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Technical Rules for Hazardous Substances	Isocyanates – Exposure and monitoring Catalog of the exposure scenarios	**Supplement to TRGS 430**

English Translation

Proviso

This translation of the official German document is made only for private use to provide technical information which might be useful to experts in this field outside of Germany. It is not endorsed or approved by the AGS. It shall not be used as legally binding document with any respect. This document is a supplement to the regulation TRGS 430 dealing with workplace safety in areas where isocyanates are made, used or handled. Since the latter is only relevant within Germany it is not translated to prevent any confusion.

Note: This translation is made on a best effort basis; it may contain some technical expressions or terms which are not used elswhere.

Technical Rules for Hazardous Substances	Isocyanates – Exposure and monitoring Catalog of the exposure scenarios	Supplement to TRGS 430

The Technical Rules for Hazardous Substances (TRGS) reflect the status of the safety, occupational medicine, hygiene and ergonomics requirements placed on hazardous substances with respect to marketing and handling. They are developed by the

Committee for Hazardous Substances (AGS)

and adapted depending on further developments.

The Technical Rules for Hazardous Substances are published by the German Federal Ministry of Labor and Social Affairs in the Federal Labor Gazette (Bundes Arbeitsblatt).

Preliminary remark

This supplement to TRGS 430 contains a catalog of exposure scenarios for typical workplaces at which isocyanates are handled. The particular exposure situation (column 3) expected for the specified workplace situation (column 2) is given for these workplaces. The categorisation is made on the basis of the exposure stages for inhalative aerosol or vapor exposure or for skin exposure as listed in No. 4 TRGS 430 (column 3).

The minimum protective measures required to reach the specified exposure stages are listed in the description of the work areas (column 2). Examples of further precautions which have to be applied according to experience in this work area are listed in column 4. They are mainly set with respect to the exposure to isocyanates but they consider in some cases also other exposures that typically occur in this work area, for example to solvents.

The prerequisite for the use of this catalog is the appropriate installation of ventilation and exhaust systems specified in italics in column 2 at the particular workplace and their proper operation. It is also assumed that the basic requirements for occupational hygiene according to TRGS 500 are observed . These exposure scenarios do not provide a the state of the art technical description; Merely an estimate is provided for the exposure situation to be expected at typical workplaces under the conditions that can be definitely met in industrial practice.

The other precautions listed in the catalog (column 4) shall provide to the employer information on a selection of measures actually to be used at the workplace beyond the basic requirements regarding occupational hygiene. The selection must be made with respect to the actual exposure situation at the workplace using the assessment and monitoring concept described in TRGS 430 (main document).

Table: Exposure stages according to No. 4 TRGS 430

Route of exposure	Exposure stages	Probability of exposure
Skin (e.g. also via contaminated clothing)	**H0**	No skin contact possible e.g. closed systems
	H1	Skin contact rare, small areas and immediately appropriately removed e.g. splashes
	H2	Repeatedly short term skin contact Max. 4 x 15 minutes per shift
	H3	Repeatedly prolonged skin contact A total of max. 2 hours per shift
	H4	Constant skin contact More than 2 hours per shift
Vapor inhalatory route (No aerosol formation from the application process but condensation aerosols)	**AD0**	Very low vapor formation or condensation
	AD1	Low vapor formation or condensation
	AD2	Moderate vapor formation or condensation
	AD3	High vapor formation or condensation
Aerosol inhalatory route (Application process with aerosol formation, e.g. atomizing and rolling)	**AA0**	Very low aerosol formation
	AA1	Low aerosol formation
	AA2	Moderate aerosol formation
	AA3	High aerosol formation

Catalog of the exposure scenarios

Product area BS	**Coating materials**		
Application area BS 1	**Production of coating materials**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
BS 1.1 Production of 2-component coating materials	**BS 1.1.1** Filling, refilling, diluting, filling, emptying and sampling *Without exhaust being applied to the object*	AD3 AA0 H1	• Protective gloves • Face mask or fully enclosed goggles • Apron when processing large volumes • Respirator when processing large volumes, at least gas filter A2 • Ventilation independent respirator for possible hazardous emission of inert gas
	BS 1.1.2 Filling, refilling, diluting, filling, emptying and sampling *Exhaust applied to the object*	AD1 AA0 H1	• Protective gloves • Face mask or fully enclosed goggles • Apron when processing large volumes
BS 1.2 Production of 1-comp.onent coating materials with blocked isocyanates	**BS 1.2.1** Pasting, grinding and dispersing of pigmented materials Filling and emptying *Without exhaust applied to the object*	AD3 AA0 H0	• Respirator when processing large volumes, at least gas filter A2
	BS 1.2.2 Pasting, grinding and dispersing of pigmented materials Filling and emptying *Exhaust applied to the object*	AD1 AA0 H0	

Product area BS	**Coating materials**		
Application area BS 1	**Production of coating materials**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
BS 1.3 Production of 1-component coating materials with moisture-hardening isocyanates	**BS 1.3.1** Pasting, grinding and dispersing of pigmented materials Filling and emptying *Without exhaust of the object*	AD3 AA0 H1	• Protective gloves • Face mask or fully enclosed goggles • Respirator when processing large volumes, at least gas filter A2
	BS 1.3.2 Pasting, grinding and dispersing of pigmented materials Filling and emptying *Exhaust applied to the object*	AD1 AA0 H1	• Protective gloves • Face mask or fully enclosed goggles
BS 1.4 Further processing of PUR binders by means of chemical synthesis steps	**BS 1.4.1** Chemical reaction in closed reactors (temperature up to 100°C) Filling and emptying *Without exhaust applied to the object*	AD3 AA0 H1	• Protective gloves • Face mask or fully enclosed goggles • Respirator when processing large volumes, at least gas filter A2
	BS 1.4.2 Chemical reaction in closed reactors (temperature up to 100°C) Filling and emptying *Exhaust applied to the object*	AD1 AA0 H1	• Protective gloves • Face mask or fully enclosed goggles
BS 1.5 Production of PUR powder coatings	**BS 1.5.1** Extrusion of powder coatings raw materials (temperature up to 100°C) *Exhaust applied to the object*	AD1 AA0 H0	

Product area BS:	**Coating materials**		
Application area BS 2:	**Use of 1-comp./2-comp. coating materials**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
BS 2.1 Rolling, brushing and non-spray applications outdoors or in rooms	**BS 2.1.1** Mobile workplaces for rolling, brushing and non-spray application in buildings, rooms and halls *No exhaust air equipment*	AD2 AA0 H2	• Protective gloves • Respirator when coating large areas, at least gas filter A1
	BS 2.1.2 Permanent workplaces for rolling, brushing and non-spray application in buildings, rooms and halls *Exhaust at the workplace*	AD1 AA0 H2	• Protective gloves
	BS 2.1.3 Rolling, brushing and non-spray application outdoors *Natural ventilation*	AD2 AA0 H2	• Protective gloves
	BS 2.1.4 Rolling, brushing, non-spray application in confined rooms without ventilation *Without natural ventilation, e.g. in pits*	AD2-3 AA0 H2	• Protective gloves • Effective ventilation required, e.g. since an oxygen deficiency may occur

