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| <p style="text-align: center;">Technical Rules for Hazardous Substances</p> | <p style="text-align: center;">Fumigations</p> | <p style="text-align: center;">TRGS 512</p> |
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The Technical Rules for Hazardous Substances (TRGS) reflect the state of technology, occupational health and occupational hygiene as well as other sound knowledge for activities involving hazardous substances including their classification and labelling. The

Committee on Hazardous Substances (AGS)

establishes the rules and adapts them to the current state of development accordingly.

The Technical Rules for Hazardous Substances are announced by the Federal Ministry of Labour and Social Affairs (BMAS) in the Joint Ministerial Gazette (GMBI).

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Annexes

1 Scope

(1) The present TRGS applies to activities with the following substances and preparations if they are used as fumigants:

1. Hydrogen cyanide (prussic acid) as well as substances and preparations which serve to form or evaporate hydrogen cyanide or highly volatile hydrogen cyanide compounds,
2. Phosphorus hydride and substances and preparation forming phosphorus hydride,
3. Sulfuryl difluoride (sulfuryl fluoride).

(2) This TRGS also applies to fumigation activities with other highly toxic and toxic substances and preparations which

- are authorised as a biocidal products in accordance with Section 2a of the German Chemicals Act by the Federal Institute for Occupational Safety and Health (BAuA) or
- as plant protection agents in accordance with the Plant Protection Agent Act are subject to an authorisation procedure by the Federal Office of Consumer Protection and Food Safety (BVL)

and used as fumigants.

(3) Biocidal products must not be used if it can be expected that their use in individual cases has detrimental effects on the health of people, non-target organisms or the environment.

(4) This TRGS also applies to fumigation activities with bromomethane (methyl bromide) if exemptions have been issued by the competent authorities, for example for the import and export of goods and articles or for individual applications.

(5) This TRGS does not apply to activities

- involving fumigations with ethylene oxide and formaldehyde in sterilisation and disinfection plants (TRGS 513 applies here) and
- for room disinfection with formaldehyde as well as substances and preparations which serve to form or evaporate formaldehyde (TRGS 522 applies here).

(6) If, as part of the risk assessment according to number 5.4.3.1 of this TRGS, knowledge is available that an imported transport unit for the purposes of pest control was fumigated with substances other than those mentioned in number 1 para. 1 which are to be classified as very toxic or toxic, the measures listed in number 5.4.3.2 and number 5.4.3.3 are suitable to ensure the protection of workers or other persons here, too.

2 Definitions and comments

(1) Fumigations within the meaning of this TRGS are activities for the targeted control of harmful organisms using the substances and preparations listed in number 1 (fumigants). This covers all work which is required in connection with the safe use of a fumigant.

(2) Fumigation plants within the meaning of this TRGS are structural and technical facilities, such as fumigation chambers or rooms, which are set up and operated especially

for the purpose to eradicate pests from goods and articles therein.

(3) Rooms within the meaning of this TRGS are buildings or parts of buildings enclosed on all sides in which fumigations are to be conducted. Fumigations of goods under covering sheets in buildings or in cargo holds on ships are to be treated as room fumigations. Rooms which mainly serve to store and process goods as intended and only have to be fumigated when required are not fumigation plants within the meaning of this TRGS. These include, for example, mills and grain stores.

(4) Transport units within the meaning of this TRGS are vehicles, railway wagons, containers, tanks or other transport containers in which fumigation takes place.

(5) A person with expert knowledge pursuant to Annex III No. 5.3 of the Hazardous Substances Ordinance (GefStoffV) is someone who, due to his training and examination, can verify that he has sufficient qualifications for the safe performance of fumigations. Evidence of this expert knowledge is provided by the successful participation in an officially recognised training course in accordance with the annexes 1a - c of this TRGS.

(6) A knowledgeable person pursuant to Annex III No. 5.6 para. 5 of the Hazardous Substances Ordinance (GefStoffV) is someone who, due to his qualifications gained through training and experience, has sufficient knowledge to determine and assess possible hazards when opening and ventilating containers or other transport or loading units fumigated with toxic and/or highly toxic fumigants and to take the necessary measures to protect workers and other people.

(7) The head of fumigation responsible within the meaning of this TRGS is the holder of a certificate of competence mentioned in the notification according to number 7.1.

(8) In the case of activities with biocidal products, a proper procedure must be adopted in accordance with good expert practice. Proper and good expert practice in fumigation activities within the meaning of this TRGS is given if the application regulations of the manufacturer or distributor of a fumigant, the specifications of the safety data sheet provided and the provisions of this TRGS are observed.

3 Application restrictions and exceptions

(1) Anyone who wants to perform fumigations with highly toxic and toxic substances and preparations (fumigants) according to number 1 para. 1 or number 1 para. 2 requires the permission of the competent authority. To this end, the conditions according to number 4.1 must be satisfied. Fumigations which solely serve for research and development or the institutional suitability test of fumigants and fumigation processes do not require permission. If fumigations with substances and preparations packed in portions, which develop no more than 15 g of phosphorus hydride in the ground when properly used for pest control, are performed not only occasionally, especially as part of a commercial activity, a permission is not required. For this purpose, an appropriate certificate of competence is sufficient.

(2) Only persons may be deployed for fumigations who have expert knowledge within the meaning of number 4.3 of this TRGS. Persons who work for the purposes of training according to paragraph 5 or who work as auxiliary staff members according to paragraph 6 may also take part in fumigations.

(3) A restricted certificate of competence according to number 4.2 is sufficient for opening, ventilating and, in particular, releasing transport units in which fumigant residues were verifiably detected. Reference is made at this point to the expert knowledge rele-

vant to this activity according to annex 1c and the certificate of release according to annex 3 d.

(4) For fumigation activities involving the use of hydrogen cyanide or sulfuryl difluoride, only persons may be deployed who have a certificate of competence for fumigations with these substances, unless paragraph 5 is to be applied.

(5) Workers may only participate without a certificate of competence provided their health condition is appropriate according to number 4.2 para. 3 for the purposes of training with the fumigants mentioned in number 1 if the issuance of a certificate of competence only becomes possible through the verification of participation.

(6) If preparations forming phosphorus hydride and portioned ready for use are used, previously instructed people may also be deployed as auxiliary workers in the preparations and for the introduction of the fumigant as well as the release work under the direct supervision of a sufficient number of people according to number 4.3 (persons with expert knowledge).

4 Permission, certificate of competence, expert knowledge

4.1 Permission

(1) Permission is granted to anyone who

- as an applicant has the required reliability and, insofar as he acts as the head of fumigation activities with the fumigants mentioned in number 1 para. 1 and para. 2, has a certificate of competence according to number 4.2 and
- has at his disposal an adequate number of holders of a certificate of competence according to number 4.2.

Each change in the holders of a certificate of competence must be reported to the competent authority immediately.

(2) The permission and the certificate of competence according to number 4.2 may be granted for a limited period and under certain conditions, limited in particular to certain types of fumigation activities. Conditions may also be subsequently imposed.

(3) As part of the introduction into the performance of fumigations or the inclusion of new fumigation technologies, provisional, fixed-term permission may be granted if the applicant has a sufficient number of persons with expert knowledge on the training course and an officially recognised training company accompanies and guarantees the supervision of the first four fumigations.

(4) The necessary reliability for the granting of permission is verified by means of an official certificate of good conduct, document type O.

(5) For the granting of permission, an applicant has a sufficient number of holders of a certificate of competence if he has, for fumigations

- with sulfuryl difluoride, hydrogen cyanide or preparations forming hydrogen cyanide, at least four,
- with phosphorus hydride or preparations forming phosphorus hydride, at least two or
- with fumigations with preparations forming phosphorus hydride in the ground, at least one

person(s) with a valid certificate of competence.

(6) For permission which is applied for exclusively for fumigations of transport units, it is sufficient if the necessary competence for this is demonstrated by two people with valid certificates of competence according to number 4.2. Permission is to be restricted accordingly.

4.2 Certificate of competence

(1) The competent authority grants a certificate of competence to anyone who

1. has the reliability necessary for activities with the fumigants mentioned in number 1 para. 1 and para. 2,
2. proves by means of the certificate of a physician within the meaning of section 15 subs. 3 GefStoffV that no reasons exist which make him appear physically or mentally unsuited to handle the fumigants mentioned in number 1 para. 1 and para. 2,
3. proves he has the necessary expert knowledge and sufficient experience for fumigations and
4. is at least 18 years of age.

(2) The necessary reliability for the granting of a certificate of competence is demonstrated by means of an official certificate of good conduct of document type O.

(3) The medical examination for the suitability requirements must comprise the following tests:

- Assessment of the sense of smell and the ability to distinguish colours in accordance with the recommendation of the Federal Ministry of Labour and Social Affairs on the performance of suitability examinations for applicants for a certificate of competence (BArbBl. Vol. 12/1995 p. 41)
- Suitability to wear respiratory protection equipment in accordance with the Principle G 26 II of the Berufsgenossenschaften (institutions for statutory accident insurance and prevention) for wearing filter equipment (full-face mask with mounted filter) for fumigation activities involving phosphorus hydrogen and/or hydrogen cyanide,
- Suitability to wear respiratory protection equipment in accordance with the Principle G 26 III of the Berufsgenossenschaften for wearing insulation equipment (self-contained respiratory protection equipment) for fumigation activities involving sulfur dioxide,

provided that no valid examination certificate is available (see annex 1e "Certificate template for the suitability examination"). The suitability examination for respiratory protection equipment can be dispensed with if the certificate of competence is restricted to pest control in the ground.

(4) The certificate of competence is to be limited to max. 6 years and subject to the condition that it becomes invalid if the holder has no longer performed any activity with the fumigants in question for more than 2 years. In the case of a certificate of competence for an expert according to annex 1c, the condition according to sentence 1 relates to the activity with fumigated transport units.

(5) The certificate of competence expires if a new certificate of competence is not presented to the competent authority at the latest 6 years from the issuance of the certificate according to para. 1 No. 2.

(6) In addition to the certificate according to para. 1 No. 2, a prerequisite for each extension of the certificate of competence is evidence of the successful participation in a further training course recognised by the competent authority according to annex 1b. Para. 5 applies accordingly.

