



## Operating Instructions

Working in a laboratory and handling of hazardous substances may cause certain risks for health of persons being there. Improper performed reactions may also endanger the environment.

According to fter § 20 of the *Ordinance on Hazardous Substances* the responsible person has to formulate an operating instruction with regard to the risks at special workplaces and substances dealt with. These operating instructions must include the risks for men and the environment which may arise from working with the particular hazardous substances at these workplaces and also contain protective measures. An important item is the directive for disposal of hazardous wastes formed. The operating instructions must be written in an understandable form and language of the staff working there and be mounted at a suitable location at the workplace. The operating instructions must also contain directives for procedures in case of accident and First Aid to be applied.

Chemical lab courses belong to workplaces for which special operating instructions have to be written. Technical Instruction TRGS 555 (*“Operating Instructions and Introduction of the Staff”* according to § 20 of the *Ordinance on Hazardous Substances*) contains recommendations to mount up the operating instructions and to organize the introduction meetings for the staff.

**The aim of any operating instruction is to minimize the risks for men and the environment.**

**Therefore, the operating instructions must be available for all employees at any time.**

To meet these goals the operating instructions must not be lost in a laboratory corner, but they should serve as adviser for daily tasks and problems. Therefore, operating instructions do not contain legal formulations from laws and decrees which are difficult to understand, but practical transcriptions of these regulations to daily routine in the laboratory.

Operating Instructions for chemical laboratories are based on regulations which rule working with chemicals and hazardous substances, like *Chemicals Act* and *Ordinance on Hazardous*



*Substances.* (Refer also to (i) *Legal Conditions for Handling of Hazardous Substances*, and (ii) *Technical Guidelines for Safety in Chemical Lab Courses*.)

Further important items are the *Regulations for Safety and Health Protection while Handling of Hazardous Substances at Universities* (GUV 19.17) and the *Ordinance on Flammable Liquids* (VbF), as well as general regulations like *Instructions for Prevention of Accidents and for Occupational Safety*, *Guidelines for Laboratories*, *Hazardous Waste Laws*, *Instructions for Handling of Gas Cylinders*, etc.

During the formulation of operating instructions the following items should particularly be considered:

- Instructions of the *Ordinance on Hazardous Substances* and its Annexes for handling of hazardous substances,
- Material Safety Data Sheets (MSDS),
- Technical Guidelines for hazardous substances and other generally accepted procedures for occupational safety, hygiene and health,
- additional informations of the producers, and
- accident leaflets after transport regulations as supplement.

Operating instructions contain the following items:

- *Operating area, workplace, field of activity*  
The field of application will be defined by identifying the company, the operating area, the workplace, and the field of activity. For similar fields of activities with comparable risks a common operating instruction can be formulated.
- *Hazardous substances (names)*  
All hazardous substances will be listed up individually. If several substances have the same risk characteristics and need, therefore, the same protection measures, these can be summarized in common groups.
- *Risks for men and the environment*



Possible risks which may arise while handling of the substances are described by listing the R-phrases, likely completed with additional informations of the producer. It is of advantage also to draw the hazard symbols.

- *Protection measures and instructions*

The necessary protection measures should be subdivided in three groups:

Technical and Organizational Measures

Personal Protection Equipment

Occupational and Workplace Hygiene.

If suitable restrictions and limitations for working of certain persons and for utilization of substances must be pointed out.

- *Measures in case of emergency*

The protective measures in case of emergency given (fire, explosion, outflow of hazardous substances) should particularly include relevant informations about unsuitable fire extinguisher, additional technical protection measures, personal protection equipment, and measures to be taken in order to avoid an environmental pollution.

- *First Aid*

Important points are measures to be taken in case of inhalation, contact with skin or eyes, ingestion of hazardous substances as well as first aid in case of burns. Also relevant first aid institutions, the names of first-aiders and emergency telephone numbers should be given.

- *Appropriate disposal*

In order to apply protective measures informations must be given about the personal protection equipment, disposal containers, collection stations, sorbents, cleaning agents and procedures.

