

Recommendation of the Federal Environment Agency

Recommended Usage of Human Biomonitoring for Chemical Release Related to Accidents or Non-Normal Conditions of Operation with Exposure of the Public

Opinion of the Human Biomonitoring Commission of the Federal Environment Agency

Contents

1	Introduction.....	1
2	Exposure Survey after Chemical Release – Monitoring of the Surrounding Area and Environment.....	2
3	Exposure Survey after Chemical Release – Human Biomonitoring.....	4
4	Practical Proceedings for HBM Examinations for Non-Normal Operating Conditions or Accident-Related Release of Chemicals.....	6
4.1	Informed Consent of Affected Individuals and Data Security.....	6
4.2	Selection of Appropriate Parameters and Sampling Materials.....	7
4.3	Sample Collection.....	13
4.4	Logistics.....	15
5	Quality Assurance.....	16
6	Participation of External Expertise.....	16
7	Risk Communication.....	16
	Acknowledgement.....	17
	Internet Tips and Links:.....	17
	References.....	17

1 Introduction

Past experience with non-normal operating conditions or accident related chemical release shows that authorities responsible for crisis management request advice and expertise from the Department of Public Health (DPH, German: Öffentlicher Gesundheitsdienst, ÖGD) regarding toxicological and chemical questions as well as problems affecting the public. The DPH facilities are generally used only for consultation and do not have a primary decision-making responsibility in connection with chemical incidents. This resulted in the recommendation that the DPH be explicitly included in the immediate emergency management for disaster control and in the delegation of instructions [Pfenninger et al. 2004]. The DPH maintains diverse expertise that provides service in the acute and follow-up phases and can be used in a reasonable way [Thriene und Oppermann 2005].

According to the type of damage, it can be of general interest to examine potential health effects. If necessary, observation of the affected community over a longer period of time could be helpful in recognizing possible long-term effects. Such examinations could contribute to better understanding the potential danger of each noxious substance, which is often described by the affected persons themselves who wish to obtain information about possible health problems and risks. In this situation, it is advised that details regarding the exact exposure as well as the emergence of health affliction in the affected individuals be collected. According to the experience of the "German Poison and Product Documentation Centre" in the Federal Institute for Risk Assessment (German: Bundesinstitut für Risikobewertungen, BfR), generally no systematic, accident-related exposure report and documentation is collected in cases where a larger number of affected residents report health problems. As a result, the follow-up processing of such accidents becomes difficult if not impossible to assess and communicate the risks of the health consequences [Hahn 2003]. The processing (risk assessment and risk communication) often lasts long after the time period of the acute event [Cullinan 2002, Ferner 1993].

This article will provide recommendations and assistance for the practical application of human biomonitoring (HBM) in connection with risk assessment and risk communication during non-normal operating conditions or accident-related release of chemicals with exposure of the public. Certain rules apply to emergency task forces and to professionals, which will not be addressed herein. Detailed recommendations for the DPH in the case of bioterrorist attacks have already been published [Fock et al. 2005].

It is strongly suggested that the acute medical care and decontamination of affected persons [Domres et al. 2005] take priority. Additionally, there are no recommendations regarding accident management in this report, which is controlled by each individual state and has no established legal procedure that guarantees the financial support for HBM examinations per se.

2 Exposure Survey after Chemical Release – Monitoring of the Surrounding Area and Environment

Decisions regarding the course of action after a larger release of chemical matter (gases, aerosols, particles) are generally made by an emergency task force, in which the DPH can be included even in the early phases of danger prevention. It is the professional task of the DPH to assess the possible health hazards to the public and to submit the appropriate

recommendations for a further course of action (conduct, evacuation, sanitation procedures). Previous cases of non-normal operating conditions or transportation accidents have shown that public health departments or other institutions must comment on potentially acute but also potentially long-term consequences [Heudorf und Peters 1994 und 1997, Heudorf 1998].

The exposure situation after non-normal operating conditions or accident-caused chemical release can roughly be separated into two scenarios: the released substances are either known or are (predominately) unknown. To evaluate possible health hazards, toxicological data such as acute and chronic toxicity or carcinogenicity of the released chemical(s) should be identified and a initial exposure assessment should be conducted according to the type, amount and extent of the release and contamination.