4.3 Expert knowledge

(1) Evidence of expert knowledge according to number 4.2 para. 1 No. 3 has been provided by anyone who presents a certificate on his participation in a course recognised by the competent authority for the intended activity in which an examination is passed. The certificate of competence is to be limited according to the evidence provided of the expert knowledge.

(2) In the courses for the acquisition of expert knowledge according to annex 1a to c, the participants learn the knowledge which is necessary to safely perform fumigation activities to protect workers, other people and the environment.

(3) The course (see annexes 1a - c) must conclude with a theoretical and a practical examination. The examination can also be taken, in whole or in part, at a later date. The theoretical examination must be taken in writing according to the requirements of annex 1d. In addition, oral examination questions may be asked.

(4) The examination must be taken in the presence of a representative of the body holding the course before a representative of the competent authority in whose supervisory area the course is held. The examination result must be documented.

(5) A certificate showing the type of knowledge communicated is to be issued to the applicant for his successful participation in the course. The certificate must be signed by the representative of the competent authority and the representative of the body responsible for the course.

(6) In the case of the expert knowledge being limited to individual areas of use, the duration of the course may be shortened accordingly.

(7) The following is to be regarded as sufficient experience:

- a) Participation in a minimum number of fumigations with each of the fumigants in the relevant areas of use (e.g. fumigation of silo cells, rooms, stacks of sacks, flat stores, transport containers, ships) for which a certificate of competence is being applied. Participation in at least four fumigations is required for the first two areas of use, participation in at least two fumigations for each additional area of use.
- b) As a reference period, a practical period of 12 to 18 months under the instruction of a head of fumigation. A period less than that according to sentence 1 may be sufficient if the certificate of competence is restricted to fumigation activities with phosphorus hydride and preparations forming hydrogen cyanide as well as to areas of use with a reduced risk potential, e.g. grain stores, stationary fumigation plants or containers.
- c) For the opening, ventilation and release of fumigated transport units, the verified participation in at least four appropriate and complete work operations under the instruction of a holder of a certificate of competence.
- d) Evidence of training in first aid.

Participation in an appropriate fumigation is sufficient to acquire certificates of competence for pest control in the ground.

5 Risk assessment

- (1) Proceeding from the general requirements of the Hazardous Substances Ordinance and its special provisions in Annex III No. 5 for the safe performance of activities involving toxic and highly toxic fumigants, number 5 contains notes on the establishment of risk assessments for fumigation. The catalogue of the measures indicated in numbers 5.3 and 5.4 is suitable to largely minimise the risks that occur.
- (2) The specialist for occupational safety and health as well as the physician charged by the employer according to section 15 para. 3 are to always participate in the preparation of the risk assessment for the fumigation activities.
- (3) If the fumigant is not substituted, deviations from the measures according to number 5.3 et seq. may only be made if the health and safety of workers and other people is guaranteed in at least an equivalent way. Otherwise, this is only possible by submitting an application to the competent authority for an exception permit in accordance with section 20 of the Hazard Substances Ordinance (GefStoffV).

5.1 General notes

- (1) Fumigations are to be performed so that people are not put at risk. Rooms and goods to be fumigated are therefore to be adequately sealed. The factsheets published by the Federal Biological Research Centre (BBA) (see also number 15 letter d of the notes on accompanying provisions for fumigations) contain relevant technical notes.¹
- (2) Whether sufficient sealing is present must be determined, depending on the location and properties of the object to be fumigated,
 - on the basis of factsheet No. 66 of the BBA or
 - by means of a leakage test conducted by the head of fumigation or another person with expert knowledge using factsheet No. 71 of the BBA.
- (3) For the safe performance of fumigation with toxic and highly toxic fumigants, a risk assessment must be established which has to be adapted to suit the respective circumstances and requirements of the individual case. It must include all risks identified to which workers may be exposed as a result of their fumigation activity or other persons through the use of a fumigant and establish suitable measures with which the safety and protection of the health of workers and other people can be ensured.
- (4) Activities with toxic and very toxic fumigants are always assigned to the requirements of protection level 3. The resultant substitution obligation must be examined according to the procedure described in number 5.2 of this TRGS.
- (5) If the examination according to number 5.2 has shown that the objective of a necessary pest control measure can only be achieved with the use of a fumigant according to number 1, the safety and health of workers and other persons are sufficiently protected during fumigation if the steps of a risk assessment established in number 5.3 have been performed and the measures to be established according to the respective circumstances has been taken.

¹ Current factsheets of the BBA are available at <http://www.bba.bund.de>.

(6) For risk assessments of fumigation activities, it is recommended to identify any risks to workers and third parties separately in each case as the resultant catalogue of measures may differ. The protective measures to be taken can be of a technical or organisational nature and must be tailored to the special features of a fumigant or a specific application.

(7) Anyone who, as a contractor, wants to perform fumigations outside fumigation plants must inform the customer in writing of the risks associated with the fumigation and of the start of the fumigation work.

5.2 Substitution examination

(1) The customer must examine for activities with hazardous substances whether they can be replaced with substances, preparations or articles or processes which are not or less dangerous to the health and safety of the workers under the respective conditions of use. If an equally effective process is identified, it must be given preference. Waiving possible substitution must be justified in the documentation of the risk assessment.

(2) For example, the following processes have so far been used instead of fumigation with very toxic or toxic fumigants:

- Heat treatment of wooden pallets and dunnage as an alternative to bromomethane (see also directory in number 15 letter c ISPM 15)
- Heat pest eradication in mills and empty rooms as an alternative to sulfuryl difluoride
- Inert gases, such as carbon dioxide and nitrogen with residual oxygen contents, to protect stocks and material for insect control as an alternative to the use of phosphorus hydride or sulfuryl difluoride

(3) The following principles must be observed within the framework of the substitution examination:

1. The control objective must not be questioned. This also includes that the formation of resistance must remain largely excluded as this results in ineffectiveness or the need for a repetition of the treatment with an increased dose of a fumigant according to number 1.
2. If, according to the state of the art of fumigation, alternatives are available for fumigation with the substances and preparations mentioned in number 1, they are appropriate or if they are mentioned in other fumigation regulations, substitution must be given preference in all considerations. This applies in particular if a reasonability test according to relevant TRGS Rules has shown that the treatment objective can also be achieved without substantial extra expense with the alternative process.

5.3 Recommendations for risk assessments for fumigation activities

(1) Risk assessments for fumigation activities must always be established comprehensively. That means that all potential hazards to the workers of the fumigation company, the customer and other persons have to be considered. The main work steps of fumigation can be systematised as follows by allocating identical risk elements to the fumigation activity:

1. Main work step/activity:

- Inspection of the object to be fumigated, preliminary work, sealing and leakage test, storage of fumigant
- Introduction and removal of the fumigant
- Supervision during the fumigation phase
- Ventilation and release
- Disposal of fumigant residues

2. The following hazards in particular are to be assessed for fumigation activities:

- Material effects incl. dust
- Mechanical risks, e.g. risk of damage to installations and machines, falling over and falling down, visibility conditions
- Risks from electricity,
- Physical effects, e.g. noise,
- Fires and explosions if caused by fumigant,
- Physical loads

3. The table below provides help to determine which risk can be assigned to which work steps of a fumigation process:

| Possible risk \ Work step | Inspection of the object to be fumigated, preliminary work, sealing, storage of fumigant | Introduction and removal of the fumigant | Supervision during the fumigation phase | Ventilation and release | Disposal of fumigant residues |
|---|--|--|---|-------------------------|-------------------------------|
| Material effects including dust | X | X | X | X | X |
| Mechanical effect, e.g. damage to installations and machines, falling over and falling off, visibility conditions | X | X | | X | - |
| Electricity or electromagnetic fields | X | - | | X | - |
| Fire and explosion risks if caused by properties of the fumigant | - | X | | - | X |
| Physical effects, e.g. noise, vibrations etc. | X | X | | X | - |
| Increased physical loads | X | X | X | X | - |

(2) If this TRGS does not contain any other statements on individual risk elements mentioned in the table, the other relevant occupational safety and health regulations are to be used to determine protective measures. Numbers 14 and 15 contain references to other relevant provisions.

(3) The procedure is analogous for fumigation activities in stationary fumigation plants. Here, the following activities in particular are to be assessed:

- Supply of the fumigation plant with the fumigant,
- Changing compressed gas cylinders (if necessary),
- Removal and disposal of the carrier material.

5.4 Protective measures for fumigation activities

5.4.1 Fundamental protective measures for all fumigation activities

(1) The employer must ensure that written working instructions which allow for the risk assessment of the fumigation activity are made available to the workers in a form and language which is understandable for the workers. The working instructions must, in particular, contain the information for the workers which is necessary to be able to assess the risks presented by the fumigant.

(2) The employer must also ensure that the workers are instructed verbally using the working instructions once a year about the risks arising during fumigation activities and the measures required for their protection. This instruction must contain general occupational medical and toxicological advice with the participation of the company doctor.

(3) A danger area is to be set up around an object to be fumigated and secured with an appropriate cordon. Outside the established danger area the fumigant must not be detectable during the action time with the gas measurement methods according to number 13.3 usual for fumigation. If necessary, the danger area is to be enlarged accordingly. People who have to perform an activity related to the fumigation may only be in the danger area with the approval of the head of fumigation. If necessary, a cordon or clearance must be initiated.

(4) After the introduction of a fumigant, all rooms must be kept locked until release so that they cannot be entered.

(5) The compressed gas containers used for fumigation have to be deposited outside the object to be fumigated so that they are stable and sufficiently protected against misuse.

(6) If fumigants from compressed gas cylinders are used, dosing lines or used hoses must be flushed with compressed air or nitrogen on completion of the dosing process.

