



## 1. Roles und definitions

### a. Safety Trainings

All persons handling gases require a valid "Gases" or "Liquid Nitrogen/Helium" module in the Online Safety Training via DOOR. Persons who do not hold any of these roles are not authorized to order or handle gases.

### b. Persons authorized for gas order „Gasabrufberechtigte“

Only the persons authorized for gas order, called "Gasabrufberechtigte", (all Technical hall managers) may order gases and cryogenic liquids from MEA6 at the request of a Qualified Person and have the gas cylinders delivered to the gas delivery box. "Gasabrufberechtigte" are only responsible for ordering the product required for work or experimental use. Further work tasks and authorizations do not result from the function "Gasabrufberechtigte". "Gasabrufberechtigte" will be proposed by the FS deputy director (Bereichsreferent) and must be appointed by a responsible MEA person and instructed by MEA6 before the start of the activity.

### c. Responsible Person

**VPU:** Responsible person with corporate responsibility (Verantwortliche Person mit Unternehmer Eigenschaft).

**GV:** Area manager and their deputies (e.g. beamline manager and deputies).

These persons are responsible for the safe handling of gases and gas equipment in their area of responsibility and must therefore designate Qualified Persons for their area.

### d. Qualified Person (= requester named in gas order form „Lagerabrufschein“)

A Qualified Person is a person who, through his or her vocational training, professional experience and prompt professional activity, has the necessary specialist knowledge for handling gases. These can be the responsible persons (e.g. beamline manager) or persons determined by them, e.g. beamline engineers or other persons. In addition to their qualification, they must have appropriate training in gas safety ("Linde-/Air Liquide training").

Qualified Persons are allowed to request gases via the "Gasabrufberechtigte". The Qualified Person concerned is named on the label of the gas cylinder as the customer. Starting with the transfer from the delivery box to its destined gas cabinet, the customer named on the label is responsible for the safe handling of the gases. They also instruct the users in the use of the gases and gas fittings.



### e. Instructed Person

Persons who have been instructed by the Qualified Persons in the handling of gases at DESY, e.g. Photon Users, who can then carry out a gas cylinder exchange on their own. However, guests must always have experience in handling gases and must also be instructed by the Qualified Person at the beamline.

## 2. Declaration of gases

The use of compressed or hazardous gases has to be declared via DOOR in the "DECLARATION OF SUBSTANCES AND EXPERIMENTAL APPARATUS". Gas systems must be inspected and approved by the relevant safety managers of DESY FS-TI group. Any gas system must be built and operated according to the DESY Safety Regulations.

We recommend an early registration and close coordination with your local contact and FS-TI group, especially when hazardous gases (flammable, corrosive, toxic or oxidizing) are used. For larger setups or special hazards, we will ask you to upload a safety concept, describing your setup and its operation in detail, including possible hazards and safety measures foreseen.

If necessary, FS-TI must provide safety installations such as gas warn systems or ventilation. Please be aware, that longer delivery times or preparation time have to be expected for safety devices.

## 3. Gas order and delivery

- Technical gases will be supplied by the DESY Gases group MEA6 upon request. Consider that special gases, mixtures or very expensive gases may have a long delivery time up to 12 weeks. Please request early.
- Qualified persons (e.g. beamline engineers/beamline staff, who are trained in the use of gases) ask the Technical Hall Service (who typically has the role "Gasabrufberechtigter") to order the gases required by the user. The gases may only be ordered by "Gasabrufberechtigte". After delivery, the qualified person who triggered the gas order, will be named on the delivery label as the customer. Starting with the transfer from the delivery box to its destined gas cabinet, the customer named on the label is responsible for the safe handling and the proper use of the gases. They instruct the user in operating the DESY gas systems and use of gases.
- Gases may be brought along by the user, if permitted and unavailable at DESY. These gases must be registered on site with a responsible person (Beamline Manager, Local Contact or Hall Master), who in turn inform each other. Observe special regulations for transport of hazardous substances.
- If the gases are to be delivered before the beamtime, they must be registered with MEA6 (by one of the above-mentioned responsible persons). The gases will then be temporarily stored at MEA6 until the measurement time and delivered to FS according to the order (Lagerabrufschein, E-mail).
- Request gas order via your Local Contact well in advance.



- Use as little amount of gases as necessary. Compressed gas cylinders may only be used in the FS experiment halls in the fire-retardant gas cabinets (T90) provided for this purpose for the duration of their use.
- Gas cylinders can be stored temporarily in the DESY gas group warehouse, but only after consultation with MEA6. Storage in the FS area is prohibited!