Generally, the monitoring of the surrounding area and environment (ambient monitoring), that is, the analyses of the air, ground and bodies of water, are well established. These analyses are normally conducted immediately after the chemical release: for verification, for answering questions regarding evacuation and sanitation necessity and for water-quality alert. So that these data can also be used for the estimated exposure of the affected individuals, a systematic place and time-related measurement of the released substances, as well as standardized documentation of the exposure of the affected individuals is recommended. Such an example is given in the proposals of the "German Poison and Product Documentation Centre" in the Federal Institute for Risk Assessment (BfR). Figure 1 is a schematic representation of the recommended spatial arrangement of measurement points in the surrounding area, which are to be more exactly defined when considering the regional topography. An appropriate questionnaire from the BfR regarding exposure evaluation during non-normal operating conditions and transportation accidents is seen in Attachment 2 [Hahn 2003, Hahn et al. 2003].

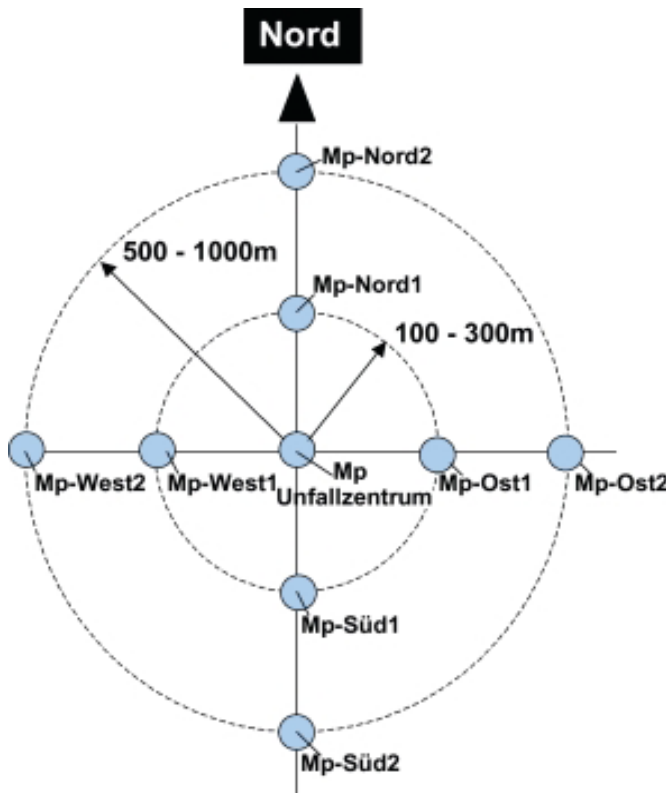


Figure 1: Measurements during non-normal conditions of operation/transport accidents; schematic representation of a recommended layout for measurement points (mp) in the surrounding area

3 Exposure Survey after Chemical Release – Human Biomonitoring

Possible effects of a chemical exposure are dependent not only on the substance, but also on the dose or types of exposure. For exposure assessment of the affected individuals it is advised to measure the individual internal exposure using human biomonitoring examinations [Zielhuis 1980; Kommission HBM 1996, Brondeau 1999, Angerer und Weiss 2001, Ewers und Wilhelm 2001]. If data regarding the internal exposure are available, a quantitative risk assessment and reliable health evaluation can be conducted. Additionally, using human biomonitoring data, the individual exposure and therefore potential individual risk can be communicated in a more differentiated and better manner than if the exposure and risk were modeled from ambient measurements [Ewers und Suchenwirth 1996, Neumann 2004, Pirkle et al. 1995, Verberk 1995].

Because of this, human biomonitoring should have a comparable importance to ambient monitoring during non-normal operating conditions and transportation accidents. Human biomonitoring can be used to determine necessary actions, especially for the verification and

expert opinion of long-term consequences, acute damage, and possibly for the monitoring and control of treatment.

Human biomonitoring can also be relevant for workers compensation in regards to service accident notifications for the emergency task forces (such as fire department, ambulance, police). For this, the Permanent Conference for Catastrophe Precaution and Catastrophe Protection (German: SKK= Ständige Konferenz für Katastrophenvorsorge und Katastrophenschutz) is currently working on supplementary attachments to the existing BfR department service regulations 500 [FwDV 500 “Units in ABC-Assignment”, German: “Einheiten im ABC-Einsatz“].

Even if there are currently no analysis methods that consider environmental medical demands at a very low detection level, initial urine and perhaps also blood samples should be collected for verification through a possible future analysis. In cases in which sufficient samples numbers and reference values from the general public are not available [<http://www.umweltbundesamt.de/uba-info-daten/daten/monitor/referenz.htm>], it is recommended that samples from a non-exposed, demographically comparable group simultaneously be taken [Heudorf et al. 1997].