5.4.2 First aid, emergency measures and safety drills

(1) Before the start of fumigation, it must be ensured that

1. the telephone number of the rescue and emergency medical service and the directory of poison information centres are on hand,
2. escape and rescue routes are established and kept clear,

3. any people injured, especially from lower rooms, can be rescued quickly using suitable lifting gear and approved stretchers with sufficiently long rescue lines.
- (2) Safety drills must be held regularly for emergency situations during fumigation activities. The purpose of the safety drills is to gain control over possible emergency situations such as the rescue and treatment of people as well as to execute an emergency chain. Here, particular local conditions and requirements must be considered, including the participation of local emergency crews.
- (3) Suitable equipment and medication for first aid in the event of poisoning are to be kept on hand ready for use at the fumigation site or near the fumigation plant and are to be inspected at least once a year for completeness and functionality.
- (4) The requirement for reasonable and suitable first-aid facilities and medication at the fumigation site are satisfied when the following equipment and medication are on hand:
 1. an emergency telephone in the vicinity with a landline connection or a ready-to-use mobile phone,
 2. an emergency information card according to Annex 3a about the fumigant used
 3. a large first aid box to DIN 13169,
 4. a steroid-containing inhalation spray, for example Ventolair 100 or an equivalent, to prevent swelling in the respiratory tract and the collection of fluid in the lungs (lung oedema) and
 5. for fumigation with hydrogen cyanide also an infusion bottle with a 25% sodium thiosulphate solution as well as 2 ampoules of 4-DMAP (4-dimethylaminophenol)
- (5) Prior to a fumigation operation, the head of fumigation must
 - ensure that the emergency alarm chain works,
 - charge a suitably trained person to perform the necessary first-aid measures if he cannot perform or adequately supervise them himself for fumigation reasons.
- (6) immediately take affected workers to a doctor in the event of poisoning and skin injuries.
- (7) Holders of certificates of competence and persons with expert knowledge are to undergo vocational and further training by a doctor in accordance with section 15 subs. 3 GefStoffV, if applicable with suitable trainers, in first aid, especially with regard to the first aid in case of poisoning with the fumigants used, in addition to the general company first aid. The further training must be repeated at least two years after initial training or the last further training course.

5.4.3 Extended catalogue of measures for fumigation activities on and in transport units

- (1) The regulations in this chapter must be applied when opening potentially fumigated transport units in the event of an inspection of the load or before unloading at the destination. If a fumigated transport unit is not opened properly, the safety and health of workers and other people may be endangered.
- (2) Transport units, also referred to as containers, from overseas are from experience frequently contaminated with hazardous substances that are present in the gas or vapour state. In addition to fumigants pursuant to number 1, other hazardous substances may

also be present here. A risk assessment is always necessary for the safe opening of contaminated transport units. Information on risks that could possibly occur can be taken from the freight documents, which are to be examined before transport units are opened. Factors such as the country of origin, supplier, type of goods and packaging are to be included in the evaluation. A non-exhaustive list of hazardous substances that have frequently occurred and been detected in the past can be found in the tables in annex 4 to this TRGS.

(3) Measurements of pollutants with the container door closed are necessary in order to determine the risk potential. Measuring devices and methods are to be chosen to allow detection of all of the eligible substances and measurement of the corresponding assessment criteria pursuant to table 1 in annex 4. In case of flows of goods of a known nature (countries of origin, contents, sender), measurements carried out on a random sampling basis may be sufficient. The frequency and scope of the random sampling should be determined on a statistical basis in accordance with the risk potential. In this respect, reference is to be made to the existing residual risk and to protective measures that are to be derived from this.

(4) If unusual odours are perceived in the atmosphere of a transport unit, it is also to be assumed that contamination is present. This is to be characterised more precisely, e.g. by screening with multifunction devices (RFA). Odours are deemed unusual if they are primarily aromatic or pungent in nature and cannot be attributed to a specific product.

(5) Contaminated transport units are to be ventilated until the measured concentrations are below the assessment criteria pursuant to table 1 in annex 4. If ventilation does not lead to a reduction in the pollutant concentration to below the corresponding assessment criteria because of the nature of the goods and packaging, the transport unit in question must be unloaded with the use of suitable respiratory protection (full-face mask with a class AB filter attachment) and the goods subjected to further forced ventilation by fans with the packaging open in suitable sheds, which must be secured against unauthorised entry, until the values fall below the assessment criteria pursuant to table 1 in annex 4.

5.4.3.1 Identification of the risk potential

(1) If one of the following features is present, it must always be assumed that a transport unit has been fumigated with hazardous substances pursuant to number 1 and that the health and safety of workers and other people may be particularly at risk if the unit is not opened properly:

- Labelling of the transport unit as fumigated in accordance with hazardous goods regulations (labelling readily legible and not older than three months),
- Labelling of the transport unit as fumigated and ventilated in accordance with hazardous goods regulations (wording: "Danger, ventilated on ..."),
- Relevant information or notes in the loading and freight documents, e.g. UN No. 3359, Class 9 according to the IMDG Code, or ADR special provisions for fumigated cargo transport units (CTUs) in chapter 5.5 of the aforementioned provisions,
- Detection of a fumigant after the introduction of a measuring probe into the unopened transport unit through door seals or ventilation slits.

If one of the above-mentioned features is present, the measures listed in number 5.4.3.2 to protect workers and third parties against hazardous fumigants are to be taken when opening, ventilating and entering a transport unit.

(2) The features listed below are to be regarded as indications that a potentially fumigated transport unit was fumigated with hazardous substances according to number 1:

- Labelling of the transport unit as fumigated according to hazardous goods regulations not fully removed, illegible or otherwise unclear,
- Ventilation slits of the transport unit glued together or sealed,
- Freight according to loading and freight documents packed and stored on wooden pallets or in wooden packaging,
- Result of measurements unspecific,
- or other suspicious facts.

If one of these features is present, proceed initially in accordance with number 5.4.3.3 to determine protective measures. If at least two of the features according to sentence 1 are present, proceed directly in accordance with number 5.4.3.2 as long as it can be ruled out by measurement or comparable assessment that a hazardous volume of fumigant may still be present in the transport unit.

5.4.3.2 Opening potentially fumigated transport units according to number 5.4.3.1 para. 1

(1) If one of the features listed under number 5.4.3.1 para. 1 is present, the following measures must be taken to protect the health and safety of workers and other persons:

- Inspection of the interior of the closed transport unit by a knowledgeable person using a sufficiently selective measurement system from outside, e.g. by introducing a measuring probe at a suitable location.
- Establishment of a safety area of at least 10 m around the loading door to be opened.
- Establishment of the ventilation period by a person with expert knowledge according to number 4.3.
- Opening and ventilating the unit using suitable respiratory protection equipment:
 - using self-contained respiratory protection equipment in the presence of sulfur dioxide or an unknown fumigant,
 - using a full-face mask with a class AX filter attachment in the presence of bromomethane and with a class B2 filter attachment in the presence of hydrogen cyanide or phosphorus hydride.
- Visual inspection of the load contents for any fumigant residues, e.g. carrier materials or aerosol dispensers/cans and removal of the same.
- Identification of the fumigant residual concentration on expiry of the ventilation phase and release of the loading unit.

(2) When determining the duration of ventilation, the crucial parameters such as the meteorological and physical environmental conditions, physical and chemical properties of the fumigant, adsorption and desorption behaviour of the goods loaded, the type and density of the packaging in the transport unit and, if applicable, other factors in individual cases must be taken into account.

(3) If a fumigated transport unit is not completely and finally unloaded after ventilation and interim release, e.g. to check the load, but is closed again and transported on, re-

newed ventilation is necessary owing to possible degassing of the load during transportation or after prolonged standing at the destination.

(4) The necessary ventilation period for release can be shortened considerably with mechanical ventilation measures on transport units. If suitability is proven, this can result in the introduction of procedural and substance-specific criteria that permit the application of section 7 subs. 8 sentence 5 GefStoffV.

5.4.3.3 Opening potentially fumigated transport units according to number 5.4.3.1 para. 2

(1) If one of the features listed under number 5.4.3.1 para. 2 is present, the following measures must be taken to protect the health and safety of workers and other people:

- Inspection of the interior of the closed transport unit from outside by a knowledgeable person using a sufficiently selective measuring system, e.g. by introducing a measuring probe at a suitable location,
- Determination of a safety area of min. 10 m around the loading door to be opened, then proceeding as described in number 5.4.3.2, if a fumigant concentration in excess of the corresponding assessment criteria is detected,
- Visual inspection of the load contents for any fumigant residues, e.g. carrier materials or cans, and for other indications of fumigation performed prior to opening.

(2) If, during the visual inspection of the opened unit, fumigant residues are found, the unit must be sealed again immediately, the precautionary safety area made sufficiently identifiable and the procedure under number 5.4.3.2 followed.

5.4.3.4 Release of fumigated containers after opening and ventilation

(1) Prior to the release of an opened transport unit pursuant to annex I No. 4.4.3 para. 4 GefStoffV, it must be ensured by a sufficiently long ventilation phase that no further risk due to fumigant residues is present. In addition, measurements are to be taken to check whether fumigants pursuant to number 1 may still be present inside the unit at a concentration that could impair the health of the workers. The tables in annex 4 contain corresponding assessment criteria for this.

(2) If a transport unit that has been treated with fumigants pursuant to number 1 is not unloaded after interim ventilation but sealed again and transported on, ventilation is to be performed again at the destination and a release is required at that location. In this case, the label pursuant to ADR subsection 5.5.2.3 and attached in accordance with hazardous goods regulations must not be removed before further transport.

(3) The release of contaminated containers, especially in case of import containers, is regulated according to annex I No. 4.4.3 para. 4 GefStoffV with regard to the fumigants covered by this TRGS and is carried out after release measurement with suitable measurement equipment in accordance with number 13.3. The printed form according to annex 3d is to be used for the purpose of documentation. In addition to the date, the form must also include a note of the time. If there is a risk of subsequent fumigation by fumigants pursuant to number 1 and further transport is carried out, an issued release certificate loses its validity after 24 hours at the latest.

(4) The measurement results in respect of other hazardous substances pursuant to num-

ber 5.4.3.1 para. 2 are to be documented in a separate log and enclosed with the release certificate.

5.4.4 Extended catalogue of measures to protect workers and other people indirectly affected by fumigation activities

The measures listed below are suitable to ensure the protection of workers and other people who may be endangered indirectly as a result of the use of a fumigant according to number 1.

(1) The users of rooms, buildings or properties which adjoin the fumigation object are to be warned in writing by the head of fumigation at least 24 hours before the introduction of fumigants with reference to the risks which may stem from the fumigant. For this purpose, the notes listed in annex 3a to this TRGS are to be taken into account.

