INFORMATION

Cases of Poisoning Reported by Physicians

2006

BfR

Risiken erkennen – Gesundheit schützen

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Cases of Poisoning Reported by Physicians 2006

Centre for Documentation and Assessment of Poisonings
at the Federal Institute for Risk Assessment – 13th Report (2006)

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Table of Contents

1 Legislation on chemicals to serve the needs of people

On 1 August 1990, the requirement of compulsory notification of poisonings by attending physicians within the framework of the Chemicals Act came into force. This compulsory notification is a meaningful counterpart, so to speak, to the reporting of adverse reactions to medicinal products.

It has been the purpose and objective of this legal provision in the Chemicals Act to receive from physicians acting "on the scene" well documented findings on human health complaints caused by chemical products. In addition, it has been the intent to obtain valuable data on the incidence of poisoning accidents, doses and effects of chemicals as well as on product formulations involved in cases of poisonings which at a very early date may suggest effective preventive measures that could be taken. In this regard, it has been a special intent of legislation that assessment of poisonings should not only rely on toxicological data from animal studies but as much as possible make use of knowledge gained from poisoning accidents that have occurred in humans. If regrettably, such accidents occur, their evaluation should at least be useful to humans and in addition, contribute to animal welfare by reducing the number of toxicological studies required for assessment.

Thus, legislation has resulted in a most useful project which is unique on the global level: The "Cases of Poisoning Reported by Physicians" have been compiled at the Federal Institute for Risk Assessment (BfR) in direct cooperation with attending physicians and the German Poison Control Centres (PCCs) and subsequently evaluated as data derived from humans for more than 15 years now. The annual reports published (meanwhile also in English) have met with a very affirmative response owing to their topicality with regard to toxicological issues, their proposals of measures and consistent presentation of individual case reports. In addition, ministries, companies and industrial associations are informed about adverse effects of chemical products (technical term: toxicovigilance) either immediately (in severe cases) or at annual intervals through a well-working product information system.

Meanwhile, the data recorded on humans have provided a sound basis of facts and figures for meaningful regulatory measures. Before, cases of exposure to lamp oil and liquids for grill lighting had been clearly underestimated based on toxicological data from animals, and other substances, in contrast, overestimated. Emotions and concerns that had been associated for example with pyrethroid exposure could be reduced to a technical level and replaced by a more objective assessment merely by facts from a consistent documentation of data on humans. In contrast to former expectations, frequent complications (aspiration) due to ingestion of solutions containing surfactants did not affect children and adults but instead, have proved a particular risk for elderly and disoriented persons. Last but not least, given the fact that compulsory notification by physicians also refers to cases involving harmful substances from the environment, a new basis has been formed by legislation to ensure that in the event of an industrial accident not only the technological aspects are taken into account but also the resulting cases of health impairment among exposed groups of individuals are recorded.

From now on, the German regulatory framework on chemicals will be completed by the new European regulatory framework on chemicals, REACH (Registration, Evaluation, Authorization

and Restriction of Chemicals) which has come into force on 1 June 2007. Nevertheless, the German national legislation on chemicals had already achieved a very high level of consumer protection as compared to that in other countries. The reporting of cases of poisoning by physicians is a good example for this. Hopefully, REACH will provide for such monitoring systems being furthermore promoted and supported to the benefit of consumers. Based on physicians' reports of cases of poisoning and the legally founded collaboration with the German PCCs, the BfR could make an essential contribution to an effective identification of health risks posed by chemical substances and products by means of the documentation of accidents involving humans. Obviously, animal studies alone are not sufficient for this purpose.

Horst Spielmann,
Head of the Scientific Services Department ("Wissenschaftliche Querschnittsaufgaben") at the BfR

2 Introduction

2.1 Legal basis and activities of the Centre
With the Chemicals Act (ChemG), legislation in the Federal Republic of Germany has provided a basis "to protect humans and the environment from harmful effects of dangerous substances and preparations, particularly to make them recognizable, to avert and to prevent the development of such effects" (according to §1).

For a realistic assessment of risks for human health, importance has been increasingly given to the knowledge of data on human toxicology that can be obtained from the evaluation of cases of poisoning in humans. This is why legislation has introduced compulsory notification of poisonings by attending physicians from 1 August 1990, by the first amendment to the ChemG (§16e).

A physician who is consulted for treatment or evaluation of sequelae of diseases caused by chemical substances or products is obliged to submit essential data on poisonings to the Centre for Documentation and Assessment of Poisonings at the Federal Institute for Risk Assessment (BfR).

According to the Chemicals Act, reporting refers to illnesses or suspected poisonings that are associated with the following substances:

- Chemical substances and products used in the household, e.g. detergents and cleansing agents, hobby and DIY articles;
- Cosmetics;
- Pest control products;
- Plant protection products;
- Wood preservatives;
- Chemicals used at the workplace;
- Harmful chemical substances found in the environment, also after industrial accidents; and
- Plants/animals.

Within the meaning of the Chemicals Act, the term of poisoning designates all cases in which health impairment has occurred, including suspected cases of poisoning. Under the Act, also the poison information and treatment centres (Poison Control Centres, PCCs) were subjected to compulsory reporting of their knowledge (of general importance) gained in the context of their activities.

In 2006, the Poison and Product Documentation Centre moved from Berlin-Dahlem to Berlin-Marienfelde. Of course, the aspects of secrecy and security with regard to formulation data will be paid at least the same attention at the new premises as formerly at the Dahlem site.

2.2 Processing of reports received
Reports received on health impairment associated with chemicals are subjected to an assessment procedure resulting in the rating of a possible causal relationship between the toxicant and the manifestations observed, as well as other conclusions. Such relationship may be classified as "possible", "probable", "confirmed", "absent" or "cannot be assessed". The rules applied in the assessment of individual cases have been described in detail in earlier annual reports.

The estimation of toxic risks in humans is based on differentiated analyses and evaluation of the data on cases. For these purposes, the data on cases in humans are continuously documented in the form of case data sets and case reports. Information on identified risks is passed on to the responsible ministries, manufacturers and industrial associations in the form of rapid communications or annual summarizing reports by means of the product information system PRINS (see Chapter 3.3). At the same time, the responsible manufacturers or distributors are requested to submit information on the measures envisaged by them to improve product safety.

The BfR publishes annual reports on the knowledge gained from the cases of poisoning reported by physicians. These publications are available on request by writing to Pressestelle, Bundesinstitut für Risikobewertung, Thielallee 88-92, 14195 Berlin, Germany, and they have also been published as electronic documents on the internet (www.bfr.bund.de).

In Fig. 1, these tasks and procedures are shown in graphical form.

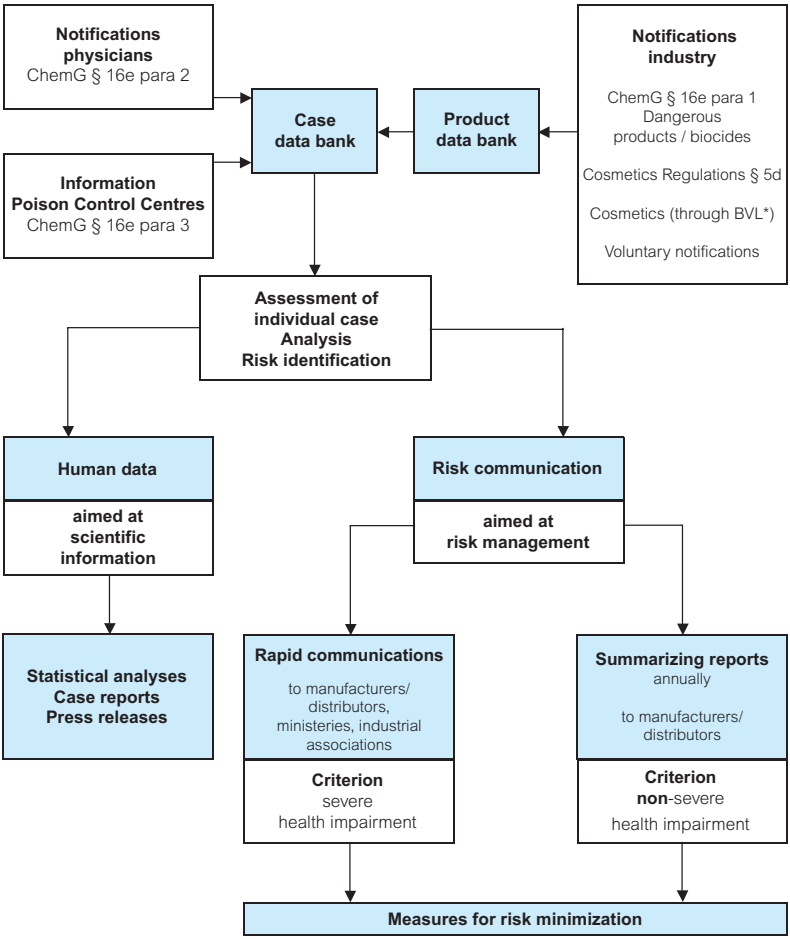

Fig. 1: Terms of reference of the Centre for Documentation and Assessment of Poisonings

*BVL: Bundesamt für Verbraucherschutz und Lebensmittelsicherheit (Federal Office for Consumer Protection and Food Safety)

2.3 Product data bank (poison information data bank)

2.3.1 Figures

Until late December 2006, 228 418 documents on individual products were recorded in the poison information data bank maintained by the BfR which can be accessed by the PCCs in Germany, thus supporting their activities in providing consultation and treatment in cases of poisoning. Thus, the number of notifications on products submitted to the Poison and Product Documentation Centre at the BfR increased by 22 469 in 2006. The structure of the data bank and the different types of product data sets have been described in detail in earlier reports.

2.3.2 Collaboration between the BfR, industry and Poison Control Centres

The major part of product data on dangerous preparations and biocidal products as well as of the voluntary reports by manufacturers, distributors and importers received by the BfR is still submitted on paper forms. The recording of cosmetics, which until June 2005 had been entered into the poison information data bank at the BfR predominantly in electronic form, is now carried out at the Federal Office for Consumer Protection and Food Safety (BVL), as a consequence of the subdivision of the former Federal Institute for Health Protection of Consumers and Veterinary Medicine (BgVV) into the two successor institutes, BfR and BVL. From the BVL, the data are returned to the BfR at monthly intervals and from there, transmitted to the PCCs together with the other product data in the well-established way.

Of the dangerous preparations and biocidal products notifiable under §16e para 1 of the Chemicals Act, 17 077 product data sets have been transmitted to the Poison Control Centres so far. Of these, 7 582 refer to dangerous preparations and 9 495, to biocides. Due to restructuring, the figures for voluntary and legally required reports have slightly changed compared with the reporting year of 2005.

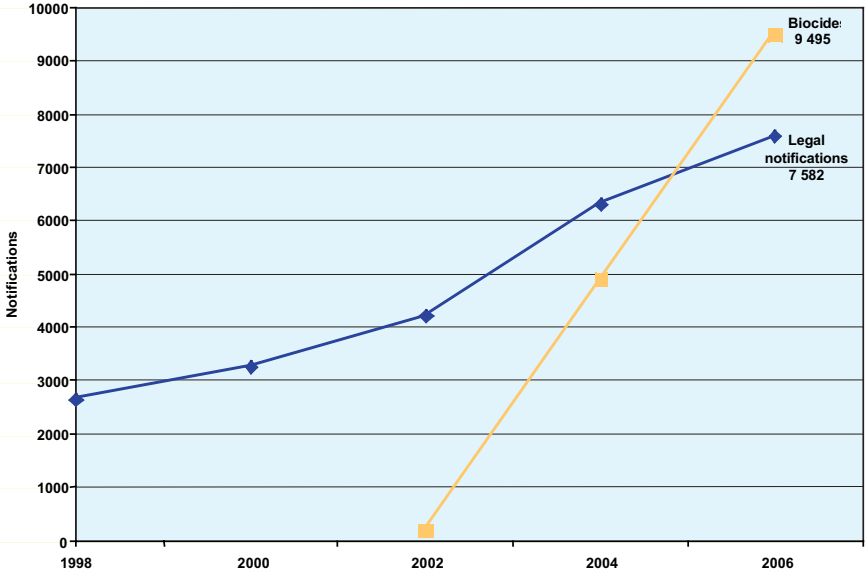

Fig. 2: Notifications under § 16e para 1 of the Chemicals Act: legal products and biocidal products (2002: entry into force of the regulations on biocides)

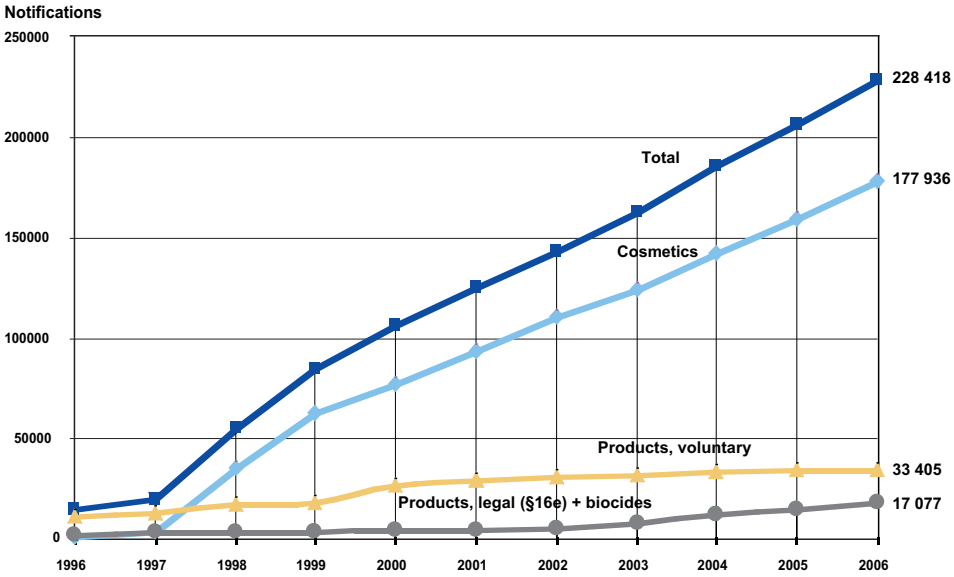

Fig. 3: Notifications on products received since 1996 and transmission of information to the German Poison Control Centres

3 Case reports by physicians

3.1 Evaluation of reports

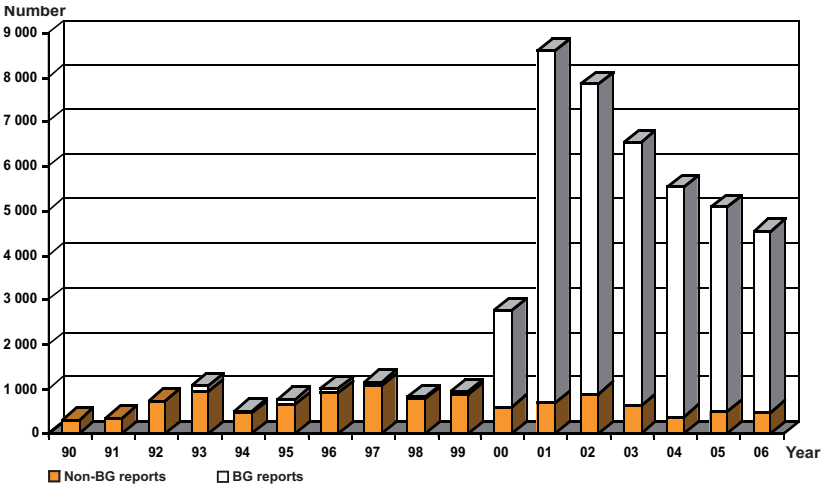

Fig. 4: Cases reported (BG reports 100 % = 4 069; non-BG reports 100 % = 482) BG: Berufsgenossenschaften - institutions for statutory accident insurance and prevention for trade and industry in Germany

During the period between 1 August 1990, i.e. the beginning of the compulsory notification, and 31 December 2006, altogether 48 705 reports on cases of health impairment, poisoning or suspected cases of poisoning were received by the BfR. In 2006, the reporting year considered, 4 551 notifications were received (Fig. 4).

The increase in the number of notifications received in 2000 was due to an agreement with the Berufsgenossenschaften. According to this agreement, all notifications on cases of acute health impairment after contact with chemicals or chemical products are directly reported by the Berufsgenossenschaften to the BfR. However, since 2001, a continuous decrease has been observed in the number of reports by the Berufsgenossenschaften. According to the BG-Institute for Occupational Safety and Health (Berufsgenossenschaftliches Institut für Arbeitsschutz – BGIA), the number of accidents is in fact on the decrease. This is caused by a better occupational safety and accident prevention, campaigns informing about accidents and changes in operational processes (in part automation).

3.2 Reports on cases of poisoning in 2006

3.2.1 Origin

In 2006, 4 069 cases, i.e. 89.4 % of all cases notified, were reported by the Berufsgenossenschaften. The remaining 482 notifications (10.6 %) were essentially submitted by hospitals, medical practitioners and PCCs. Single notifications were also received from the Arzneimittelkommission der Deutschen Ärzteschaft (Drug Commission of the German Medical Profession) or the Arzneimittelkommission der Deutschen Apotheker (Drug Commission of the German Pharmacists) and others.