**The operating instructions are mandatory. In case of non-observance the employer and the employee risk to lose their insurance cover and to be made liable for the damages. The instructions must not be followed if they are obviously unfounded and against safety. The employer must be informed about possible lacks of safety measures, or these must be redressed if that is the task of the staff. According to § 3(4) of the *Ordinance on***



***Hazardous Substances* the employer must provide the employee with personal protection equipment and apparatus which enable them to meet the rules of the operating instruction.**

Operating instructions contain numerous directives which have to be followed in any case. It is strictly forbidden to smoke in the laboratory. Each employee has the obligation to wear personal protection equipment (e.g., safety glasses, protective gloves, etc.), to clean and to maintain them regularly. But it is also unsuitable to wear respiratory masks and protective suits permanently

Missing protective equipment and the necessity of exchange the material must be told to the employer. The employee are obliged to use all working substances, machines, equipment, tools, transportation and other materials as directed. They are only allowed to handle hazardous substances and to use devices and facilities which are needed to carry out their duties.

**The operating instructions are also valid for working with apparatus' which are needed to handle of hazardous chemicals.**

Protection measures to be taken while handling of hazardous substances must particularly consider the risks and safety recommendations (R&S-phrases) and further informations of the producers written in safety sheets.

The design of operating instructions is not imperatively provided. All informations needed can also be given in the instructions of the experiments or in standard operation procedures if the risks and protection measures to be taken are provided, as well. But just a table listing the substance properties is not sufficient. The operating instruction should contain further informations which enable the staff in the laboratory to recognize and to solve problems by themselves and to properly dispose of the laboratory wastes.

**Deviation from the rules in the operating instruction is only allowed when the new approach provides at least the same safety level, and also in case of accidents to rescue endangered persons.**



**Operating instruction formulated as an example for the substance group  
„toxic and very toxic chemicals“**

<b><u>OPERATING INSTRUCTION FOR HAZARDOUS SUBSTANCES</u></b> (§ 20 GefStoffV)	
<b><u>TOXIC AND VERY TOXIC CHEMICALS</u></b>	
Examples:	Acetonitrile, Arsenic, Benzene, Chloroacetic acid, Methanol, Methyl iodide, Potassium cyanide, mercury and its salts, Tetrachloromethane, Uranium salts
<b>R-Phrases: 23, 24, 25, 26, 27, 28</b>	
<b><u>RISKS FOR MEN AND THE ENVIRONMENT</u></b>	
Observe the risk informations (R-Phrases) on the label ! Toxic and very toxic substances can be incorporated into the body through breathing, swallow, or the skin. By contact of even very small amounts of toxic and very toxic substances there exists a serious risk of health damage including intoxication leading to death. Toxic and very toxic substances shall not enter the environment.	
<b><u>PROTECTION MEASURES, INSTRUCTIONS AND HYGIENIC MEASURES</u></b>	
Observe the safety informations (S-Phrases) on the label ! Avoid any contact with the skin. Do not breath nor swallow the substances. Only work in a fume hood with toxic and very toxic substances. Always wear protection clothes, safety gloves, and safety glasses! Wash regularly your hands and your face. It is not allowed to work with toxic and very toxic substances in easily breakable vessels above 5 liters. Exceptions can only be made if particular protective measures are taken, e.g., the use of a catch tank. Observe special instructions for the handling of mercury!	
<b><u>MEASURES IN CASE OF EMERGENCY</u></b>	
Thoroughly clean the contaminated skin. Immediately take off contaminated clothes. Sweep spilled toxic and very toxic solid substances, bind spilled toxic and very toxic <b>liquid</b> substances with absorbers, and dispose them of in a suitable way.	
<b><u>FIRST AID</u></b>	
<b>Skin:</b>	Clean immediately with water, soap, or polyglycols (e.g., Roticlean), use emergency shower, if needed.
<b>Eyes:</b>	Flush the eyes with an eye shower at least for 10 minutes, then go to an ophthalmologist (eye specialist).
<b>Ingestion:</b>	Induce vomiting.
<b>Inhalation:</b>	Fresh air, rest, heat.
<b>In serious cases alert the doctor on call via the emergency call .....</b> If possible, show the substance flask/label/vomit to the doctor.	
<b><u>APPROPRIATE DISPOSAL</u></b>	
Toxic and very toxic substances must be disposed of in safe way according to the informations provided by the producer.	



