FEDERAL INSTITUTE FOR RISK ASSESSMENT

BfR
Bundesinstitut für Risikobewertung

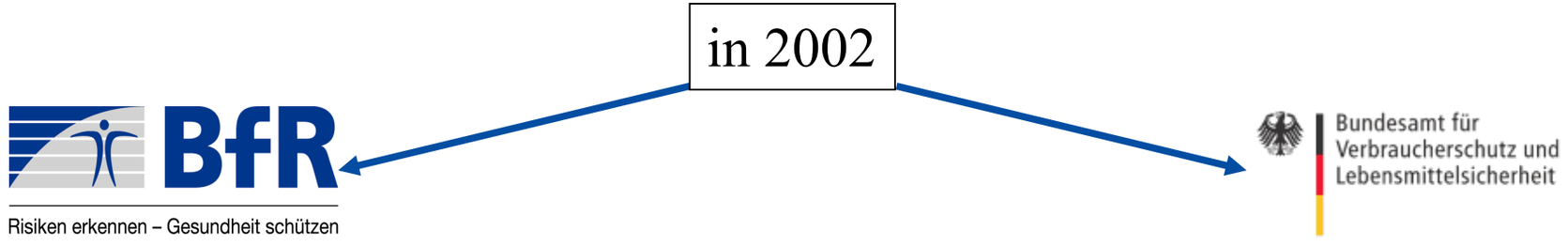
Short courses in food safety risk assessment

Andreas Hensel

The German Federal Institute for Risk Assessment (BfR)

Federal Health Office (1952-1994)

Federal Institute for Consumer Health Protection and Veterinary Medicine (1994-2002)



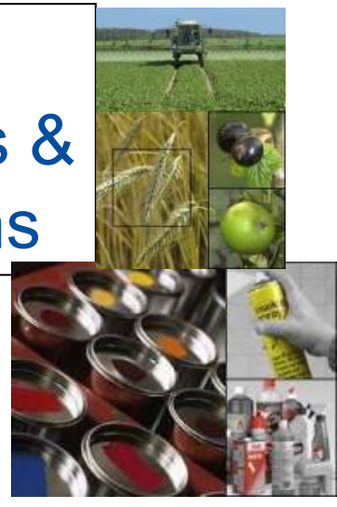
Risk assessment **Risk management**

- body under public law in the responsibility of the Federal Ministry of Food and Agriculture (BMEL)
- independent in its scientific assessments, in its research and in its risk communication
- approx. 830 employees, including 330 scientists
- the current annual budget is 88.1 m EUR
- annual research expenditure of 6 m EUR
- around 2 m EUR are third-party funding

Fields of competence

Biological Safety

Safety of Substances & Preparations



Food Safety

Safety in the Food Chain

Risk Communication

Safety of Consumer Products

Experimental Toxicology and ZEBET

General activities and tasks

- **Risk assessment**

  expert reports, opinions according to internationally recognized scientific criteria

- **Work in national & international bodies**

  committees & panels, working groups

- **Research activities & cooperation**

  primarily to strengthen risk assessment processes

- **Risk communication**

  informing the public in a transparent, comprehensive way

Education activities

- expert reports, opinions according to internationally recognized scientific criteria

- **Work in national & international bodies**

  committees & panels, working groups

- **Research activities & cooperation**

  primarily to strengthen risk assessment processes

- **Risk communication**

  informing the public in a transparent, comprehensive way

Hazard and risk

Hazard

A negative health effect that is induced by a biological, chemical, or physical agent.

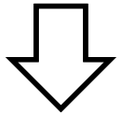
Risk

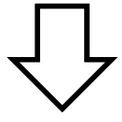
Describes the probability of health impairment by a certain amount / dose of a given substance.

Risk assessment

Hazard identification

What health problems are caused by the substance?



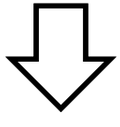


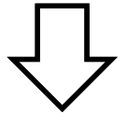
Exposure assessment

How much of this substance is taken up by a consumer?

Dose-response assessment

What are the health problems at different concentrations?