3.2.2 Spectrum of cases reported

Fig. 5 provides a synoptic view of the spectrum of product groups involved in the cases report-

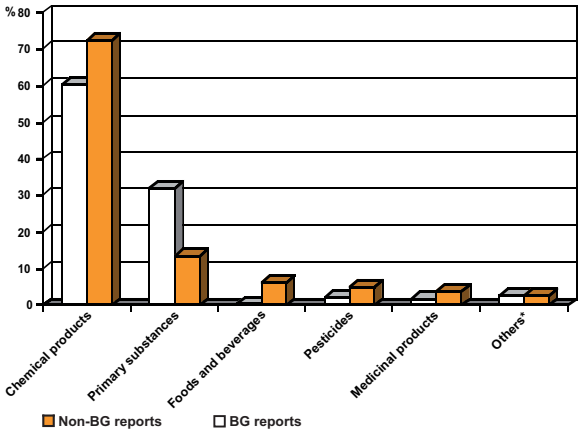

Fig. 5: Spectrum of cases reported (BG reports 100 % = 4 069; non-BG reports 100 % = 482)

* Others: Cosmetics/personal hygiene products, plants, fungi, animals, veterinary medicines, agrochemicals, narcotic drugs, warfare/anti-riot agents, others

ed. Among the total of cases reported by the Berufsgenossenschaften, those of poisoning by chemical products and primary substances have remained in top position. All other product groups played a minor role, with shares of 2.5 % each, or less.

As expected, the spectrum of substances and products involved in cases of poisoning is different in the reports received from the Berufsgenossenschaften and in those received from hospitals and medical practitioners. Also among the latter, notifications related to chemical products ranked first in the reporting year. They are followed, at a clear distance, by the group of primary substances, similar to the BG reports. Next in the ranking are health complaints caused by foods, beverages, pesticides and medicinal products that were reported although these are not subject to compulsory notification.

The high percentage share of chemical products found among the reports received from hospitals and medical practitioners is due to the use of "nano" sprays and health complaints experienced shortly after placing on the market of a new type of such sprays.

	BG reports (100 % = 4 069 reports)		Non-BG reports (100 % = 482 reports)	
Chemical products	60.4 %	(2 459 cases)	72.4 %	(349 cases)
Primary substances	32.2 %	(1 312 cases)	13.5 %	(65 cases)
Pesticides	2.2 %	(91 cases)	5.2 %	(25 cases)
Medicinal products	1.9 %	(76 cases)	3.9 %	(19 cases)
Cosmetics/personal hygiene products	0.7 %	(30 cases)	0.6 %	(3 cases)
Foods and beverages	0.5 %	(22 cases)	6.4 %	(31 cases)
Agrochemicals	0.4 %	(17 cases)	0.0 %	(0 case)
Veterinary medicinal products	0.1 %	(3 cases)	0 %	(0 case)
Warfare/anti-riot agents	0 %	(2 cases)	0.2 %	(1 case)
Plants	0 %	(1 case)	0.6 %	(3 cases)
Animals	0 %	(1 case)	0 %	(0 case)
Narcotic drugs	0 %	(0 case)	0.2 %	(1 case)
Fungi	0 %	(0 case)	0 %	(0 case)
Industrial accidents	0 %	(0 case)	0 %	(0 case)
Others	2.5 %	(102 cases)	1.7 %	(8 cases)

Tab. 1: Spectrum of reports – synoptic view (repeat listing of toxicants per case possible)

For a detailed list of toxicants in tabular form see Annex. In this table, the cases reported in 2006 have been classified by product application groups (assignment of toxicants according to their intended use).

3.2.3 Causes of poisoning

The Berufsgenossenschaften almost exclusively reported cases of exposure to poisons in the context of occupational accidents (ca. 97 % of cases). The remaining 3 % of cases referred to accidents that had occurred during the common use of a product or because a chemical had been mistaken for another substance, or the cause of the accident was unknown.

Among the reports submitted by hospitals and medical practitioners, exposure during common use was the predominant cause of poisoning (45.2 %) followed by poisoning accidents (42.5 %). The high share of cases where common use was the cause of the health impairment experienced is due to the events associated with "nano" sprays (see Chapter 4.1). Exposure due to mistaking chemicals for other substances was the cause in 3.1 % of cases, suicidal actions were reported in 2.3 % of cases. 0.4 % of cases were associated with abuse of substances. In the remaining cases, the cause was unknown.

On principle, acute poisoning takes a predominant position among the reports (Table 2). This is mainly due to the fact that the agreement on the submission of reports on cases of poisoning by the Berufsgenossenschaften expressly provides for the submission of reports on acute cases of poisoning only.

3.2.4 Age structure and sex distribution

In 2006, the share of cases referring to adults among the total of cases reported was 97.6 %. The share of cases in adults predominated also among the reports received from hospitals and medical practitioners. However, the share of children in these cases was as high as 21 % (Table 3).

	BG reports (100 % = 4 069 reports)		Non-BG reports (100 % = 482 reports)	
Acute	99.9 %	(4 065 cases)	94.4 %	(455 cases)
Chronic	0 %	(1 case)	2.7 %	(13 cases)
Unknown	0.1 %	(3 cases)	2.9 %	(14 cases)

Table 2: Duration of exposure – synoptic view

	BG reports (100 % = 4 069 reports)		Non-BG reports (100 % = 482 reports)	
Children	0 %	(0 case)	21 %	(102 cases)
Adults	100 %	(4 069 cases)	78 %	(375 cases)
Unknown	0 %	(0 case)	1 %	(5 cases)

Table 3: Age groups – synoptic view

	BG reports (100 % = 4 069 reports)		Non-BG reports (100 % = 482 reports)	
Male	62.5 %	(2 544 cases)	47.1 %	(227 cases)
Female	25.6 %	(1 043 cases)	4.4 %	(21 cases)
Unknown	11.8 %	(482 cases)	48.5 %	(234 cases)

Table 4: Sex distribution – synoptic view

3.2.5 Degree of severity of health impairment

Also in 2006, the majority of cases reported referred to minor health impairment only, both among the cases reported by the Berufsgenossenschaften and among those reported by hospitals and medical practitioners. Moderate and severe health impairment is more often reported by medical practitioners or physicians working in hospitals because they also deal with reports on suicide attempts (Table 5).

The product groups involved most frequently with regard to the degree of severity of health effects have been listed in Table 6 for the cases reported by the Berufsgenossenschaften and in Table 7, for the cases reported by hospitals and medical practitioners. Of course, the toxicants reported from occupational environments were different from those reported from the private sphere because the availability of certain product groups differs, for example. One of the reasons for the high number of cases involving lamp oil may be seen in the specific ascertainment of such cases in collaboration with ESPED (Erhebungseinheit für seltene pädiatrische Erkrankungen in Deutschland – clinical registration unit for rare paediatric illnesses in Germany), an organization cooperating with almost all paediatric hospitals in Germany.

	BG reports (100 % = 4 069 reports)		Non-BG reports (100 % = 482 reports)	
None	2.7 %	(110 cases)	6.0 %	(29 cases)
Minor	86.7 %	(3 528 cases)	65.1 %	(314 cases)
Moderate	7.0 %	(285 cases)	16.0 %	(77 cases)
Severe	0.1 %	(6 cases)	5.4 %	(26 cases)
Cannot be assessed	3.4 %	(140 cases)	7.5 %	(36 cases)

Table 5: Degree of severity of health impairment – synoptic view

	Health impairment		
Product group	Minor (3 528 cases)	Moderate (285 cases)	Severe (6 cases)
Primary substances	1 108	105	1
Cleansing products	622	47	
Drain cleansers	*11*	*1*	
All-purpose cleansers	*50*	*1*	
Oven and grill cleansers	*15*	*6*	
Descaling products	*25*	*1*	
Industrial cleaners	*39*	*3*	
Milking machine cleaners	*35*	*4*	
Lavatory cleansers	*19*		
Disinfectants/sterilizers	308	22	
Waste gases	140	11	1
Paints and related materials	133	8	1
Accumulators	100	1	1
Building materials	101	17	
Pesticides	83	3	
Glues	68	7	

Table 6: Product groups involved most frequently, by degree of severity of health impairment (BG reports)

	Health impairment		
Product group	Minor (314 cases)	Moderate (77 cases)	Severe (26 cases)
Cleansing products	123	36	9
Glass cleaners	*62*	*19*	*3*
Lavatory cleansers	*30*	*12*	*2*
Primary substances	44	7	6
Lamp oil	28	15	
Pesticides	21		1
Insecticides	*12*		*1*
Foods and beverages	16	4	5
Medicinal products	11	3	2

Table 7: Product groups involved most frequently, by degree of severity of health impairment (non-BG reports)

3.2.6 Outcome of cases

For the notifications submitted by the Berufsgenossenschaften, the outcome has remained unknown in ca. 59 % of cases. The reason for this is that in the majority of cases, the report submitted corresponds to that by the "Durchgangsarzt" ("transition doctor" appointed by the Berufsgenossenschaft). The reporting form is completed after the patient's first presentation. Therefore, such report does not contain any information on the course of the patient's illness. In selected cases, enquiries were made to obtain information on the course of illness. In the majority of cases on which information was available, patients had recovered completely.

Of the notifications submitted by hospitals and medical practitioners, patients recovered completely in 305 cases (63.3 %). In 153 cases (31.7 %), the outcome was unknown; in fourteen cases (2.9 %), late sequelae could not be excluded or partial recovery was reported.

Ten deaths were reported to the BfR in 2006:

Case No 1:
An elderly patient died from the sequelae of aspiration pneumonia after accidental ingestion of a detergent (see Chapter 4.2). The problem of oral ingestion of solutions containing surfactants, particularly in elderly persons, is again dealt with in Chapter 4.2.

Case No 2:
The patient had suffered chemical burns due to formaldehyde affecting 33 % of his body surface in his working environment. He died from multiple organ failure in spite of intensive therapy.

Case No 3:
The patient had ingested, with suicidal intent, a solution containing dimethoate. Resuscitation attempts and antidote administration remained unsuccessful (see Chapter 4.3.5.3).

Case No 4:
A male adolescent died after ingestion of p-nitroaniline. It was impossible to conclusively establish whether the substance had been ingested with suicidal intent in the sense of abuse or due to being mistaken for another substance (see Chapter 4.3.4.3).

Case No 5:
A male adolescent had sniffed deodorant spray and died from cardiac decompensation (see Chapter 4.3.4.2).

Case No 6:
A young adult died after he had ingested cannabinoids, atropine and scopolamine.

Cases 7 and 8
Two patients died after ingestion of 2,4-dinitrophenol: A young female had ingested the sub-

stance as a fat burner with the intent to lose weight (see Chapter 4.3.4.1). The second patient had ingested 2,4-dinitrophenol with suicidal intent (see Chapter 4.3.5.2). Both patients developed malignant hyperthermia and respiratory insufficiency; cardiopulmonary resuscitation was unsuccessful.

Case No 9:
The patient had to check a propane gas tank at his workplace and therefore climbed into the tank. He lost consciousness and developed increasing respiratory insufficiency. Cerebral death was diagnosed. Neither the information available from the description of the accident nor that on the clinical course were sufficient to elucidate whether the patient's death had to be attributed to propane gas.

Case No 10:
The patient died after accidental ingestion of an industrial dishwasher cleanser. Post-mortem findings did not reveal any association between the patient's death and the toxicant (see Chapter 4.3.1.2).

3.3 The product information system, PRINS

The notifications by physicians in cases of poisoning legally required under §16e para 2 of the Chemicals Act (Chemikaliengesetz – ChemG) are regularly evaluated to protect consumers from health risks posed by chemicals and chemical products. Since 1994, the reporting physicians, the responsible ministries and the scientific community have been informed by annual reports on analyses of these notifications and the corresponding results. In the context of these notifications, the term, poisoning, is used to designate any health impairment associated with chemicals, including for example also allergies.

Since 1998, manufacturers and distributors of chemical products such as household chemicals and DIY products, cosmetics, plant protection and pest control products and corresponding products for commercial use have been informed about cases of health impairment associated with their products that have become known to the BfR through case reports.

3.3.1 Rapid communications

If reports on severe health risks (except those related to suicides) are received by the BfR, it will provide for immediate information of the manufacturer/distributor of the chemical product involved as well as the competent industrial association/federal trade association and the responsible ministries, i.e. the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV), the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), and the Federal Ministry of Health (BMG) as well as the Federal Office for Consumer Protection and Food Safety (BVL).

Between 1 January 1998 and 31 December 2006, 25 rapid communications were prepared

Year	Product	Toxicologically relevant substance	Person exposed	Outcome	Proposal by BfR (P) and results (R)
1998	Impregnating agent	Fluorinated hydrocarbons	Adult male	Death	P: Warnings for asthmatics R: Accepted
1998	Disinfectant	Quaternary ammonium compounds (surfactants)	Elderly male	Death	P: Information, labelling Ñcorrosive“ R: Accepted
1999	Toilet drain cleanser	Sodium hydroxide	Adult male	Chemical burns	None
1999	Solvent	Petrol	Adult male	Lung oedema	None

Year	Product	Toxicologically relevant substance	Person exposed	Outcome	Proposal by BfR (P) and results (R)
1999	Depilatory cream	Thioglycolic acid	Adult male	Scars	None
1999	Disinfectant	Quaternary ammonium compounds (surfactants)	Elderly male	Death	P: Information, labelling
1999	Industrial cleanser	Sodium hydroxide	Young child	Chemical burns	P: Information
1999	Medicinal product	Dimenhydrinate	Infant	Death	P: Warnings
2000	Cream bath product	Surfactants	Elderly male	Death	P: Information
2000	Lamp oil	Paraffins	Young child	Severe pneumonia	P: Partial ban R: Accepted, paraffin substitute
2001	Disinfectant	Alkylamine (surfactants)	Elderly male	Death	P: Information
2001	Tea (biodrug)	Atropa belladonna	Adolescent female	Respiratory insufficiency	P: Information
2002	Lavatory cleanser	Surfactant	Elderly male	Chemical burns	P: Information
2002	Mild detergent	Surfactant	Elderly male	Death	P: Information
2003	Cleanser	Surfactant	Elderly male	Respiratory insufficiency	P: Information
2003	Food supplement	Proteins	Adult male	Severe allergy	P: Information
2003	Fumigant	Sulfuryl difluoride	Adult male	Death	P: Information
2003	Drain cleanser	Potassium hydroxide solution	Child	Severe chemical burns	P: Information
2003	Disinfectant	Peracetic acid	Adult male	Respiratory insufficiency	P: Information
2004	Garden torch	Paraffins, colourless	Young child	Respiratory insufficiency, death	P: Information R: Accepted
2004	Oil lamp	Paraffins, colourless	Infant	Respiratory insufficiency, death	P: Information R: Accepted
2005	Detergent	Surfactant	Elderly male	Death	None
2005	Dishwasher cleanser for industrial use	Potassium hydroxide	Elderly female	Severe chemical burns	None
2005	Breadseed poppy	Morphine	Infant	Respiratory insufficiency	P: Guideline values/ maximum levels and control, measures to reduce opiate levels R: Accepted
2006	Detergent	Surfactant	Elderly female	Death	None

Table 8: Rapid communications 1 January 1998 – 31 December 2006

and communicated. A synoptic view of these is given in Table 8. For explanations with regard to individual cases until 2005, reference is made to the 2002, 2003, 2004 and 2005 annual reports.

In the reporting year of 2006, one rapid communication was distributed. This case referred to a poisoning accident suffered by an elderly male, which had a lethal outcome as a result of foam aspiration. The case report is described in detail in Chapter 4.2.

3.3.2 Summary reports

Reports referring to non-severe health impairment caused by chemical products in occupational or private environments are transmitted to the manufacturers/distributors in the first quarter of each new year in a summarized form. As recommended by manufacturers, also suicides and attempted suicides have been included in the summary reports since 2003 irrespective of the degree of severity of poisoning. Thus, manufacturers and distributors gain knowledge on possible risks involved in the handling of their products. If they find the information provided to be insufficient, additional information can be obtained from the BfR. Much use has been made of this opportunity.

The information provided for the manufacturer and distributor, respectively, is a contribution to increase product safety and thus, to improve

First level		Second level		Third level	
Agrochemicals	6				
Chemical products	419	Paints and related materials	5		
		Building materials, auxiliary products	8		
		Fuels, liquid	16	Lamp oil	16
		Dental materials	3		
		Disinfectants/sterilizers	88		
		Glues	7		
		Metallurgy, auxiliary products	3		
		Cleansing products	221	All-purpose cleansers	3
				Washing-up detergent (manual use)	5
				Dishwasher detergent	4
				Industrial cleansers	9
				Glass cleaners	86
				Milking machine cleansers	11
				Shoe and leather cleansers	19
				Lavatory cleansers	48
Cosmetics/personal hygiene products	6	Oral care/dental products	3		
		Skin care products	3		
Pesticides	26	Herbicides	3		
		Insecticides	9		
		Fungicides	3		

Table 9: Product groups frequently involved in 2006 summary reports

First level		Second level		Third level	
Agrochemicals	1				
Chemical products	55	Building materials, auxiliary products	3		
		Fuels, liquid	4	Lamp oil	4
		Disinfectants/sterilizers	4		
		Refrigerants	1		
		Metallurgy, auxiliary products	1		
		Cleansing products	39	Dishwashing detergent	1
				Oven and grill cleansers	1
				Glass cleaners	17
				Industrial cleansers	1
				Metal cleansers	1
				Soot removers	1
				Lavatory cleansers	11
				Shoe and leather cleansers	4
				No data	2
		Others	3		
Cosmetics/personal hygiene products	1	Oral care/dental products	1		

Table 10: Product groups associated with moderate health impairment listed in summary reports in 2006

consumer protection. There has been great interest in such information. For example, accident analyses have revealed that eye injuries caused by chemical products have frequently occurred in spite of wearing safety goggles. The safety data sheet should therefore draw attention to wearing “closely fitting safety goggles”.

