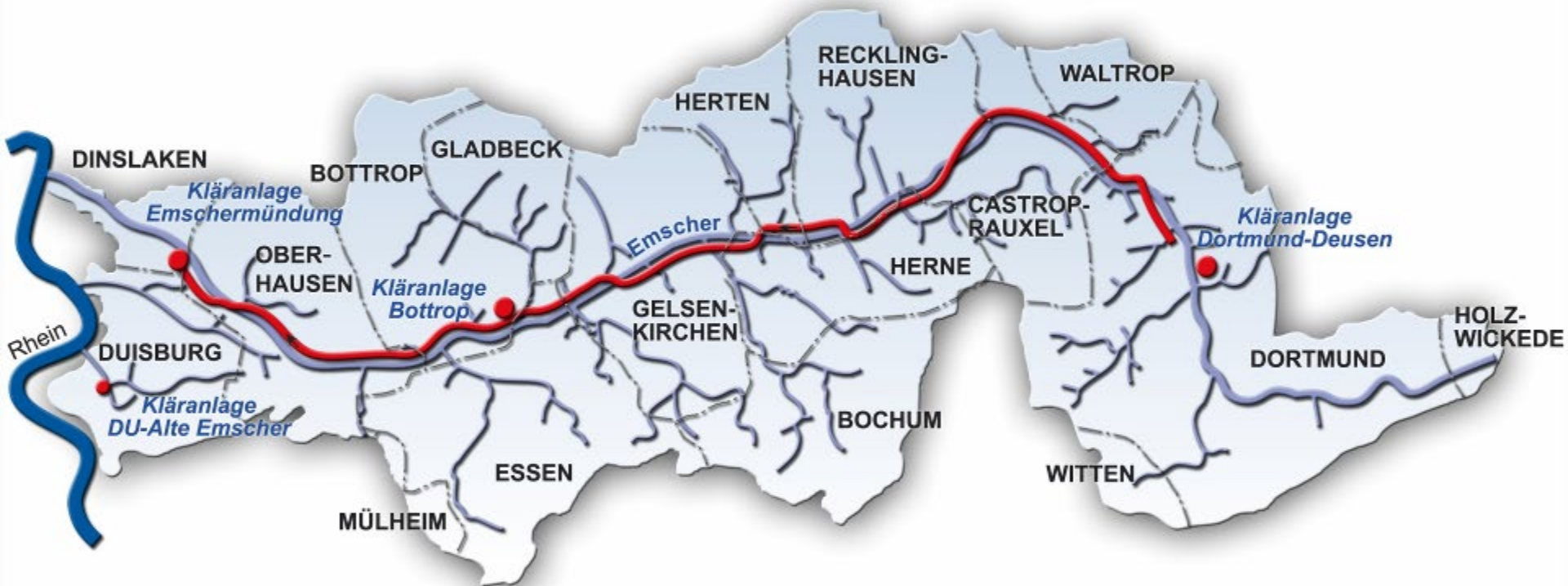




## **BV Berlin- Alexanderstr.**

**Berliner  
Wasser-  
betriebe**

app. 400 km new sewage system



ZTV Emscher: Concrete with higher acid resistance

EMSCHER



# Concrete with higher acid resistance



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International Symposium, 2012-10-30 in Bottrop



Partner for progress



## **Regulations on Sustainability for Construction Materials**

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