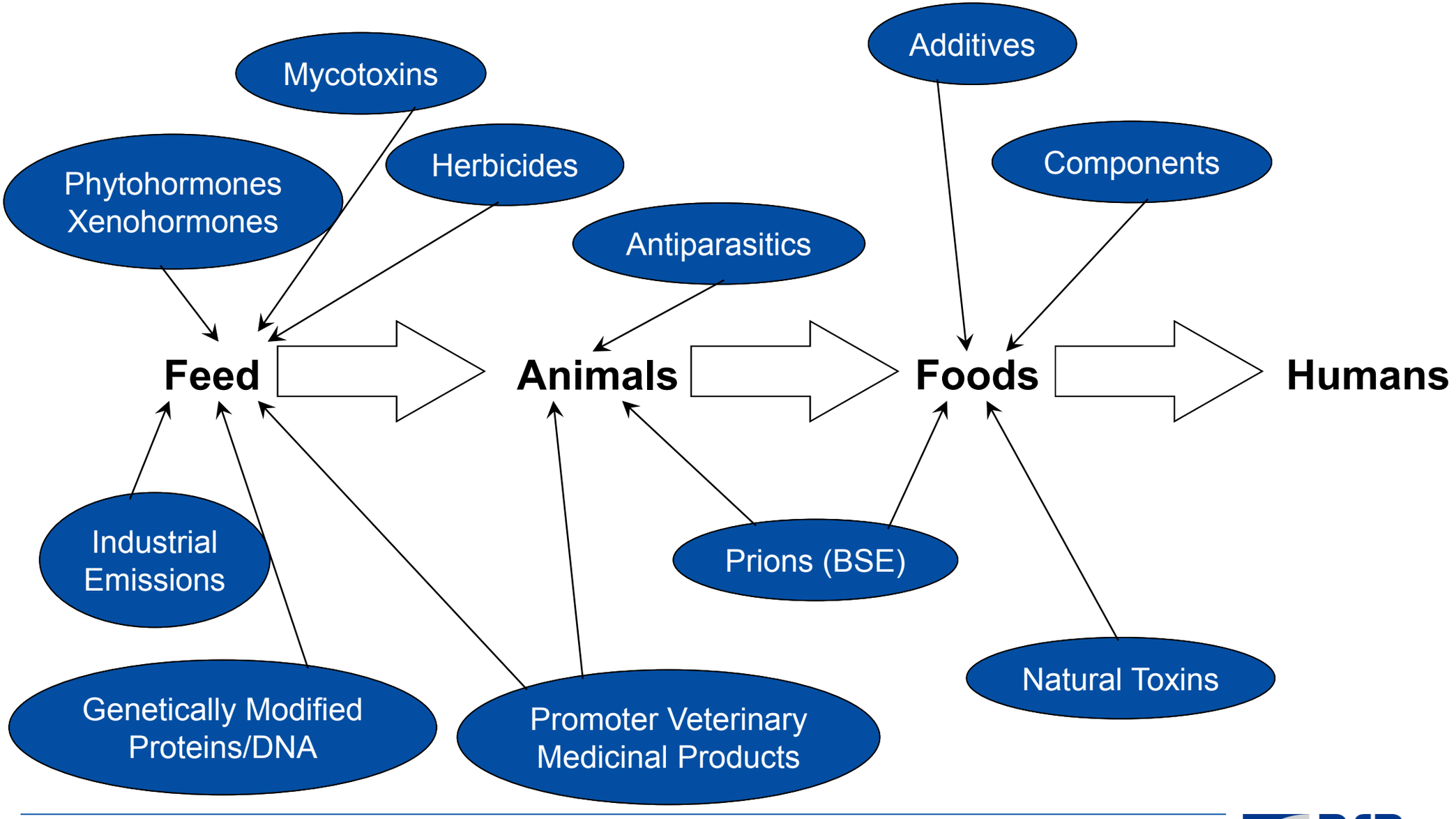




Risk characterisation

What is risk for the consumer caused by that substance?

Hazardous substances in the food chain



Additives, residues, and contaminants

Additives

- substances added intentionally to food
- *e. g.* to preserve flavour or enhance its taste and appearance

Residues

- Substances used during the production process
- *e. g.* veterinary medical products, herbicides, insecticides

Contaminants

- Environmental substances, ubiquitous
- Heavy metals
- Dioxins, PCBs, DDT
- Mycotoxins, bacterial toxins

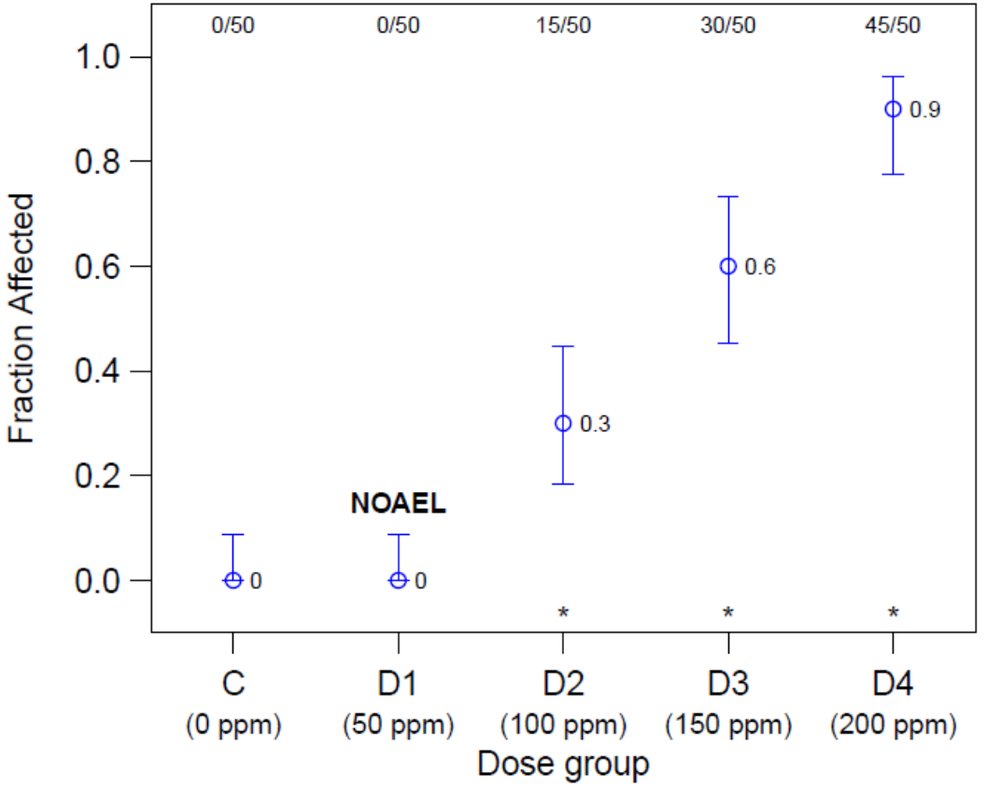
Hazard characterisation: The NOAEL approach