In 2006, 451 cases of poisoning were reported with a specification of the products incriminated. These cases referred to 244 different products from altogether 131 manufacturers.

Table 9 provides a synoptic view of product application groups (minimum three listings) of the 2006 summary reports. Strikingly high numbers have been recorded for disinfectants (88 cases) and cleansing products (221 cases). Attention has to be drawn to the relatively high number of accidents involving glass cleaners (86 cases) and lavatory cleansers (48 cases) in the form of “nano” sealant sprays, see Chapter 4.1.

Table 10 shows the numbers of moderate health disturbances associated with the respective product groups in 2006. 57 cases have been listed. It may be concluded that ca. 13 % of reports requiring summary reports to manufacturers referred to cases of severe health impairment. For 29 cases, the degree of severity of the health impairment could not be assessed despite further investigations.

The BfR also performs cumulative data analyses of case reports. If trends become apparent, the manufacturers of the products concerned are informed. Manufacturers are requested by the BfR to, in turn, communicate comparable data and trends that may serve to improve product safety.

4 Selected toxicological problems

4.1 Acute health impairment due to "Magic Nano" sealant sprays

At the end of March 2006, a series of rapidly developing and in part, severe cases of health impairment such as lung oedema were observed after the correct use of "nano" sealant sprays intended for the treatment of glass and ceramic surfaces. These sprays had been sold by discount shops as a special offer. On 27 March 2006, the first case was reported to the Poison Control Centre in the city of Erfurt. Until noon of the following day, more than 10 cases were reported to the Poison Control Centre of the city of Göttingen, and another day later, the number of cases recorded had increased to 69. So far, the Federal Institute for Risk Assessment (BfR) has received reports on a total of 150 cases, which are being processed and evaluated in a standardized and harmonized procedure and screened for a uniform pattern of manifestations. The persons affected had used these water repellent sprays in their households in closed rooms that had been insufficiently ventilated (e.g. bathroom). Subsequently, they developed, in part severe, pulmonary manifestations and their general condition was affected in a similar way as from a common cold. The cardinal sign was a strong cough. Dyspnoea and, in severe cases, lung oedema, were observed (8 cases).

Sealant sprays are used as impregnating agents in the household to restore the water and dirt repelling properties of textiles and leather products and for sanitary facilities to act as a sealing coat. They are liquids commercially available in pressure-tight bottles with a pump mechanism or aerosol cans, which provide for an even distribution. These impregnating agents contain propellants, solvents and the active substance. Propellants used include propane, butane, dimethylether and air. Typical solvents used include petrol or short-chain alcohols, and in a few products, xylene. Active substances used include silicones (polysiloxanes), fluorocarbon and melamine resins, beeswax or wool fat.

In the form of pump sprays, impregnating or sealant sprays have been considered as safe in terms of health. In contrast, problems have been associated with aerosol sprays. The use of such sprays in small and insufficiently ventilated rooms may result in conjunctival irritation, dyspnoea or in rare cases, narcosis-like manifestations due to the solvents contained. Based on systematic animal studies in birds, a key role has been attributed to fluorocarbon resins and/or reactive polysiloxanes in combination with solvents. In addition, improper use such as spraying for extended periods or failure to shake the contents sufficiently etc. should also be taken into account. However, it is mainly the physical properties such as the droplet size of the sprays that decide on whether and which toxic effects are caused in the respiratory tract. Obviously, the persons affected had inhaled components of the atomized sprays that had remained in the indoor air as fine aerosols. Due to the small droplet size, these components may have reached the alveolar region causing accumulation of fluid, which resulted in an impairment of the oxygen and humidity exchange in the lungs.

The small droplet size is only achieved if the liquid applied contains a propellant and is applied by means of a correspondingly small nozzle in the spray head. If, in contrast, the same liquid is applied by means of a pump mechanism, the droplets are larger than 100 micrometres and therefore, cannot penetrate into the alveolar tissue. This is probably the reason why products applied to surfaces by means of pump spray bottles have not caused any problems so far. Hence, toxic effects may only occur if the product itself, i.e. the entire substance mixture of the formulation is inhaled as a fine spray fog char-

acterized by a correspondingly small droplet size.

Risk communication

Following the receipt of initial information, the BfR, as required under § 16e of the Chemicals Act, immediately contacted the German PCCs and the manufacturers involved, in an investigative effort to establish as soon as possible the formulation of the incriminated products as well as possible health problems associated with its use. In cooperation with the PCCs of Erfurt and Göttingen, the BfR could achieve a recall being launched within a single day with the assistance of the crisis unit of the distributor, the Rewe Group, thus preventing further cases of such poisoning and contributing to an effective consumer protection. In parallel, information was communicated to the responsible government authorities of the German Länder, the Federal Office for Consumer Protection and Food Safety (BVL) (EU rapid alert system for non-food products – RAPEX), the Federal Ministry of Food, Agriculture and Consumer Protection (BMELV), the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the WHO rapid information system (WHO INTOX). The public as well as authorities and ministries were informed about findings and results by timely publication of three press releases in German and English which were mostly based on three meetings held at the BfR to which experts had been called immediately. In addition, an extraordinary EU meeting involving German and Luxembourgian authorities was held in Brussels in early May 2006 because one of the suppliers was resident in Luxembourg.

Fig. 6: Nano product

Investigations into the composition of the product were considerably complicated by the fact that the distributor had no knowledge at all concerning the composition of his products, and the suppliers claimed trade secrets with regard to their component preparations. The supplier companies and the components provided by these for the formulation of the final product could only be established through investigations by the BfR and information obtained from the Länder authorities. The basic component of the assumed “nanofluid” had been produced abroad.

Results and evaluation of the incidents

The components responsible for the cases of health impairment, some of which had been severe, were largely determined in the context of an expert meeting held at the end of May 2006.

1. The products concerned did not contain any nano-sized particles. The nano function suggested by the product name referred only to the thickness of the film of the active substance remaining on the glass and ceramic surfaces treated.
2. Due to chemical changes during the processing to produce aerosol sprays, the active compounds contained in the share of active substances had obviously disappeared to a large extent. Thus, the spray applied consisted only in a mixture of solvents which no longer contained any shares of active substances.
3. With regard to their pattern, the manifestations observed in the cases associated with nano sealant sprays were very similar to the health problems documented in a number of earlier case clusters associated with

leather and impregnating sprays (Germany, USA, Netherlands, Denmark, Switzerland). As in the most recent series of cases attributed to nano sealant sprays, repetitive series involving 100–200 cases each, among them seriously ill patients, had been recorded at that time.

Considerations regarding product safety

The series of cases associated with nano sealant sprays and characterized by sometimes severe health impairment among consumers has shown considerable gaps to exist with regard to the documentation of formulations that is available in the event of medical emergency. Where products not subject to compulsory notification are involved, neither the distributor nor any other party in the chain of supplier companies is sufficiently informed about the formulation of the final product. Knowledge of the complete formulation of a product will considerably enhance product safety. It is therefore required that in the future, prior to placing on the market of a product not subject to compulsory notification, sufficient information about the formulation of the final product is made available for cases of emergency at least at one point of the production chain or from a neutral party where it has been deposited (e.g. at a lawyer's office).

Especially for products which are applied by spraying and therefore may readily enter the lungs and be extensively absorbed, the following measures should be taken to enhance product safety:

1. Sprays tested according to acknowledged criteria (e.g. OECD) should be awarded a label well recognizable for consumers.
2. Sprays containing defined nanoparticles should be recognizable as such for product safety reasons.
3. For early identification of possible health effects, products containing defined nanoparticles should be listed in a register such as the BfR poison information data bank.

In the opinion of the BfR, further research is urgently required with regard to nanoparticles that can be absorbed by the inhalational route. As far as surface sealant sprays are concerned, a number of research projects are under way at the BfR: With regard to the case series in April 2006, comprehensive studies should concentrate on the manifestations observed, the special risk posed by the substances involved and the risk involved for the individual persons affected. The next step to follow immediately will consist in a review and analysis of case series reported from other countries. In parallel, a chemical analysis will be carried out to examine the respirable components of the aerosol fractions in the sprays that caused the health impairments reported. Proof-of-principle experiments on aerosol behaviour are conducted and studies carried out using standardized animal models. The BfR will report on further progress made in this matter.

Case report

Toxic lung oedema following use of a nano impregnation spray

In an indoor environment with open window, the female patient aged 37 had applied a nano impregnation foam to four pairs of shoes and used the entire contents of a 125 ml spray can. For this purpose, she had drawn the high boots over her lower arm and tried to keep a distance of 20 cm as recommended by the spray manufacturer. During the operation, some of the foam also hit her glasses. Approximately 30 minutes after starting the operation, she experienced a sudden shortness of breath at rest which became more pronounced at work, and hacking cough, which was particularly intensive in her throat and retrosternally. For this reason, she sought assistance at the emergency unit of a hospital.

It should be added that the patient was a smoker with a daily consumption of some 10 cigarettes.

Manifestations/course
On admission, a weakened breathing sound and shortness of breath were found to be present while other physical findings were normal.

Chest X-ray performed for completion of diagnosis demonstrated the presence of a butterfly-like interstitial lung oedema with an initial alveolar component. The patient was admitted as an inpatient for monitoring and treatment. After having consulted a PCC, the patient was treated by administration of a single i.v. dose of 500 mg glucocorticoid, inhalation of ipratropium bromide and salbutamol. Additional oxygen supply was continued. Under conditions of permanent monitoring, this therapy led to a continued improvement of the patient's complaints. Already on the next day, control radiology showed an obvious regression of the toxic interstitial lung oedema.

Clinical chemistry revealed the presence of a discrete leukocytosis (19.5/nl) while the other paramaters routinely examined were found to be within their normal ranges.

After 24 h of monitoring, the patient who had become symptom-free could be discharged and referred to her family doctor's care. Steroid therapy was to be continued on an outpatient basis by sytemic and topical administration, as was the administration of betamimetics. Eight days after the toxic event, the patient consulted a pulmonologist for a control examination. Residual lung oedema could be demonstrated by radiology. Spirometry values had become completely normalized while the diffusion capacity was still impaired. In contrast, blood gas values had remained stable also under conditions of exercise. In view of the good lung function results, systemic administration of steroids was discontinued and the patient asked to present herself for a control examination four weeks later. The BfR lacks information about the further course of this case.

Notes:
As a first measure, patients showing a corresponding symptomatology are provided with a fresh air supply. There should be an early inhalative therapy using topical steroids and the patient be presented to a hospital, to exclude a presence of lung infiltrates. Onward therapy will be oriented by the existing symptomatology.

In Germany, attention was directed to the pulmonary toxicity of impregnation sprays already in 1981. Because of their inherent health risk, several sprays for the impregnation of leather were withdrawn from the market. Numerous modifications of the respective formulations by the manufacturers also contributed to a reduction in the number of cases of poisoning showing relevant manifestations. This was followed, in 2002, by another rise in the number of reports concerning impaired airway functions associated with impregnation sprays for leather and textiles in the Netherlands and in Switzerland.

As a result of the introduction of new technologies in consumer products, shoe leather impregnation sprays and sealant sprays for ceramic and glass surfaces containing nano particles appeared in the market. It is unknown whether also nano particles, which are hydrophobic, are capable of penetrating into the lungs and have adverse effects on the alveolar tissue. Therefore, it has to be clarified whether these particles may have contributed to the development of the health disorders observed. It has not yet been finally elucidated whether nano particles are among the components of the incriminated shoe impregnation spray.

Evaluation of the case described
Based on the data concerning a temporal association between application of the impregnating product in aerosol form and the appearance of typical manifestations, a causal relationship is considered as confirmed. It remains open whether also nano particles were involved in the case of this product.

Case report
Severe poisoning associated with lung oedema after use of a "nano" surface sealant spray and vinegar concentrate
The female patient aged 47 had cleaned her small and poorly ventilated bathroom using vinegar concentrate for descaling. Ca. 15 minutes later, she applied a surface sealant spray to the WC seat and the mirror. During these operations, she left the bathroom several times to perform other household work. Approximately one hour after use of the product, she experienced shortness of breath, tickle in her throat, a suffocating sensation and a feeling of narrowness in her chest. For these reasons, she immediately sought help at a hospital.

The patient, who is a heavy smoker, consumes two packs of cigarettes per day. In addition, she has a history of wasp sting allergy.

Manifestations/course
On admission, severe dyspnoea and tickle were noted. Oxygen saturation was measured to be 85–88 %. A PCC was consulted and then she was administered a parenteral dose of 250 mg glucocorticoid and 6–8 L of oxygen by means of a nasal tube. Repeatedly, she was given a steroid-containing metered aerosol. As a result of this therapy, her symptomatology improved.

Chest X-ray showed an increased reticular marking on both sides together with dense clouding of lower areas, a picture which is compatible with lung oedema. Control examination on the next day showed a retrograde development of these findings which were present in a residual form only. Lung function testing, which was interfered with by the continued tickle, revealed a moderate obstruction (FEV1 reduced to 76 %, RAW raised to 168 m %) and restriction (vital capacity reduced to 57 %). Conspicuous findings by clinical chemistry included leukocytosis (15/nl) and an increase of C-reactive protein to 93 mg/l.

Already on the next day after admission, the patient whose state had improved could be discharged and referred to her family doctor for onward attendance. However, one month after the incident, she still complained of dyspnoea on effort, cough (more intensive at night than over the day) and nightly problems of breathing when lying in a flat position so that she had to sit up. Because of this continuing symptomatology, it was suggested that she should consult an environmental health clinic. The BfR is unaware of whether the patient took advantage of this offer.

Evaluation of the case described
Based on the data referring to the temporal association between use of the surface sealant spray and the appearance of typical manifestations like those which also occurred in a considerable number of other consumers after use of this product, a causal relationship is considered as confirmed.

Case report
Inhalational poisoning subsequent to use of a "nano" surface sealant spray
A 20-year-old patient had used a surface sealant spray in his well ventilated bathroom and observed the instructions given. Both the window and the door of the bathroom had been kept open during the operation. He also took care not to inhale too much of the spray.

Immediately upon termination of the cleaning process, i.e. when leaving the bathroom, he experienced episodes of coughing which lasted for ca. 1 1/2 h, and of vomiting. A friend accompanied him on his way to the family doctor who prescribed a metered aerosol containing steroids. When taking a rest after he had returned to his home, frequency and intensity of the cough attacks became initially reduced. When after a few hours he made an attempt to rise, coughing attacks and vomiting returned. For this reason, the patient decided to seek help at a hospital.

Two days prior to having used the sealant spray, the patient had already experienced episodes of vomiting and diarrhoea after excessive alcohol consumption. He also had a history of hypothyreosis compensated by medication and was adipose.

Manifestations/course
On admission, the patient exhibited marked dyspnoea and a vehement tickling in his throat on deep inhalation. The adipose patient's general state of health was found to be moderately reduced. Auscultation revealed spastic ronchi. He was admitted for inpatient treatment at the intensive care ward under conditions of permanent monitoring. Because of the dyspnoeic symptomatology, the pronounced initial tickling and the presence of tachycardia, medication for the patient consisted of a steroid-containing metered aerosol and i.v. administration of prednisolone, furosemide and theophyllin. Ciprofloxacin was administered as antibiotic treatment. To control his gastroenteric complaints, the patient was administered pantoprazole and given fluid supply with an addition of metoclopramide. As a result of this therapy, an obvious improvement in the patient's condition was seen on the next morning, so that he could be transferred to a normal ward.

Radiology revealed a discrete reduction of transparency and a minor mesh-like increase in structures. Clinical chemistry showed high-degree leukocytosis, a reduced Quick's value and elevated values of hepatic parameters. In view of the short latency period, changes in the levels of hepatic parameters were not attributed to the acute inhalation trauma. There may have been an association with a history of acute gastroenteritis two days ago or with the preceding event of excessive alcohol consumption. Due to the patient's adiposity, the presence of chronic exogenous toxic hepatitis and at least, of a considerable nutritive steatosis was suggested.

In the onward course, all laboratory parameters which had shown pathological changes exhibited an obvious tendency towards remission. Continuation of antibiotic treatment with a supplementary dihydrocodeine medication resulted in an increasing improvement of the patient's complaints, in particular of the tickle in his throat. After three days of inpatient care, the patient, who was in a state of subjective well-being, could be discharged and returned to his home.