Product area BS:	**Coating materials**		
Application area BS 2:	**Use of 1-comp./2-comp. coating materials**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
BS 2.2 Spraying incl. electrostatic support in booths, on spray stands, on spray walls, outdoors or in rooms	**BS 2.2.1** Hand spray booth No rebound or spray stream from other painters in the breathing area *With ventilation and exhaust equipment*	AD2 AA1-2 H1	• Respirator with at least gas filter A1 and particle filter P2
	BS 2.2.2 Hand spray booth Rebound or spray stream from other painters in the breathing area *With ventilation and exhaust equipment*	AD2 AA3 H2	• Respirator with at least gas filter A2 and particle filter P3, if possible supported by fan (TM3AP, TH3AP) or with supplied air • Protective gloves • Face mask
	BS 2.2.3 Spray wall and spray stand No rebound or spray stream from other painters in the breathing area *With exhaust equipment without defined air supply*	AD1-2 AA2 H1	• Respirator with at least gas filter A1 and particle filter P2
	BS 2.2.4 Coating in halls *No exhaust equipment at the spray workplace*	AD1-2 AA3 H2	• Respirator with at least gas filter A2 and particle filter P2, combined with face mask and fully enclosed goggles • Protective gloves
	BS 2.2.5 Spraying work in confined spaces, e.g. bilges of ships, containers *Exhaust equipment at the spray workplace*	AD2 AA2-3 H2	• Effective aeration and ventilation • Supplied-air respirator, combined with face mask and fully enclosed goggles • Protective gloves

Product area BS:	**Coating materials**		
Application area BS 2:	**Use of 1-comp./2-comp. coating materials**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
BS 2.2 Spraying incl. electrostatic support in booths, on spray stands, on spray walls, outdoors or in rooms (continued)	**BS 2.2.6** Spraying in buildings *No exhaust equipment at the spray workplace*	AD1 AA3 H2	• Respirator with at least gas filter A2 and particle filter P2, combined with face mask and fully enclosed goggles • Protective gloves
	BS 2.2.7 Spraying outdoors *No enclosure of the spray workplace*	AD1 AA2 H2	• Respirator with at least gas filter A2 and particle filter P2, combined with face mask and fully enclosed goggles • Protective gloves
	BS 2.2.8 Spraying in enclosed building sites *Exhaust equipment at the spray workplace*	AD1, AA3, H2	• Respirator with supplied air or supported by fan (TM3AP), combined with face mask and fully enclosed goggles or TH3AP • Protective gloves

Product area BS:	**Coating materials**		
Application area BS 2:	**Use of 1-comp./2-comp. coating materials**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
BS 2.3 Mixing and diluting of 1- or 2-component PUR coating materials at the mixing site	**BS 2.3.1** Mixing and diluting *Natural ventilation*	AD1 AA0 H2	• Protective gloves • Face mask or fully enclosed goggles • Apron when processing large volumes • Respirator when processing large volumes, at least gas filter A1
	BS 2.3.2 Mixing and diluting *Without natural ventilation, e.g. in garages*	AD2 AA0 H2	• Protective gloves • Face mask or fully enclosed goggles • Apron when processing large volumes • Effective aeration and exhaust with additional ventilation units, otherwise respirator with at least gas filter A2
BS 2.4 Cleaning of equipment and emptying containers with residues of 1- or 2-component PUR coating materials outdoors or in rooms	**BS 2.4.1** Cleaning of equipment, spray nozzles, etc. *Natural ventilation, open cleaning container*	AD1 AA0 H2	• Protective gloves • Respirator with at least gas filter A1 and particle filter P2, combined with face mask or fully enclosed goggles
	BS 2.4.2 Cleaning of equipment, spray nozzles, etc. *Cleaning equipment with exhaust*	AD1 AA0 H1	• Protective gloves
	BS 2.4.3 Emptying residues from container *Natural ventilation*	AD1 AA0 H1	• Protective gloves

Product area BS:	**Coating materials**		
Application area BS 3:	**Sealing parquet with PUR 1- or 2-comp. sealants (TDI basis)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
BS 3.1 Preparations	**BS 3.1.1** Opening container/drum at room temperature *Natural ventilation*	AD1 AA0 H1	• Protective goggles • Protective gloves
	BS 3.1.2 Refilling at room temperature *Natural ventilation*	AD1 AA0 H2	• Protective goggles • Protective gloves
	BS 3.1.3 Mixing (2 components) by hand with stirrer attached to drill at room temperature *Natural ventilation*	AD2 AA1 H2	• Protective goggles • Protective gloves
BS 3.2 Application of sealant	By hand over large areas with roller at room temperature *No ventilation*	AD2 AA0 H2	• Protective gloves • Respirator with gas filter at least A1
BS 3.3 Cleaning	**BS 3.3.1** Cleaning tools by hand at room temperature *Natural ventilation*	AD1 AA0 H2	• Protective goggles • Protective gloves
	BS 3.3.2 Open evaporation of residues at room temperature *Natural ventilation*	AD1 AA0 H2	

Product area IS:	**PUR integral foams**		
Application area IS 1:	**Production of PUR integral foams (semi-rigid and rigid MDI systems)**[1]		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
IS 1.1 Metering equipment	**IS 1.1.1** Filter and dosing pump, capacity adjustement or check *Enclosure with exhaust applied to the object*	AD2 AA1 H1	• Protective gloves • Protective goggles • Spray protection
	IS 1.1.2 Reduce pressure on day container, open and fill with raw materials Check pressure control valves and sealings *Enclosure with exhaust applied to the object*	AD2 AA1 H1	• Avoid reducing pressure by counterpressure filling; if necessary, reduce pressure by passing stream via tubing into exhaust • Extract raw materials with vacuum and filling pipe • Protective gloves • Protective goggles • Spray protection

[1] PUR integral foams are produced practically exclusively in molds by machines. The molds must withstand the foaming pressure of the usually closed-cell integral foams until they have finally hardened. The raw material basis is mainly MDI. Integral foams have a closed foam skin and a fine-cell foam that becomes lighter toward the core; the overall structure resembles a sandwich system. Silicon- or wax-like release agents are used for release from the mold in the case of the metal molds that are generally of a uniform temperature. Reaction mixtures are filled in a few seconds with hand mixing heads, with mechanically controlled mixing heads into open molds with lids, into closed molds with sealable filling opening or with an attached mixing head. The reactivity of the raw material systems used is adjusted to moderate to very fast, depending on the size of the articles, the filling method used and the temperature of the molds. The extent to which the molds are filled with liquid reaction mixture is generally substantially more than 50% of the volume of the molded article. Therefore, only a little and only slightly contaminated volume is specifically expelled as off-gas from the ventilation openings of the molds. The PUR integral foam articles are removed from the molds manually or mechanically with ejectors.