Retrospectively, an actual exposure is only difficult to quantify. It can, however, often be detected as an internal exposure using applicable human biomonitoring examinations directly after an occurrence. This requires knowledge of the applicable methods and immediate action with substances with rapid degradation rates (Table 1). Experience with larger accidents has

Table 1: HBM-exposure markers – appropriate time frames for the use of different human biomonitoring procedures after an acute exposure. [according to IPCS, Environmental Health Criteria 155, Geneva, 1993]	
Human-Biomarker	Time frame (Days after exposure)
Metabolites in urine	1 – 2
Albumin adducts	1 – 10
DNA adducts	1 – 20
Hemoglobin adducts	1 – 60

shown that the exposure assessment of affected individuals in an acute situation, without previous planning or defined responsibilities, is difficult if not impossible [Ferner 1993, Int. Clearinghouse 1999].

4 Practical Proceedings for HBM Examinations for Non-Normal Operating Conditions or Accident-Related Release of Chemicals

A flowchart for the use of HBM for non-normal operating conditions or accident related release of chemicals can be found in Figure 2. The following provides recommendations for the practical application of HBM examinations. These include the informed consent of the affected individuals and the data security, the selection of applicable parameters and materials for sampling, the collection of samples including documentation and the logistics regarding shipping and handling of the samples.

4.1 Informed Consent of Affected Individuals and Data Security

Before collecting samples for human biomonitoring, the affected individuals are to be informed of the procedure and must give written consent to the collection and examination of samples. It must be ensured that personal information and data security remain confidential according to patient/physician confidentiality laws and that only group results will be evaluated and published anonymously.

For each participant a sampling protocol and questionnaire for exposure assessment (see Attachment 2) and possibly for documenting emerged symptoms must be filled out and marked with a code.

In order to maintain the trust of the public and of each public health office, the enforcement of data protection is imperative. The name and address of the individual is to be documented on a separate “cover page” (Attachment 3), which will remain in the hands of the public health office, will not be recorded and will be used solely for the sharing of personal test results using a code. If possible, the experience and methods of the respective countries’ cancer registry could be used regarding abidance to data security. The countries’ jurisdiction regarding the determination of data security will be referred to, recommended and used by the respective data security official.