Notes:
During the period between 27 March and ca. 10 April 2006, partially severe health complaints such as cough, shortness of breath and in single cases, toxic lung oedema appeared among a considerable number of consumers. This had been due to sales of two surface-sealing "nano" sprays by a major chain of discount shops in the context of an advertising campaign. Already a few hours after these products had appeared in the market, they were removed from the shelves upon intervention by the BfR and the PCCs.

The pattern of manifestations resembled the series of cases experienced in the past which had

occurred after the use of impregnating sprays in 1982/83 in Germany and 2002 in Switzerland and the Netherlands. Extensive research into the formulations of such surface sealant sprays revealed a great similarity of the chemical spectrum of the relevant components with that of the impregnating sprays. This suggests that the symptomatology seen after inhalational exposure may correspond to that of the known "impregnating agent syndrome". Analysis of the "nano" sprays, however, demonstrated the absence of nano particles as claimed by the advertising campaign. The term "nano" was to refer to the ultra fine water and dirt repelling layer formed from silanes undergoing a chemical process.

Evaluation of the case described
Based on the data referring to the temporal association between use of the surface sealant spray and the appearance of typical manifestations like those which also occurred in a considerable number of other consumers after use of this product, a causal relationship is considered as confirmed regarding the pulmonary manifestations. It is noted with interest that despite intensive efforts made by the patient to keep exposure as low as possible and to apply the products in a well-ventilated room, he developed complaints.

4.2 Specific risks for the elderly – Poisoning by cleansers and disinfectants
Shower gels, bubble baths, shampoos, all-purpose cleansers, disinfectants, liquid detergents, etc. may involve considerable risks for elderly persons. In the context of cases of poisoning reported by physicians since 1990, a total of 23 cases have come to the knowledge of the BfR where the ingestion of large amounts of household cleansers and disinfectants resulted in severe manifestations of poisoning. A lethal outcome was recorded in 17 cases. All of these cases referred to disoriented elderly persons. There has certainly been a considerable number of undetected and unreported cases. As to the possible causes, research and consultation of experts have revealed the following:

- Frequently, the olfactory and gustatory perception is reduced in old-age persons. Even if their olfactory and gustatory senses have been preserved, disoriented patients often lack the ability of distinguishing between acceptable (eatable, drinkable) and unacceptable matter.
- Once started, they are unable to discontinue an action in a reflexive way like young persons do.
- Elderly people cannot call for help immediately, or they keep silent about what has happened, for reasons of shame or uncertainty.
- Things may be confounded due to impaired vision.
- Unlike young children, elderly persons are often left by themselves for extended periods and they are not under constant observation, as a rule.

Fig. 7: Elderly lady in need of care

In 2002, the BfR had launched a large-scale campaign involving press releases, manuals and flyers in a variety of languages, pointing out the risks for the elderly and addressing nursing and cleaning staff in hospitals, nursing homes and homes for the aged.

On account of the fact that fresh cases of this type have been reported in 2005 and 2006, the BfR will conduct another concerted action to

draw public attention to the risks for the elderly from such substances. By visits to the homes of elderly persons, they may be alerted regarding the risks of accidents which could be reduced by using special dispensers for detergents and cleansers. Such dispensers are being used on a large scale already now, for example in hotels, pensions and also hospitals.

Case report
Liquid detergent
Severe health impairment with lethal outcome in an 82-year-old female temporally related to the ingestion of ca. 100 ml of a detergent

In accordance with § 16e para 2 of the Chemicals Act, the Rostock University Hospital reported a case of severe health impairment with lethal outcome in a female patient aged 82 years who at her home due to her lack of orientation had ingested ca. 100 mL of a liquid detergent containing ca 25 % surfactants.

Although the course of her illness had been fairly uncomplicated, the patient died after 11 days from aspiration pneumonia associated with septicaemia.

Manifestations/course

Because of her initial senile dementia, the patient had been in need of care and was attended by her sister-in-law at her own home. In addition, an ambulant nursing service looked after her in the morning and in the evening. On the day of the accident, as usual, her sister-in-law had placed the supper for the patient on the kitchen table and then left the flat. When the nursing service arrived about one hour later, they found the patient on the kitchen floor, retching and with foam in her mouth. The patient vomited when the nurse was present. On the kitchen table, there were two opened bottles containing liquid detergent for fine textiles, side to side with a drinking glass which still contained residual detergent. Owing to the situation in which the patient had been found, an oral intake of detergent was assumed to have taken place.

Obviously, the patient in her disoriented situation had brought these bottles from the bathroom and poured some of the contents into the glass. According to the nurse and the sister-in-law, the bottle with the liquid detergent had been unused and full, and the other one also containing detergent was of less recent date, probably dating back to GDR times. Since from the first mentioned bottle, the amount corresponding to that of a drinking glass was missing, it can be assumed that the patient had primarily ingested that. Whether also part of the contents of the other bottle was missing, could not be clearly established.

Assuming that the patient had ingested detergent, the nursing service immediately called for emergency medical services. The patient, whose respiration was sufficient and cardiovascular condition stable, was initially admitted to the ward for general internal medicine. After three days with relatively little complications, the patient developed an increasing global respiratory insufficiency which required her transfer to the intensive care ward for intubation and artificial respiration. Her circulation remained stable and did not require any medication. Radiology demonstrated the presence of pneumonia on the right side which in the further course clearly aggravated despite a broad antibiotic therapy. There was complete clouding of both sides on chest X-ray and an obvious increase in respiration intensity. In addition, there was anuric renal failure. In spite of the intensive therapy, the patient died eleven days after ingestion of the detergent, from aspiration pneumonia. The pathologist stated that both lungs had become completely destroyed.
A post-mortem report in writing has not come to hand.

Evaluation
Based on the available data concerning a temporal association between the accidental intake and appearance of manifestations and in the absence of other causes for these, a causal relationship is probable.

4.3 Selected cases by cause of poisoning

4.3.1 Mistake

4.3.1.1 Descaling products

Oral intake of descaling solutions

Case No 1:
The electric kettle in an office was descaled. The descaling solution remained in the kettle. A 25-year-old female clerk wanting to make tea added water to the descaling solution and took one sip of the tea made with this diluted descaling solution.

Manifestations/course
The patient saw a physician. The BfR does not have information on the manifestations observed and the medical findings, so that a course with a mild symptomatology is assumed.

Case No 2:
The staff of a laundry business performed descaling on their coffee machine. The descaling solution was used to make coffee; a male staff member aged 49 drank some of this coffee.

Manifestations/course
The subsequent medical examination established a "chemical burn" on his tongue. The patient did not state any other complaints. Other organs did not show any appreciable disease so that there was no need for further measures.

Case No 3:
By mistake, a 45-year-old member of the staff of an industrial establishment drank descaling solution instead of coffee. Probably, the coffee machine had undergone descaling and descaling solution had been left in the machine. Since the patient noticed his mistake immediately, he spat out the solution and did not swallow it. Immediately afterwards, he presented at the accident surgery ward of a hospital from where he was referred to the ENT department.

Manifestations/course
Medical examination by a specialist showed that the patient's tongue was reddened and slightly swollen in the front part, while all other findings were normal. The BfR lacks information about the further course of this case.

Case No 4:
During a break, a 42-year-old nurse wanted to drink some coffee in the recreation room. The coffee machine had just undergone descaling and residual descaling solution was still in the machine. By mistake, the nurse drank half a sip of the descaling solution. She soon realised her mistake, spit out the remaining descaling solution that was still in her mouth and rinsed her mouth with water. Afterwards, she presented to the ENT department of the hospital.

Manifestations/course
The examination did not reveal any signs of chemical burns, mucosae were free from irritation, there was no hypersalivation and the patient had no complaints. Following consultation of a PCC she was discharged and returned to her home. A continued dilution therapy was recommended.

Case No 5:
A merchant served himself with a cup of coffee from the coffee machine. However, he had

failed to notice that the machine still contained residual descaling solution. He inadvertently drank a small sip of the diluted descaling solution, noticed his mistake right away and spit out the rest of the diluted solution he still had in his mouth. Later on, he complained of a retrosternal burning sensation and also in his pharynx and throat. As a first measure, he drank an ample helping of water immediately and then presented to a physician on duty.

Fig. 8: Household chemicals

Manifestations/course
The ensuing physical examination which included an inspection of mouth and pharynx did not show anything appreciable. A consultation of the responsible PCC provided the information that there was no further risk; drinking of water with an added antifoaming agent was recommended.

Case No 6:
A 22-year-old patient inadvertently drank a sip of a descaling solution which in addition to surfactants contained up to 12.5 % hydrochloric acid and phosphoric acid. Afterwards, the patient had difficulties to swallow and a sensation of swelling and closing of his pharynx. As a self-help measure, he drank water and then called for an emergency physician.

Manifestations/course
The emergency physician administered three puffs of a corticoid spray. He administered 250 mg prednisolone by the i.v. route and had the patient transferred to a hospital.
On admission, a reddening of the pharynx was noted but there was no swelling. Else, medical findings and routinely established laboratory parameters were normal.

The patient was to be admitted for stationary monitoring and presentation to an ENT specialist. Also, gastroscopy was envisaged to demonstrate or rule out chemical burns in the oesophagus. However, the patient shunned all these measures by leaving the ward on his own.

Notes:
Descaling agents or cleansers for coffee machines and electric kettles are specific cleansing products for the removal of scales from household appliances. The calcium carbonate is dissolved by acids. In most cases, descaling products for household use contain organic acids, e.g. citric acid in concentrations of up to 100 %, malic acid up to 60 %, or formic acid up to 25 %. In contrast, products for industrial use preferentially contain more aggressive inorganic acids like hydrochloric and/or phosphoric acid as in the present case.

For descaling, the household appliance is filled with descaling solution. This solution will remain resident in the appliance. Frequently, persons performing the descaling operation would forget to remove the solution later on. Some time later, another person will use this inconspicuous descaling solution for making tea or coffee. Such tea will often be only somewhat lighter in colour and have a strong lemon flavour. Like coffee, it may also have a bad taste and lead to minor manifestations such as nausea and irritation of the gastrointestinal tract. For those affected,

it will mean nothing but a scare and an unpleasant sensation. This has been similar in most of the cases reported to the BfR. As a treatment, drinking of fresh water or some other well-tasting fluid that does not contain carbonic acid such as tea will be sufficient.

Inadvertently ingested descaling products for industrial use will be more problematic. Due to their aggressiveness and depending on their degree of dilution, they may produce chemical burns. As a first measure in these cases, drinking of water is recommended and presentation to a physician is indispensable. Depending on the medical findings, the patient must remain under observation or the scheme for treatment of chemical burns must be applied like that described in the last mentioned case.

Accidents involving descaling solutions mistaken for drinks are a daily routine activity for PCCs. In 2005, more than 500 events of this type were registered by the Berlin PCC, and the tendency is on the rise. Some relief may be brought about by a conspicuous staining of the descaling products to distinguish them easily from coffee, tea, or water. In this way, confounding could be avoided in advance. Potential victims would be spared discomfort and medical consultations with the associated expenditure.

Evaluation of the cases described
Based on the data about a temporal relationship between ingestion and appearance of manifestations fortunately involving only minor health complaints and in the absence of other causes, causal relationships probably exist in these cases.

4.3.1.2 Dishwasher detergent

Death erroneously associated with a dishwasher detergent
From a press report, we came to know about an alleged case of poisoning with lethal outcome in a 54-year-old male inmate of a nursing home. Due to negligence, the patient had been offered a dishwasher detergent containing sodium hydroxide instead of tea. Upon appearance of severe health disorders, the patient was immediately transferred to a hospital where he died despite intensive care measures. Post-mortem findings, however, did not confirm the initially suspected effects of oral intake of a highly caustic detergent as cause of death.

The course of the accident was described as follows. In the large kitchen of a nursing home, a female member of the cleaning staff had filled a tea-making machine with a cleaning agent and then left the machine for the detergent to take effect. At the end of her shift, she left a written note for her colleague who was to continue the cleaning operation on the tea-making machine. No warning was fixed to the machine proper. When the colleague arrived, she had other duties to fulfil first so that the tea-making machine containing the detergent fluid was left unattended for some time. In the meantime, a nurse arrived and poured “tea” from the machine. The patient who later died took medicines together with this „tea”. Although he complained about the bad taste of the “tea”, he drunk a few sips when again asked to do so. The nursing staff did not have any qualms in this context. Four other patients also drank the fluid but none of them developed severe health disturbances. Judging by the press release, it was assumed initially that a descaling agent was involved. Further investigations, however, revealed that a dishwasher detergent had been used which is known to contain the toxicologically relevant substances, sodium hydroxide, sodium metasilicate and sodium polyphosphate. This formulation may cause severe chemical burns.

Manifestations/course
Only when the mix-up had become known and the patient was in a very bad state, a possible link to poisoning was seen. The patient was admitted to the nearest hospital. He died there shortly afterwards. Unfortunately, the BfR lacks information about the clinical manifestations in this patient. Autopsy did not reveal any signs of chemical burns on the patient's skin or mucous membranes so that the dishwasher detergent can be ruled out as a cause of death. According to the post-mortem report, the cause of death was of cardiac nature.

Notes:
Even though in this case, the nursing home inmate's death had not been caused by the dishwasher detergent, the course of the accident is of general interest and suitable to draw attention to the poisoning potential due to confusion and insufficient labelling of detergents and cleansers.

Evaluation of the case described
On account of the findings stated in the post-mortem report, no poisoning with detergents had taken place.

4.3.2 Health disorders caused by foods

4.3.2.1 Shiitake mushroom

Flagellate dermatitis after consumption of raw shiitake mushrooms
In February 2006, a 65-year-old patient came to the BfR and reported a highly discomfortable skin reaction after having consumed about twelve raw shiitake mushrooms. He had become aware of the BfR through the publication of a similar case on the internet.

Manifestations/course
Inspired by a holiday in Japan, he had prepared for himself a salad from raw shiitake

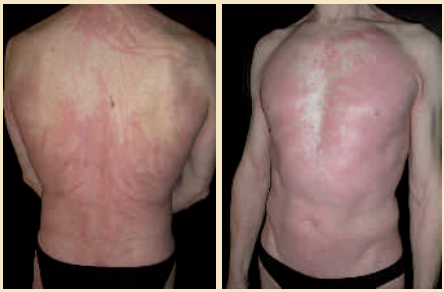

Fig. 9: Flagellate dermatitis after consumption of raw shiitake mushrooms

mushrooms in the evening. During the following night he complained of stomach disorder and an unpleasant burning sensation over his entire back. Initially, there was no pronounced itch. On the next morning, he was the more surprised about a massive reddening of the skin on his entire belly and back, with clearly visible whip-like weals. He described a sensation like that of a massive sunburn. Over the following days, the burning sensation intensified and turned into a painful itch while reddening spread over the entire body and the skin changes became pale and then reappeared. Since initially, the patient declined to undergo a cortisone therapy, a first attempt was made to treat his condition by homeopathic medication (a general remedy against fungi) and sedatives on a vegetal basis. Under this treatment regimen, however, the patient's symptomatology deteriorated. There were a strong pruritus, headache, swollen eyelids and finger joints, bluish-pink spots on arms and legs and a formation of urticaria and papulae. Therapy including oral cortisone (20 mg/day) and antihistamines from day 10 of illness resulted in the healing of skin changes within one week.

During the following weeks, the patient developed an increased susceptibility to infections, with initial signs of allergic rhinitis and later

on, even with asthmoid complaints. Allergy testing for birch pollen was positive.

Notes:
The shiitake mushroom (*Lentinus edodes*) is a member of the family Tricholomataceae; it is one of the wood-dwelling saprophytic species. Its cap has a width of up to 20 cm, it is of brownish-grey to grey colour with closely fitting triangular scales, the lamellae are whitish-brown, the spores colourless. The fungus is esteemed as a food because of his excellent seasoning and gustatory properties. It is ascribed allround health effects. Above all, in Chinese and Japanese cookery, it constitutes a rather popular food. Also in Germany, it is farmed and consumed in large quantities. As a food worldwide, this fungus is second to the mushroom (*Agaricus bisporus/campestris*). The "all around healthy fungus" is ascribed favourable properties such as being a source of protein, potassium, zinc, vitamins B_1, B_2, and D, activator of the immune system, cholesterol reducer, and favourable influences on the immune system in the therapy of cancer and AIDS. Cyclic sulfur compounds have been identified as its principal flavour components. These include lenthionine, tetrathiane, trithiolane and the amino acid, eritadenine.

For a small number of people, consumption of this fungus has unpleasant consequences: The so-called shiitake of flagellate dermatitis will appear a few hours after the meal. The name of the disease was derived from the flagellants, persons whipping themselves, because of the characteristic picture shown by the skin of persons affected, consisting in weal-like reddening of the skin of the body as well as of arms and legs and the neck. In the past, such skin manifestations were observed above all after the consumption of undercooked fungi. For this reason, it has been recommended to eat shiitake fungi only well-cooked or well-fried. However, recent reports indicate that the mode of preparation has no influence on health complaints developed by susceptible persons.