#### **4. minicans<sup>®</sup> and Lecturebottles<sup>®</sup>**

minicans<sup>®</sup> or Lecturebottles<sup>®</sup> may be used if only small quantities of gas are required with a short line length, e.g. test gases, gases for calibration or small quantities of gas of high purity at the experiment.

After a prior risk assessment by the person responsible for the project, the use of minican<sup>®</sup> compressed gas cans or Lecturebottles<sup>®</sup> must be approved by the Safety Manager.

- Label Lecturebottles<sup>®</sup>
- Store separate (flammable, oxidizing, toxic, toxic-oxidizing) as for gas cylinders.
- Store toxic gases in ventilated cabinets/fume hoods.
- Completely emptied, unpressurized cans have to be labeled with "empty".
- All emptied minicans<sup>®</sup> and those not completely emptied, that were filled with toxic gases must be disposed of via V8 department.
- Do not use after expiration date, but dispose of via V8 department.

#### **5. Pressure reducers, fittings, connectors**

Pressure reducers and other fittings must be brought along by the user, this also applies for gas mixing systems, tubing, valves etc. to be used at the beamline. If minicans<sup>®</sup> or Lecturebottles<sup>®</sup> will be used, you have to provide the adaptors as well.

Brought along pressure reducers and fittings etc. must comply with the DESY requirements and European standards which are valid for Germany. They have to be technically in order and tested. Pressure reducers must have metal bellows and standard bottle connections in accordance with DIN477. If aggressive gases will be used, only corrosive-resistant fittings and pressure reducers with a purge block may be used.

- Pressure reducing valves must have Swagelok<sup>®</sup> 6 mm tube fittings on the outlet side.
- Pressure reducers for hazardous gases must be equipped with a pressure relief valve that adapts to a 6mm Swagelok<sup>®</sup> fitting.
- Pressure regulators that are connected to a vacuum system or that are to be evacuated to clean the gas system must be suitable for vacuum.



- FS-TI group provides gas cabinets and stainless-steel tubes, starting from the pressure reducer inside the gas cabinet to the beamline.
- The gas tubes must not be used for aggressive gases. Only specially marked lines may be used for this purpose, but only after special agreement.
- The gas tubes should be flushed with inert gas after use. DESY does not guarantee the cleanliness of the lines. If necessary, users must clean the lines themselves by flushing or evacuating according to the requirements.
- Gas pipes (stainless steel), usually end at the experimental station with a 6mm Swagelok® screw fitting.
- For hazardous gases, only metal gas lines must be used at the experimental station.
- Gas lines, connections, valves etc. must be marked with the respective gas type.
- Gas systems may only be set up, commissioned and operated by qualified and experienced persons. For large setups, a flow chart and an operating instruction must be available.
- All gas systems must be checked for leaks before start of operation. The test has to be documented.
- If necessary, the operating data of gas systems must also be regularly monitored and documented. Detailed safety measures will be given during the safety inspection.
- Photon Science division uses only Swagelok® fittings with metric threads. Swagelok® QC4 quick couplings are common at many experimental stations. Exceptions to this are possible in individual cases and after consultation with the FS-TI safety group.



## 6. SAVE –Support during initial operation and gas cylinder replacement of gases according to table 1 (sulfur dioxide, fluorine, hydrogen sulfide, ammonia, nitrous monoxide)

### Introduction

To support the FS division, an agreement was made according to which the Technical Emergency Service supports the FS division in initial operation of connected gas cylinders and/or the exchange of gas cylinders of certain gases (see table 1). The background is that the replacement of certain gases must be carried out under respiratory protection.

### Gases

The attached table 1 specifies the gases for which the Technical Emergency Service carries out the replacement and/or opening under respiratory protection.

### Request of support

The initial operation or an exchange of a gas cylinder shall be notified in due time by competent persons of FS or instructed users with the indication of the gas to be used. The approval for the use of the gases can be taken from the declarations posted at the respective experiment. The executing guard has to inform himself about the following data of the substance in the respective material safety data sheet:

- Possible hazards
- Fire fighting measures
- Accidental release measures
- Exposure controls and personal protective equipment (PPE)

### Gas cylinder replacement procedure

Before initial operation or exchange of the gas cylinder, a danger zone of 5 meters must be formed around the respective gas cabinet. This area must be kept free of persons and ignition sources. In addition, radio contact with the control center must be ensured. The control center must be manned during the changeover so that another person can go to the scene in case of an emergency.