NOAEL	„no observable adverse effect level“ this is the maximum dose which does not cause an adverse effect
LOAEL	„lowest observable adverse effect level“ this is the lowest dose which does show an adverse effect
Principle:	- compares treatment groups with control groups - **can only be applied to effects with a threshold**
Disadvantages:	- dependent on dose spacing - dependent on the size of test groups, *i. e.* number of animals, dose - shape of the dose-response curve is not considered - NOAELs can differ significantly between different studies
Advantages:	- easy to use - established standard method - well established in risk assessment

Hazard characterisation: The NOAEL approach

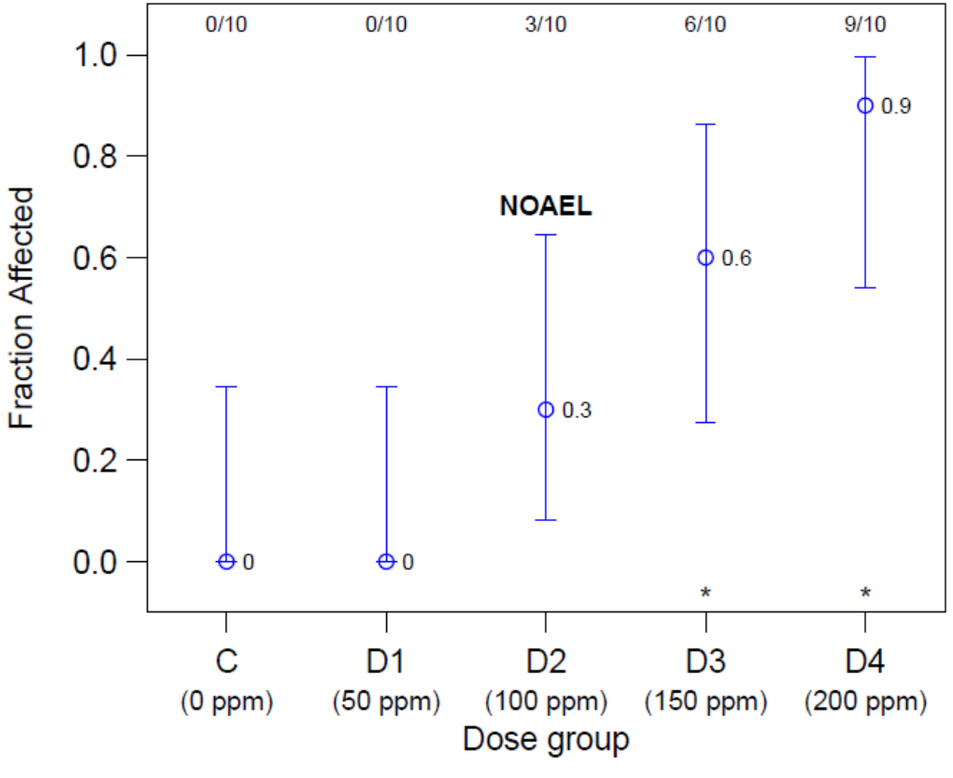
Two studies for testing the same substance

50 animals per group



NOAEL: 50 ppm

10 animals per group



NOAEL: 100 ppm

Hazard characterisation: The BMD approach

BMD „benchmark dose“
BMDL BMD including a 90% confidence interval
BMDL defines the lower confidence bound of the BMD

Principle:
- a quantitative dose-response curve is used for the evaluation, data are fitted to a dose-response model)
- a benchmark response is defined, *i. e.* 5% affected
- dose leading to this benchmark response: benchmark dose (BMD)
- **can only be applied to effects with threshold**