(2) Before introducing the fumigant, the head of fumigation must convince himself that structurally connected buildings or building complexes are cleared and that no one is present in these, in adjacent or other rooms into which fumigants can penetrate. The same applies to buildings with which the object to be fumigated is structurally connected via shafts, channels, cable ducts, empty pipes and similar.

(3) With fumigation in structurally connected buildings used for different purposes, the following additional measures must be carefully examined, as part of the risk assessment, if odourless fumigants are used to increase the safety and protection of people who could be there:

- Installation of equipment to detect the fumigant with optical/acoustic warning signals if the detection limit is exceeded,
- Addition of an odorous substance with a pronounced sensory warning effect to the fumigant (odorisation) and
- Continuous monitoring of the object being fumigated by holders of a certificate of competence.

The feasibility of the above-mentioned measures must be examined in each individual case regardless of other safety measures demanded in this TRGS. Partial or total implementation may only be waived if

- there are concrete fumigation reasons for this or
- the measures prove to disproportionately difficult after examination of the individual case.

The required safety must then be guaranteed in a different way.

(4) The result of the examination is an indispensable part of the risk assessment for fumigation in structurally connected buildings and must be documented in the report on fumigation. The annexes 2a and 2b of this TRGS are to be used for this purpose.

(5) Concrete fumigation reasons exist if chemical reactions of the odorant have a negative impact on the object to be fumigated, reduces its value or results in the inedibility of food.

(6) An object to be fumigated which is structurally connected to other buildings or has a cubic capacity of less than 500 m³ is to be subjected to a leakage test using a tracer gas after performance of the necessary sealing measures.

(7) After introduction of the fumigant until the release, all rooms are to be kept locked so that they cannot be entered. Access to the rooms mentioned in para. 1 is to be prevented during fumigation by replacing the locks or installing additional securing devices if the existing locking devices do not offer sufficient protection.

(8) The head of fumigation or a person sufficiently knowledgeable for measurements of the fumigant used must regularly check to see whether fumigants occur outside the established danger area. Measurement points and the frequency of the measurements are to be adapted to suit the local circumstances of the building and use, the prevailing meteorological ambient conditions and the stage of fumigation. The measurement results are to be recorded and kept with the fumigation report.

(9) If structurally connected rooms, e.g. warehouses, workshops, electrical machine rooms and passages, have to be entered during fumigation for operationally necessary reasons or activities have to be performed there, measurements of any fumigant concentrations must be taken continuously in the room air for the duration of this activity. People may only stay in such rooms or workers may only be employed in these areas if every single measurement does not exceed the respective OEL of the fumigant (as limit value).

(10) When opening and ventilating fumigated objects, the head of fumigation must ensure that no one is endangered by the discharge of the fumigant. Particular care must be taken to ensure that fumigants are not drawn in by neighbouring ventilation systems. Furthermore, the demand according to sentence 1 may be satisfied

- with fumigation plants through the use of suitable filter systems,
- with the ventilation of occasionally fumigated objects, e.g. mills and grain stores, by the discharge at a sufficient height allowing for the surrounding buildings,
- with weather conditions with a low exchange of air through the postponement of the ventilation operation.

(11) The competent authorities for the enforcement of air pollution regulations may, if required, issue more detailed statements. At this juncture, express reference is made to the relevant provisions, e.g. in the Federal Immissions Control Act and the German Clean Air Code (see also number 15 letter b References to accompanying regulations for fumigation).

5.4.5 Additional protective measures for fumigation activities onboard ships

The fumigation of grain in ships' cargo holds at berths in ports or during the crossing represents special challenges for the head of fumigation responsible and the management of the ship. The functioning of the safety facilities which are indispensable for the ship's safety, for example the fire alarm systems and bilge pumps, must not be impaired as part of the necessary sealing work. In view of the high strains in a heavy gale the mechanical properties of the versatile bulk carrier represent a particular problem for the leak-tightness of fumigated ships' cargo holds. At the same time, the safety of the ship's crew members must also be guaranteed during transit with a fumigated cargo. The internationally applicable statements contained in the IMO directive "Recommendations on the Safe Use of Pesticides in Ships" (see also number 15 letter c References to accompanying regulations for fumigation) are, in principle, suitable, when observed, to guarantee the safety and protection of the health of crew members on ships with a fumigated cargo. Against this background, the following additional statements are made in this TRGS for the fumigation of ships:

1. In the case of fumigation of ships and cargoes onboard ships it is imperative to comply with the Internal Maritime Organisation's "Recommendations on the Safe Use of Pesticides in Ships" in its ruling version.
2. The head of fumigation must hand over a risk assessment to the ship's manager for the transit in which the possible risks to the crew from the fumigant discharged on board are listed and measurements laid down on how the safety and health of the crew members are to be guaranteed.
3. In addition to the warning signs required according to number 8 para. 1 on the fumigated ship's cargo holds, warning signs with the same wording are to be clearly put up on the gangway and at the entrances to the crew's quarters and illuminated in the dark.
4. The head of fumigation ensures that the crew members are sufficiently informed about the fumigation on board. If he cannot provide the instruction himself, e.g. because this is not possible in the language of all crew members, instruction must be provided by the ship's officer responsible who is adequately instructed by the head of fumigation, if necessary with the help of an interpreter.

6 Keeping and storing fumigants

(1) Very toxic and toxic fumigants must be stored so that they do not endanger the health of workers, other people and the environment. Furthermore, precautions must be taken to prevent misuse. The fumigants are to be locked up and stored so that only persons with expert knowledge according to number 4.3 have access. Moreover, reference is expressly made to the special provisions on the storage of very toxic and toxic substances and preparations in TRGS 514.

(2) Fumigants must not be refilled into and kept in containers whose shape or labelling could lead to a mix-up with food. They must not be kept or stored in the direct vicinity of medication, food or fodder.

7 Notifications and reporting to the competent authority

7.1 Notification of fumigation

(1) Anyone who wants to perform fumigation with the fumigants according to number 1 outside a stationary plant must notify the competent authority in writing and at least one week, in the case of a ship fumigation 24 hours beforehand. The competent authority may, in justified cases, permit exceptions to this notification deadline (printed form for notification, see annex 3b to this TRGS).

(2) A 24-hour notification period is sufficient for the fumigation of transport units which are located at a port or railway terminal or other transshipment depot for export.

(3) Notification of a one-off fumigation is sufficient for fumigations in fumigation plants. The notification to the competent authority must be updated for

- every change of the head of fumigation,
- changes in the fumigation process and to the fumigation plant which require a review of the risk assessment and/or

- as soon as another fumigant is used.
- (4) The following are to be indicated in the notification:
1. The head of fumigation,
 2. The date of fumigation,
 3. The location of the fumigation and the object to be fumigated and the goods to be fumigated in a current layout plan with a scale of 1:1000,
 4. The fumigant used and the planned quantities,
 5. The probable start of fumigation,
 6. The probable end of fumigation,
 7. The probable date of the release,
 8. The time of the leakage test if this is required,
 9. The proposed measurement points and the intervals in which measurements are to be taken in a measurement plan,
 10. The registration or authorisation number of the fumigant.

7.2 Reporting to the competent authority in cases of damage and accidents

- (1) The employer must immediately notify the competent authority
- about every accident and every operational malfunction which have resulted in a serious health impairment of the workers during activities with the fumigants or
 - about cases of sickness or death where there are concrete indications that the cause was due to the activity with fumigants, with an exact indication of the activity and the risk assessment.
- (2) A serious health impairment during activities with toxic or very toxic fumigants is given if acute symptoms of poisoning occur with a worker or the person affected has reported for medical treatment.
- (3) The report to the competent authority according to para. 1 is to be made 24 hours, but at the latest within 48 hours, after the potential case of poisoning becomes known.
- (4) Sending a copy of the accident report to the accident insurance institution responsible is also regarded as sufficient notification to the competent authority.

8 Labelling of fumigated transport units and rooms

- (1) Fumigated transport units are to be labelled with a rectangular warning sign visible on all sides, at least 300 mm wide and 250 mm high. The following information is to be provided in black lettering at least 25 mm high on a white background:
1. The word "DANGER",
 2. The danger symbol for "toxic",
 3. The inscription "UNDER FUMIGATION",
 4. The name of the fumigant

5. The date and time of fumigation and
6. The inscription "ENTRY PROHIBITED".

Furthermore, the name, address and telephone number of the fumigation company are to be indicated on the warning sign.

(2) The labelling necessary according to para. 1 is also to be provided in English in the shipping and aviation sectors.

(3) Para. 1 always applies to the labelling at entrances to rooms

- which are to be fumigated or
- which are adjacent to such rooms and into which fumigants can penetrate

provided that no use is made of the provision in para. 4.

(4) In derogation of paragraph 1, entrances to rooms which are to be fumigated or which are adjacent to such rooms and into which fumigants can penetrate may be labelled with a 300 x 250 mm large orange warning sign with the following features:

1. The danger symbol T for "toxic",
2. The inscription "Very toxic gases! Danger! No entry",
3. The designation of the fumigant,
4. The date and time of the fumigation,
5. The name, address and telephone number of the fumigation company,
6. The name and telephone number of the head of fumigation,
7. For an emergency: "Phone the emergency control room at tel. No. xxxxx".

9 Disposal of fumigant residues

(1) Residues which are produced during fumigation must be disposed of in accordance with the waste regulations, in particular in compliance with the Ordinance on the Determination of Wastes (AbfBestV), the Waste Avoidance, Recycling and Disposal Act (KrW-/AbfG) and the Waste Register Ordinance (AVV). Accordingly, e.g. bags, tablets, pellets as well as plates and strips that form phosphorus hydride have the waste code 061301 (not yet degassed wastes) or 060316 (degassed wastes). Small quantities that occur, including contaminated packaging materials, are to be collected separately and taken directly to the municipal collection point for problematic substances.

(2) Transport packaging is disposed of in accordance with the provisions of the Packaging Ordinance (VerpackV). Accordingly, transport packaging can be returned to the distributor.

(3) Sales packaging that is free of residue, such as cans, bottles, canisters and the like (see also section 3 subs. 1 No. 2 VerpackV) must be rendered unusable and disposed of via the household or industrial waste system.