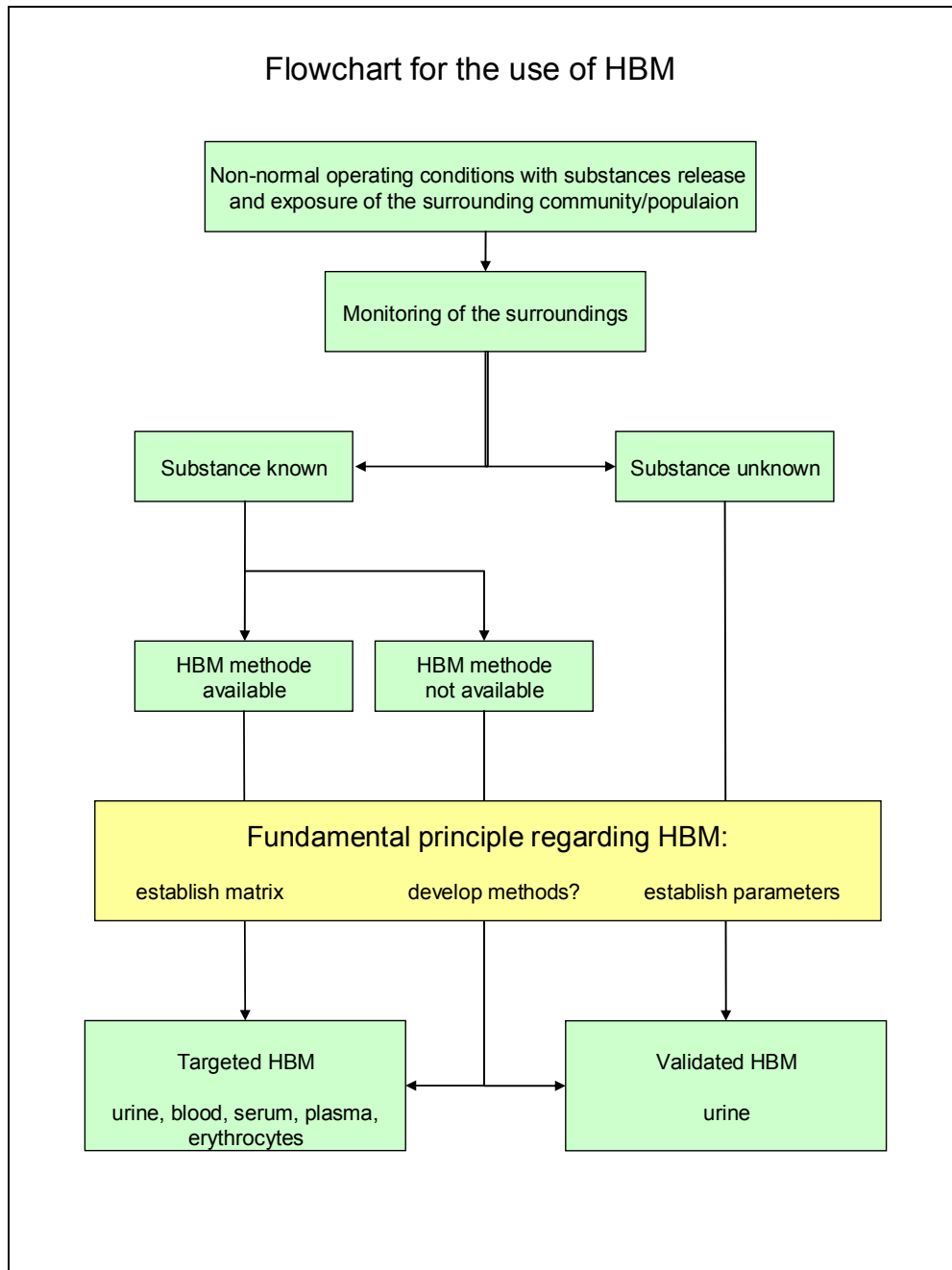


Figure 2: Flowchart for adaptation of HBM for non-normal operating conditions/transport accidents.

4.2 Selection of Appropriate Parameters and Sampling Materials

As long as the released substances are known, the appropriate parameters for human biomonitoring can be researched in the relevant literature and on the Internet. The corresponding samples can then be selectively collected. A fitting sampling matrix (blood, urine, etc.) and valid detection methods can initially be found in the published procedures of the DFG

Senate Committee (German Research Foundation) for the testing of hazardous substances [DFG 1976-2006]. These publications contain information regarding substance determination and their metabolites found in bodily fluids. The health risk after exposure to these chemical substances can be roughly evaluated according to the BAT-values [DFG 1983-2006]. Detailed recommendations for methods of human biomonitoring of heavy metals and trace elements were compiled by Cornelis and co-workers (1995). A comprehensive compilation of volatile organic compounds (VOC) can be accessed online [Heinrich-Ramm et al. 2000].

In Table 2, substances that are appropriate and implemented for human biomonitoring have been compiled. Carcinogenic substances are also listed in the table, several of which exhibit a high risk potential as volatile compounds [EC, Seveso II Direktive 1996 and 2003; Christou 2000]. The biochemical changes in a person after exposure to a genetically toxic substance could be documented using the detection of adducts. A reliable method is the hemoglobin adduct monitoring [Commission 2003], which is sufficiently valid for analysis and diagnosis in acute cases. DNA adducts, despite several current publications, are still not seen as being fully developed and diagnostically reliable.

Table 2:

List of established substances for the parameters of human biomonitoring (incl. hemoglobin adducts) with details regarding sampling materials and instructions for sample collection.

[IPASUM 2005: www.arbeitsmedizin.uni-erlangen.de]

Metals and relevant intermediate metabolic products	Whole Blood	Plasma	Urine
Aluminium	•E	• E(P) #	•PC
Antimony			•PC
Arsenic			•PC
Beryllium			• PC
Cadmium	• E		• PC
Chromium	• E, Ery		• PC
Cobalt	• E		• PC
Copper		• EP	• PC
Lead	• E		
Magnesium	• E		• PC
Manganese	• E		• PC
Nickel	• E		• PC
Platinum		•EP	• PC
Selenium		• EP	• PC
Thallium			• PC

Table 2 (continued)