Product area IS:	**PUR integral foams**		
Application area IS 1:	**Production of PUR integral foams (semi-rigid and rigid MDI systems)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
IS 1.2 Foaming facility	**IS 1.2.1** Introduction of the reaction mixture with hand mixing head Swinging away and deposition of the hand mixing head *Exhaust applied to the molds, the mixing head and the resting position of the mixing head*	AD2 AA1 H1	• Optimize the flow and exhaust of the air exhaust of the whole introduction area in the molds • Extension of the holding device on the hand mixing head in order to extend the distance to the molds when the reaction mixture is being introduced • Protective gloves • Protective goggles • Possibly spray protection
	IS 1.2.2 Inserting the reaction mixture with mechanically guided mixing head Swinging away and deposition of the mixing head *Exhaust applied to the molds, the mixing head and the resting position of the mixing head*	AD1 AA1 H1	• Optimize the flow and exhaustion of the air exhaust of the whole introduction area in the molds • Protective gloves • Protective goggles
	IS 1.2.3 Manual and mechanical closing and sealing of the foaming molds *Exhaust applied to the object*	AD1 AA1 H1	• Specifically exhaust manually any air expelled when the lid is closed; take account of the direction in which the air stream is moving • Protective gloves when manually closing the lid

Product area IS:	**PUR integral foams**		
Application area IS 1:	**Production of PUR integral foams (semi-rigid and rigid MDI systems)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
IS 1.2 Foaming facility (continuation)	**IS 1.2.4** Venting of the mold cavities by the foaming reaction mixture[2] *Application of exhaust to venting openings of the molds*	AD2 AA1 H0	• Exhaust the air in the ventilation area of the molds (at least 2-3 mold cycle positions or distance moved by molds in 1 min.); note direction and rate of air flow • Avoid diffuse distribution of the mold off-gas • Specific fresh air veil along the mold track to assist the exhaustion
	IS 1.2.5 Unlocking and opening of the foaming molds *Exhaust applied to the object*	AD1 AA0 H1	• Unlocking and opening of the mold lid with specific exhaust laterally and in front of the mold a little above the separation level of mold lid and mold cavity • Protective gloves
	IS 1.2.6 Removal of the molded article and placing on transport devices for storage *Exhaust applied to the object*	AD1 AA0 H1	• Protective gloves

[2] Emission from the molds continues until the mold cavity has been completely filled with foam.

Product area IS:	**PUR integral foams**		
Application area IS 1:	**Production of PUR integral foams (semi-rigid and rigid MDI systems)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
IS 1.3 Finishing	**IS 1.3.1** Storage (tumbling) *No thermal processing*	AD0 AA0 H1	
	IS 1.3.2 Other work up or finishing *Mechanical finishing with knives, no thermal processing*	AD0 AA0 H1	
IS 1.4 Maintenance and repair work	On flexible connection pipes, flanges, sealings, storage containers, pipes, valves, (drum) pumps, filters, foaming machines, mixing heads and other parts of foaming machines and foaming facility in direct contact with isocyanates	AD2-3 AA1 H2	• If possible, carry out maintenance and repair work in exhaust area • Rinse and decontaminate pipes, containers, filters, pumps and mixing head before dismantling • Close off and mark the maintenance and repair area if there is a possibility of isocyanate release • Protective gloves • Protective goggles • Respirator with supply of fresh air • Face mask when carrying out work overhead

Product area MS:	**Production and use of foam in cans**		
Application area MS 1:	**Production of foam in cans**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
MS 1.1 Storage, delivery of liquid MDI/PMDI	**MS 1.1.1** Liquid MDI/PMDI – filling/emptying of a tank truck, CTC (cubic tank container) *Exhaust applied to the container to be filled*	AD2 AA1 H1	• Protective gloves • Protective goggles • Clear allocation of flanges; possible use of twin-ball valves
	MS 1.1.2 Liquid MDI/PMDI - filling/emptying of drums *Exhaust applied to the container to be filled*	AD2 AA1 H2	• Protective gloves • Face and eye protection • Clear allocation of flanges; possible use of twin-ball valves • Connection couplings outdoors; maximum temperature 42°C for MDI
MS 1.2 Filling of cartridges	All operations *Technical room ventilation With exhaust applied to the container to be filled*	AD1 AA1 H1	• Protective gloves • Protective goggles • Spray protection at the filling stations
MS 1.3 Maintenance/ cleaning	Maintenance and cleaning of pumps, pipes and containers	AD2 AA0 H2	• Protective gloves • Protective goggles • Face mask when carrying out work overhead • Explosion protection if flammable blowing agents are used (e.g. propane/butane)

Product area MS:	**Production and use of foam in cans**		
Application area MS 2:	**Use of foam in cans**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
MS 2.1 Application outdoors	Manually Ready-to -use foam surges out of foam can *Natural ventilation*	AD1 AA1 H2	• Protective gloves • Protective goggles while carrying out work overhead
MS 2.2 Application in closed rooms	Manually Ready-to-use foam surges out of foam can *Natural ventilation: windows and doors open*	AD1 AA1 H2	• Protective gloves • Protective goggles while carrying out work overhead • When large amounts are being processed, danger of explosion from propellant

Product area KS:	**Production and use of adhesives**		
Application area KS 1:	**Production of adhesives (PUR, 1-comp. and 2-comp.)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 1.1 Preparatory work	**KS 1.1.1** Filling of storage tanks from tank truck or railway car *Gas displacement*	AD2 AA0 H1	• Protective goggles • Protective gloves • Clear allocation of flanges; possible use of twin-ball valves • Connection couplings outdoors; maximum temperature 42°C with MDI
	KS 1.1.2 Reactor filling from storage tanks *Closed system*	AD0 AA0 H0	• Reactor ventilation by exhaust air incineration
KS 1.2 Carrying out the reaction	**KS 1.2.1** Reaction process in the reactor *Closed system*	AD0 AA0 H0	
	KS 1.2.2 Sampling via manhole with ladle *Exhaust applied to the object*	AD3 AA1 H2	• Protective goggles • Protective gloves • Respirator with gas filter A1
	KS 1.2.3 Sampling via tapping line *Exhaust applied to the object*	AD2 AA1 H1	• Protective goggles • Protective gloves
KS 1.3 Filling	Filling into containers, drums, hobbocks and cans *Exhaust applied to the object*	AD2 AA0 H1	• Protective goggles • Protective gloves • Operating temperature 45–55°C

Product area KS:	**Production and use of adhesives**		
Application area KS 2:	**Use of 1-comp. hot melt adhesive in bookbinding (MDI, TDI)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 2.1 Heating of adhesive in premelter Operating temperature 120°C	**KS 2.1.1** Open container by hand *Natural ventilation*	AD0 AA0 H1	• Protective gloves
	KS 2.1.2 Depressurize empty drum and remove seal *Closed system with exhaust applied to the object*	AD1 AA0 H0	
	KS 2.1.3 Change of drum with/without inliner by hand *Exhaust applied to the object*	AD2 AA0 H1	• Protective gloves
	KS 2.1.4 Disposal of empty drum without inliner by hand (adherence of residual material) *Natural ventilation*	AD2 AA0 H1	• Protective gloves
	KS 2.1.5 Heating of adhesive *Closed system*	AD1 AA0 H0	
	KS 2.1.6 Cleaning of equipment by hand at room temperature *Natural ventilation*	AD1 AA0 H2	• Protective gloves