Presumably, the polysaccharide, lentinan, being a natural ingredient of the fungus, triggers the incompatibility reaction. It appears that the polysaccharide is not heat-labile so that the dermatitis can occur also after consumption of well-done fungi. In spite of the wide global distribution of shiitake fungi, cases of shiitake dermatitis are very rare in Germany. Obviously, only a small number of persons tends to sensitive reactions and the reasons for this are still unknown. In addition to the amount consumed and the mode of preparation, there may be other, unknown co-factors. At present, if judged by the number of cases described, the risk for consumers would seem to be low.

Fig. 10: Shiitake mushroom

Above all, Japanese authors have reported that staff of fungus farms who had inhaled shiitake spores fell ill from allergic alveolitis. In this context, also cases of allergic contact dermatitis were mentioned that could be diagnostically confirmed by means of the patch test. As a sign of the allergic reaction, the skin rash was found to be associated with eosinophilia. Fla-

gellate dermatitis was described for the first time in 1977 by Nakamura. In 1985, he reported on 30 cases observed in Japan within a period of nine years. They referred to patients presenting with severe erythema and pruritus after ingestion of the mushrooms in traditional Asian dishes. All of his patients exhibited strongly itching, linear, dense and very small papulae and stated that these stripes had appeared one or two days after consumption of the meal containing the mushrooms. The papulae had obviously formed by scratching in the form of stripes (Koebner phenomenon). The manifestations receded after a period of 20–30 days. Additional cases were recorded by Nakamura later, until 1991. Other authors reported on 58 patients presenting with shiitake dermatitis during the 1997–2001 period. In 33 of these cases, the disease had developed after the consumption of sufficiently cooked fungi. In Germany, there have been quite sporadic cases of disease following consumption of this edible fungus.

So far, three cases involving health disorders due to shiitake fungi were reported (one in 2004 and two in 2005). In all cases, a typical whip-like reddening of the skin was present. The degree of severity was rated as minor in all cases, but for those affected, the general discomfort was quite disagreeable.

In the case described above in detail, quite pronounced dermatitis was seen after consumption of shiitake fungi which led to an appearance of urticaria in the further course. However, there was rapid healing as a result of therapy consisting in administration of cortisone and antihistamines. Some weeks later, an allergic diathesis associated with rhinitis (running nose) and asthmoid complaints became manifest for the first time. The clinical course seen has supported the hypothesis that proneness to allergy may become enhanced by consumption of shiitake fungi in persons with a latent allergic predisposition.

The mode of preparation, i.e. whether the fungi are raw or cooked, does not seem to have any influence on the development of dermatitis. Shiitake dermatitis has been observed also after consumption of well-cooked meals containing the fungus.

It is recommended to pay attention to incompatibility reactions after the consumption of shiitake mushrooms and if first signs appear, to omit consumption of this fungal species in the future. Since UV radiation may amplify the reaction, skin areas affected should not be exposed to sunlight.

Evaluation of the case described
In the case described above, a causal relationship between the ingestion and the appearance of manifestations has been rated as probable on the basis of the information given and in the absence of other causes for the manifestations.

4.3.2.2 “Butterfish”

Intestinal haemorrhage in a 65-year-old male patient after consumption of “butterfish”
After surgical treatment of cancer of the large intestine in 2005, the patient had been carrier of an anus praeter. Before consumption of the “butterfish”, he had felt well and did not have any digestive disorder.

Manifestations/course
Immediately after the meal, the patient complained of an uncomfortable feeling in the upper abdomen. One and a half day later, the patients stool showed a bloody-liquid consistency. On account of this symptomatology, the patient was admitted to hospital and subjected to a detailed differential diagnosis. Findings revealed an initial ischaemic colitis. The intestinal haemorrhages spontaneously came to a halt so that the patient could be discharged in a state of relative well-being.

The attending physicians saw a possible association between the appearance of colitis and the consumption of "butterfish". Differential diagnosis also considered an adverse reaction to the short-term use of a vasodilative medicine. In the medical press, there have been reports of vascular disease which in rare cases may occur after use of that particular medicinal product.

Notes:
In mid-2003, Australian health authorities reported health disorders associated with the consumption of escolar, also referred to as butterfish, rudderfish, or butter mackerel. Since 1999, 98 cases have been recorded in Australia. In a press release dated 30 April 2003, the BfR drew attention to the fact that after consumption of major quantities of fish of the species *Lepidocybium flavobrunneum* (escolar) and *Ruvettus pretiosus* (oil fish or escolar) of the Gempylidae family (German terms: Butterfisch or Buttermakrele) particularly sensitive persons may suffer health disorders such as diarrhoea, abdominal cramps, vomiting and headache. Caution when consuming these fish species was suggested. Experts assume that these disorders are caused by the presence of not readily or not at all digestible wax esters accounting for 90 % of the oil or fat of these two fish species. It has not yet been elucidated whether the wax esters alone can be held responsible for such health complaints or whether there are other contributing factors. One could think of certain fish proteins having allergenic activity or of biogenic amines (among these, histamine) which may form in fish when stored over extended periods. Also, the quantities of fish are unknown which would have to be ingested to produce such health disorders. "Butterfisch" and "Buttermakrele" (butter mackerel) are collective terms (trade names) for marketing a number of fish species which are rich in fat and come as a bycatch from deep-sea fishing. They have been marketed in Germany for a number of years as pieces of "butter mackerel" treated by hot smoke and offered under the name of "smoked butter mackerel", formerly as "smoked butterfish". Also the oil or fat of such smoked fish marketed in Germany as "Butterfisch" and "Buttermakrele" consist of wax esters with a share of 90 %, as established in a study conducted by the Federal Research Centre for Fisheries, Hamburg.

Fig. 11: "Butterfish"

In an expert opinion dated 30 August 2004, the Scientific Panel on Contaminants in the Food Chain stated the following regarding the toxicity of fishery products from fish of the Gempylidae family: EFSA (European Food Safety Authority) has stated that on the basis of the case reports received, it is not possible to fix daily intake levels for fish which do not produce the side effects reported. It may be possible to avoid an appearance of these manifestations by suitable practices of preparation such as discarding of the oil that has become liberated from the food.

Evaluation of the case described
Based on the data about a temporal association between ingestion and appearance of manifestations, a causal relationship is considered as possible.

In view of the intestinal haemorrhage described, the case under reference has to be rated as moderately severe while the extent of the

associated health disorder depended on the patient's underlying disease as a co-factor.

Further cases involving "butterfish"
For the first time, a similar report was published in the BfR brochure entitled Cases of Poisoning Reported by Physicians in 2004. The patient involved had been alerted to this problem by the internet publication of the respective BfR comments (No. 12/03) and had sought contact with the BfR as somebody personally affected by the health disorder described. Also in the present case, the patient made reference to the comments cited. He pointed out that at his home place on the Baltic Sea, a number of persons had suffered from the manifestations described (diarrhoea, abdominal cramps, headache, vomiting) after having consumed "butterfish". In addition to describing his own case, he had intended to draw attention to the fact that there had been obviously more cases than those reported to the BfR.

Summary: During the reporting period, 2004–2006, a total of 14 cases involving gastrointestinal disorders after the consumption of "butterfish" were recorded at the BfR (5 cases in 2004, 6 cases in 2005 and 3 cases in 2006). In all cases recorded so far, health disorders were rated as minor. Nevertheless, these complaints meant an obvious impairment of the well-being of the persons affected.

4.3.3 Accidents

4.3.3.1 Chemical burns from sodium hydroxide

Chemical burns from sodium hydroxide: Severe course
A male patient aged 39 suffered severe damage to his eye. Causes of the accident are not known. Examination by an ophthalmological practitioner resulted in findings of severe chemical burn. The patient was admitted for inpatient treatment. At the hospital, surgical intervention was performed consisting in removal of the vitreous body (vitrectomy) and insertion of an artificial lens (pseudophakia).

Manifestations/course
Details of the accident situation and first aid measures applied are unknown. The patient's eye was accidentally hit by sodium hydroxide. Owing to the severe chemical burn which presented itself by the aspect of a "cooked fish eye", the attending practitioner referred the patient to a hospital. At the hospital, the vitreous body, which had suffered severe posttraumatic damage, was removed by surgery. An artificial lens had to be inserted and a corneal graft performed. As a result of these numerous complicated interventions, the patient's visual acuity could be restored to such a degree that movements of the hand could be recognized by him. To obtain a further improvement of the patient's sight, a transplantation of stem cells is envisaged. Nevertheless, partial recovery is expected in this case.

Notes:
In this case, the grave consequences of a chemical burn by sodium hydroxide involving difficult surgical intervention followed by partial healing become evident. Alkaline compounds such as sodium and potassium hydroxide and ammonia produce local damage to skin and mucosae as well as the eye, resulting in soap-like liquefaction of tissue and colliquative necrosis. Owing to the ability of alkalis to liquefy protein and to dissolve it, alkalis have a greater in-depth effect than acids.

- In the event of a **minor** chemical burn, only the uppermost layer of the cornea will become detached. The rim of the cornea will remain. From there, the cornea can regenerate itself. No corneal clouding will develop later.

- In the event of a chemical burn of **moderate** severity, also the conjunctiva is damaged in addition to the outer layer of the cornea. In this case, reddening is a favourable sign because this indicates that circulation is still intact.
- **Most severe** chemical burns are recognized by the presence of a dense white opacification of the eyeball. In this case, also deeper parts of the eye such as iris, lens, blood vessels and sclera have suffered irreparable damage. The eye will remain blind unless surgical intervention is performed for correction.

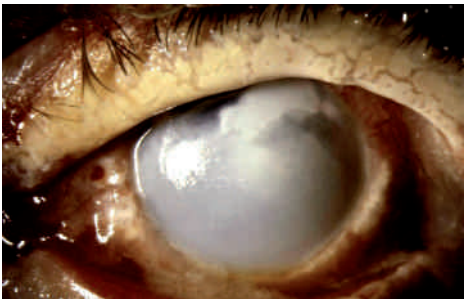

Fig. 12: Severe chemical burn of the eye – "fish eye" (Copyright © Online Journal of Ophthalmology)

If exposure to a corrosive substance has affected the eyes, intensive rinsing with water (minimum 10 minutes) should be performed. For this purpose, the eyelids must be ectropionized which often is difficult to accomplish. A slipping of fingers may be prevented by the use of dry cloth or swabs. If unsuccessful, 2 % lidocaine from the emergency kit can be applied dropwise to the edge of the eyelid to produce analgesia and thus opening of the eyelid. Ideally but impossible in most cases for technical reasons, would be rinsing of the open eye under running water from the tap. As an alternative, repeated pressing out of a piece of water-soaked cloth may be used.

In the case described, it is unknown which first aid measures were taken. White opacification of the eyeball in the event of most severe chemical burns is referred to, as in the present case, as "cooked fish eye". Vitrectomy consists in surgical removal of the damaged vitreous body and subsequent replacement by Ringer's solution, gas, or silicone oil while damaged cornea is replaced by corneal grafting. Thus, a complete loss of sight could be prevented for the eye affected. It remains to be seen whether the envisaged stem cell transplantation can improve the patient's visual acuity. Modern surgical techniques may be successful in such severe cases and perhaps partially cure amaurosis.

Evaluation of the case described
Based on the data regarding the corrosive substance that caused the damage and the manifestations seen, and in the absence of other causes, a causal relationship is probable.

4.3.3.2 Fire breathing

Severe health damage from aspiration pneumonia after amateur fire breathing
The male adult patient had performed fire breathing as a hobby. During this activity, some of the fire breathing fluid he kept in his mouth was aspirated. He was admitted to a hospital and then transferred to another hospital for onward treatment. There, bronchoscopy was performed, during which the patient developed bronchospasm so that he had to be intubated and respirated. Chest sonography revealed bilateral pleural effusions which, however, underwent regression in the further course. After slightly more than two weeks which he spent at the hospital, the patient could be discharged and referred to ambulatory care.

Manifestations/course
One day after the aspiration event, the patient was transferred to another hospital. For reasons unknown to the BfR, it was decided there to perform bronchoscopy on the following day. When this was performed a compli-

cation arose in the form of a bronchospasm so that the patient had to be intubated and intensively respirated for some hours. Extubation could be accomplished still on that day, without any complication. Bronchoscopy revealed an acute inflammation in the tracheal area and, in the bronchial area, the presence of acute bronchitis with moderate formation of green mucus. Chest sonography revealed bilateral pleural effusions which, however, were clearly retrograde in the further course of inpatient treatment. On admission, blood gas analysis showed the presence of partial respiratory insufficiency with values of p_aO_2 61.5 mm Hg, p_aCO_2 35.4 mm Hg and pH 7.45. By lung function analysis, a mixed ventilation disorder was observed, in particular with obstruction but also with signs of overdistension of the lungs. Initially, infection parameters were clearly elevated, with a CRP

Fig. 13: Fire breather

level of 29 mg/dl and leukocytosis (17.9/nl). Therefore, the patient was administered an antibiotic over a period of 12 days which resulted in a clear decrease of the levels of infection parameters. Furthermore, he was treated by systemic and inhalational administration of steroids. An obvious regression from the initial levels of the pathological lung function and blood gas analysis values could be achieved. Final radiology after termination of antibiotic treatment also exhibited clearly loosened infiltrates in the lower area left and an absence of fresh lesions which indicated a decisive improvement of findings. After a total of 17 days of stationary monitoring and treatment, the patient was discharged in a clearly improved general state and referred to ambulatory care. A pulmonological practitioner was to check the patient's lung function after two or three weeks and to gradually reduce the dosage of steroids. The patient was strongly recommended to abstain from nicotine consumption.

Notes:

Fire breathing (Fig. 13) is the act of creating a flame by spraying, with one's breath, a flammable substance upon the open flame of a torch thus lighting the fine spray fog. On principle, the flammable substances used are powders or liquids. Beginners are recommended to use powders such as *Lycopodium* (club moss) spores because the health risk involved is lower. This substance is available in pharmacies as a natural laxative. Liquid fuels used (e.g. Pyrofluid™) are mostly based on highly purified kerosene or low-viscosity paraffinic preparations, as in the case described above. The fire breather takes this liquid into his mouth and blows it out again under high pressure, using a special technique. During the performance, the fire breather needs to deeply concentrate and constantly control the natural swallowing reflex in order to avoid accidental swallowing. Also, an inhalation of droplets of the liquid poses the risk of severe lung damage. Due to certain physical properties of the fire-breathing liquids such as low volatility, viscosity and surface tension, they readily "undercreep" the epiglottis and enter the lungs (aspiration). Even the smallest quantities inhaled may cause this effect. Owing to their physicochemical properties, these substances penetrate further into the lungs thus reaching

the deep lung areas. This will result in a reduction of gas exchange in the alveoli followed by oxygen deficiency (hypoxia). It has been assumed that the surfactant effect is impaired in the alveolar region. The direct capillary damage is attributed to the development of chemical pneumonia (pneumonitis), haemorrhagic bronchopneumonia and lung oedema. In severe cases, patients die presenting a clinical picture of ARDS. Up to the present time, no promising therapy has become known. Since 1990, as many as five children died in the Federal Republic of Germany from the sequelae of kerosene or paraffin aspiration.

Initial manifestations after aspiration such as cough and/or vomiting are experienced rapidly after exposure. The simultaneous presence of nausea and vomiting are caused by the local irritating effect of pyrofluids on the mucous membranes. Either initially or after a symptom-free interval, patients will develop, in addition to cough, other pulmonary manifestations of aspiration pneumonia. These may increase in intensity in the course of the first day and will, as a rule, recede within two to five days. In severe cases, lung oedema associated with haemoptysis, pneumothorax or, as in the above case, pleuritis (pleural effusion) may develop. Radiology will reveal pneumonic infiltrates in the basal or perihilar regions, less frequently, a migrating pneumonia or pneumatoceles forming in the period between the 3rd and 15th day. The first changes may be demonstrated by radiology after approximately two hours, as a rule, however, they should become evident within a period of 12 hours. Other manifestations may include cardiac arrhythmia resulting from hypoxia, or CNS manifestations indicating ingestion of major quantities (which in fire breathing is rather improbable to occur). Fever developed initially, which is unrelated to the clinical findings and will in most cases recede within 24 hours, is a frequent occurrence and should be considered as a “resorption fever”; there is no need for treatment. Prophylactic administration of antibiotics is not recommended. However, if fever lasts for an extended period, a bacterial superinfection may be present and should be treated accordingly. Also prophylactic administration of glucocorticoids will not result in any improvement of the clinical picture. In contrast, it will even increase the risk of infection. It is only required for the treatment of lung oedema. Bronchial lavage should also be omitted because it poses an additional risk of aspiration by shifting pyrofluid into deeper lung areas. In cases of pneumonitis, a reasonable therapy should only be oriented by the manifestations observed and avoid any unnecessary manipulating measures.

Fig. 14: Fire eater

An art related to that of fire breathing is referred to as fire eating (Fig. 14). The performer places a specially prepared flaming torch into his/her mouth and extinguishes the flame. The „art“ consists in placing the flame of the torch into the mouth in an absolutely vertical position, i.e. with the head bent backwards. In this position, the oxygen supply for the upward-blazing flame is completely interrupted. Hence, use is only made of the laws of physics (hot air rises). There is no such thing as a “cold flame” nor is there any special substance in the performer’s mouth other than saliva. Unless having undergone a special training, fire eating amateurs cannot perform fire eating without running serious risks.