## Operating instruction formulated as an example for an individual hazardous substance "Hydrogen fluoride"

### **OPERATING INSTRUCTION FOR HAZARDOUS SUBSTANCES (§ 20 GefStoffV)**

#### **NOTATION OF THE HAZARDOUS SUBSTANCE**

##### **Hydrogen fluoride - Hydrofluoric acid**

**R-Phrases: 26, 27, 28, 35**

Hydrofluoric acid is very toxic if inhaled, swallowed, and in contact with the skin.  
Hydrofluoric acid causes serious cauterization

#### **RISKS FOR MEN AND THE ENVIRONMENT**

Hydrogen fluoride affects the skin, the eyes, and the respiratory tract as concentrated gas, liquid, and in aqueous solution. Due to its high lipophilicity a rapid uptake occurs into the body. Fluoride ions block Ca and Mg ions in the body and inhibit important enzymes resulting in acute and alarming metabolic disturbances, and liver and kidney damages. Typical HF cauterizations are very painful, the latency period can last up to 2 days. The degeneration effects on tissue cause hardly healing abscesses. Inhalation leads first to an irritation of the upper respiratory tract, Laryngitis, Bronchitis and partly to the lost of sense of smell. An inhalation of 50 – 100 ppm HF in air over 30 – 60 min can be lethal. Chronic uptake of doses exceeding the limit values leads to fluorosis damages.

Hydrogen fluoride is harmful to water – Water Hazard Class 2.

#### **PROTECTION MEASURES, INSTRUCTIONS, AND HYGIENIC MEASURES**

Store the tight-fitting vessels at a well-aerated place. Do not inhale vapor/aerosol. Always wear protection clothes, safety gloves, and safety glasses/face protector. In contact with the eyes flush them with an eye shower and then go to an ophthalmologist (eye specialist). In case of accident and nausea contact immediately the doctor or the rescue service (Tel: 0-112). (Refer also to measures of first aid.)

#### **MEASURE IN CASE OF EMERGENCY (Emergency Call: 0-112)**

*Substance release:* In case of a release of water-free HF immediately evacuate the laboratory.

If available, wear a respiratory mask (filter: ABEK Kombi) and aerate/ventilate the laboratory. Hydrofluoric acid will be mixed with lime milk. (Refer also to disposal measures.)

*Fire accident:* Evacuate the laboratory and apply extinguishing measures according to the combustible materials on site. HF does not burn itself, but there is the risk of inhalation of HF containing vapor or aerosols. Wear respiratory mask while fire fighting, otherwise call for fire brigade.

#### **FIRST AID**

- Skin:** Clean immediately (each second is important!) with large volume of water, then rub calcium gluconate gel into the skin, and inform/contact the doctor.
- Eyes:** Flush the eyes with an eye shower at least for 15 minutes, open the eyelids with the thumb and forefinger, move the eye in all directions, then go to an ophthalmologist (eye specialist).
- Inhalation:** Fresh air, immediately introduce *Auxiloson*, inform doctor on call.
- Clothes:** Immediately take off contaminated clothes (each second counts)!

#### **APPROPRIATE DISPOSAL**



HF containing waste will be dropped carefully into lime milk and then collected in particularly labeled vessels.

**CONSEQUENCES OF NON-OBSERVANCE**

The disregard of the above written safety instructions can lead to serious health damages (tissue damages, painful ignitions, hardly healing abscesses, cauterization of respiratory tract, and arrhythmia) or to death of the persons affected.