(4) Compressed gas cylinders must be returned to the producer/supplier for re-use.

(5) PH₃ carrier material which is used in fumigation can, after it is sufficiently degassed in accordance with the distributor's instructions for use in a safety area to be specially set up, be deactivated as follows, for example, and then transported and disposed of without risk: a container standing outdoors is to be filled with water and the tension relieved by

adding a commercially available washing-up liquid under stirring. The carrier material (e.g. plates, bags, tablets) is then gradually added in portions and left for at least 12 hours in the safety area. During this period the container is to be kept open. Then the carrier material can be disposed of with industrial waste.

(6) Hydrogen cyanide carrier material used for fumigation can be disposed of after use via industrial waste without further treatment.

10 Release of ventilated rooms and transport units

(1) The head of fumigation may only release rooms, fittings and fumigated goods when it has been ensured by means of suitable detection processes that there is no longer a risk from fumigants.

(2) A requirement for the release of fumigated empty rooms, rooms with fittings and goods for their further risk-free use is that the desorption of the fumigant used has progressed so far that the concentrations of the following substances in the ambient room air are reliably below these values when the respective substances are used:

- Bromomethane: 3.9 mg/m³ (1 ppm)
- Hydrogen cyanide: 2.1 mg/m³ (1.9 ppm)
- Phosphorus hydride 0.14 mg/m³ (0.1 ppm)
- Sulfuryl difluoride: 10 mg/m³

Provided that the substance-specific detection limit of the measurement system used permits reliable determination of detected fumigants at concentrations of less than a third of the assessment criteria pursuant to annex 4, a note is to be included in the release log if the values fell below the detection limit of the measuring device.

(3) If fumigants other than those listed in paragraph 2 are detected, in particular with imported transport units, paras 2 and 4 apply analogously.

(4) The head of fumigation may also permit fumigated objects to be entered prior to the release without respiratory protection equipment if the OEL is undershot.

11 Fumigation report

(1) A fumigation report is to be prepared for fumigations. On request, a copy is to be sent to the competent authority. The report is to contain in particular the type and quantity of the fumigants used, location of use, the staff involved, the start and end of the fumigation activity as well as the time of the release. The fumigation report is to be kept for at least 6 years, in particular as practical verification for the issuance of certificates of competence.

(2) In the case of stationary fumigation plants, the reports may also be prepared in the form of a tabular logbook.

12 Supplementary regulations for certain fumigants

12.1 Hydrogen cyanide

(1) Hydrogen cyanide is classified as very toxic, dangerous to the environment and highly inflammable. Moreover, there is a risk in fumigation activities that hydrogen cyanide is absorbed through the skin, in particular through injured or even open parts of the skin. People with open wounds must not be deployed for fumigation activities involving hydrogen cyanide.

(2) For the fumigation of rooms the gas quantity used must not exceed 10 g/m³.

(3) More than 100 kg of hydrogen cyanide must not be used by one holder of a certificate of competence on one working day.

(4) Workers must wear working clothes which cover the body as well as respiratory protection equipment with gas filter type B2 when performing fumigation with hydrogen cyanide.

12.2 Phosphorus hydride

(1) Pure phosphorus hydride is classified as very toxic, highly inflammable, caustic and dangerous to the environment. Moreover, it is self-igniting in air.

(2) Fumigation activities with phosphorus hydride for pest control outdoors do not require notification to be sent to the competent authority nor a report.

(3) For the fumigation of rooms the quantity of gas used must be selected so that no explosive gas-air mixture can form at any point in the room.

(4) Holders of certificates of competence and persons with expert knowledge must carry with them respiratory protection equipment with suitable gas filters (type B2) for fumigation work with phosphorus hydride. If auxiliary workers according to number 13.4 are deployed for fumigation with preparations that develop phosphorus hydride, one more holder of a certificate of competence or person with expert knowledge with suitable respiratory protection equipment must be provided per 10 auxiliary workers.

12.3 Sulfuryl difluoride

(1) Sulfuryl difluoride is classified as toxic and dangerous to the environment.

(2) The compressed gas cylinders used for fumigation with sulfuryl difluoride must be deposited outside the object to be fumigated. Continuous monitoring with measurement equipment is to be insured especially when handling the compressed gas cylinders. When opening cylinder valves, working clothes covering the body, safety shoes, face splash guard or tightly sealing goggles must be worn as personal protective equipment.

(3) If objects exposed to fumigants have to be entered, e.g. in order to initiate ventilation, this may only take place if the person is wearing self-contained respiratory protection equipment. Filter units are not suitable for fumigations with sulfuryl difluoride.

13 Additional explanatory notes

13.1 Head of fumigation

- (1) A responsible head of fumigation must be appointed for each fumigation. The head of fumigation must have a certificate of competence sufficient for the intended fumigation.
- (2) In the case of fumigation plants, heads of fumigation may be appointed for the duration of the validity of the certificate of competence as the functionary responsible. In this case, the appointment must be made in writing.

13.2 Presence and availability of persons with expert knowledge

- (1) During the main work steps mentioned in the risk assessment under number 5.3 para. 1 another person with expert knowledge according to number 4.3 must be present in addition to the head of fumigation. This requirement is satisfied for the period of the phase under gas if the holder of a certificate of competence appointed is the head of fumigation or his representative is available.
- (2) A head of fumigation is generally available as required if he
 - can be contacted within 1/4 hour, e.g. by mobile phone or, in the case of fumigations on ships, by a VHF radiotelephone that operates on the channels of the port authority and
 - can arrive at the fumigation site within two hours.
- (3) In the case of fumigation plants, the presence of at least one person with expert knowledge during the following work steps must be ensured at all times in compliance with number 13.3 para. 3:
 - supply of the fumigation plant with the fumigant,
 - change of the compressed gas cylinders if the fumigant is being supplied from compressed gas cylinders,
 - supervision of the leakage test of the plant if this does not automatically result in the stoppage of the process sequence in the case of program-controlled fault diagnosis,
 - triggering or monitoring of the start process of the fumigation,
 - end of the fumigation process,
 - removal and disposal of the carrier material if produced and
 - release of the fumigated goods according to number 10.

Furthermore, the availability of the head of fumigation appointed according to paragraph 2 must be guaranteed.

13.3 Monitoring duty, measurements and detection limits

- (1) In the performance of fumigation, it is necessary to measure the concentration of fumigants in the air in several work steps. This applies in particular to the monitoring of the fumigant concentration outside the established danger area (number 5.4.1 para. 3, number 5.4.4 para. 8), its examination prior to a release (number 10

para. 1) or for the examination of the risk potential of any fumigated containers (number 5.4.3.1). These measurements are to guarantee the timely warning of possible exposure to fumigants and are not equivalent to workplace measurements. Accordingly, other requirements have to be placed on the performance of the measurements, the type of measurement facilities used and the qualifications of the people performing the measurements. Direct-display measurement systems must be used to identify the concentration of fumigants in the air. In practice, the following have proved to be suitable

- test tubes,
- measurement systems on an electrochemical basis and
- photo ionisation detectors (PID).

(2) Measurements of fumigant concentrations in the air during fumigation work are part of the fumigation activity. Therefore, the expert knowledge according to number 4.3 of this TRGS is also always required to perform these measurements. In derogation of this, measurements may also be performed on potentially fumigated transport units by two people who have the relevant occupational training (knowledgeable persons). This requires knowledge of the measurement system used and of possible factors which may influence the measurement result.

(3) If a knowledgeable person ascertains during his measurements that the detection limit of the fumigant is exceeded, a person with expert knowledge according to number 4.3 must be called in immediately.

(4) Reference is made to number 10 para. 2 as regards the detection limit within the meaning of this TRGS.

(5) When ventilating fumigated rooms, monitoring is to be performed to determine whether the fumigant can be detected outside the danger area. This does not apply to the ventilation phase of fumigation plants.

13.4 Deployment of auxiliary workers for fumigation activities

(1) The required supervision is sufficient when one supervisor with expert knowledge is deployed for 10 auxiliary workers.

(2) During the work the people deployed must not be under the influence of alcohol or other drugs.

(3) Before their deployment for fumigation activities, auxiliary workers must be adequately instructed about possible risks, the recognition of symptoms and rules of conduct in the event of poisoning.

13.5 Personal protective equipment

(1) Very toxic or toxic substances are released, as intended, during fumigation with the substances and preparations mentioned under number 1. To prevent these substances entering the body through inhalation or possibly through the skin, adequate personal protective equipment must be worn during some stages of fumigation. The type and nature of the personal protective equipment to be provided by the employer and to be worn by the worker are to be established in the risk assessment according to number 5. The correct handling, maintenance and care of personal protective equipment are indispensable,

especially with fumigations involving very toxic and toxic fumigants.

(2) Fumigants liquefied under pressure can cause freezing if they impact unprotected body parts as they expand. At the same time, the absorption of the toxic or very toxic substance through the skin into the body is accelerated. Therefore, in the case of activities with fumigants liquefied under pressure, protective clothing is to be worn in addition to respiratory protection equipment, which adequately protects parts of the skin which are at particular risk.

(3) Suitable respiratory protection equipment for fumigation with phosphorus hydride or hydrogen cyanide including full-face masks with a filter at least of class B2 according to BGR 190 (see also number 14 Other applicable regulations). Workers who wear full-face masks with a filter must verify their suitability to wear respiratory protection equipment according to the Principle G 26 II of the Berufsgenossenschaften (institutions for statutory accident insurance and prevention).

(4) If sulfuryl difluoride is used, self-contained respiratory protection equipment is to be used as, at present, no filter units are known which retain this fumigant. Workers who wear this heavy respiratory protection equipment must verify its suitability in accordance with the Principle G 26 III of the Berufsgenossenschaften.

(5) Personal protective equipment, in particular respiratory protection equipment, requires diligent care and maintenance. The relevant notes of the manufacturers are to be observed for this purpose with regard to the inspection intervals in addition to the BGR 190.

(6) The filters of respiratory protection equipment used for fumigation are to be disposed of properly after being used once.