Evaluation of the case described
Because the fluid used involved a high risk of aspiration, the description of the accident (an amateurish attempt of fire breathing) and the temporal relationship between aspiration and appearance of pulmonary manifestations, a causal relationship is considered as probable. It has remained unclear why the patient underwent bronchoscopy and was administered steroids. The bronchospasm requiring intubation and artificial respiration has to be considered as a complication arising during medical intervention, i.e. bronchoscopy.

4.3.3 Abuse

4.3.4.1 Slimming agent (2,4-dinitrophenol)

Death after ingestion of 2.4-dinitrophenol for weight reduction
A 19-year-old healthy female had obtained 2,4-dinitrophenol (DNP) from a friend. Neither the trade name of the product nor its origin are known. In order to reduce her body weight, she took half a teaspoon of the substance once in the evening. She did not take any other medicines or narcotic drugs. She reported that four hours later she had a sensation of heat, her heartbeat accelerated and she felt sick and vomited. During the night, the patient vomited several times, she could hardly retain any fluid supplied and was sleepless. In addition, she suffered from excessive sweating and hyperventilation. On the next morning, she saw her family physician who ordered her admission to a hospital. In the further course, a rapid increase in the patient's CK and a continuous increase of her heart frequency were observed. In addition, she developed lung oedema and a vehement rise in body temperature. In spite of massive measures of intensive medical treatment such as cooling and artificial respiration, cardiac arrest occurred eventually leading to the patient's death.

Manifestations/course
On admission to the hospital, the patient was wet with sweat, her symptomatology had remained unchanged since the last night and her body temperature was still normal (36.4 °C). Clinical chemistry showed leukocytosis (20 800/µl), a CK of 826 U/L and a blood sugar level of 183 mg/dL. Due to hyperventilation, blood gas analysis showed a compensated respiratory alkalosis of pH 7.45, pCO_2 30 mmHg, pO_2 79.7 mmHg, BE –2.7. In the further course, a rapid CK increase of up to 1067 U/L was seen. A strikingly vehement increase in body temperature by ca. 0.1 °C/min was observed which could not be stopped in spite of external cooling by means of ice packs, administration of cool gastric lavage and cool infusions. In addition, a continuous increase of the heart rate from an initial value of 136/min to 180/min was recorded. Echocardiography revealed a hyperdynamic left ventricle with a low filling status. Due to imminent respiratory exhaustion, the patient had to be intubated and respirated. Blood gas levels deteriorated under controlled artificial respiration with an increase of pCO_2 to 68.3 mmHg and a BE of –9.9 associated with a pO_2 of 112 mmHg. The patient developed a massive uncontrollable lung oedema. Shortly afterwards, cardiac arrest occurred that required resuscitation measures. These remained unsuccessful and therefore, were discontinued after 45 min. Death occurred under the clinical picture of multiple organ failure. A striking observation was seen in the fact that complete rigor mortis developed within a period of 15 minutes.

Notes:
2,4-dinitrophenol is a lipophilic substance belonging to the substance group of nitrophenols. All substances of this group are highly toxic and may cause poisoning by the inhalational, dermal and oral routes. DNP, in particular, is assumed to

have embryotoxic, carcinogenic and mutagenic effects.

DNP was used for the first time already in 1919, namely in France to produce ammunition. Workers in factories producing explosives who suffered from health disorders such as attacks of dizziness, sweating and headache were also found to lose body weight. This resulted in the idea that overweight might be treated by administering DNP. However, in 1938, it became known that DNP administration involved considerable risks such as the formation of cataract associated with a yellow-brownish discoloration of the ocular lenses. As a consequence, DNP was withdrawn from the market in the USA as a medicinal product for weight reduction. Later, DNP was used as a wood preservative, a photochemical substance and a pest control agent.

In the 1980ies, a Texan physician rediscovered the substance: he sold a product for weight reduction that contained DNP. The death of a wrestler treated with this product was followed by an investigation which resulted in DNP being banned again as a medicinal product for weight reduction. Up to the present, no food supplement or medicinal product containing DNP has been authorized by the US Food and Drug Administration (FDA).

DNP uncouples oxidative phosphorylation. The high-energy molecules for ATP synthesis continue to be delivered but they are converted to heat instead of ATP. This elicits a high thermogenesis associated with a drastic increase in body temperature. Because no more ATP is formed, the body uses other resources for energy production and reduces body fat. The liver releases glucose as an alternative ATP source. This anaerobic degradation process results in the formation of lactate and ethanol as end products, which results in metabolic acidosis.

The lethal dose is stated to be of 1–3 g DNP (single dose). The details of pharmacokinetics are unknown, however, the half-life period of the substance seems to permit its accumulation. This is suggested for example by the death of a bodybuilder who took a daily dose of 600 mg DNP for four days and died on the fifth. Probably, many deaths due to DNP have to be attributed to the fact that the cumulative effect was not taken into account.

DNP is a highly toxic substance. Manifestations of poisoning with this substance include hypotension, tachycardia, cardiac arrhythmia, sudden cardiac death, dyspnoea, aspiration pneumonia, lung oedema, headache, agitation, cerebral oedema, coma, hyperthermia, dehydration, metabolic acidosis, rhabdomyolysis, thyroid dysfunction, hyperglycaemia, gastrointestinal disorders, cyanosis, haemolytic anaemia, methaemoglobinaemia, agranulocytosis, yellowish discoloration of skin, sperm and the ocular lenses associated with cataract formation, renal insufficiency, hepatic failure and finally, multiple organ failure.

Results of investigations at the German Sport University, Cologne, have indicated that recently, DNP has been massively advertised as a fat-burner for effective weight reduction. The substance is very cheap and can be obtained relatively easily from companies trading in chemicals. It might also be used as an anabolic steroid to accentuate the muscles after body fat reduction. Therefore, a survey among all PCCs was initiated in order to find out whether an increasing number of inquiries referring to DNP or cases of poisoning involving the substance had been recorded recently. Fortunately, it was found that no other cases of poisoning had occurred except for the two cases reported to the BfR. Information on the second case reported is given in the Section on suicides (Chapter 4.3.5.2).

Evaluation of the case described

Based on the data concerning a temporal association between the intake of a lethal dose of

DNP (half a teaspoon corresponds to approximately 2.5 grams) and the appearance of typical manifestations, a causal relationship is considered as confirmed in the case described.

4.3.4.2 Sniffing agents (deodorant spray)

Death of an 11-year-old boy after sniffing of deodorant spray

An 11-year-old boy returned home from school. He complained of nausea and wanted to take a shower. Shortly afterwards, his grandmother found him unconscious in the closed shower cabinet. He was cyanotic and unresponsive and showed a gasping breathing. About one minute later, the mother's partner arrived and started lay resuscitation measures. Next to the boy, an empty deodorant spray can was found which had been full before. Therefore, inhalation of propellants was strongly suspected. Later, the boy's mother reported that she had become aware of occasional sniffing among the boy's friends. She stated that also the boy himself had sniffed several times before. Otherwise he had been a healthy and normally developed boy.

Manifestations/course

The emergency physician, who arrived ten minutes after the emergency call had been made, found ventricular fibrillation. The patient was immediately intubated and defibrillation administered with energies of 200 joules initially, followed by 240 and subsequently, 360 joules. Because no spontaneous cardiac rhythm set in, cardiopulmonary resuscitation was continued. After repeated administration of atropine and adrenaline and of defibrillation, a sinus rhythm set in with 130 beats/min which, however, was associated with broadened ventricular complexes and a aerodynamically insufficient cardiac output. Oxygen saturation measured at that time was approximately 80 %. Because of repeated vomiting occurring during intubation, aspiration was suspected in addition.

When the patient was transferred from the ambulance to the intensive care unit, oxygen saturation was 80 %. Clinical findings included a heart rate of 130–150/min with inadequate circulation. Adrenaline was again administered and buffering with sodium bicarbonate initiated. This resulted in a stabilization of circulation with beginning cardiac output and development of measurable blood pressures. The patient was administered norepinephrine to support his circulation. In order to improve cardiac output, sodium nitroprusside was administered for afterload reduction and an appropriate volume replacement performed. These measures as well as administration of a phosphodiesterase inhibitor and intensive respiration therapy were intended to stabilize the patient's circulation.

The first echocardiography performed demonstrated a pronounced damage to the endocardium. Also the ECG revealed severe repolarization disorders. Ventricular contractility was markedly impaired. This could be compensated initially. Transcranial doppler sonography soon revealed a reduced cerebral perfusion which had to be interpreted as a consequence of the poor cardiac output and of the development of progressive cerebral oedema. Resistance indicators showed sometimes values of no more than 0.4, associated with a clearly elevated diastolic and reduced systolic pressure. Repeated CT and MRI revealed a pronounced focal cerebral oedema.

Clinical chemistry showed a massive increase in creatine kinase levels including CK-MB as an indicator of myocardial damage. Increased levels were also found for

LDH, AST and ALT. Also the initially normal renal parameters increased, showing a progressive renal insufficiency. In the context of terminal renal insufficiency, a gradual increase in phosphate levels was observed. Elevated levels were also found for ammonia while electrolytes and lactate remained within their normal ranges. Deep sedation was performed for cerebral protection. Under sedation, the EEG showed changes of short-term segments of low-amplitude reflex activity and extended phases in the sense of an incipient burst suppression pattern. Circulation could be stabilized for a short period of time. Subsequently, however, a condition of increasing cardiac decompensation set in associated with a deformation of ventricular complexes, echocardiography showed almost no activity. Blood pressure levels could only be maintained by means of maximum doses of norepinephrine and the phosphodiesterase inhibitor. Doppler sonography showed a further deterioration of cerebral perfusion. Given the still persisting cerebral perfusion and low-amplitude EEG pattern, transfer of the patient to a heart centre was decided in order to consider the option of using an assist device.

Prior to the envisaged transfer, a sudden increase in pCO_2 occurred, pupils became unround and showed no reaction to light at all. No spontaneous respiration at all could be demonstrated by the apnoea test so that a clinical picture of cerebral death was seen. The latter was confirmed over the next 48 hours by means of repeated apnoea tests, a positive doll's eye sign and repeated isoelectric EEGs over a period of more than 30 minutes. Doppler sonography showed the absence of cerebral perfusion, and an unequivocal oscillatory flow was seen in the carotid arteries. After completion of all criteria of cerebral death and consultation of the boy's parents, it was decided to discontinue all therapy including dialysis that had been initiated because of progressive renal insufficiency. The boy died ten days after the incident.

Notes:
Propellants used in sprays include butane and propane. Both gases are characterized by a comparatively low toxicity. At higher concentrations (> 6 %) they have a weak narcotic effect. They displace oxygen because their volume increases by 250 times on transition from the liquid to the gaseous state.

Due to their euphoric effects, these as well as other substances are frequently used by adolescents as **sniffing agents**. According to epidemiological studies, first experiences with narcotic drugs in the form of sniffing agents are made as early as at the age of 9–10 years, 3–10 % of all school children have already made corresponding experiences. The children involved mostly come from a difficult social background. On the European level, several hundreds of deaths have to be assumed to occur due to sniffing every year. Recently, the predominant number of cases has been due to propane/butane mixtures like those used in camping stoves or in aerosol cans, as in the case described. After three to six months of sniffing, the desired effects will decrease. This will inevitably be followed by increasing of the doses or starting of narcotic drug abuse, which is associated with a very poor rehabilitation prognosis. Sniffing agents have a considerable psychological addiction potential, which essentially depends on the social situation of the persons affected.

Short-term accidental inhalational exposure to propane or butane does not result in poisoning. At sufficiently high concentrations and after extended duration of exposure, the persons affected will rapidly develop reversible manifesta-

tions such as the desired euphoric feeling from drug abuse, but also effects ranging from sedation to coma, muscular tremor, dizziness and nausea. The „kick“ experienced from sniffing or due to stress, panic etc. causes myocardial sensitization to endogenous catecholamines. This may result in severe cardiac arrhythmia or ventricular fibrillation with a lethal outcome. Also myocardial infarction has been observed in adolescents with healthy hearts, which were probably due to vascular spasm after catecholamine action.

Due to the above-mentioned displacement of oxygen, massive exposure may result in hypoxia including all its consequences such as acidosis, shock, unconsciousness and suffocation. This plays a minor role in cases of abuse but may occur after exposure caused by a release from defective technical installations.

Therapy should include absolute physical immobilization because physical activity increases the imminent risk of ventricular fibrillation. If required, the patient should be sedated by means of a benzodiazepine. Catecholamine administration should be avoided because this could promote myocardial sensitization to exogenous and endogenous catecholamines and possibly trigger severe cardiac arrhythmia. Onward therapy will be oriented by the existing symptomatology.

The above case provides an impressive description of the tragic and typical picture of addiction to sniffing propellants from aerosol cans. Immediately after inhalation of butane/propane, patients will collapse under sudden cardiac arrhythmia, in particular ventricular fibrillation. The cardiac damage causes cardiovascular insufficiency associated with deficient perfusion of vital organs such as brain and kidneys. In the above case, the myocardial damage was so pronounced that the patient could probably have survived only by receiving a heart transplant.

Evaluation of the case described
Based on the case history, the characteristic manifestations and the course, a causal relationship between the inhalation of deodorant spray and poisoning is considered as confirmed.

4.3.4.3 p-Nitroaniline

Death from nitroaniline poisoning in a male adolescent
A 15-year-old male had attended a party with friends and therefore spent the following night at a friend’s home. Allegedly, neither drugs nor alcohol had been consumed at the party, however, the patient was said to have told a friend that he was taking drugs. The type of drugs could not be specified by the friend. On the following day, the patient returned to his parents’ home at about 14:00 h. The next evening was said to have passed in a “normal” way, and the boy went to bed at about 21:00 or 22:00 h. He was said to have been well and not having complained of any pain or discomfort. In the night, the parents heard their son scream. They found him unconscious on the floor of his room in the basement and called for the fire brigade. On arrival at the hospital, respiratory arrest occurred. Resuscitation attempts remained unsuccessful, and the boy died at the emergency unit of the hospital. To elucidate the cause of death, a post-mortem was performed whose results provided indications of nitroaniline poisoning.

Manifestations/course
The emergency physician found the patient in his room. He was unconscious and showed mydriasis. Since drug abuse was suspected, she injected naloxone. There were no injection sites found suggesting narcotic drug consumption, also the parents were not aware of any drug abuse by their son. No diseases or abnormal behaviour possibly associ-

ated with drug consumption had been observed. A small pharmaceutical bottle containing a yellow powder was found on the windowsill of the boy's room.

The patient was brought to a hospital by emergency ambulance. On arrival at the emergency unit, respiratory and cardiovascular insufficiency occurred. Resuscitation attempts that had been initiated remained unsuccessful, the boy died at the emergency unit. Except for a head laceration, no information has been available to the BfR regarding the findings on admission. No blood was collected for toxicological analysis at the hospital.

To elucidate the cause of death, post-mortem was performed at a forensic medical unit. The above-mentioned contused laceration was found in the temporal area, and in addition, abrasions in the region of the patient's hips. These injuries may have resulted from falling down in his parent's flat. They were, however, of no relevance for the cause of death. Findings included haemostasis of the internal organs, which can be considered as an indication of heart failure. Both palms showed yellow discoloration resembling a map which could have originated from contact with the yellow powder from the pharmaceutical bottle found in the patient's room. The contents of the stomach was interspersed with tiny yellowish powdery particles adhering to the stomach lining also in a map-like pattern. This suggested oral ingestion of the substance. Whether the cause of ingestion was a suicidal intent, abuse or a mistake has remained unclear. The post-mortem findings did not reveal any cause of death that could have been expressed in morphological terms.

A toxicological-chemical analysis was ruled to examine poisoning as a suspected cause of death. Analysis detected **p-nitroaniline** and corresponding metabolites in the venous blood, in the contents of the stomach and in a liver specimen. Also the yellow powder mentioned in the case history contained p-nitroaniline as the main component. There were no indications found of the presence of other toxic substances (including ethanol) that might have been associated with the patient's death. This applies also to the special analysis to detect illicit (narcotic) drugs in venous blood and hair. Since nitroaniline is a methaemoglobin producer, MetHb determination was performed after death that revealed an elevated level of 36.8 %. Repeat measurements performed in this case found MetHb levels to have decreased during extended periods of sample storage. Hence, the level present at the time of death may have been markedly higher and possibly caused the boy's death.