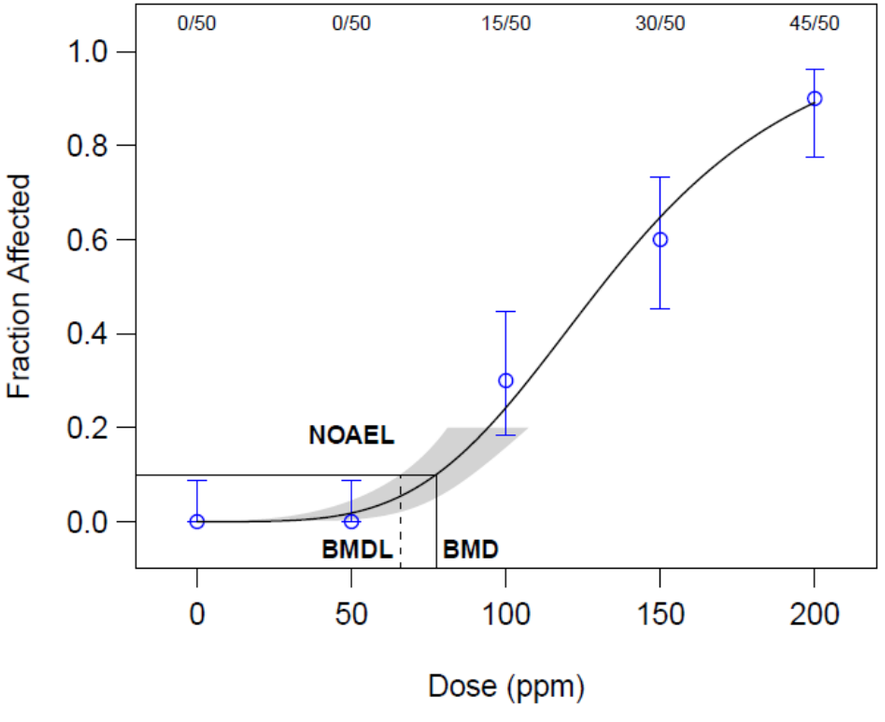
Disadvantages:
- more difficult to use compared to NOAEL approach
- more time-consuming

Advantages:
- less dependent on the choice of the tested doses
- shape of the dose-response curve is taken into consideration
- BMD between different studies do not vary that much

Hazard characterisation: The BMD approach

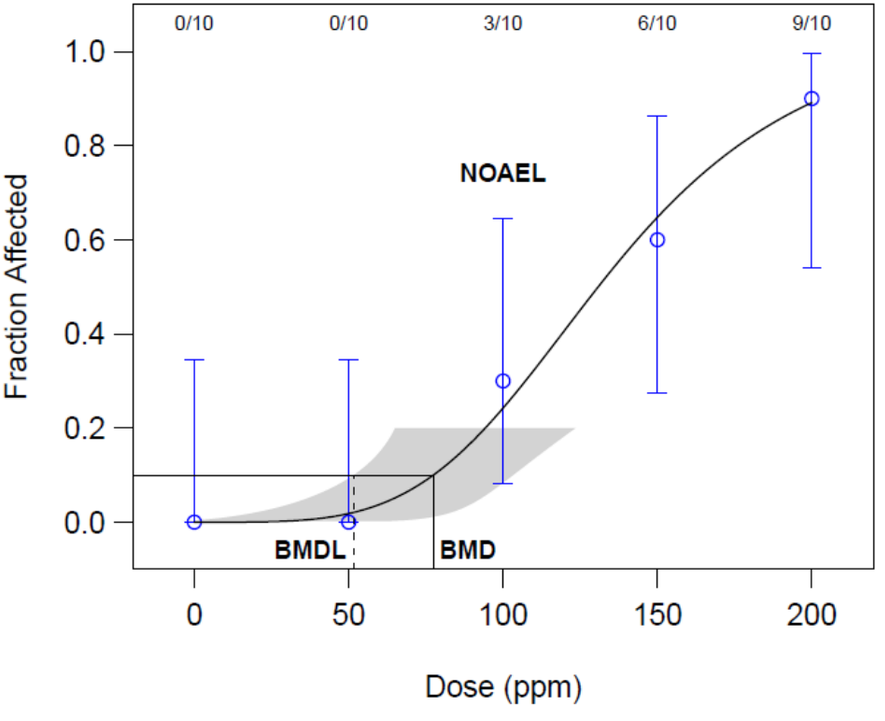
Two studies for testing the same substance

50 animals per group



BMD: 77 ppm
BMDL: 66 ppm

10 animals per group



BMD: 77 ppm
BMDL: 52 ppm

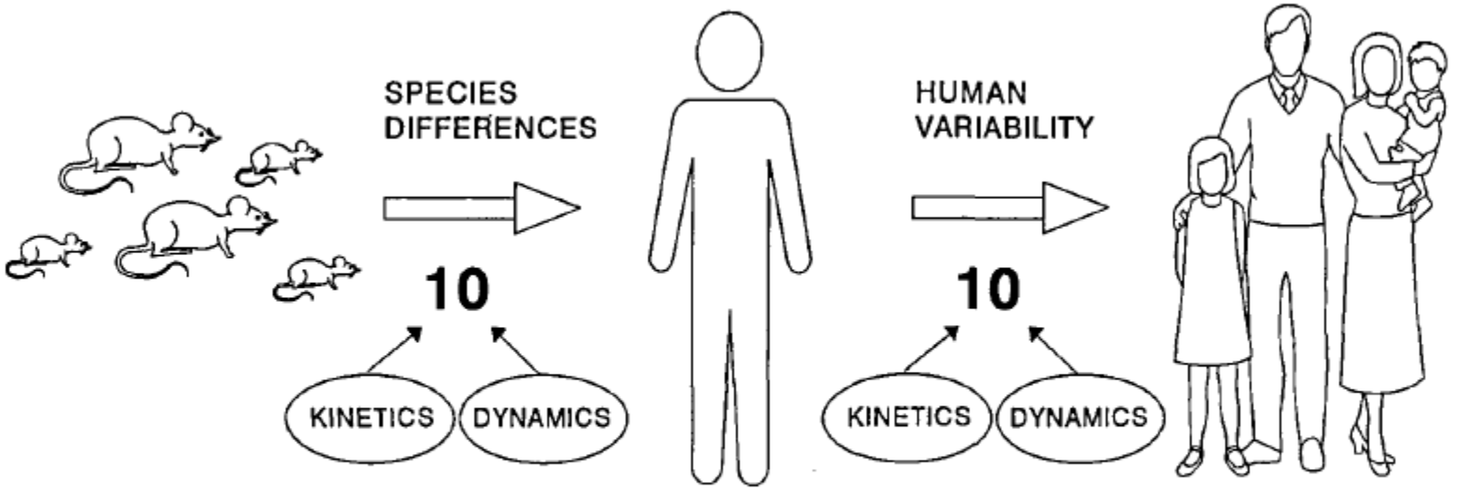
Acceptable Daily Intake (ADI)