Product area KS:	**Production and use of adhesives**		
Application area KS 2:	**Use of 1-comp. hot melt adhesive in bookbinding (MDI, TDI)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 2.2 Adhesive applied in the gluing machine Operating temperature 120°C	**KS 2.2.1** Setting up the gluing machine by hand *Exhaust applied to the object*	AD1 AA0 H2	• Protective gloves
	KS 2.2.2 Application of adhesive (basin with and spray nozzle) *Closed system with exhaust applied to the object*	AD1 AA0 H1	
	KS 2.2.3 Elimination of disturbances by hand *Exhaust applied to the object*	AD2 AA0 H2	• Protective gloves • Respirator with gas filter A1
	KS 2.2.4 Glue change manually by removing the glue basin from the equipment *Natural ventilation*	AD2 AA0 H1	• Protective gloves • Respirator with gas filter A1
	KS 2.2.5 Cleaning of the equipment by hand (mechanically) at room temperature *Natural ventilation*	AD0 AA0 H2	• Protective gloves
	KS 2.2.6 Cleaning of the equipment by hand with detergents at 80–120°C *Natural ventilation*	AD2 AA0 H2	• Protective gloves • Respirator with gas filter A1
KS 2.3 Hardening	On palette in the working room at room temperature with manual stacking *Natural ventilation*	AD1 AA0 H1	• Protective gloves

Product area KS:	**Production and use of adhesives**		
Application area KS 2:	**Use of 1-comp. hot melt adhesive in bookbinding (MDI, TDI)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 2.4 Refinishing	Mechanical cutting with paper dust extraction at room temperature *Enclosure and exhaust applied to the object*	AD1 AA0 H1	

Product area KS:	**Production and use of adhesives**		
Application area KS 3	**Film lamination with solvent-free 1-comp. or 2-comp. adhesive (MDI, IPDI)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 3.1 Preparatory work	**KS 3.1.1** Glue connection/continuation: Open container by hand; mixing if 2-component adhesive is used *Natural ventilation*	AD1 AA0 H1	• Protective goggles • Protective gloves
	KS 3.1.2 Heating of glue in drum at 50–80°C *Natural ventilation*	AD0 AA0 H1	• Protective goggles • Protective gloves
	KS 3.1.3 Glue transport: Connect heated drum to transport system *Natural ventilation*	AD0 AA0 H2	• Protective goggles • Protective gloves
KS 3.2 Lamination in the film lamination machine at up to 240 m/min	**KS 3.2.1** Adhesive applied by the open process to dimensionally stable part at 50–80°C *Enclosed space with exhaust applied to the object*	AD0 AA0 H1	• Protective gloves
	KS 3.2.2 Adhesive applied by the open process to dimensionally stable part at 50–80°C *Exhaust applied to the object*	AD0 AA2 H1	• Protective gloves
	KS 3.2.3 Application of lamination by the open process at 50–80°C *Enclosure with exhaust applied to the object*	AD0 AA0 H1	• Protective gloves
KS 3.3 Hardening at room temperature in intermediate storage	*Natural ventilation*	AD0 AA0 H1	

Product area KS:	**Production and use of adhesives**		
Application area KS 3	**Film lamination with solvent-free 1-comp. or 2-comp. adhesive (MDI, IPDI)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 3.4 Cleaning of the equipment; elimination of operating disturbances	**KS 3.4.1** Cleaning of the equipment with solvents at room temperature *Exhaust applied to the object*	AD0 AA0 H2	• Protective gloves
	KS 3.4.2 Cleaning of parts of equipment by burning out at > 800°C *Closed equipment*	AD0 AA0 H1	
	KS 3.4.3 Elimination of operating disturbances in the laminating area	AD1 AA2 H1	• Protective gloves • Respirator with gas filter A1 and particle filter P2

Product area KS:	**Production and use of adhesives**		
Application area KS 4:	**Film lamination with solvent-free 1-comp. or 2-comp. adhesive (MDI, IPDI)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 4.1 Preparatory work	**KS 4.1.1** Opening of the container and connecting to automatic mixing system at room temperature *Enclosure with exhaust applied to the object*	AD0 AA0 H2	• Protective goggles • Protective gloves
	KS 4.1.2 Opening of the container and mixing by hand at room temperature *Exhaust applied to the object*	AD1 AA0 H2	• Protective goggles • Protective gloves
KS 4.2 Lamination in the film lamination machine at up to 260 m/min	**KS 4.2.1** Adhesive applied by the open process to dimensionally stable parts at room temperature *Exhaust applied to the object*	AD0 AA0 H1	• Protective gloves
	KS 4.2.2 Adhesive applied by the open process to dimensionally stable parts at room temperature *Exhaust applied to the object*	AD0 AA2 H1	• Protective gloves
	KS 4.2.3 Drying of the adhesive and evaporation of the solvent at 60-120°C in the drier *Enclosure with exhaust applied to the object*	AD1 AA0 H1	
	KS 4.2.4 Application of the lamination by the open process at room temperature *Technical ventilation*	AD1 AA0 H1	• Protective gloves

Product area KS:	**Production and use of adhesives**		
Application area KS 4:	**Film lamination with solvent-free 1-comp. or 2-comp. adhesive (MDI, IPDI)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 4.3 Hardening at room temperature in intermediate storage	*Natural ventilation*	AD0 AA0 H1	
KS 4.4 Cleaning of the equipment; elimination of operating disturbances	**KS 4.4.1** Cleaning of the equipment with solvents at room temperature *Exhaust applied to the object*	AD0 AA0 H2	• Protective gloves
	KS 4.4.2 Cleaning of parts of the equipment by burning out at > 800 °C *Closed equipment*	AD0 AA0 H1	
	KS 4.4.3 Elimination of operating disturbances in the laminating area	AD1 AA2 H1	• Protective gloves • Respirator with gas filter A1 and particle filter P2

Product area KS:	**Production and use of adhesives**		
Application area KS 5:	**Film lamination with solvent-free 1-comp. hotmelt adhesive (PUR hotmelt, MDI)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 5.1 Preparatory work	**KS 5.1.1** Open container; pre-warming at up to about 100°C *Exhaust applied to the object*	AD1 AA0 H1	• Protective gloves
	KS 5.1.2 Prewarming in melting bath at 100°C *Exhaust applied to the object*	AD1 AA0 H1	
	KS 5.1.3 Heating to final temperature in a closed system at 100 - 250°C *Enclosure with exhaust applied to the object*	AD0 AA0 H1	
KS 5.2 Lamination in the laminating machine at up to 260 m/min	**KS 5.2.1** Application of adhesive by the open process to dimensionally stable parts at 100–250°C *Enclosure with exhaust applied to the object*	AD0 AA0 H1	• Protective gloves
	KS 5.2.2 Application of adhesive by the open process to dimensionally stable parts at 100–250°C *Exhaust applied to the object*	AD0 AA2 H1	• Protective gloves
	KS 5.2.3 Application of the lamination by the open process at 100–250°C *Enclosure with exhaust applied to the object*	AD0 AA0 H1	• Protective gloves