13.6 Occupational health care

(1) Irrespective of the suitability examination according to number 4.2 para. 2 and the necessary suitability of respiratory protection equipment according to the Principle G 26 of the Berufsgenossenschaften, the employer must offer workers who regularly perform fumigation precautionary occupational medical examinations according to annex V No. 2.2 of the Hazardous Substances Ordinance (GefStoffV). The type and the scope of this occupational health care are to be established separately by the company doctor or by the physician charged by the employer according to section 15 subs. 3 in line with the knowledge and assessment of the fumigation activity. Knowledge gained from precautionary occupational medical examinations according to annex V No. 2.2 GefStoffV is to be taken into account

- in establishing measures in the risk assessment
- in the performance of suitability examinations according to number 4.2 para. 1.

(2) Depending on the result of the risk assessment, other special precautionary examinations may have to be arranged for the endangered workers or offered to them.²

² This applies in particular to the effect of grain or fodder dusts (Annex V No. 2.1 para. 3 and No. 2.2, para. 7 GefStoffV) and work at great heights with a risk of falling (G 41). If workers without any knowledge of fumigation have to wear respiratory protection equipment for certain work, e.g. opening and ventilating fumigated transport units, the suitability of the respiratory protection equipment must be determined at regular intervals, but at the latest every three years, in accordance with G 26 as part of

(3) Precautionary occupational medical occupations according to annex V No. 2.2 also have to be offered to workers deployed as auxiliary staff members in fumigation work if they are to be deployed on a regular basis.

14 Other applicable regulations

The safety and protection of workers in fumigation activities with very toxic and toxic fumigants are largely ensured if, in addition to the TRGS 512 Fumigation, the TRGS Rules and statutory provisions listed below are followed and observed:

a) Technical Rules for Hazardous Substances

- TRGS 400 Risk assessment for activities involving hazardous substances
- TRGS 401 Hazard due to skin contact – identification, assessment, measures
- TRGS 402 Identification and assessment of airborne concentration of hazardous substances in working areas
- TRGS 403 Evaluation of substance mixtures in the workplace atmosphere
- TRGS 440 Identification and assessment of the risks resulting from hazardous substances at the workplace: procedure (identification duty)
- TRGS 500 Protective measures: Minimum standards
- TRGS 514 Storage of highly toxic and toxic substances in packages and mobile containers
- TRGS 555 Working instructions and information for workers according to section 14 GefStoffV
- TRGS 900 Occupational exposure limits
- TRGS 905 List of carcinogenic, mutagenic, toxic-to-reproduction substances

b) Laws and ordinances (applicable in the latest version)

- German Chemicals Act – ChemG dated 20.06.02 (BGBl. I P. 2090)
- Hazardous Substances Ordinance – GefStoffV dated 23.12.04 (BGBl. I P. 3758)
- Biocidal Products Authorisation Ordinance – ChemBiozidZulV dated 04.07.2002 (BGBl. I P. 2514)
- Chemicals Ban Ordinance – ChemVerbotsV dated 13.06.2003 (BGBl. I P. 867)
- Occupational Safety and Health Act – ArbSchG dated 07.08.96 (BGBl. I P. 1246)
- Ordinance on the safety and health protection in the use of personal protective equipment at the workplace (PSA-BV) dated 04.12.96 (BGBl. I P. 1841)
- Plant Safety Ordinance – BetrSichV dated 27.09.2002 (BGBl. I P. 3777)

15 References to accompanying regulations for fumigations

In the performance of fumigations, a series of other occupational safety and health regulations, in addition to the other applicable regulations listed in number 14, national and European and regulations on the protection of workers and third parties are to be observed. These include in particular:

occupational health care.

- a.) Regulations, rules and information of the Berufsgenossenschaften (institutions for statutory accident insurance and prevention)
- BGV A 1 Principles of Prevention
 - BGV A 2 Company doctors and specialists for occupational safety and health
 - BGV A 4 Occupational health care
 - BGV D 36 Ladders and steps
 - Accident prevention regulations for shipping companies
 - BGR 117 - 1 Work in containers, silos and confined spaces
 - BGR 139 Use of personal emergency signal systems
 - BGR 190 Use of respiratory protection equipment
 - BGI 569 Factsheet on hydrogen cyanide
- b.) Laws and ordinances (applicable in the current version)
- Infection Protection Act – IfSG dated 20.07.2000 (BGBl. I P. 1045)
 - Plant Protection Act dated 14.05.98 (BGBl. I P. 971, 1527, 3512)
 - Plant Protection – Application Ordinance dated 27.10.1999 (BGBl. I P. 2070)
 - Phytosanitary Ordinance dated 03.04.00 (BGBl. I P. 337)
 - Ordinance governing expert knowledge in plant protection dated 28.07.1986 (BGBl. I P. 1752)
 - Federal Immissions Control Act – BImSchG - dated 26.09.2002 (BGBl. I P. 3830)
 - Waste Avoidance, Recycling and Disposal Act – KrW-/AbfG dated 27.09.94 (BGBl. I P. 2705)
- c.) European and international regulations
- EC Regulation 2037/2000 on substances that deplete the ozone layer dated 29.06.2000 (ABl. EU No. L 359/28)
 - EC Regulation 2032/2003 dated 4.11.2003, amended by EC Regulation 1048/2005 dated 13.06.2005 (biocide review programme, Annex 2 (notified biocides) and Annex 4 (identified biocides))
 - IMO "Recommendations on the Safe Use of Pesticides in Ships"
 - RM 003 "Directive on First Aid Measures - Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG) in Federal Gazette No. 235a dated 14.12.1984
 - ISPM 15 International Standard for Phytosanitary Measures – No. 15 : Guidelines for regulating wood packaging material in international trade
- d.) Information publications of the authorisation offices
- List of the pesticides and stored product protection agents approved by the Federal Office for Consumer Protection and Food Safety
 - List of the disinfection agents and processes for decontamination according to section 18 of the Infection Protection Act (Infektionsschutzgesetz) tested and approved by the Robert Koch Institute
 - Notification of the means and processes approved and recognised by the Federal Biological Research Centre for Agriculture and Forestry (BVL) for pest control according to section 18 of the Infection Protection Act; published in "Bundesarbeitsblatt" (Federal Health Sheet)
 - Factsheet No. 64 of the Federal Biological Research Centre for Agriculture and
 - Committee on Hazardous Substances – AGS management - BAuA - www.baua.de -

Forestry on the control of stored product pests using phosphorus hydride

- Factsheet No. 66 of the Federal Biological Research Centre for Agriculture and Forestry on the sealing of warehouses and grain silos for fumigations against stored product pests
- Factsheet No. 71 of the Federal Biological Research Centre for Agriculture and Forestry on the pressure test to determine the fumigation capability of buildings, chambers or sheet-covered goods in pest control

Annexes:

- Annex 1a Basic course – Expert knowledge
- Annex 1b Advanced course – Expert knowledge
- Annex 1c Shortened course on expert knowledge for transport units
- Annex 1d Theoretical examination on expert knowledge
- Annex 1e Certificate template for suitability examination
- Annex 2a Safety checklist for fumigation technicians
- Annex 2b Safety checklist structural properties fumigation object
- Annex 3a Emergency information card
- Annex 3b Notification to the competent authority
- Annex 3c Release certificate according to TRGS 512 No. 10
- Annex 3d Release certificate for fumigated transport units

Annex 1a to TRGS 512

Basic course for fumigations

Requirements: First-aider course and suitability to wear respiratory protection equipment

Contents of the course:

1 Properties and mode of action of the fumigants

1.1 General

- Basics of the stored product protection and other fields of application for the fumigants (pests and their control)
- Explanation of basic physical terms such as boiling point, solubility, specific weight, explosion limit, ignition temperature, terms and their abbreviations, e.g. ppm
- Physical and chemical properties of the fumigants
- Penetration capability
- Action on goods and materials

1.2 Mode of action

- Explanation of basic fumigation and toxicological terms
- Biological efficacy of the fumigant on target organisms
- Toxicological effect of the fumigant on humans, animals and the environment
- Limit values (occupational exposure limit (OEL), biological limit value etc.)

2 Statutory regulations

2.1 Statutory basics

- General (legal hierarchy law, ordinance, Technical Rule etc.)
- Laws on occupational safety and health and hazardous substances
 - Occupational Safety and Health Act, Plant Safety Act, rules and regulations of the Berufsgenossenschaften (institutions for statutory accident insurance and prevention), personal protective equipment (respiratory protection equipment, protective clothing)
 - Chemicals Act, Hazardous Substances Ordinance, Chemicals Ban Ordinance, Technical Rules for Hazardous Substances
- Authorisation law

- Plant Protection Act, Ordinance governing expert knowledge in plant protection
- Chemicals Act
- Protection Against Infection Act
- Food law
 - Foodstuffs and animal fodder code,
 - Max. Residue Limit Ordinance, Food Hygiene Ordinance
- Environmental law
 - Federal Immissions Control Act, German Clean Air Code
 - Waste Avoidance, Recycling and Disposal Act, Waste Register Ordinance
- Transport law issues
 - Transport of Hazardous Goods Act, Ordinance on the Transportation of Hazardous Goods by Road/Rail
- Other legal areas
 - German Criminal Code, German Civil Code

2.2 Special rules and regulations for fumigation activities

- Hazardous Substances Ordinance
Permission, certificate of competence, expert knowledge, knowledge, notification duty
- TRGS 512

3 Main features of fumigation technology

3.1 Examination prior to fumigation

- Structural and material aspects of fumigation
- Clearance of structurally connected buildings
- Sealing materials and sealing methods
- Leakage test
- Cordoning-off of a danger area
- Labelling of fumigated objects
- Other safety measures for fumigation

3.2 Introduction of the fumigants

- Conventional processes with the various fumigants in the different fields of application
- Safety measures during introduction

3.3 Supervision

- Availability of the head of fumigation
- Gas concentration measurements
 - Selection of suitable equipment and processes
 - Handling
 - Calibration, maintenance
 - Sources of error
- Measurement protocols

3.4 Ventilation of fumigated objects

- Allowance for the effects on the environment
- Allowance for legal matters

3.5 Removal of carrier materials (if required)

3.6 Release of fumigated objects and goods

In particular, problems of subsequent fumigation

3.7 Disposal of carrier materials (if required)

4 Risk assessment

- Preparation of a risk assessment
- Risk factors to be taken into account with the hazardous substance and the object to be fumigated
- Protective measures for activities with fumigants

5 First aid

- Symptoms of poisoning, antidote
- Special first-aid measures when handling fumigants
- First aid by laypersons, physicians, poison information centres
- Equipment, medication, resuscitation measures, organisational measures (transport routes, telephone) etc.