Notes:
4-nitroaniline (p-nitroaniline) usually exists in the form of pale yellow needles and is used for the production of dyes, antioxidants and pharmaceuticals. Nitroaniline is very toxic: the oral LD_{50} for mice is 750 mg/kg. It may be absorbed through the airways by means of inhalation of dust, vapour or aerosols. However, due to the relatively low vapour pressure, absorption of relevant quantities seems to be hardly possible. It is readily absorbed and may cause poisoning also on contact with the skin. No special data are available on dispersion, metabolism and excretion in humans. After ingestion or absorption by other routes, **methaemoglobin is formed** as a primary toxic effect. Oxidation of the ferrous haemoglobin causes methaemoglobinaemia. The **normal value** for MetHb is **1–2 %**, **in smokers approximately 10–20 %**. Oxidative stress may denature haemoglobin resulting in haemolysis. Once the „normal" haemoglobin has undergone change, it is no longer available for oxygen transport. MetHb concentrations of **10–30 %** will

result in isolated cyanosis. If a generalized cyanosis in patients with a healthy cardiopulmonary system is unresponsive to oxygen supply, methaemoglobinaemia should always be considered. Due to presence of oxidized iron, the blood has a dark brown colour. Therefore, a suitable bedside test consists in the filter paper test for which a single drop of poisoned patient's blood is placed on dry white filter paper. At MetHb concentrations of 10-15 % and higher, the colour of this drop will appear chocolate brown while that from a healthy person is red. Anaemic patients will show a less pronounced cyanosis but in turn, more severe clinical manifestations. Concentrations of **30–40 %** MetHb will cause cardiovascular and central nervous manifestations such as headache, dyspnoea, tachypnoea, tachycardia and discrete hypertension; concentrations of **40–50 %** MetHb will result in disorientation, lethargy and metabolic acidosis; and concentrations **exceeding 50 %** MetHb will cause coma, convulsive seizures, cardiac arrhythmia and a drop in blood pressure. A lethal outcome has to be expected at levels of **70 %** MetHb and above.

The treatment of methaemoglobinaemia may include administration of the antidotes, methylene blue and toluidine blue, in addition to oxygen supply. Both substances will reduce MetHb to functional Hb and become oxidized during this process. If a life-threatening methaemoglobinaemia cannot be controlled by means of the above-mentioned redox dyes, blood transfusion is indicated in order to supply functional red blood cells.

The high blood levels of methaemoglobin detected in the case described above have to be considered as a possible cause of respiratory and circulatory depression with a lethal outcome.

However, it has remained unclear how poisoning developed in this case. An assumption that cannot be excluded is that p-nitroaniline was mistaken for 2.4-dinitrophenol. This substance is also yellow in colour and has recently been the subject of massive advertising as a fatburner, either to reduce weight or to accentuate muscles by reducing body fat.

Evaluation of the case described
Based on the facts that p-nitroaniline was detected in the patient's body fluids, in his stomach, on his hands and that the substance was found in the pharmaceutical bottle, and after other causes could be excluded by post-mortem findings, a causal relationship between the ingestion of p-nitroaniline and poisoning is considered as confirmed.

4.3.5 Suicides

4.3.5.1 Valproic acid

Severe poisoning with valproic acid due to suicidal attempt
After a family quarrel with her mother, a 13-year-old girl ingested an unknown quantity of valproic acid tablets in a suicidal attempt. She had been stabilized on valproic acid because of a seizure disorder. On admission to hospital she was suffering from severe manifestations already which required aggressive intensive therapy. Measures for primary and secondary detoxification were performed, the girl had to be respirated and was administered an antidote. Complications arose due to hepatic damage and pneumococcal septicaemia. Owing to such maximal therapy, the girl could be transferred to a normal ward in a stable general condition after five days of intensive medical care, apparently without having suffered any recognizable long-term damage to her health. The BfR lacks information about the further course of this case.

Manifestations/course
On admission to the hospital, the patient was unresponsive and did not show any reaction

to pain stimulus. Her cardiorespiratory state was initially stable, however, in the further course, she had to be intubated and respirated due to respiratory insufficiency associated with hypercapnia (pCO_2 70.5 mm Hg) and acidosis (pH 7.133, bicarbonate 18.2 mmol/l, BE –5,3, lactate 40) (GCS 3). For primary detoxification, she was administered charcoal and Glauber's salt as a laxative by means of a gastric tube. Due to the very high valproate level (>1000 mg/L), an initial haemodialysis was required followed by haemoperfusion over charcoal as measures of secondary detoxification, of which the latter was repeated on the next day. When dialysis was initiated, problems arose from a hypotonic circulatory situation which could be controlled by means of continuous catecholamine infusion (norepinephrine) over a period of three days. After consultation of a PCC, also carnitine was administered as an antidote in this severe case. The course became complicated in addition due to pneumococcal septicaemia and impaired liver function. Findings included an increase of ammonia to a maximum of 300.99 µmol/L and thrombocytopenia of up to 31/nl. Another toxic effect seen was CK increase up to 1 280 U/L. Cerebral oedema could be excluded by cranial CT scan. As expected, EEG findings demonstrated severe general changes, however, without any signs of elevated predisposition to an attack.

The massive detoxification measures led to a rapid improvement of the patient's condition. Artificial respiration could be discontinued quickly and subsequently, extubation was performed without any problems. She became increasingly more awake, was responsive again and showed improved spontaneous motor functions. Valproate levels receded, as did the elevated ammonia levels (on transfer, to 40.8 µmol/L). Only thrombocytes remained at a reduced level of 38/nl.

After five days, the patient, who was in a stable general condition, was transferred to a normal ward for onward care.

Notes:
Poisoning with medicinal products is not subject to compulsory notification under § 16e of the Chemicals Act or any other legal provision. According to an arrangement, reports submitted to the BfR are transmitted to the Federal Institute for Drugs and Medical Devices (BfArM).

We have reported on this case because the young patient's life could be saved thanks to an adequate and consistent therapy. Attention should be drawn to the age of the 13-year-old patient because suicidal attempts are rather uncommon among such young adolescents.

Valproic acid is an anticonvulsive agent. The therapeutic dose stated is 25–40 mg/kg body weight. After oral administration, it is readily and completely absorbed, however, absorption is delayed in the case of tablets resistant to gastric juice. The maximum plasma level is reached after two hours, the half life of 10–17 hours is reduced to 6–9 hours in stabilized patients. The plasma protein binding is 85–95 %, the substance is metabolized in the liver and renal clearance takes place in a predominantly inactive, i.e. 3–10 % unchanged, state. The therapeutic serum concentration is 50–100 mg/L. There is a poor correlation between the quantity ingested and the serum concentration, respectively, and clinical manifestations observed. Manifestations at serum concentrations of < 450 mg/L, if any, will be only minor to moderate in nature. At levels of 450–850 mg/L, severe manifestations may occur, as a rule, and at levels of > 850 mg/l, severe manifestations are probable to occur. Irrespective of the dose, an irreversible and frequently lethal hepatic coma may occur under prolonged therapy.

In cases of poisoning, patients will initially suffer from nausea and vomiting. In the further course, CNS manifestations such as somnolence, muscular hypotension and a modified reflex behaviour will predominate. Severe poisoning will result in coma, respiratory depression, areflexia, and less often, convulsive seizures and anisocoria. EEG changes usually correspond to the severity of CNS manifestations, but not to the serum concentration. Frequently observed complications include cerebral oedema, hearing and visual disorders, aspiration and bronchopneumonia. Also cardiovascular manifestations such as tachyarrhythmia, bradycardia and other types of arrhythmia as well as a drop in blood pressure may occur. Clinical chemistry may show metabolic acidosis, often becoming manifest as lactacidosis, increase in ammonia levels, CK increase, drop in blood sugar levels, thrombocytopenia, etc.

As a measure of *primary detoxification*, gastric lavage should only be considered within the first hour after ingestion of very large quantities (if manifestations have already set in, only under protective intubation). A meaningful measure consists in the administration of charcoal and Glauber's salt as a type of "enteric dialysis" because of the enterohepatic circulation. A *further measure* recommended in cases of severe poisoning consists in carnitine administration. Several authors have reported on successful therapeutic attempts involving naloxone in the treatment of coma, respiratory depression and miosis. Effective measures of *secondary detoxification* include haemoperfusion in combination with haemodialysis. In cases of already existing thrombocytopenia, also haemodialysis alone may be useful due to the high share of non-protein bound valproic acid. Otherwise, therapy will be oriented by the existing symptomatology.

Evaluation of the case described
On the basis of the information given on the temporal relationship between tablet intake and the occurrence of manifestations including the detection of clearly elevated blood levels, a causal relationship has been confirmed. Symptoms, course and therapy correspond to those of a "classical" valproic acid poisoning.

4.3.5.2 2,4-Dinitrophenol (DNP)

4.3.5.3 Dimethoate

Lethal poisoning with dimethoate, probably associated with suicidal intent

The 74-year-old male patient had ingested a quantity of max. 100 mL of a pesticide, probably with a suicidal intent. Dimethoate belonging to the group of organophosphates constitutes the active substance of the product. In spite of resuscitation efforts and administration of high doses of atropine, the patient died on the same day.

Manifestations/course

When the emergency medical service found the elderly patient, he was unresponsive and showed almost no measurable blood pressure. He was intubated and respirated by the emergency physician. 100 mg atropine was administered as an antidote. After transport to a hospital, another dose of 300 mg atropine was administered. Despite such measure, no adequate blood pressure could be achieved, in the further course, even a tendency towards bradycardia was observed. Also a cardiac massage administered in the meantime was unsuccessful while the patient's blood pressure remained virtually unmeasurable. The patient's situation was furthermore complicated by gastrointestinal haemorrhage associated with melanorrhoea and anaemia. The cause of these complications has remained unknown to the BfR. Two and a half hour after the emergency medical service had been called, the unsuccessful resuscitation measures were discontinued and the patient's death was established.

Notes:

The active substance, dimethoate belongs to the group of organophosphates. Organophosphates (organophosphoric esters) are used as a contact, stomach and inhalative poison to control pests, in particular insects and spider mites. By way of acetylcholinesterase blocking, they produce a long-lasting depolarization of nicotinergic and muscarinergic acetylcholinesterase receptors. Both the organophosphate and the acetylcholine form a bond with the active centre of acetylcholinesterase. The bond which initially is reversible and can be reactivated by oximes at this stage, will stabilize due to cleavage of another substituent from the remaining organophosphate: the complex undergoes "ageing". Thus, the enzyme becomes irreversibly inhibited. The long-lasting polarization can only be neutralized by neosynthesis of acetylcholinesterase. Due to the esterase inhibition, an accumulation of acetylcholine in the brain, on the cholinergic synapses of the autonomic nervous system and on the motor end plate will take place. In addition, organophosphates inhibit carboxyesterase in the nervous tissue which, depending on the type of compound involved, may lead to direct and in some cases, irreversible damage to the nervous tissue after a certain latency period.

Organophosphates are readily absorbed by the oral route, but also by the inhalational and dermal routes. Due to their high toxicity, already small quantities are sufficient to cause relevant manifestations of poisoning. Depending on

type, quantity and mode of absorption, manifestations may occur within a few hours in cases of minor poisoning, or within a few minutes in cases of severe poisoning. The cardinal signs consist in the classical triad of miosis, hypersalivation and bradycardia. In cases of minor poisoning they are seen in a milder form. In addition, the clinical picture of poisoning includes visual disturbances, nausea, headache, vertigo, weakness of muscles and tremor. Findings of clinical chemistry will include a reduced activity of serum and erythrocyte cholinesterase, which in severe cases is below 10 % of the lower normal value or is not measurable. The renewed rise in cholinesterase levels may extend over a period of days or even weeks. Repeat determination of cholinesterase is a good indicator of the course of the poisoning and therefore may serve as a therapeutic criterion.

Therapy will be primarily focussed on the preservation of the vital functions, i.e. resuscitation, intubation, respiration and stabilization of the circulatory condition. During all these measures, self-protection of the helper is imperative. Atropine should be rapidly administered as an antidote in sufficiently high doses. The most adequate criterion for adequate dosage consists in the normalization of bronchorrhoea and other secretions such as sweating (dry armpits). Symptom-free patients need not be administered atropine. Administration of another antidote, namely oximes, is not required in cases of accidental or minor poisoning. However, in cases of severe poisoning, administration of this cholinesterase reactivator should be initiated (after atropine administration), if possible within the first six hours. However, the efficiency of obidoxime varies depending on the organophosphate involved. First aid measures and administration of antidote are followed by measures of primary detoxification. These include excessive gastric lavage in cases of oral ingestion, which is performed as long as the characteristic odour of the lavage fluid is still perceptible, and repeated (continuous) administration of charcoal and Glauber's salt. However, attention should be paid to possible intestinal atonia or even paralytic ileus caused by a prolonged administration of atropine. In such cases, charcoal administration should not be repeated but high enemas administered instead. In cases of severe poisoning, atropine is "biologically titrated" as a continuous infusion which is continued until a rise in cholinesterase to >30 % of the lower normal value is achieved, and may be discontinued abruptly at that point. Depending on the severity of the clinical picture, this stage may last for several days or weeks (in extremely severe cases). Measures of secondary detoxification are ineffective, they do not improve the prognosis.

As in the case described above, a quantity of 100 mL may cause severe poisoning which cannot be controlled in spite of administration of sufficiently high atropine doses.

Evaluation of the case described
Based on the case history data and the characteristic manifestations (coma, respiratory insufficiency, bradycardia) and in the absence of other causes, a causal relationship has been considered as possible.

5 Annex

5.1 Spectrum of cases reported during the 1 January – 31 December 2006 period

Table 11: 4 551 reports vs. degree of severity of health disturbances, classified by children and adults, with the adult cases differentiated by exposure in the private sphere and the working environment (except for cases with a causal relationship rated as "absent")

Incriminated products/uses	Reports, total numbers					Health impairment moderate/severe				
First level Second level Third level	*Total*	*Children*	*Adults*	*Home*	*Work*	*Total*	*Children*	*Adults*	*Home*	*Work*
I. Medicinal products	92	4	88	11	77	6	1	5	4	1
II. Veterinary medicinal products	3		3		3					
III. Chemical products	2.781	76	2.701	180	2.521	246	22	224	44	180
Wastes, solid	27		27		27	5		5		5
Waste gases	180		180	1	179	14		14		14
Sewage	21		21		21	2		2		2
Paints and related materials	158	1	157	2	155	9	1	8		8
Paint removers/strippers	15		15		15	1		1		1
Alkyd resin paints										
Emulsion paints	5		5		5	1		1		1
Artist's painting materials	1		1		1					
Glossy paints	31		31		31	1		1		1
Parquetry sealers	2		2		2					
Pigments										
Primers	12		12		12					
Paint thinners	56	1	55	1	54	5	1	4		4
Fire lighting products	9	7	2	2		5	3	2	2	
Building materials, auxiliary products	24		24	1	23	4		4	1	3
Building materials	126		126		126	18		18		18
Fuels, solid; auxiliary products										
Fuels, liquid	89	43	45		45	17	15	2		2
Petrol	27		27		27	1		1		1
Ethanol for technical use	9		9		9	1		1		1
Lamp oil	44	43				15	15			
Fuels, gaseous	6		6		6	2		2		2
Office materials, chemical	5		5		5	1		1		1
Decoration materials	1	1		1						
Dental materials	31		31		31	3		3		3
Disinfectants/sterilizers	350		350	2	348	22		22		22

Incriminated products/uses	Reports, total numbers					Health impairment moderate/severe				
First level Second level Third level	*Total*	*Chil-dren*	*A-dults*	*Home*	*Work*	*Total*	*Chil-dren*	*A-dults*	*Home*	*Work*
Deodorants for technical use	5	2	3		3					
Diagnostic agents/reagents	2		2		2					
Printing, auxiliary products	1		1		1					
De-icing products	2		2		2	1		1		1
Fire extinguishing media	24		24		24					
Flame retardants										
Galvanic cells	115		115		115	2		2		2
Dry cells	3		3		3					
Button batteries										
Accumulators	112		112		112	2		2		2
Galvanizing agents	2		2		2					
Galvanizing agents, auxiliary products	3		3		3					
Gases for technical use										
Antifreezes	4		4	1	3	2		2	1	1
Glass-working, auxiliary products										
Rubber, production materials	1		1		1					
Semiconductors, production materials										
Household auxiliary products, chemical-technical										
Hydraulic fluids	31		31		31	4		4		4
Refrigerants	12		12		12	1		1		1
Ceramics, auxiliary products	1		1		1					
Ceramic materials										
Glues	82	1	81	1	80	7		7		7
Coolants	26		26		26	4		4		4
Plastics, starting materials	16		16		16	2		2		2
Plastics, formulating materials	4		4		4	1		1		1
Leather processing products										
Luminophors	1		1		1					
Solvents for technical use	57		57		57	3		3		3
Soldering and welding products (except welding fumes)	13		13		13	1		1		1
Measuring equipment, chemical-technical										

Incriminated products/uses	Reports, total numbers					Health impairment moderate/severe				
First level Second level Third level	*Total*	*Chil-dren*	*A-dults*	*Home*	*Work*	*Total*	*Chil-dren*	*A-dults*	*Home*	*Work*
Heating meters										
Mercury thermometers										
Thermometer fluids										
Metallurgy, auxiliary products	20		20		20	4		4		4
Dairy, auxiliary products										
Paper-making, auxiliary products										
Photography, auxiliary products	6		6		6					
Radioisotopes, radionuclides	2		2		2					
Cleansing products	879	19	858	145	713	91	3	88	38	50
Drain cleanser	14	1	12		12	1		1		1
All-purpose cleansers	52		52	1	51	2		2	1	1
Oven and grill cleansers	23	1	22		22	7	1	6		6
Cleansers for electronic products										
Descaling products	29		29	1	28	1		1		1
Front wall and stone cleaners	8		8		8	1		1		1
Stain removers	1		1		1					
Floor polishes	4		4		4					
Washing-up detergents (manual use)	7	1	6		6					
Dishwasher detergents	10		10		10	1		1		1
Dishwasher cleaners	4		4		4					
Glass cleaners	97	4	93	89	4	22	1	21	21	
Industrial cleansers	44		44		44	3		3		3
Rinse aid for dishwashers	11	2	9		9					
Plastic cleansers										
Glossy paint cleansers	2		2		2					
Milking machine cleaners	42		42		42	4		4		4
Metal cleansers	24		24		24	2		2		2
Furniture polishes	1	1				1	1			
Soot removers	1		1		1	1		1		1
Lavatory cleansers	66		66	45	21	14		14	14	
Shoe and leather cleansers	21	3	17	17		5		5	5	
Carpet/upholstery cleansers	1		1		1					