Product area KS:	**Production and use of adhesives**		
Application area KS 5:	**Film lamination with solvent-free 1-comp. hotmelt adhesive (PUR hotmelt, MDI)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 5.3 Cleaning of the equipment; elimination of operating disturbances	**KS 5.3.1** Cleaning of the equipment with solvents at room temperature *Exhaust applied to the object*	AD0 AA0 H2	• Protective gloves
	KS 5.3.2 Cleaning of parts of the equipment by burning out at > 800°C *Closed equipment*	AD0 AA0 H1	
	KS 5.3.3 Elimination of operating disturbances in the laminating area	AD2 AA2 H1	• Protective gloves • Respirator with gas filter A1 and particle filter P2

Product area KS:	**Production and use of adhesives**		
Application area KS 6:	**Production of fluted filters with 2-comp. sealing compound (MDI)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 6.1 Preparatory work	Change drum, open drum, pierce lid, and mount drum lid with extraction unit gastight *Natural ventilation*	AD0 AA0 H1	• Protective goggles • Protective gloves
KS 6.2 Pouring in of the sealing compound round the fluted filter (bottom and lid)	**KS 6.2.1** Mixing (2-component) in the mixing tube at room temperature *Closed system with exhaust applied to the object*	AD0 AA0 H1	
	KS 6.2.2 Pouring in by hand with metering unit around the folded filter at room temperature *Exhaust applied to the object*	AD1 AA0 H2	• Protective gloves
	KS 6.2.3 Manual transfer of the product to the heating plate *With exhaust applied to the heating plate*	AD1 AA0 H2	• Protective gloves
	KS 6.2.4 Cleaning/elimination of disturbances by hand at room temperature *Exhaust applied to the object*	AD1 AA0 H2	• Protective gloves
KS 6.3 Hardening on the heating plate	**KS 6.3.1** Open hardening at the heating plate at 60–80°C *Exhaust applied to the object*	AD1 AA0 H2	• Protective gloves
	KS 6.3.2 Removal of the finished product from the mold at room temperature *Exhaust applied to the object*	AD0 AA0 H1	• Protective gloves
KS 6.4 Refinishing	Burring, cutting and polishing	AD0 AA0 H1	• Protective gloves

Product area KS:	**Production and use of adhesives**		
Application area KS 7:	**Laying of parquet with PUR 1-comp. or 2-comp. adhesives (MDI basis)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 7.1 Preparations	**KS 7.1.1** Opening of container/drum at room temperature *Natural ventilation*	AD1 AA0 H1	• Protective goggles • Protective gloves
	KS 7.1.2 Refilling at room temperature *Natural ventilation*	AD1 AA0 H2	• Protective goggles • Protective gloves
	KS 7.1.3 Mixing (2 comp.) by hand with stirrer attached to drill at room temperature *Natural ventilation*	AD1 AA1 H2	• Protective goggles • Protective gloves
KS 7.2 Application of adhesive	**KS 7.2.1** Ready-to-use parquet: by hand at room temperature with toothed spatula *Natural ventilation*	AD1 AA0 H2	
	KS 7.2.2 Parquet fillets: By hand at room temperature with toothed spatula; pressing of the parquet fillets into the bed of adhesive by hand *Natural ventilation*	AD1 AA0 H4	• Protective gloves
KS 7.3 Cleaning	**KS 7.3.1** Cleaning of tools by hand at room temperature *Natural ventilation*	AD0 AA0 H2	• Protective goggles • Protective gloves
	KS 7.3.2 Open evaporation of residues in container at room temperature *Natural ventilation*	AD0 AA0 H1	

Product area KS:	**Production and use of adhesives**		
Application area KS 8:	**Laying of floor coverings except parquet with PUR 1-comp. or 2-comp. adhesives (MDI basis)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 8.1 Preparations	**KS 8.1.1** Opening of container/drum at room temperature *Natural ventilation*	AD1 AA0 H1	• Protective goggles • Protective gloves
	KS 8.1.2 Refilling at room temperature *Natural ventilation*	AD1 AA0 H2	• Protective goggles • Protective gloves
	KS 8.1.3 Mixing (2 comp.) by hand with stirrer on drill at room temperature *Natural ventilation*	AD1 AA1 H2	• Protective goggles • Protective gloves
KS 8.2 Application of adhesive	By hand at room temperature with toothed spatula *Natural ventilation*	AD1 AA0 H2	
KS 8.3 Cleaning	**KS 8.3.1** Cleaning of tools by hand at room temperature *Natural ventilation*	AD0 AA0 H2	• Protective goggles • Protective gloves
	KS 8.3.2 Open evaporation of residues in container at room temperature *Natural ventilation*	AD0 AA0 H1	

Product area KS:	**Production and use of adhesives**		
Application area KS 9:	**Gluing of shoes with 2-comp. PUR LM adhesive (MDI, TDI)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 9.1 Preparations	**KS 9.1.1** Opening of container at room temperature *Natural ventilation*	AD1 AA0 H1	• Protective goggles • Protective gloves
	KS 9.1.2 Mixing of components at room temperature *Natural ventilation*	AD1 AA1 H2	• Protective goggles • Protective gloves
KS 9.2 Application of adhesive	**KS 9.2.1** Application to small areas with rollers, nozzles or brushes at room temperature *Exhaust applied to the object*	AD1 AA1 H2	• Protective goggles • Protective gloves
	KS 9.2.2 Application to small areas with rollers, nozzles or brushes at room temperature *No exhaust applied to the object; natural room ventilation*	AD3 AA2 H2	• Protective goggles • Protective gloves • Respirator with gas filter A1 and particle filter P2
	KS 9.2.3 Exhaust ventilation at room temperature *Exhaust applied to the object*	AD1 AA0 H0	
KS 9.3 Hardening	Covered for hours at room temperature *Enclosure with exhaust applied to the object*	AD0 AA0 H0	
KS 9.4 Refinishing, storage and cleaning	Cleaning of working tools with solvents at room temperature *Exhaust applied to the object*	AD0 AA0 H2	• Protective goggles • Protective gloves

Product area KS:	**Production and use of adhesives**		
Application area KS 10:	**Gluing of shoes with 2-comp. PUR dispersion adhesive (HDI)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 10.1 Preparations	**KS 10.1.1** Opening of container at room temperature *Natural ventilation*	AD1 AA0 H1	• Protective goggles • Protective gloves
	KS 10.1.2 Mixing of components at room temperature *Natural ventilation*	AD1 AA0 H2	• Protective goggles • Protective gloves
KS 10.2 Application of adhesive	**KS 10.2.1** Application to small areas with rollers, nozzles or brushes at room temperature *Natural ventilation*	AD1 AA1 H2	• Protective goggles • Protective gloves
	KS 10.2.2 Exhaust ventilation at room temperature *Natural ventilation*	AD1 AA0 H0	
KS 10.3 Hardening	Covered for hours at room temperature *Closed facility and natural ventilation*	AD0 AA0 H0	
KS 10.4 Refinishing, storage and cleaning	**KS 10.4.1** Cleaning of the working tools with solvents at room temperature *Exhaust applied to the object*	AD0 AA0 H2	• Protective goggles • Protective gloves
	KS 10.4.2 Cleaning of the working tools with water at room temperature *Natural ventilation*	AD0 AA0 H2	• Protective goggles • Protective gloves