ADI value (in mg kg^{-1} body weight)

- An estimate of the daily exposure dose / of the amount of a substance that is likely to be without noxious effect even if continued exposure occurs / even if ingested **daily** by humans over a **lifetime**.
- Occasional, short exceeding is tolerable.
- Does not apply to infants under the age of twelve weeks.

Precondition for establishing an ADI is a valid or effective threshold.

Assessment factors, uncertainty factors



Renwick AG (1998), Food Add Contam 15 (Suppl 1), 17-35

For effects with thresholds, typically a safety factor of 10 x 10 is used to reflect

1) Uncertainties resulting from inter-species variation

Data from animal studies are applied to estimate effects on humans.

2) Uncertainties resulting from intra-species variation

Different individuals may respond differently. Each human is unique.

Assessment factors, uncertainty factors

INTERSPECIES

- extrapolation form „average animal“ to „average human“

Allometric Scaling

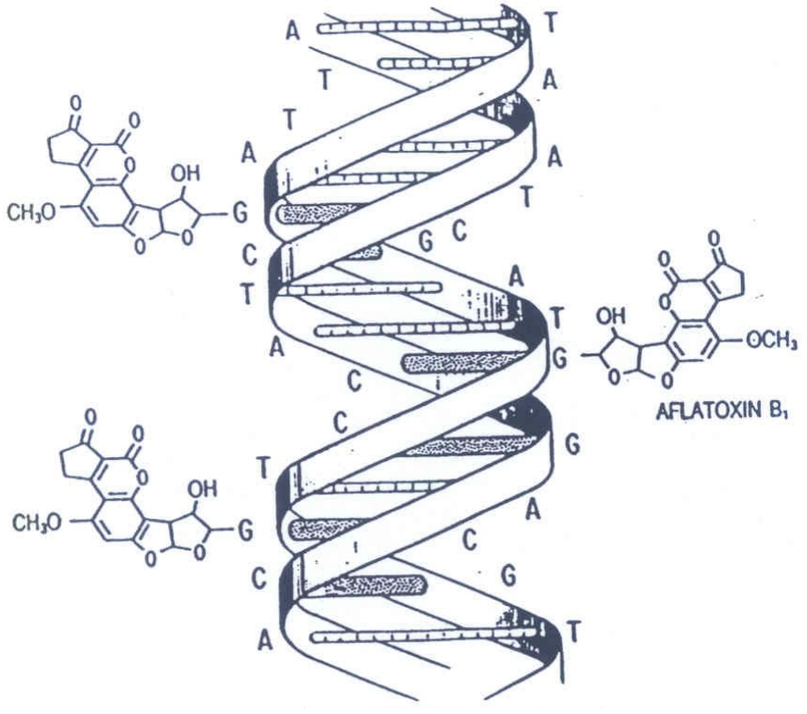
- scaling based on body size
- important: dose metric (mg kg^{-1} body weight d^{-1})
- default is 10 (valid only for rats!)
- additional default values may be used to consider additional differences, *e. g.* additional default of 2.5 for additional differences in toxicokintetics or toxicodynamics

INTRASPECIES

- extrapolation from „average human“ to „sensitive human“

- for consumers: default 10
- for occupationally exposed: default 5

The ALARA principle



Genotoxic cancinogens

- A derivation of a safe dose is normally not possible.

The risk may possibly be evaluated by extrapolation within the last step of risk assessment.

Risk management: minimisation of exposure

"**A**s **L**ow **A**s **R**easonably **A**chievable" (**ALARA principle**)