Metals and relevant intermediate metabolic products	Whole Blood	Plasma	Urine
Vanadium			• PC
Zink		• EP	• PC
Organic Solvents and their Metabolic Products			
Acetone	• A		• A
Aliphatic Hydrocarbon-Screening	• A		
Alcohols, Ketone-Screening			• A
Alcoycarbonic acid - Screening			• PC
Aromatic Hydrocarbon-Screening	• A		
Benzene	• A		
Butyl Alcohol			• A
Butanone (Methylethylketone)			• A
Butoxy Acetic Acid			• PC
Butyl Acetate (as Butyl Alcohol)			• A
Butoxypropanol			• PC
Chloroform	• A		
Chlorphenols			• PC
Cyclohexane (Metabolite Cyclohexandiol)			• PC
Cyclohexanone (Metabolite Cyclohexandiol)			• PC
1,1- und 1,2-Dichlorethane	• A		
1,1- und 1,2-Dichlorethene	• A		
Dichloromethane	• A		
1-Ethoxy- 2-Propanol			• PC
Ethoxyacetic Acid			• PC
Ethylbenzene	• A		
Frigenes	• A		
Glycoles			• PC
Halogenated Hydrocarbon-Screening	• A		
n-Heptane	• A		
Heptanone	• A		
n-Hexane	• A		
2,5-Hexandione			• PC
Hexanone (als 2,5-Hexandion)			• A
Hippuric Acid			• PC
Isopropanole (as Acetone)			• A
o-Cresol			• PC
Mandelic Acid			• PC
Methanol			• A
1-Methoxypropanol-2			• PC
2-Methoxypropionic Acid			• PC

Table 2 (continued)

Organic Solvents and their Metabolic Products	Whole Blood	Plasma	Urine
Methoxyacetic Acid			• PC
Methyl Acetate (as Methanol)			• A
Methylhippuric Acid			• PC
Methylisobutylketone			• A
Methylpentane	• A		
t,t-Muconic Acid			• PC
Octane	• A		
Phenol			• PC
Phenylglyoxylic Acid			• PC
Propanol			• A
Propylbenzene	• A		
S-Phenylmercapturic Acid			• PC
Carbon Disulphide (as 2-Thio-1,3-thiazolidin-4-carboxylic acid)			• PC
Styrene	• A		
Tetrachlorocarbon	• A		
Tetrachlorethene (Perchlorethylene)	• A		
Tetrahydrofurane			• A
Tolulene	• A		
Toluric Acid (Methylhippuric Acid)			• PC
1,1,1-Trichlorethane	• A		
Trichlorethene	• A		
Trichloroacetic Acid			• PC
Trichlorethanol	• E		
Xylene	• A		
Aromatic Amines, Nitro-Compounds and their Metabolic Products			
Acrylnitrile	• Hb-AD		• PC
4-Aminobiphenyl	• Hb-AD		• PC
Amino-Dinitrotoluenes (TNT-Metabolites)	• Hb-AD		• PC
Amino-Nitrotoluenes (Dinitrotoluene-Metabolites)	• Hb-AD		• PC
o-Anisidine (ubiquitous, dye)	• Hb-AD		• PC
Aniline	• Hb-AD		• PC
Aromatic Amines – Screening	• Hb-AD		• PC
Benzidine	• Hb-AD		• PC
3-Chloraniline (Barbam, Chlorpropham)	• Hb-AD		• PC
4-Chloraniline (Diflubenzuron, Buturon, Monolinuron, Monuron)	• Hb-AD		• PC
Diaminodiphenylmethane	• Hb-AD		• PC
3,4-Dichloraniline (Diuron, Linuron, Neburon, Propanil)	• Hb-AD		• PC
3,5-Dichloraniline (Chlozolinates, Iprodione, Procymidones, Vinclozolin)	• Hb-AD		• PC

Table 2 (continued)

Aromatic Amines, Nitro-Compounds and their Metabolic Products	Whole Blood	Plasma	Urine
Dichlorbenzidine	● Hb-AD		● PC
Dimethoxybenzidine	● Hb-AD		● PC
Dimethylbenzidine	● Hb-AD		● PC
1-Naphthylamine	● Hb-AD		● PC
2-Naphthylamine	● Hb-AD		● PC
Nitroaromates	● Hb-AD		● PC
o-Nitrophenol (Aniline)			● PC
p-Nitrophenol (Aniline)			● PC
m-Toluidine (Phenmedipham)	● Hb-AD		● PC
o-Toluidine	● Hb-AD		● PC
p-Toluidine	● Hb-AD		● PC
Toluylendiamine	● Hb-AD		● PC
Others			
Acrylamide	● Hb-AD		● PC
Bisphenole A			● PC
Cotinine			● PC
DDT, DDE	● E, G	● EP, G	
Dichlorphenole			● PC
Diethylsulfate	● Hb-AD		
Dimethylformamide	● Hb-AD		
Epichlorhydrine	● Hb-AD		
Ethylene	● Hb-AD		● PC
Ethylenoxide	● Hb-AD		
Fluoride			● PC
Glycidol	● Hb-AD		
HCB, HCH	● E, G	● EP, G	
Hydroxyethylvaline (Ethylenoxid-Metabolit)	● Hb-AD		
Hydroxyphenanthrene (PAH-Metabolite)			● G
1-Hydroxypyrene (PAH-Metabolite)			● G
Methemoglobin	● E		
Methyl Bromide	● Hb-AD		
N-Methylformamide (Dimethylformamide)	● Hb-AD		● PC
Organochloride Compounds	● E, G	● EP, G	
Organophosphates (6 Metabolites)			● PC
PCBs	● E, G	● EP, G	
PCP		● EP, G	● G
Perfluorooctanoic Acid und Salts		● EP	
Phthalates (Metabolites)			● PC
Propylenoxide	● Hb-AD		