The person changing the cylinder must wear personal protective clothing (helmet is not required) and carry out the exchange under respiratory protection. In addition, he/she carries an activated gas detector. After opening or exchanging the gas cylinder, the cylinder has to be opened and the connection has to be checked for obvious leakage (e.g. hissing sound or pressure drop). The second person forms the safety guard. He stands at the border of the danger area with breathing protection in readiness, with radio and a suitable extinguishing agent. Their task is to supervise the preceding respirator wearer and to monitor the danger area.



### Behavior in the event of an incident

- **Release of the substance**

Close the cylinder. Clear the area of people and ventilate.

- **Unconsciousness of the person replacing/opening the gas cylinder**

The backup person notifies the control center of the incident. The control center sends another person to the scene. The security guard, wearing respiratory protection, rescues the unconscious person from the danger area. It is at the discretion of the security guard to remove the unconscious person from the danger area without respiratory protection if a danger to himself can be excluded.

## 7. After the experiment

### a. Instructions for flushing the gas lines after usage.











**Gas outlet of the experiment or the line to be flushed must be connected to the suction exhaust gas (KF40 stainless steel line)!**

- Note the residual pressure of the bottle on the ticket.
- Close the gas bottle (handwheel), open all other valves (pressure reducer, solenoid valves, experiment).
- The inlet and outlet pressure at the pressure reducer must drop to "0".
- Remove the tube from the pressure reducer and connect it to a bottle with purging gas ( $N_2$ , Ar, He).
- Open the gas cylinder (flushing gas).
- Run at approx. 4-6 bar for five to ten minutes (depending on the type of gas: corrosive gases longer, non-critical shorter).
- Close the valve on the pressure reducer and allow the residual gas to escape from the line.
- Connect the next line to be flushed to the exhaust line and start again at point 2.
- When all lines have been flushed: Close the gas cylinder and allow the remaining pressure to escape via the line until the upstream and downstream pressures are at 0.

### b. Have gas cylinders removed, inform technical hall service

Have gas cylinder removed (check with Beamline Staff). The Safety Manager or the technical hall service (informed by safety manager) close solenoid valves if necessary.

**8. Attachment: Table 1, Gases**

<b>Gases</b>	<b>Gas cylinder sizes</b>	<b>Substance properties</b> <i>AGW: occupational exposure limit value</i>	<b>Comment</b>
Sulfur dioxide (SO <sub>2</sub> )	max. B10	 <b>AGW<sub>8h</sub>: 1 ppm</b>	<b>Gas cylinder replacement and opening via SAVE under respiratory protection*</b>  * case specific decision by FS-Safety Manager  <b>DO NOT STORE TOGETHER</b>   <b>oxidizing gases</b> and  <b>flammable gases</b>
Fluorine (F <sub>2</sub> )		 <b>AGW<sub>8h</sub>: 1,6 ppm</b>	
Hydrogen sulfide (H <sub>2</sub> S)		 <b>AGW<sub>8h</sub>: 5 ppm</b>	
Ammonia (NH <sub>3</sub> )		 <b>AGW<sub>8h</sub>: 20 ppm</b>	
Nitrogen monoxide (NO)		 <b>AGW<sub>8h</sub>: 25 ppm</b>	
Carbon monoxide (CO)		 <b>AGW<sub>8h</sub>: 30 ppm</b>	
Hydrogen (H <sub>2</sub> )	B10 or B50		<b>Gas cylinder exchange by Qualified Person or instructed User</b>
Methane (CH <sub>4</sub> )			
Propene (C <sub>3</sub> H <sub>6</sub> )			
Propane (C <sub>3</sub> H <sub>8</sub> )			
Acetylen (C <sub>2</sub> H <sub>2</sub> )			
Oxygen (O <sub>2</sub> )	B10 or B50		<b>Gas cylinder exchange by Qualified Person or instructed User</b>
Nitrous oxide (N <sub>2</sub> O)			
Helium (He)	minican, B10 or B50	<b>inert</b>	<b>Gas cylinder exchange by Qualified Person or instructed User</b>
Argon (Ar)			
Nitrogen (N <sub>2</sub> )			
Xenon (Xe)			
Neon (Ne)			
Carbon dioxide (CO <sub>2</sub> )			