Incriminated products/uses	Reports, total numbers					Health impairment moderate/severe				
First level Second level Third level	*Total*	*Chil-dren*	*A-dults*	*Home*	*Work*	*Total*	*Chil-dren*	*A-dults*	*Home*	*Work*
Detergents	14		14	1	13	1		1	1	
Detergents, auxiliary products	4	1	3		3					
Joke articles										
Lubricants	25		25		25	2		2		2
Welding fumes	35		35	1	34					
Dust-laying oils										
Toys	1	1			1					
Textile, auxiliary products	3	1	2	3						
Propellants/sprays	2		2		2					
Water treatment products	3		3		3					
Pet shop products										
IV. Cosmetics/personal hygiene products	33	1	32	2	30	2	1	1	1	
Hair care products	10		10		10					
Permanent wave products	3		3		3					
Depilatory products										
Hair dyes/colorants	5		5		5					
Hair conditioners										
Hair tonics										
Shampoos	2		2		2					
Skin care products	16	1	15		15	1	1			
Bath oils/salts	2		2		2					
Tanning products										
Creams/ointments	2		2		2					
Deodorants	2	1	1		1	1	1			
Face tonics										
Make-up products	1		1		1					
Oils										
Perfumes/after shaves	2		2		2					
Powders										
Soaps	5		5		5					
Sun blockers										
Oral care/dental products	4		4	2	2	1		1	1	
Nail care products	2		2		2					
V. Pesticides	107	2	105	6	99	4		4	1	3
Acaricides										
Fungicides	5		5	1	4					
Herbicides	20		20	1	19					

Incriminated products/uses	Reports, total numbers					Health impairment moderate/severe				
First level Second level Third level	*Total*	*Chil-dren*	*A-dults*	*Home*	*Work*	*Total*	*Chil-dren*	*A-dults*	*Home*	*Work*
Wood preservatives	6		6		6					
Insecticides	30		30	4	26	2		2	1	1
Carbamates										
Chlorinated hydrocarbons	1		1		1					
Phosphoric esters	11		11	1	10	1		1	1	
Pyrethroids	4		4	2	2					
Molluscicides										
Repellents	1		1		1					
Rodenticides	4	2	2		2					
Anticoagulants										
Phosphates	2		2		2					
Seed dressings	1		1		1					
VI. Agrochemicals other than pesticides	16		16		16	1		1		1
Fertilizers	6		6		6					
Plant care products	1		1		1					
Growth regulators										
VII. Substances of abuse Narcotic drugs	1		1	1		1		1	1	
VIII. Plants	4		4	3	1	1		1		1
IX. Fungi										
X. Animals	1		1		1					
XI. Foods and beverages	52	4	48	25	23	11		11	9	2
Alcoholic beverages	7		7	4	3	2		2	2	
Food additives	4		4	1	3	1		1		1
Tobacco and tobacco products										
Food supplements	10		10	9	1	4		4	4	
XII. Warfare/anti-riot agents	3		3		3					
Pyrotechnic products										
Tear gas										
XIII. Miscellaneous	109	1	108	5	103	13		13	2	11
Textiles	6		6	1	5					
Clothing	5		5	1	4					
Furnishing fabrics										
XIV. Primary substances	1.371	5	1.366	8	1.358	119	2	117	5	112
XV. Industrial accidents										

5.2 Notification form for cases of poisoning

Bundesinstitut für Risikobewertung
Dokumentations- und Bewertungsstelle
für Vergiftungen
Postfach 33 00 13

14191 Berlin

Stempel, Telefon-Nummer und Unterschrift der/des Ärztin/Arztes

Mitteilung bei Vergiftungen

nach § 16e Abs. 2 des Chemikaliengesetzes
(Telefon: 01888-412-3460, Fax: 01888-412-3929. E-Mail: giftdok@bfr.bund.de

1. Angaben zur/zum Patientin/en:

Alter: Jahre ☐ Monate (bei Kindern unter 3 Jahren) ☐ ☐ männlich ☐ weiblich Schwangerschaft (**freiwillig** auszufüllen) ☐ ja ☐ nein

2. Vergiftung ☐ **Verdacht** ☐

Unbedingt Handelsname der Zubereitung/des Biozid-Produktes oder Stoffname, aufgenommene Menge und Hersteller (Vertreiber); ggf. vermutete Ursache

a.

b.

c.

3. Exposition ☐ akut ☐ chronisch ☐ oral ☐ inhalativ ☐ Haut ☐ Auge sonstiges, welche

Art der Vergiftung:	☐ akzidentell (Unfall)	☐ gewerblich	☐ Verwechslung	
	☐ suizidale Handlung	☐ Abusus	☐ Umwelt	☐ Sonstiges
Ort:	☐ Arbeitsplatz	☐ im Haus	☐ Schule	
	☐ Kindergarten	☐ im Freien	☐ Sonstiges	
Labor-Nachweis:	☐ ja	☐ nein		
Behandlung:	☐ keine	☐ ambulant	☐ stationär	
Verlauf:	☐ nicht bekannt	☐ vollständige Heilung	☐ Defektheilung	☐ Tod
	☐ Spätschäden (nicht auszuschließen)			

(**freiwillig** auszufüllen)

4. Symptome, Verlauf – stichwortartig – (ggf. anonymisierte Befunde, Epikrise beilegen)

5.3 Notification form for industrial accidents

BfR-Fragebogen zur Expositionsermittlung bei Stör- und Transportunfällen

Pers. Nummer

weiblich ☐ männliich ☐ Erwachsene(r) ☐ Kind ☐

Bereich I

Unmittelbar Betroffene(r)

(Bitte Eintrag in die Landkarte)

Direkt am Unfallort ☐
Nahe Unfallort ☐
☐ m

Arbeiter(in) ☐
Feuerwehr ☐
Polizei/Rettungsdienst ☐
Privatperson ☐
Sonstige(r) ☐

Erstexposition Uhrzeit ☐ Datum ☐
Dauer ständig ☐ nicht ständig Stunden/Tage ☐
Schutzmaßnahmen ja ☐ nein ☐
Symptome ja ☐ nein ☐
(Wenn ja, bitte Dokumentation auf dem Meldebogen)

Bereich II

Nicht unmittelbar Betroffene(r)

(Bitte Eintrag in die Landkarte)

Entfernung vom Unfallort
☐ m
☐ km

Anwohner ☐
Beschäftigte(r)/Arbeitnehmer(in) ☐
Sonstige(r) ☐ ☐

Erstexposition Uhrzeit ☐ Datum ☐
Dauer ständig ☐ nicht ständig Stunden/Tage ☐
Schutzmaßnahmen ja ☐ nein ☐
Symptome ja ☐ nein ☐
(Wenn ja, bitte Dokumentation auf dem Meldebogen)

Biomonitoring **Stoff:**

Blutentnahme ☐ Datum ☐ Zeitpunkt ☐ Konzentration ☐
Urinprobe ☐ Datum ☐ Zeitpunkt ☐ Konzentration ☐
Spontanurin ☐ 24h Sammelurin ☐ Kreatinin ☐

List of Poison Control Centres in Germany

Berlin	BBGes – Giftnotruf Berlin Institut für Toxikologie Klinische Toxikologie und Giftnotruf Berlin	Oranienburger Str. 285	13437 Berlin Germany	Phone: +49-30-19240 Fax: +49-30-30686721 E-Mail@giftnotruf.de www.giftnotruf.de
Bonn	Informationszentrale gegen Vergiftungen Zentrum für Kinderheilkunde Universitätsklinikum Bonn	Adenauerallee 119	53113 Bonn Germany	Phone: +49-228-19240 Fax: +49-228-28733314 GIZBN@ukb.uni-bonn.de www.meb.uni-bonn.de/giftzentrale
Erfurt	Gemeinsames Giftinformationszentrum der Länder Mecklenburg-Vorpommern, Sachsen, Sachsen-Anhalt und Thüringen	Nordhäuser Str. 74	99089 Erfurt Germany	Phone: +49-361-730730 Fax: +49-361-7307317 Info@ggiz-erfurt.de www.ggiz-erfurt.de
Freiburg	Zentrum für Kinderheilkunde und Jugendmedizin Vergiftungs-Informations-Zentrale	Mathildenstr. 1	79106 Freiburg Germany	Phone: +49-761-19240 Fax: +49-761-27044 57 giftinfo@kikli.ukl.uni-freiburg.de www.giftberatung.de
Göttingen	Giftinformationszentrum-Nord der Länder Bremen, Hamburg, Niedersachsen und Schleswig-Holstein (GIZ-Nord) Universität Göttingen – Bereich Humanmedizin	Robert Koch-Str. 40	37075 Göttingen Germany	Phone: +49-551-383180 Fax: +49-551-3831881 giznord@giz-nord.de www.giz-nord.de
Homburg	Informations- und Behandlungszentrum für Vergiftungen des Saarlandes Klinik für Kinder- und Jugendmedizin		66421 Homburg/Saar Germany	Phone: +49-6841-19240 +49-6841-1628314 Fax: +49-6841-1628438 kigift@uniklinikum-saarland.de www.uniklinikum-saarland.de/de/einrichtungen/andere/giftzentrale
Mainz	Klinische Toxikologie und Beratungsstelle bei Vergiftungen der Länder Rheinland-Pfalz und Hessen Universitätsklinikum	Langenbeckstr. 1	55131 Mainz Germany	Phone: +49-6131-19240 +49-6131-232466 Fax: +49-6131-232469 +49-6131-232468 giftinfo@giftinfo.uni-mainz.de www.giftinfo.uni-mainz.de

Munich	Giftnotruf München Toxikologische Abteilung der II. Medizinischen Klinik und Poliklinik, rechts der Isar der Technischen Universität München	Ismaninger Str. 22	81675 München Germany	Phone: +49-89-1 92 40 Fax: +49-89-41 40 24 67 tox@lrz.tum.de www.toxinfo.org
Nurem-berg	Giftnotrufzentrale Nürnberg Medizinische Klinik 2, Klinikum Nürnberg Lehrstuhl Innere Medizin-Gerontologie, Universität Erlangen-Nürnberg	Prof.-Ernst-Nathan-Str. 1	90419 Nürnberg Germany	Phone: +49-9 11-3 98 26 65 Fax: +49-9 11-3 98 21 92 Giftnotruf: +49-9 11-3 98 24 51 or +49-9 11-3 98 26 65 muehlberg@ klinikum-nuernberg.de www.giftinformation.de

5.4 Press releases on toxicological problems issued by the BfR in 2006

From welding fumes to sewage gas – Hidden risks for consumers
New brochure gives overview of poisoning cases in 2004
02/2006, 2006-01-12

Elevated morphine levels in poppy seeds: Risk to health not ruled out
BfR recommends a guidance value and a daily upper intake level
05/2006, 2006-02-20

Exercise caution when using "nano-sealing sprays" containing a propellant!
When used in confined spaces, they can cause respiratory problems
08/2006, 2006-03-31

Nanotechnology – Applications, Trends and Risks
BfR gathers up-to-date information on nano particles in consumer-related application areas
09/2006, 2006-04-06

Cause of intoxications with nano spray not yet fully elucidated
Scientific discussions at BfR did not produce any clear results
10/2006, 2006-04-12

Nano particles were not the cause of health problems triggered by sealing sprays!
Products did not contain any ultrafine particles
12/2006, 2006-05-26

Carcinogenic effect of inhaled formaldehyde sufficiently documented
BfR presents results of scientific assessment and recommends new classification
14/2006, 2006-05-29

Health effects should be systematically recorded for industrial and transport accidents involving chemicals!
Standardised notification forms can now be downloaded from the Internet
19/2006, 2006-07-07

BfArM and BfR warn: Exercise caution when buying muscle-building products
Joint press release by BfArM and BfR
24/2006, 2006-08-28

Indications that styrene has a tumorigenic effect in humans
Results of experimental research at BfR are of importance for the reassessment of this existing substance
25/2006, 2006-08-31

REACH: An opportunity for more consumer protection
The success of the new European chemicals legislation will depend on its practical implementation
32/2006, 2006-12-18

List of abbreviations (German notation)

Used in the brochure	Meaning	Common use
µmol/l	Masse pro Volumen in Mikromol pro Liter	µmol / l
136/min	Herzfrequenz	HF 136 / min
170/107 mmHg	Blutdruck (Einheit: Millimeter Quecksilbersäule)	RR 170 / 107 mm Hg
31/nl	Menge pro Volumen	31 / nl
ALAT	Alaninaminotransferase	ALT
ALT	Alaninaminotransferase	ALT
ARDS	Adult Respiratory Distress Syndrome (Atemnotsyndrom)	ARDS
ASAT	Aspartataminotransferase	AST
AST	Aspartataminotransferase	AST
ATP	Adenonsintriphosphat	ATP
BE	Base-Excess (Basenüberschuss)	BE
BfR	Bundesinstitut für Risikobewertung	BfR
BG	Berufsgenossenschaften	BG
BgVV	Bundesinstitut für gesundheitlichen Verbraucher-schutz und Veterinärmedizin	BgVV
BMELV	Bundesministerium für Ernährung, Landwirtschaft und Verbraucherschutz	BMELV
BMU	Bundesministerium für Umwelt Naturschutz und Reaktorsicherheit	BMU
BVL	Bundesamt für Verbraucherschutz und Lebensmittel	BVL
ChemG	Chemikaliengesetz	ChemG
CK	Creatinkinase	CK
CK-MB	Creatinkinase, Herzmuskeltyp	CK-MB
CPK	Creatinkinase	CK
C-reaktives Protein	Capsel-reaktives Protein	CRP
CT	Computertomographie	CT
d	Tag	d
DNP	Dinitrophenol	DNP
EEG	Elektroenzephalogramm	EEG
EFSA	European Food Safety Authority	EFSA
EG	Europäische Gemeinschaft	EG
ESPED	Erfassungsstelle für seltene Pädiatrische Erkrankungen	ESPED
EU	Europäische Union	EU
FEV1	Einsekundenkapazität	FEV1
GCS	Glasgow Coma Scale	GCS
GIZ	Giftinformationszentrum	GIZ
GOT	Glutamat-Oxalacetat-Transaminase	GOT
GPT	Glutamat-Pyruvat-Transaminase	GPT

Used in the brochure	Meaning	Common use
h	Stunde	h
Hb	Hämoglobin	Hb
HD	Hämodialyse	HD
HNO	Hals-Nasen-Ohren	HNO
HWZ	Halbwertzeit	HWZ
HZV	Herzzeitvolumen	HZV
J	Joule	J
l	Liter	l
LD 50	mittlere letale Dosis	LD 50
LDH	Laktat-Dehydrogenase	LDH
Met-Hb	Methämoglobin	Met-Hb
mg	Milligramm	mg
mg %	Milligramm Prozent	mg / dl
mg/dl	Milligramm pro Deziliter	mg / dl
mg/kg	Milligramm pro Kilogramm	mg / kg
mg/l	Masse pro Volumen in Milligramm pro Liter	mg / l
min	Minuten	min
ml	Milliliter	ml
mm Hg	Millimeter Quecksilbersäule	mm Hg
mmol/l	Millimol pro Liter	mmol / l
MRT	Magnetresonanztomographie	MRT
n/µl	Menge pro Mikroliter	n/µl
n/nl	Menge pro Nanoliter	n/nl
p_aCO_2 35,4 torr	arterieller Kohlendioxid-Partialdruck	p_aCO_2
p_aO_2 61,5 torr	arterieller Sauerstoff-Partialdruck	p_aO_2
pCO_2	Kohlendioxid-Partialdruck	pCO_2
pH	pH-Wert, Wasserstoffionenkonzentration	pH
pO_2	Sauerstoff-Partialdruck	pO_2
PRINS	Produktinformationssystem	PRINS
RAPEX	rapid alert system for all dangerous consumer products, with the exception of food, pharmaceutical and medical devices, deutsch: Schnellwarnsystem der EU für alle gefährlichen Konsumgüter, mit Ausnahme von Nahrungs- und Arzneimitteln sowie medizinischen Geräten.	RAPEX
RAW	Atemwegswiderstand	RAW
RG´s	Rasselgeräusche	RG´s
torr	Druck in torr (alte Einheit)	mm Hg
U/l	Units pro Liter (Einheiten pro Liter)	U / l
UV	Ultraviolett	UV
WHO	World Health Organization	WHO
WRMG	Wasch- und Reinigungsmittelgesetz	WRMG
ZNS	Zentralnervensystem	ZNS

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