Table 2 (continued)

Others	Whole Blood	Plasma	Urine
Pyrethroides (5 Metabolites)			● PC
Thiodiglycolic acid (Vinyl Chloride)			● PC
2-Thio-thiazolidine-4-carboxylic acid (Carbon Disulfide)			● PC
<p>Generally, it is recommended that extraction materials and shipping vials be requested from the laboratory performing the respective analysis. A = Ampule (Whole Blood/Urine) PC = Plastic Container 50ml G = Glass Vial E = EDTA-Whole Blood (Plastic Test Tubes) EP = EDTA-Plasma, E(P) # = The material should be shipped as EDTA-Whole Blood (tube) and the determination should be done in the plasma Ery = Mature Erythrocytes (Plastic Vial) Hb-AD = Hemoglobin Adducts. Mature, erythrocyte lysate are needed for the determination of hemoglobin adducts</p>			

One should not forego the examination of a non-exposed demographically comparable control group if reference values [<http://www.umweltbundesamt.de/uba-info-daten/daten/monitor/referenz.htm>] for the respective parameters are available.

Upon the release of an unknown chemical compound, one cannot wait for the determination of the released substances before deciding which HBM examinations can reasonably be used. After a single, brief exposure, for example, a substance could already be metabolized and excreted and made therefore undetectable when testing. In such ambiguous situations, – also for validation – the affected individuals should be offered the possibility to give first-void urine samples to be deep-frozen and preserved for further investigation. If there are no established analysis methods for theoretically examinable metabolites of a known contaminant, which fulfill the needs of environmental medicine with very low detection levels, there might be enough time to develop appropriate methods. Such handling has been successfully and repeatedly used [Heudorf und Peters 1997, Heudorf et al. 1997].

Urine samples are advantageous in that they can easily be collected – even from children with informed consent from the parents. Even if no adequate analysis method can be developed, there is no ethical problem involved in discarding these samples, which are collected in a non-invasive manner. This possibility should be communicated in advance with the affected individuals so as to avoid creating false hope.

The taking and storage of “suspicious” blood samples, in contrast, seems to be problematic when considering ethical aspects, especially if children are affected. Blood samples should, therefore, only be collected in large amounts if it is clear how and when they can be reasonably examined.

If blood or urine samples from affected individuals are collected for clarification of acute symptoms at a doctor’s office or in a hospital, it is recommended that the affected individual agree to have an aliquot of these samples deep-frozen for the possible later conduction of specific HBM examinations.

With such samples, in addition to personal information, a sampling protocol (sample type, date, time), a brief case history of the exposure (with details of time and place) and the symptoms of the affected individuals over time must be collected and documented in a standardized manner.

4.3 Sample Collection

The optimal time for sampling is dependent on the released substances, their toxicokinetics, their metabolism, and on the assumed type of intake (oral, respiratory, dermal). These factors also determine the human specimen to be examined (urine, blood, respiratory air, etc). Their half-life in the human organism and in the examined matrix has a crucial significance (see Table 1). The date as well as the exact time of the sample collection is to be documented.

Samples with substances that have half-lives of a few hours and are quickly metabolized must be collected as early as possible, i.e. on the day or at the latest the day after the exposure. Substances with half-lives of days or weeks can typically be detected up to their respective half-life after absorption in blood and/or urine. Substances or their metabolites that bind to albumin or DNA as adducts can be detected up to 20 days after absorption and up to around 3 months as hemoglobin adducts. Lipophilic substances (such as persistent organohalogen compounds, dioxins), that are practically non-metabolized but are retained in body fat can, under certain circumstances, be detected in blood (fat) or in fatty tissue samples months or years after absorption, as was shown in the Seveso case.