Product area KS:	**Production and use of adhesives**		
Application area KS 11:	**Gluing of shoes with HMMG adhesive (MDI, TDI)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
KS 11.1 Preparations	Open container and place it in machine at room temperature *Natural ventilation*	AD1 AA0 H1	• Protective gloves • Protective goggles
KS 11.2 Application of adhesive	**KS 11.2.1** Application with nozzles, rollers or brushes at 120–180°C *Exhaust applied to the object*	AD1 AA1 H1	• Protective gloves • Protective goggles
	KS 11.2.2 Application with nozzles, rollers or brushes at 120–180°C *No exhaust applied to the object; natural room ventilation*	AD3 AA1 H1	• Protective gloves • Protective goggles • Respirator with gas filter A2
	KS 11.2.3 Elimination of operating disturbances at increasing temperature *Natural ventilation*	AD3 AA0 H2	• Protective gloves • Respirator with gas filter A2
KS 11.3 Hardening	Covered at room temperature *Closed facility and natural ventilation*	AD0 AA0 H0	
KS 11.4 Cleaning	Mechanical cleaning of the working tools at about 160°C *Closed facility and natural ventilation*	AD0 AA0 H1	• Protective gloves

Product area EL:	**Production and use of elastomers**		
Application area EL 1:	**Production of elastomers**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
EL 1.1 Manual hot pouring of elastomer-molded articles based on NDI prepolymers[3]	**EL 1.1.1** **Preparation of production:** Weighing and filling of NDI powder in enclosed weighing equipment *Enclosure and exhaust applied to the object*	AD1 AA2 H2	• Protective gloves • Use of closable metal containers
	EL 1.1.2.1 **Prepolymer handling:** Remove container, weigh hot prepolymers with excess NDI in exhaustion chamber; application of exhaust to container *Exhaustion chamber as exhaust applied to the object*	AD2 AA1 H2	• Protective gloves • Protective goggles • Spray protection
	EL 1.1.2.2 **Prepolymer handling:** Crosslinking of hot NCO prepolymers with excess NDI in exhaustion chamber; application of exhaust to chamber *Exhaustion chamber as exhaust applied to the object*	AD2 AA1 H2	• Use pouring container with lid • Avoid air-driven stirrer; do not direct compressed air to surface of liquid • Protective gloves • Protective goggles • Spray protection

[3] Weighed powdery naphthylen-1,5-diisocyanate **(**NDI**)** is added to hot dehydrated polyester while stirring and converted to NCO prepolymers with excess NDI in stirred vacuum tank reactors. The NDI prepolymers at a temperature of about 120°C are divided up into appropriate batch sizes, depending on the size of the elastomer articles to be produced, and glycolic crosslinkers are added within a short time with stirring according to the stoichiometric ratio. After that, only up to maximally 120 seconds remain to pour the already reacting mixture into molded articles.
The multistage production process involves all possible exposure routes from the exposure of the skin and respiratory tract to powdery or flaky diisocyanate at room temperature to exposure of the respiratory tract to hot isocyanate vapors as well as the risk of burns through contact with hot tools, equipment, molds, heating plates, heating cabinets and with reaction mixtures during weighing, crosslinking and pouring into molds. The workplaces and the assignment of the equipment and the positioning of the casting molds to each other must be optimally adjusted to the process on account of the short reaction times of the casting systems. Account must be taken of the fact that hot isocyanate vapors evaporate by providing suitably designed and installed air exhaust equipment that must be adapted to the particular operation steps.

Product area EL:	**Production and use of elastomers**		
Application area EL 1:	**Production of elastomers**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
	EL 1.1.3.1 **Casting process:** Transport of casting vessels with crosslinked NCO prepolymers to the casting molds *Technical ventilation*	AD2 AA1 H2	• Protective gloves • Protective goggles • Spray protection • Cover casting container
	EL 1.1.3.2 **Casting process:** Manual casting of parts with crosslinked NDI prepolymer and "flame scarfing" of the air bubbles with exhaustion of the air at the casting position *Technical room ventilation Exhaust applied to the casting molds*	AD2 AA1 H2	• Fresh laminar air in direction of the exhaust • Protective gloves • Face mask with supply of fresh air • Spray protection • After "flame scarfing", cover or place in heating cabinet
	EL 1.1.3.3 **Casting process:** Treatment of emptied casting vessels with air exhaustion *Technical room ventilation and air exhaust applied to the object*	AD2 AA1 H2	• Allow remainders in the casting vessel after the casting process to run out into collecting container with edge exhaustion and to cool • Protective gloves
	EL 1.1.3.4 **Treatment of the elastomers:** Tempering, removal from the mold and reheating *Heating cabinet with exhaust equipment and exhaust applied to the object*	AD1 AA0 H1	• Operate heating cabinet with increased exhaust air fraction • On opening the heating cabinet, exhaust first wave of hot air over the door • Protective gloves

Product area EL:	**Production and use of elastomers**		
Application area EL 1:	**Production of elastomers**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
EL 1.2 Mechanical hot casting of elastomer-molded articles using MDI or TDI prepolymers	**EL 1.2.1** Storage, weighing and filling of the solid MDI/TDI prepolymers into the reactor via the enclosed weighing equipment *Enclosure and exhaust applied to the object*	AD0 AA1 H2	• Protective gloves
	EL 1.2.2 Transfer of the hot prepolymers from the reactor to machine container in extraction booth *Enclosure and exhaust applied to the object; exhaustion also at the container openings*	AD2 AA1 H1	• Cover container with lid during transport • Protective gloves • Spray protection • Protective goggles
	EL 1.2.3 Deposition of the empty, hot prepolymer container with exhaustion *Exhaust applied to the object*	AD2 AA0 H1	• To drain or cool the prepolymer container, turn it over and place it on exhausted collecting container • Deposit only with lid on top
	EL 1.2.4 Mechanical casting of parts under exhaust equipment *Exhaust applied to the casting head and over the casting molds*	AD2 AA1 H1	• Protective gloves • Operate heating cabinet with increased exhaust air fraction • Cover filled casting molds or transport to heating cabinet
	EL 1.2.5 Hot cleaning of reaction containers and machine equipment *Exhaust applied to the container openings*	AD2 AA1 H2	• Protective gloves • Laminated apron