Risk characterisation

- Comparison between threshold limit values (*e. g.* ADI, TDI) and the exposure

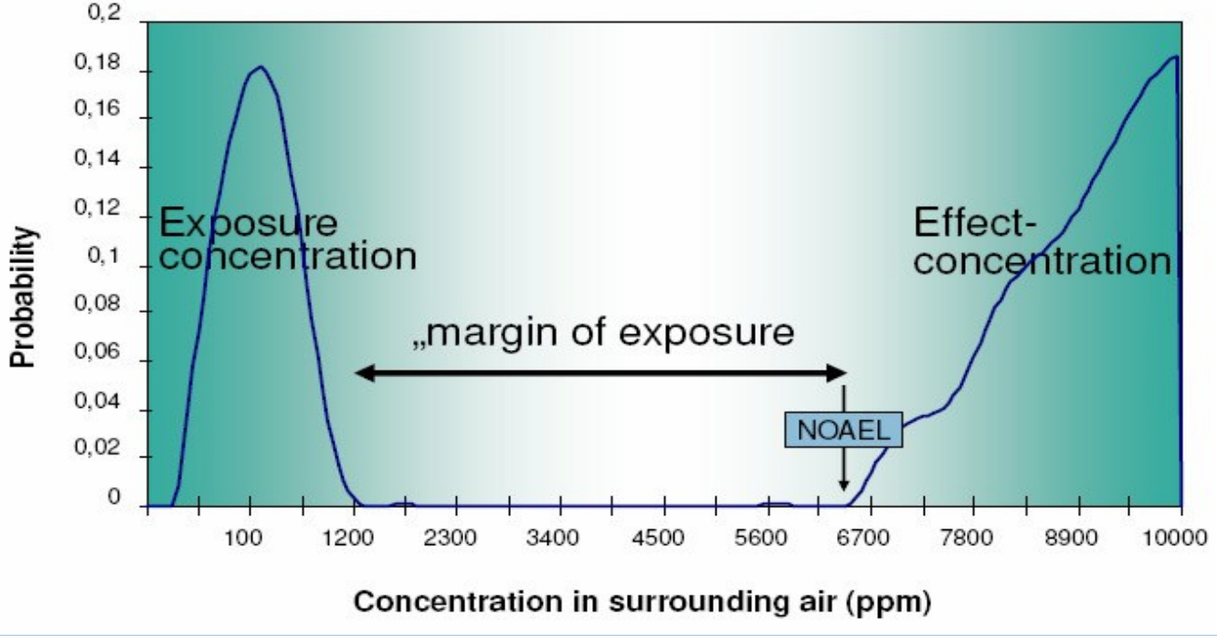
In the case of exceeding the threshold limit values for exposure:

Margin of Safety (MOS)

- Comparison between ADI / TDI and the exposure

Margin of Exposure (MOE)

- Comparison between NOAEL / BMDL and the exposure



Examples for Margin Of Exposure (MOE)

$$\text{Margin Of Exposure} = \frac{\text{Dose inducing tumours in animals}}{\text{Average human intake}}$$

	Margin Of Exposure
acrylamide	1,000
aflatoxines	100,000
nitrosoamines	100,000
benzo[a]pyrene	1,000,000

Novel approaches in risk assessment

Threshold of Toxicological Concern (TTC)

Not for substances to be authorised but acceptable for non-intentionally added substances (NIAS)

Chemical structure is known
Human exposure is (presumably) very low

Different exposure levels depending on the presence or absence of an structural alert for toxicity

exposure **below** such level: low probability of health effects
exposure **above** such level: tox data or read-across required

www.efsa.europa.eu/en/efsajournal/doc/2750.pdf

Quite complex, isn't it?