Urine: For urine collection, wide-neck containers with screw caps (> 250 ml) made of plastic (such as polyethylene) are suitable. The urine sample should be collected directly into the container. When analyzing metals, the containers must be acid-rinsed and test subjects must wash their hands and avoid contact with contaminated clothing prior to voiding the sample. The

urine volume should be at least 50 ml. There is a special system (Sarstedt Company) available for metal analysis, which is used for elements with a high contamination risk (such as aluminum and nickel).

For the determination of lightly volatile organic substances (such as acetone, methanol) in urine, about 2 ml of the urine sample are transferred with a single-use syringe into an ampule flask. The ampules serve as storage and transportation containers. Blank samples should be sent in for the exclusion of contamination during sampling, storage and transportation.

Blood, Plasma/Serum: Single-use syringes and needles are appropriate for collecting blood, plasma or serum samples. 10 ml vacutainers and Monovet tubes with the necessary dosage of coagulation activators (for serum samples) or anticoagulants (such as K-EDTA) also serve as transportation and storage vials. 5 – 10 ml of blood suffices for most analyses. This, however, is the minimal volume that should be collected.

Serum is collected by centrifuging whole blood after the coagulation process of the platelets and coagulation factors is completed. Plasma is extracted from the cell-free supernatant after centrifugation, for which EDTA anticoagulated blood is generally used. From the same amount of blood, there can be approximately 15 to 20% more examination material obtained using plasma than serum. An exception to this rule is the detection of aluminum in plasma. For this analysis, EDTA blood in Monovets should be sent in and used. The plasma extraction occurs in the lab directly before the analysis in order to keep the contamination risk as low as possible.

For persistent lipophilic substances (such as pesticides, PCB) the plasma is extracted with a glass pipette after centrifugation of a 10 ml whole blood sample and transferred into a special container (such as pre-cleaned glass vials with a Teflon or aluminum lid).

When collecting samples to detect volatile compounds (organic solvents, VOC), crimp sealed glass vials with added EDTA and a crimp cap – rubber stopper (Headspace vials) are used. For removal, single-use syringes (5 ml) and needles are used. Generally, the skin is not disinfected when taking blood for the measurement of volatile compounds. Approximately 2 ml of blood are collected from an arm vein and transferred to a vial. The vials function as storage and transport containers. Blank samples should be sent in for the exclusion of contamination during sampling, storage and transportation.

Erythrocytes: Within 8 hours after sample collection, plasma and erythrocytes must be separated from the whole blood. 5 ml of whole blood (EDTA) are diluted with 2 ml isotonic saline solution, carefully mixed and centrifuged for 5 min at 1200g. The supernatant is removed with a pipette. Approximately 4.5 ml plasma solution and 2.5 ml erythrocyte concentrate are obtained in this manner. The erythrocyte concentrate is filled up to 5 ml with isotonic saline solution and re-centrifuged for 5 min at 1200g. The supernatant is removed and discarded. The erythrocytes are washed in the same manner at least 2 more times (until the supernatant no longer has a yellow tone) and washed up to 5 times with isotonic saline solution after an acute intoxication.

7.5 ml distilled water are added to the erythrocytes isolated in this manner, they are then homogenized and frozen at -20 °C. The lysate can be stored as long as necessary at -20°C and can be kept in the refrigerator at +4 °C for a maximum of 2 days.

The samples should be cooled (Styrofoam box and freeze pack) and shipped directly after the collection and erythrocyte isolation. Freezing before shipping is not necessary. If direct shipping is not possible after sample collection and erythrocyte isolation, the erythrocyte lysate must be kept frozen at - 20 °C until shipping.

4.4 Logistics

The quick and immediate availability of a larger number of sample collection vials and containers should be organized either through an available stock or a reliable source of stock (from hospitals or doctors, etc.). As a general principle, consultation with the examination laboratory is recommended to confirm details of the sampling, sampling system, sample collection and processing (such as erythrocyte isolation) and sample shipping. Sample collection vials are to be marked according to the data security guidelines (see above) with information regarding the type of biological material and the parameters to be determined.

It should be made sure that blood and urine samples be shipped immediately after they are collected and that they reach the laboratory within 24 hours. If this is not possible, the samples may be stored for a few days in the refrigerator at 4°C with the exception of the isolated erythrocytes, which must be stored at - 20 °C until shipped.

5 Quality Assurance

As a matter of course, human biomonitoring results must be analytically correct according to the established margin of error. Analysis errors increase exponentially with decreasing concentrations of the substance to be detected [Horwitz 2003]. Because of this, regular quality assurance of the analytic procedures in a concentration range relevant to environmental medicine is crucial [Angerer et al. 1995]. Possible errors must be controlled and minimized at all levels. A complete analysis procedure includes partial sections with a pre-analytical, analytical and post-analytical phase. Each of these phases deserves particular attention. Detailed information and practical tips can be found in the publication of the HBM Commission on quality assurance of human biomonitoring [1996b] and in the guidelines of the DGAUM [2004].