6 Discussion of accidents during fumigation

7 Fumigation exercise

(with special emphasis on the risk assessment, main and subsidiary risks and protective measures)

8 Discussion

9 Examination

- Written examination: see annex 1d number 1
- The practical exercises are each completed with the practical examination.

Duration of course, teachers and number of participants

- Duration of course for one fumigant: 5 days including examination, at least 35 TU à 45 minutes (unrestricted certificate of competence)
- Duration of course for two fumigants: 7 days including examination, at least 50 TU à 45 minutes
- Duration of course for three fumigants: 9 days including examination, at least 60 TU à 45 minutes
- The shortened course duration for two and three fumigants only has a bearing when the entire basic course is completed within a period of 12 months.
- The course duration can be shortened if limited to individual fields of application.
- The number of participants should not exceed 20 people.
- Teachers: persons with expert knowledge, specialist in occupational medicine or company doctor with additional official designation "occupational medicine" (see also section 15 subs. 3 GefStoffV), representatives of authorities

Annex 1b to TRGS 512**Advanced course for the acquisition of expert knowledge
in fumigation**

Requirement: Suitability to wear respiratory protection equipment

Aim of the course:

The aim of the course is to refresh the knowledge communicated in the basic course according to Annex 1a and to teach the progress of developments in fumigation technology. The methodology concentrates on dialogue and the exchange of experience as well as practical exercises.

1. Repetition and consolidation of application-related properties and mode of action of fumigants

- Repetition of basic terms such as ppm, boiling point, solubility, specific weight, explosion limit, ignition temperature etc.
- Repetition of physical and chemical properties of the fumigants, penetration capability, action on goods and materials etc.
- In-depth information on basics of stored goods protection
- Biological efficacy on target organisms, importance of the ct product (concentration action time)
- Toxic effects on humans, animals and the environment; limit values such as OEL, LD₅₀ (dosis letalis) etc.

2. Consolidation of the knowledge of regulations, in particular discussion of new aspects in the legal fields

- Authorisation law incl. authorisation requirement for fumigants
- Food law
- Environmental law
- Matters of transport law
- Occupational safety and health including respiratory protection equipment and protective clothing
- Hazardous Substances Ordinance including Annex III No. 5
- Permission, certificate of competence, expert knowledge, knowledge, obligation to notify
- TRGS 512 Fumigations
- Other fields of law, e.g. provisions of criminal law

3. Fumigation technology

3.1 Inspections before introducing the fumigant

Structural and material aspects, clearance of structurally connected buildings, sealing processes and leakage test, labelling, cordoning-off of danger areas and other safety measures

3.2 Introduction of the fumigants

Conventional and new processes with the various fumigants

Discussion on advantages and disadvantages of various processes

Practical experience with faults and their prevention

3.3 Supervision of the object to be fumigated

With special emphasis on gas concentration measurements with various measuring methods

3.4 Ventilation of fumigated objects

With special emphasis on the effects on the environment

3.5 Removal of carrier materials (if required)

3.6 Release of fumigated objects

3.7 Disposal of carrier materials (if required)

4. Risk assessment

- Establishment of a risk assessment
- Risk factors to be allowed for with fumigations
- Measures to protect workers and third parties in fumigation activities

5. Repetition of the first-aid applications

- Symptoms of poisoning, antidote
- First aid in cases of poisoning
- First aid by laypersons, physicians, poison information centres

- Equipment, medication, organisational measures (transport routes, telephone) etc.

6. Discussion of accidents during fumigation

7. Final discussion and explanation of any questions still unanswered

8. Examination: see Annex 1d number 2

Duration of course, teachers and number of participants

- Duration of course for one fumigant: 3 days including examination, at least 21 TU à 45 minutes (unrestricted certificate of competence)
- Duration of course to two fumigants: 4 days including examination, at least 28 TU à 45 minutes
- Duration of course three fumigants: 5 days including examination, at least 35 TU à 45 minutes
- The shortened course duration for two and three fumigants only has a bearing when the total advanced course is completed within a period of 12 months.
- The course duration can be shortened if limited to individual fields of application.
- The number of participants should not exceed 20 people.
- Teachers: persons with expert knowledge, specialist in occupational medicine or company doctor with additional official designation "occupational medicine" (see also section 15 subs. 3 GefStoffV), representatives of authorities

Annex 1c to TRGS 512**Shortened course for the acquisition of expert knowledge in opening, ventilating and releasing transport containers under gas****Requirement:** First-aid course and suitability to wear respiratory protection equipment

| Subject and contents | Time |
|--|--------------|
| Statutory regulations: IMO Recommendations/Guidelines, Hazardous Substances Ordinance, TRGS 512 etc. e.g. Phytosanitary Ordinance, ISPM 15 and responsibility under criminal law | 2 TU |
| Properties and mode of action of relevant fumigants: Bromomethane, phosphorus hydride, sulfuryl difluoride, hydrogen cyanide and other fumigants which may occur and are listed in GefStoffV | 3 TU |
| Occupational safety - Risk assessment with allowance for ancillary risks such as other gases which may occur, e.g. formaldehyde, carbon dioxide, carbon monoxide and chloropicrin, phenolic substances, fungicides, insecticides, fungus spores, reduced oxygen concentrations and potentially explosive atmospheres - Regulations of the Berufsgenossenschaften | 2 TU |
| Gas measurement methods Demonstration of different measurement processes for the relevant gases | 2 TU |
| Personal protective measures with emphasis on respiratory protection equipment | 2 TU |
| First aid for accidents involving poisoning Gas poisoning in general and peculiarities of certain gases | 1 TU |
| Practical exercises: Container assessment, weak points, approach, technical handling and preparation of the release certificate | 2 TU |
| Final written examination | 1 TU |
| Total duration | 15 TU |

Examination: see number 3 in annex 1d**Course duration, teachers and number of participants**

- Course duration: at least 15 TU à 45 minutes including examination.
- The number of participants should not exceed 20 people.
- Teachers: persons with expert knowledge, specialist in occupational medicine or company doctor with additional official designation "occupational medicine" (section 15 subs. 3 GefStoffV), representatives of authorities

Annex 1d to TRGS 512

Conduct of written examinations for courses for the acquisition of expert knowledge according to number 4.3

The final examinations for seminars for the acquisition of expert knowledge according to the annexes 1a to 1c are to be held in accordance with the following scheme agreed nationwide. The competent authorities for recognising courses for the acquisition of expert knowledge are recommended to stipulate this in the recognition notification for a fumigation seminar.

1. Basic course according to annex 1a

To acquire the extensive expert knowledge according to annex 1a of this TRGS, a total of 60 questions about one fumigant are asked in the written examination, 48 of which as multiple-choice questions as well as a total of 12 calculation tasks and questions with free-text answers.

The multiple-choice questions are divided up into individual subjects as follows:

Eight questions each on the content:

- Properties and mode of action of the fumigants
- Legal basics and special statutory regulations on fumigation
- Fumigation technology

Up to five questions each on the content:

- Fumigation methods for introducing the fumigants
- Gas concentration measurements
- Risk assessment and occupational safety and health
- Personal protective equipment
- First aid

The questions for the free-text answers and the calculation tasks are taken from the entire curriculum with special emphasis on section 3 (fumigation technology and fumigation processes).

For each additional fumigant the number of the questions to be answered increases by 30 in each case as shown in the following:

Up to eight questions on the content:

- Properties and mode of action of the fumigant,

Five questions each on the content:

- Fumigation technology
- fumigation processes of introducing the fumigants

Three questions each on the content:

- Gas concentration measurements

- Risk assessment and occupational safety and health
- Personal protective equipment
- First aid

Answer options:

There may be up to four possible answers to the multiple-choice questions.

Evaluation method:

With the multiple-choice questions there is one point per question if all the answers have been correctly selected.

For the calculation and formulation questions there is one point if they have been answered completely and correctly.

The written examination has been passed if more than 50% of the questions have been answered correctly, that means at least 31 points have been scored for one fumigant.

Specified time:

Up to 120 minutes are given to answer the examination questions for one fumigant; up to 60 minutes in addition permitted for each fumigant.

Resitting the examination

This is possible if the total marks are just under 31 points.

No aids are allowed for the examination with the exception of a collection of formulas and a pocket calculator.

2. Advanced course according to annex 1b

The advanced seminar is concluded with an examination comprising 40 questions analogous to the question scheme of the examination for the basic course. Answer options, evaluation method and resitting possibility apply accordingly. Max. 45 minutes are to be given to answer the catalogue of questions.

3. Shortened course for the acquisition of expert knowledge according to annex 1c

The written examination of a shortened expert-knowledge course according to annex 1c for opening, ventilating and releasing is to comprise 30 to 40 questions and comply with the question scheme for the basic course in annex 1a; calculation questions are not asked.

Annex 2a to TRGS 512

**Questionnaire for fumigation technicians
on special safety measures
(Safety checklist)**

Please cross where applicable!

| | | |
|----|---|---|
| 1. | Is the object to be fumigated (church, museum, mill...) structurally connected with other buildings, e.g. by a common partition wall, common wall surfaces, common roof structure, common cellar, crossings, passages etc.? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 2. | Is the heating system or parts of the heating systems outside the object to be fumigated? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 3. | Do heating shafts/air ducts/hot air shafts lead into neighbouring buildings either above or below ground concealed in the masonry? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 4. | Do old, disused shafts (e.g. from disused heating systems) lead into neighbouring buildings? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 5. | Do water pipes, heating oil pipes, empty pipes lead into neighbouring buildings? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 6. | Are there any <u>underground</u> storage rooms, heating rooms, oil storage tanks, escape routes or old (buried) secret corridors under the object to be fumigated (e.g. church, museum, mill...)? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 7. | In the case of church fumigations: Is there one or more crypts under the church to be fumigated? Has the warning sign been put up at the entrances to the neighbouring property? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 8. | Were all access keys to the object to be fumigated kept safe? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 9. | Where the roof structures in the object to be fumigated checked for endangered animals (bats, falcons, owls...)? | <input type="checkbox"/> Yes <input type="checkbox"/> No |

The questionnaire was answered by the head of fumigation

.....