Product area EL:	**Production and use of elastomers**		
Application area EL 1:	**Production of elastomers**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
EL 1.3 Manual hot casting of elastomer-molded articles using MDI or TDI prepolymers	**EL 1.3.1** Heating the delivery container (about 60°C) of MDI/TDI; fill into degassing reactor and weighing *Exhaust applied to the supply container and venting reactor*	AD2 AA1 H2	• Protective gloves • Protective clothing • Laminated apron • Cover prepolymer container with lid
	EL 1.3.2 Addition of the crosslinker in the exhaust booth; transport of the crosslinked reaction mixtures to the exhausted casting molds *Enclosure and exhaust applied to the object*	AD2 AA1 H1	• Protective gloves • Protective clothing • Laminated apron • Do not direct exhaust air from air stirrers onto the surface of mixture • Cover casting container
	EL 1.3.3 Casting operation with • Filling into casting molds with exhaust applied to the object • Transport of the filled casting molds to the heating cabinet • Depositing of the emptied, hot casting container with exhaustion *Exhaust applied to the casting molds*	AD2 AA1 H2	• Protective gloves • Protective clothing • Laminated apron • If exhaust applied to the object fails, respiraror with gas filter A2 and particle filter P2 • Cover casting container • Deposit container only under exhaust equipment

Product area EL:	**Production and use of elastomers**		
Application areea EL 1:	**Production of elastomers**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
EI 1.4 Manual hot casting of elastomer-molded articles using MDI or TDI prepolymers	**EL 1.4.1** Heating the delivery container (about 60°C) of MDI/TDI prepolymers; transfer of the hot prepolymers from the container to the degassing reactor or machine *Exhaust applied to the container openings*	AD2 AA1 H2	• Protective gloves • Respirator with gas filter A2 and particle filter P2 and laminated apron for manual transfer
	EL 1.4.2 Mechanical casting of the molded articles with exhaust equipment *Exhaust applied to the casting head and above the casting molds*	AD2 AA1 H1	• Protective gloves • Operate heating cabinet with increased exhaust air fraction • Cover filled casting molds or transport to heating cabinet
EL 1.5 Cold casting of elastomer-molded articles with 2-comp. one-shot systems	**EL 1.5.1** Heating the delivery container (about 60°C) of MDI/TDI prepolymers; transfer of the hot prepolymers from the container to the degassing reactor or machine *Exhaust applied to the container openings*	AD2 AA1 H2	• Protective gloves • Respirator with gas filter A2 and particle filter P2 and laminated apron for manual transfer
	EL 1.5.2 Mechanical casting of the molded articles with exhaust equipment *Exhaust applied to the casting head and above the casting molds*	AD2 AA1 H1	• Protective gloves • Operate heating cabinet with increased exhaust air fraction • Cover filled casting molds or transport to heating cabinet

Product area EL:	**Production and use of elastomers**		
Application area EL 1:	**Production of elastomers**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
EL 1.6 Production of thermoplastic polyurethanes (TPU) based on MDI by the prepolymer process	**EL 1.6.1** Storing, weighing and filling of the solid MDI into the reaction vessel with enclosed weighing equipment *Enclosure and exhaust applied to the object*	AD0 AA1 H2	• Protective gloves
	EL 1.6.2 Melting of the MDI and filling or sucking the molten MDI into the reactor tank *Exhaust applied to the container openings*	AD2 AA1 H1	• Respirator with gas filter A2 and particle filter P2
	EL 1.6.3 Mechanical casting of the molded articles using exhaust equipment *Exhaust applied to the casting head, and above the casting molds and malleabilization molds*	AD2 AA1 H1	• Protective gloves • Operate heating cabinet with increased exhaust air fraction • Cover filled casting molds or transport to heating cabinet

Product area EL:	**Production and use of elastomers**		
Application area EL 2:	**Use of PUR window glass/automotive body adhesives and PUR joint sealants**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
EL 2.1 1-/2-comp. window glass/ automotive body adhesive (MDI)	**EL 2.1.1** Application of the glass/automotive body adhesive from cartridge press *Natural ventilation*	AD1 AA0 H1	• Protective gloves
	EL 2.1.2 Hardening of the mounted glass / automotive body adhesive *Technical ventilation*	AD0 AA0 H0	
	EL 2.1.3 Hardening of the mounted glass / automotive body adhesive *Natural ventilation*	AD1 AA0 H0	
	EL 2.1.4 Separation of the adhesive joint with an oscillating tool without additional heating *Natural ventilation*	AD0 AA0 H0	
	EL 2.1.5 Separation of the adhesive joint with hot wire[4] *Technical ventilation* *Exhaust applied to the object*	AD3 AA1 H1	• Protective gloves • Replacement by process EL 2.1.4 • Respirator with gas filter A1

[4] **When sealant joints are being separated using heat, the organic substances are decomposed to gases, vapors and smoke.**

Product area EL:	**Production and use of elastomers**		
Application area EL 2:	**Use of PUR window glass/automotive body adhesives and PUR joint sealants**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
EL 2.2 1-comp. joint sealants (MDI)	**EL 2.2.1** Application of the joint sealant from a cartridge press in naturally ventilated areas Smoothing the joint with a tool *Natural ventilation*	AD1 AA0 H1	• Protective gloves
	EL 2.2.2 Application of the joint sealant from a cartridge press in naturally ventilated areas Smoothing the joint with finger *Natural ventilation*	AD1 AA0 H2-3	• Use tool for smoothing
	EL 2.2.3 Hardening of the joint in ventilated area *Natural ventilation*	AD0 AA0 H0	

Product area HS:	**Rigid foam systems**		
Application area HS 1:	**Rigid block foam[5] (MDI system)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
HS 1.1 Foam area of the block facility	**HS 1.1.1** Checking and set up of the foaming machine (day containers, pumps, filters and seals) *Exhaust applied to the machine container ventilators (also for amine catalysts), pumps and seals*	AD1 AA0 H1	• When handling the open equipment (e.g. elimination of disturbances), ensure supply of fresh air • Protective gloves • Protective goggles
	HS 1.1.2 Adjustment of the mixing head and application area *Exhaust applied to the foaming tunnel*	AD1 AA0 H1	• Use foaming tunnel exhaust even when adjusting equipment • When handling the open equipment (e.g. elimination of disturbances), ensure supply of fresh air • Protective gloves • Protective goggles
	HS 1.1.3 Foaming operation (also start-up) Check of block in the foaming tunnel *Exhaust applied to the foaming tunnel*	AD1 AA1 H1	• Prerun and afterrun of the foaming tunnel exhaust coupled to machine control • Supply of sufficient fresh air when working in foaming tunnel • Protective gloves when working in foaming tunnel

[5] Rigid foam blocks are produced on quasi continuously operating foaming equipment. The streams of raw materials (up to 250 kg/min.) are generally conveyed and metered by means of high-pressure pumps through permanently installed pipes into a stirred mixing chamber, from which the reaction mixture is applied to a folded paper web moving continuously away from the mixing head, this web forming a U shape with lateral paper webs. There, the mixture expands continuously to form an endless block. The actual reaction time of the reaction mixture is approximately 60 seconds. The paper webs are peeled off the dimensionally stable block and rolled up; after the block strand has been cut up into individual sections, these are put into storage for final hardening and storage.