training initiatives of the BfR …

Objectives of the BfR Summer Academy on Risk Assessment and Communication

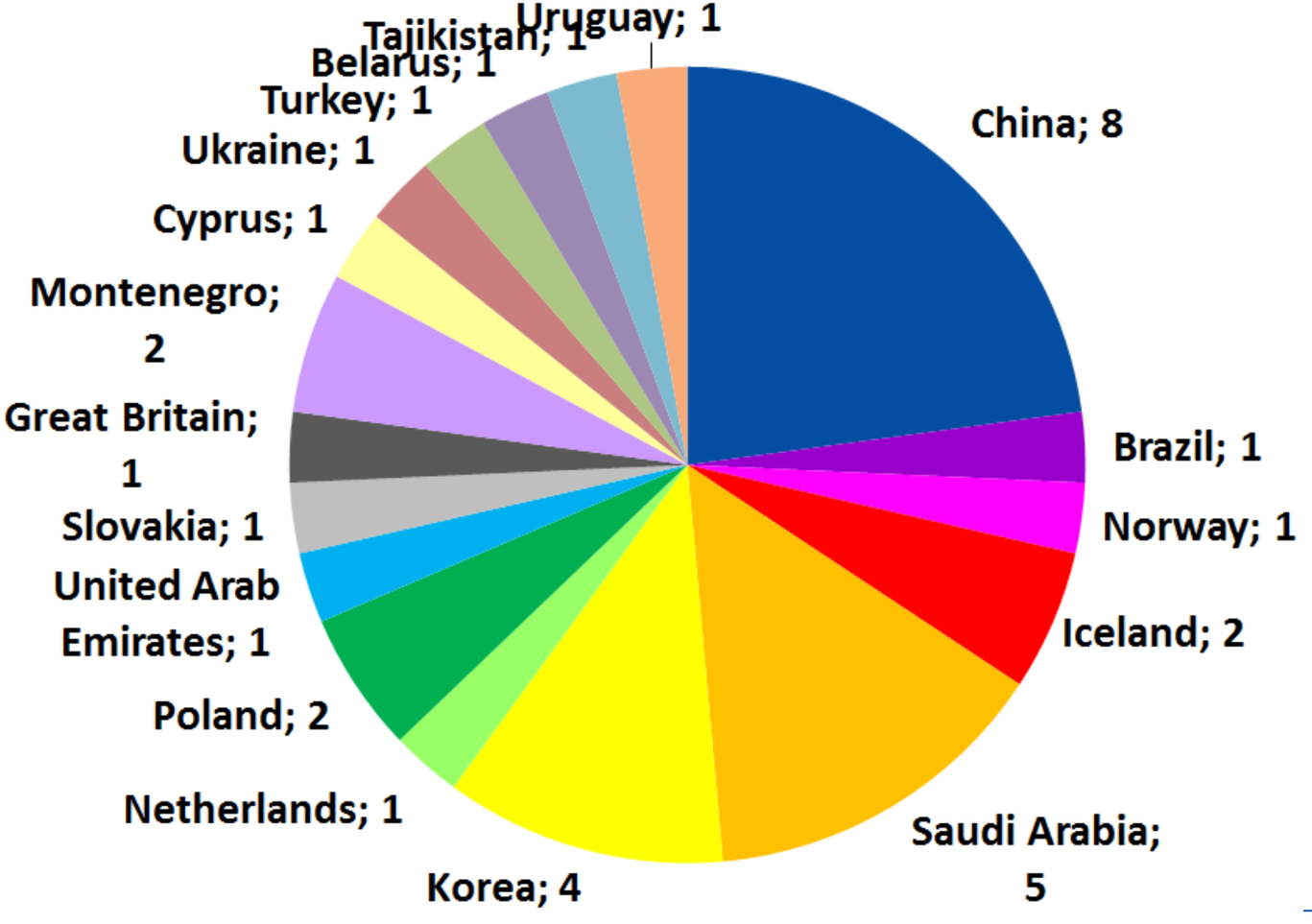
Participants should

- gain a deeper insight into the concept of food safety (especially in Germany and Europe) with a focus on risk assessment and risk communication
- gain a better understanding of hazard assessment, risk assessment and exposure assessment
- acquire practical experience in implementing risk assessment analysis (case studies)
- develop mutual understanding of possible risk communication measures (strategies, public relations)

From experts to experts

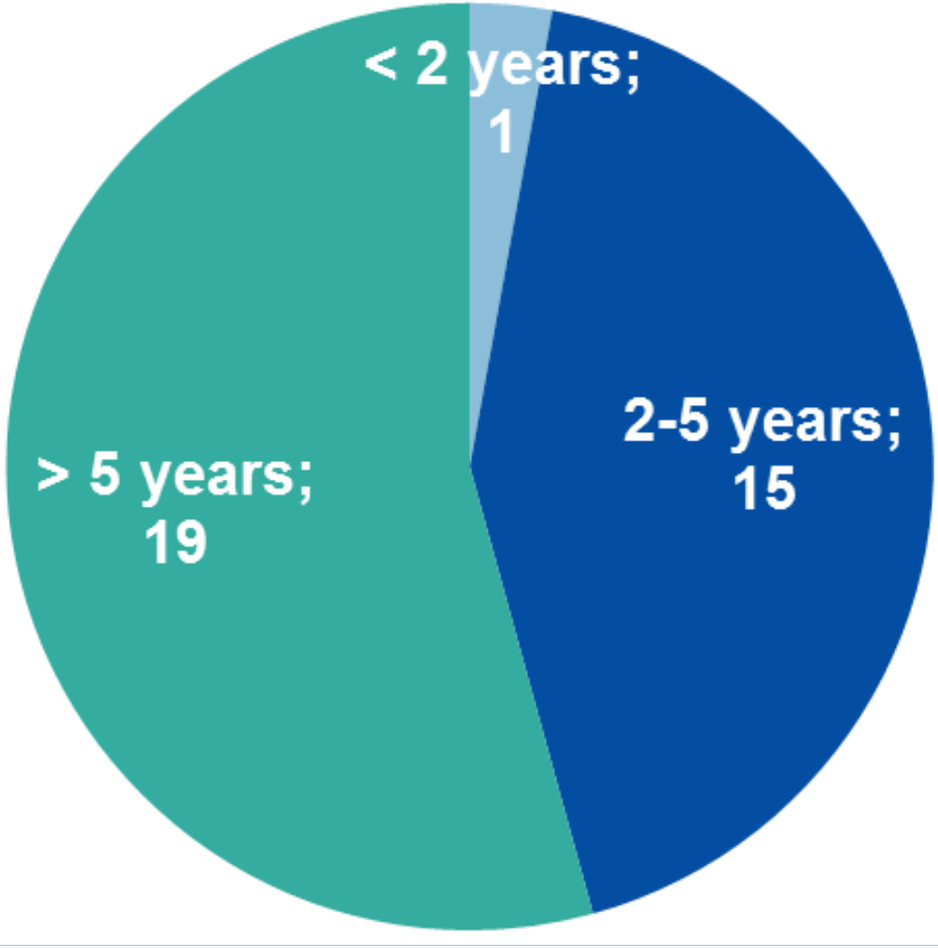
Participants of the BfR Summer Academy

2015: 35 participants from 18 countries



Professional level of participants

2015: 35 participants from 18 countries



Curriculum of the 4th BfR Summer Academy, 17/08/2015 to 28/10/2015

17.08. – Monday (INTRODUCTION):