6 Participation of External Expertise

The addresses of the nearest poison control centers and emergency depots should be readily available to insure immediate contact.

According to the German Chemicals Act § 16, any doctor, who treats or assess consequences of diseases from chemical substances, is obligated to report cases of health damage related to chemical exposures to the "German Poison and Product Documentation Centre" in the Federal Institute for Risk Assessment. This institution provides consultation for treating doctors and health departments but only during normal business hours. In the case of larger malfunction and transport accidents, this center actively contacts the treating doctors and DPH in order to establish a professional dialogue to complement the estimations and recommendations of the poison control centers.

Cause-oriented impact studies and questions regarding the design of an investigational program should be thoroughly designed using input from epidemiological and relevant medical specialties. It can also be advisable to consult the responsible cancer registry in cases with exposure to carcinogenic substances.

7 Risk Communication

Providing the affected individuals early and on a regular basis with current information is a key point and should not be underestimated. When communicating the intended or arranged investigations or studies one must be cautious to not give the affected communities any "false

hope". Judging from past experience, it seems important that the community be accurately informed of the respective update, that causes of possible communication difficulties are considered, and that rules of risk communication are upheld [Risikokommission 2003, Uth 2000, Keppler und Hartung 1995]. This also applies to the notification and explanation of investigational results.

Acknowledgement

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Internet Tips and Links:

IPASUM (Institut für Arbeits- und Sozial- und Umweltmedizin Erlangen): www.arbeitsmedizin.uni-erlangen.de

Kommission Human-Biomonitoring des Umweltbundesamtes. <http://www.umweltbundesamt.de/uba-info-daten/daten/monitor/index.htm>

LGL (Landesamt für Gesundheit und Lebensmittelsicherheit): http://www.lgl.bayern.de/de/left/fachinformationen/gesundheit/umweltmedizin/grundlagen_humanbiomonitoring.htm

Referenzwerte für Schadstoffe in Blut und/oder Urin der Allgemeinbevölkerung: <http://www.umweltbundesamt.de/uba-info-daten/daten/monitor/referenz.htm>

Extremely Hazardous Substances (EHS) Chemical Profiles and Emergency First Aid Guides http://yosemite.epa.gov/oswer/ceppoehs.nsf/EHS_Profile?openform

Medical Management Guidelines (MMGs) for Acute Chemical Exposures <http://www.atsdr.cdc.gov/mmg.html>

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Attachment 1:

Cover page example for gathering personal data with informed consent and assigned code, which will remain exclusively with the public health office

Assigned Code:		<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>
Confidential Section		
(This information will remain with the public health office. It will not be registered in our system and is to be used <u>solely</u> for providing you with your measured results)		
NAME AND ADDRESS		
Last Name	_____	
First Name	_____	
Street Address	_____	
Zip Code	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	City, State _____
INFORMED CONSENT		
I agree to the conditions of my participation in this study and examination of the collected samples for the purpose of in connection with		
"It is known to me and I agree to the conditions that the information given in this questionnaire throughwill be saved in our system <u>without my personal information</u> (anonymous), will be scientifically evaluated, and used in the context of a study regarding exposure situation and risk evaluation of the event from"		
Date:	_____ Signature: _____	

Attachment 2:

Instrument of the Federal Institute for Risk Assessment (BfR) for the documentation of exposure and adverse health effects from non-normal operating conditions/transport accidents [Hahn 2003, Hahn et al. 2003]

Translation of BfR Questionnaire for exposure evaluation from malfunction/transport accidents

Personal Number:
 Female Male Adult Child

Part I

Directly affected individual (Please mark on the map)

directly at the accident scene Worker
 near the accident scene Fire Department
 m Police/Emergency Medical Service
 Private Person
 Other
 First Exposure Time Date
 Length continuous not continuous
 Safety Measures yes no
 Symptoms yes no

(If yes, please document on the notification sheet)

Part II

Indirectly affected individual (Please mark on the map)

Distance from accident scene m Resident
 Job Holder/Employee
 Other
 First Exposure Time Date
 Length continuous not continuous
 Symptoms yes no

(If yes, please document on the notification sheet)

Biomonitoring

Substance: _____

Blood Sample Date Time Concentration
 Urine Sample Date Time Concentration
 Fresh Urine 24h Collected Urine Creatinine