(Forename and surname)

Place/Date

Signature:

Annex 2b to TRGS 512

**Questionnaire for customers about fumigation relevant structural properties
of objects to be fumigated
(such as churches, castles, museums, mills, warehouses etc.)**

Fumigants preferably have a high capability of penetrating into all building materials. Owing to their particularly high permeability, fumigants can pass through even the most unobtrusive openings.

In order to be able to assess, as a specialist company, dangers and risks of the proposed fumigation, the fumigation company is obliged to obtain answers to the following questions from the customer. It is imperative to answer the questions carefully and conscientiously to achieve fumigation without any incidents.

Please cross where applicable and explain, if necessary with a diagram or entry in the layout!

| | | |
|----|---|---|
| 1. | Is the object to be fumigated (church, museum, mill...) structurally connected with other buildings, e.g. by a common partition wall, common wall surfaces, common roof structure, common cellar, crossings, passages etc.? If so, where? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 2. | Is the heating system or parts of the heating systems outside the object to be fumigated? If so, where? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 3. | Do heating shafts/air ducts/hot air shafts lead into neighbouring buildings either above or below ground concealed in the masonry? If so, where? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 4. | Do old, disused shafts (e.g. from disused heating systems) lead into neighbouring buildings? If so, where? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 5. | Do water pipes, heating oil pipes, empty pipes lead into neighbouring buildings? If so, where? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 6. | Are there any <u>underground</u> storage rooms, underground heating rooms, oil storage tanks, escape routes or old (buried) secret corridors under the object to be fumigated (e.g. church, museum, mill...)? If so, where? | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 7. | In the case of church fumigations: Is there one or more crypts under the church to be fumigated? If so, where? | <input type="checkbox"/> Yes <input type="checkbox"/> No |

The questionnaire was answered by:

.....

.....

Forename and surname

(Signature)

Date:

Annex 3a to TRGS 512**Emergency information card**

(according to number 5.4.2 para. 4 No. 2)

This emergency information card is intended to provide a doctor as quickly as possible with the basic information required for clinical treatment if symptoms of an illness occur which may possibly be related to the intake of the toxic fumigant. This information is to be provided by the manufacturer or distributor of the fumigant. The information card is to be kept by the head of fumigation and the customer of fumigation for an emergency. In accordance with number 5.4, this applies as a precautionary measure to workers and, in accordance with number 5.5, to emergencies with people who are not involved.

1. Name of the fumigant used (also synonyms)

.....

2. Nature of the possible intake

- by inhalation
- through intact skin
- mucous membranes (eyes, wounds)
- swallowing

3. Description of possible symptoms of illness with poisoning

- by inhalation
- through intact skin
- mucous membranes (eyes, wounds)
- swallowing

4. Clinical treatment of the poisoning symptoms after

- inhalative intoxication
- dermal intoxication
- absorption through mucous membranes (eyes, wounds)
- swallowing

5. The following provide further information:

5.1 Manufacturer / telephone No.:

5.2 Head of fumigation / telephone No.:

Annex 3c

Release certificate
according to TRGS 512 No. 10

Permit holder

Name and address

.....
.....

Period of fumigation: from to 20.....

Fumigation by third party

(Object was not fumigated by the holder of a certificate of competence who issued the release.)

Place of release:

I herewith confirm that in the ventilated

Building, room

Stack of sacks

Wagon No.

Transport container (e.g. container) No.

Ship / Barge

Grain store, granary etc.

Silo cell No.

.....

the concentration measured in the room air after ventilation during the release does not exceed the following values of the lower detection limits (cross applicable substances):

- | | | |
|---|--------------------|----------|
| <input type="checkbox"/> Hydrogen cyanide | less than/equal to | 2 ppm |
| <input type="checkbox"/> Bromomethane (methyl bromide) | less than/equal to | 0.5 ppm |
| <input type="checkbox"/> Phosphorus hydride (phosphine) | less than/equal to | 0.01 ppm |
| <input type="checkbox"/> Sulfuryl difluoride | less than/equal to | 1 ppm |

Detection took place at a representative point using appropriate measurement equipment whose measurement range covers this limit.

Measurement equipment: Measurement point/s:.....

The fumigated rooms or goods were ventilated and released in accordance with the provisions of the TRGS 512. The labelling according to number 8 of the TRGS 512 was removed. Subsequent fumigation of treated goods cannot completely be excluded in spite of the greatest care. Therefore, special care must be taken when handling released goods (sufficient supply of fresh air).

A copy of this release certificate was handed over to the customer.

Attention: Transport containers which are not unloaded immediately after release but sealed again must be subjected to further ventilation of at least 30 minutes prior to unloading!

.....
(Place, date)

.....
(Signature of the head of fumigation)

Annex 3d

Release certificate
for fumigated transport units (containers)

| | |
|---|---|
| Holder of permit Company Street and No. Town, postal code | Place of release of the container(s) Terminal/Company Street and No. Town, postal code |
| Description of the container(s) Container type and size Quantity Identification No.(s) Load contents | Special aspects / Other risks <input type="checkbox"/> Missing labelling <input type="checkbox"/> Damage <input type="checkbox"/> Carrier material found in the container <input type="checkbox"/> Unusual/pungent smell <input type="checkbox"/> Formation of mould <input type="checkbox"/> Other: |

The fumigants listed below, which are identified in TRGS 512 annex 4 table 1, were found in the examined container(s). After ventilation, the assessment criteria stated in the table are safely met.

- | | | |
|--|------------------------|--------------------------|
| <input type="checkbox"/> Hydrogen cyanide: | 2.1 mg/m ³ | corresponding to 1.9 ppm |
| <input type="checkbox"/> Bromomethane (methyl bromide): | 3.9 mg/m ³ | corresponding to 1 ppm |
| <input type="checkbox"/> Phosphorus hydride (phosphine): | 0.14 mg/m ³ | corresponding to 0.1 ppm |
| <input type="checkbox"/> Sulfuryl difluoride: | 10 mg/m ³ | corresponding to 2 ppm |
| <input type="checkbox"/> Ethylene oxide | 0.2 mg/m ³ | corresponding to 0.1 ppm |

Detection took place at a representative point with appropriate measurement equipment whose measurement range covers this limit.

Measurement equipment: Measurement point/s:.....
 Date of measurement: Time:

- Fumigated by third party
 (The container was not fumigated by the holder of a certificate of competence who issued the release.)
- The container(s) was(were) unloaded after release.
- The container(s) was(were) sealed again after the release measurement(s) was(were) taken.
 This release certificate therefore loses its validity if the container is not unloaded within 2 hours / 24 hours*.
 *Delete as appropriate!

The container(s) was(were) ventilated and released for subsequent activities in accordance with the provisions of TRGS 512 with the following restriction:

Subsequent fumigation of the treated goods cannot be completely excluded in spite of every care taken. Moreover, other risks may arise (see above under Special aspects). Particular care must also be taken during unloading. Measures for protecting workers must be specified in a risk assessment following renewed measurement of pollutants.

.....
 (Place, date)

.....
 (Signature of the person with expert knowledge)

Annex 4**Assessment criteria for hazardous substances in import containers
(example list for frequently occurring hazardous substances)****Table 1:** Fumigants pursuant to annex I No. 4 GefStoffV in import containers

| Substance contained | Chemical formula | CAS No. | Assessment criterion | |
|--|---------------------------------|-----------|----------------------|--------------------|
| | | | ppm | mg/m ³ |
| Bromomethane (methyl bromide) | CH ₃ Br | 74-83-9 | 1 ^{c)} | 3.9 ^{c)} |
| Ethylene oxide | C ₂ H ₄ O | 75-21-8 | 0.1 ^{b)} | 0.2 ^{b)} |
| Formaldehyde | CH ₂ O | 50-00-0 | 0.3 ^{c)} | 0.37 ^{c)} |
| Hydrogen cyanide | HCN | 74-90-8 | 1.9 ^{c)} | 2.1 ^{c)} |
| Phosphorus hydride (phosphine) | PH ₃ | 7803-51-2 | 0.1 ^{a)} | 0.14 ^{a)} |
| Sulfuryl difluoride (sulfuryl fluoride) | SO ₂ F ₂ | 2699-79-8 | not stated | 10 ^{a)} |

Table 2: Frequently occurring gaseous hazardous substances in import containers

| Substance contained | Chemical formula | CAS No. | Assessment criterion | |
|---|----------------------------------|-----------|----------------------|--------------------|
| | | | ppm | mg/m ³ |
| Ammonia | NH ₃ | 7664-41-7 | 20 ^{a)} | 14 ^{a)} |
| Benzene | C ₆ H ₆ | 71-43-2 | 0.06 ^{b)} | 0.2 ^{b)} |
| Chloropicrin (trichloronitromethane) | CCl ₃ NO ₂ | 76-06-2 | 0.1 ^{a)} | 0.68 ^{a)} |
| Chloromethane (methyl chloride) | CH ₃ Cl | 74-87-3 | 50 ^{a)} | 100 ^{a)} |
| Carbon dioxide | CO ₂ | 124-38-9 | 5000 ^{a)} | 9100 ^{a)} |
| Carbon monoxide | CO | 630-08-0 | 30 ^{a)} | 35 ^{a)} |
| Styrene | C ₈ H ₈ | 102-42-5 | 20 ^{a)} | 86 ^{a)} |
| Toluene | C ₇ H ₈ | 108-88-3 | 50 ^{a)} | 190 ^{a)} |
| Xylene (all isomers) | C ₈ H ₁₀ | 1330-20-7 | 100 ^{a)} | 440 ^{a)} |

Sources of assessment criteria:

a) TRGS 900 "Occupational exposure limits"

b) TRGS 910: Acceptable concentration of the exposure-risk relationship

c) Recommendation of the German Research Foundation (DFG): List of MAK and BAT Values 2011 by the Senate Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area, Announcement 47, Wiley-VCH