9.30 Registration Seminaris Hotel

10.00 – 11.00
Foto, Welcoming, Introduction of Participants
Präs/VPräs, BfR

11.00 – 12.30
Introduction Risk Assessment I
Professor Dr. Matthias Greiner, BfR

Lunch

13.30 – 14.30
Introduction Risk Assessment II
PD Dr. Christine Müller-Graf, BfR

14.30 – 15.30
Legal Background of Food Safety in Germany and Europe
Dr. Tanja Ehnert, BfR

Coffee break

16.00 – 17.00
Risk Assessment and Risk Communication in the international context
Paul Ney, Federal Ministry of Food and Agriculture

18.08. – Tuesday (EXPOSURE):

9.00 – 10.30
Exposure Assessment – Introduction
Professor Dr. Mathias Greiner, BfR

11.00 – 12.30
Methods used for Exposure Assessment
PD Dr. Gerhard Heinemeyer, BfR

Lunch Break

13.30 – 17.00
Exposure Models and Practical Exercises
Dr. Jacob D. van Klaveren, Dutch National Institute for Public Health and the Environment, Wageningen, The Netherlands

19.08. – Wednesday:

9.00 – 10.30
Data Generation of Exposure Contamination Data
Dr. Oliver Lindtner, BfR

Coffee Break

11.00 – 12.30
Dietary Assessment Methods
Professor Dr. Ingrid Hoffmann
Max Rubner-Institute, Karlsruhe

Lunch Break

13.30 – 17.00
Workshop Risk Assessment – Exercises on *Trichinella* in Food
Dr. Anne Mayer-Scholl,
PD Dr. Karsten Nöckler, BfR

20.08. – Thursday (MIRCROBIOLOGY) in Marienfelde and Alt-Marienfelde:

09.00 – 10.30
Food-borne Infections and Intoxications
Dr. Juliane Bräunig, BfR

Coffee Break

11.00 – 12.30
Antimicrobial Resistance
PD Dr. Bernd-Alois Tenhagen, BfR

Lunch Break

Guided tour in Marienfelde und Alt-Marienfelde, Foto

14.30 – 16.00
Global Data, International Outbreaks and the Importance of Collaboration, Coordination and Communication
Dr. Birgitte Helwigh, Technical University of Denmark (DTU)

Curriculum of the 4th BfR Summer Academy, 17/08/2015 to 28/10/2015

21.08. – Friday (RISK-COMMUNICATION/RISK ASSESSMENT)

9.00 – 12.00
Introduction Risk Communication and Exercises
Dr. Mark Lohmann, BfR

Lunch Break

24.08. – Monday (RISK-COMMUNICATION/RISK ASSESSMENT)

9.00 – 15.00
Workshop Risk Assessment – Exercises on Arsenic in Food
Dr. Ulrike Pabel, Dr. Antje Gerofke, BfR
Lunch Break included

Coffee Break

15.30 – 17.30
Workshop Risk Communication – Exercise on Arsenic in Food
Jürgen Thier-Kundke, BfR

25.08. – Tuesday (PESTICIDES):

09.00 – 10.30
Workshop Risk Assessment – Pesticides (Introduction)
Dr. Thomas Kuhl, Dr. David Schumacher, BfR

Coffee Break

11.00 – 17.00
Workshop Risk Assessment – Pesticides
Dr. Thomas Kuhl, Dr. David Schumacher, BfR
Lunch and Coffee Break included

26.08. – Wednesday:

9.00 – 10.30
Hazard Identification and Characterisation / Subchronic Studies
PD Dr. Esther Rosenthal, BfR

Coffee Break

11.00 – 12.30
Reproductive Toxicity Studies in Hazard Assessment and Exercises
Dr. Roland Solecki, Dr. Vera Ritz

Lunch Break

13.30 – 15.00
Good Laboratory Practice (GLP)
Dr. Wolf Burchard Bulling, BfR

Coffee Break

15.30 – 17.00
Exposure – Analytical Challenges
Dr. Tewes Tralau, BfR

27.08. – Thursday:

9.00 – 17.00
Workshop Risk Assessment – Food Contamination by Plasticisers
PD Dr. Ralph Pirow, PD Dr. Detlef Wölfle, PD Dr. Sebastian Zellmer, BfR
Lunch and Coffee Breaks included

28.08. – Friday:

9.00 – 10.30
Health Risks by Endocrine Active Substances
PD Dr. Karen Hirsch-Ernst, BfR

Coffee Break

11.00 – 12.30
Risk Assessment of Food Additives and Flavourings
Dr. Rainer Gürtler, BfR

Lunch break

13.30 – 15.00
Final Discussion / Farewell Reception
Präs/VPräs, BfR


BfR -
Summer Academy
2015


BfR -
Summer School
2014, Berlin


BfR -
Summer School
2013, Berlin


BfR -
Summer School
2012, Berlin

Further training activities in 2015

1st BfR Academy Training School on Nanotechnologies for Risk Assessors (03/03/2015 to 04/03/2015)

- nanomaterials characterisation
- toxicity testing
- exposure assessment
- nanomaterials risk assessment
- methodological limitations
- needs
- challenges

BfR Academy Training „FoodChain-Lab“ in cooperation with EFSA (12/11/2015 to 13/11/2015)

- **o**pen-source software providing trace-back and forward analysis for food items along food supply chains
- specific applications will be demonstrated
- handling the software will be trained

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Thank you for your attention

Andreas Hensel

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