Product area HS:	**Rigid foam systems**		
Application area HS 1:	**Rigid block foam (MDI system)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
HS 1.1 Foaming area of the block facility (continuation)	**HS 1.1.4** Stop of the foaming (closing down process) *Exhaust applied to the foaming tunnel*	AD1 AA1 H2	• Leave foaming tunnel exhaust to run • First switch off isocyanate feed • Rinse mixing head and outlet pipe with polyol or detergent • Use protective gloves and protective goggles during cleaning work and ensure a sufficient supply of fresh air
HS 1.2 Foaming tunnel	**HS 1.2.1** Checks: • Of the foaming process • Of the ascending block • Correction of the paper run *Exhaust applied to the foaming tunnel*	AD1 AA1 H1	• Prerun and afterrun of the foaming tunnel exhaust coupled to machine control • Ensure a sufficient supply of fresh air when working in the foaming tunnel • Protective gloves when working in the foaming tunnel
	HS 1.2.2 Peeling off and rolling up of separation paper *Exhaust applied to the reeling site with air supply*	AD1 AA0 H1	• Roll up the paper webs with the side facing the foam inward • Arrange working platform with closed floor; no gratings • Protective textile gloves

Product area HS:	**Rigid foam systems**		
Application area HS 1:	**Rigid block foam (MDI system)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
HS 1.3 Cross cutter	**HS 1.3.1** Operating, checking; labeling blocks *Exhaust applied above the cross cutter*	AD1 AA0 H1	• Exhaustion of air over cross cutter in continuous operation • Protective gloves when in contact with the foam
	HS 1.3.2 Manual transport of blocks *Natural ventilation*	AD0 AA0 H1	• Protective gloves when in contact with the foam
HS 1.4 Maintenance and repair work	On flexible connection pipes, flanges, seals, storage containers, pipes, valves, (drum) pumps, filters, foaming machines, mixing heads and other parts of foaming machines and foaming facility in direct contact with isocyanates[6]	AD2-3 AA1 H2	• If possible, carry out maintenance and repair work in exhaust area • Rinse and decontaminate pipes, containers, filters, pumps and mixing head before dismantling • Cordon off and mark the maintenance and repair area if there is a possibility of isocyanates being released • Protective gloves • Protective goggles • Ensure supply of sufficient fresh air • Face mask when carrying out work overhead

[6] It is not acceptable to have unrinsed pumps and other parts of the facility contaminated with isocyanates sent away for repair or maintenance elsewhere.

Product area HS:	**Rigid foam systems**		
Application area HS 2:	**Insulating boards with flexible cover layers (DTB) (MDI system)**[7]		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
HS 2.1 Foaming area of the DTB facility	**HS 2.1.1** Check and set up of the foaming machine (day containers, pumps, filters and seals) *Exhaust applied to the machine container openings (also for amine catalysts), pumps and seals*	AD1 AA0 H1	• When handling the open equipment (e.g. elimination of disturbances), ensure supply of fresh air • Protective gloves • Protective goggles
	HS 2.1.2 Adjustment of the mixing head and application area *Exhaust applied to the foaming area*	AD1 AA0 H1	• Use exhaust even when adjusting equipment • When handling the open equipment (e.g. elimination of disturbances), ensure supply of fresh air • Protective gloves • Protective goggles

[7] Insulating boards with flexible cover layers are produced in continuously operating foaming facilities. The flows of raw materials (up to 50 kg/min.) are generally conveyed and metered to a high-pressure mixing head through firmly installed pipes using high-pressure pumps. The reaction mixture is applied in an oscillating manner to the bottom cover layer laterally raised at the edges, foamed to polyurethane in a progressive reaction within a maximum of 30 seconds, is covered with the top cover layer before the binding time is reached and thus in the foaming tunnel (pressure zone) forms an endless calibrated board strand enclosed on all sides. After the strand has been cut into lengths, the boards pass through a cooling stretch, are made up, labeled, packaged, palettized and stored.

Product area HS:	**Rigid foam systems**		
Application area HS 2:	**Insulating boards with flexible cover layers (DTB) (MDI system)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
HS 2.1 Foaming area of the DTB facility (continuation)	**HS 2.1.3** Foaming process (also start-up) Foam check in the facility *Exhaust applied to the foaming area*	AD1 AA1 H1	• Prerun and afterrun of the foaming tunnel exhaust coupled to machine control • Sufficient supply of fresh air when working at pressure zone • Protective gloves when working at pressure zone
HS 2.2 Foaming facility	**HS 2.1.4** Termination of the foaming process (closing down) *Exhaust applied to the foaming area*	AD1 AA1 H1	• Leave exhaust to run • First switch off isocyanate feed • Rinse mixing head and outlet pipe with polyol or detergent • Or mechanical removal of hardened foam from mixing head and discharge nozzles • Use protective gloves and protective goggles during cleaning work and ensure a sufficient supply of fresh air
	HS 2.2.1 Checks of the: • Foaming process • Rising foam *Exhaust applied to the foaming area*	AD1 AA1 H1	• Prerun and afterrun of the foaming tunnel exhaust coupled to machine control • Ensure sufficient supply of fresh air • Protective gloves when working in the foaming tunnel

Product area HS:	**Rigid foam systems**		
Application area HS 2:	**Insulating boards with flexible cover layers (DTB) (MDI system)**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
HS 2.3 Cross cutter, making up, labeling and packaging	**HS 2.3.1** Check cutting and confectioning *Exhaust applied above the cross cutter and making up equipment*	AD0 AA0 H1	• Exhaustion of air over cross cutter and making up in continuous operation • Protective gloves for contact with foam
	HS 2.3.2 Labeling and packaging *Natural room ventilation*	AD0 AA0 H1	• Textile protective gloves for contact with the foam
HS 2.4 Maintenance and repair work	On flexible connection pipes, flanges, seals, storage containers, pipes, valves, (drum) pumps, filters, foaming machines, mixing heads and other parts of foaming machines and foaming facility in direct contact with isocyanates[8]	AD2-3 AA1 H2	• If possible, carry out maintenance and repair work in exhaustion area • Rinse and decontaminate pipes, containers, filters, pumps and mixing head before dismantling • Cordon off and mark the maintenance and repair area if there is a possibility of isocyanates being released • Protective gloves • Protective goggles • Ensure sufficient supply of fresh air • Face mask when carrying out work overhead

[8] It is not acceptable to have unrinsed pumps and other parts of the facility contaminated with isocyanates sent away for repair or maintenance elsewhere.

Product area WS:	**Soft foam systems**		
Application area WS 1:	**Soft mold foam (hot foam) TDI system[9]**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 1.1 Metering facility	**WS 1.1.1** Degass filters and metering pumps, adjust flow rate and check (measure volume) *Enclosure with exhaust applied to the object*	AD2 AA1 H1	• When handling the open equipment (e.g. elimination of disturbances), use respirator with supply of fresh air • Protective gloves • Protective goggles • Spray protection
	WS 1.1.2 Release pressure in day container, open, introduce raw materials, check pressure relief valve and seals *Exhaust applied to the object when releasing pressure and filling open container*	AD2 AA1 H1	• Avoid counterpressure filling when releasing pressure • When releasing pressure, apply exhaust to the ventilating valve • Draw in raw materials with vacuum and filling pipe • When handling the open equipment (e.g. elimination of disturbances), use respirator with supply of fresh air • Protective gloves • Protective goggles • Spray protection

[9] The components polyol and TDI are fed separately from the pressurized day containers of the foaming machine to the mixing head and mixed into the reaction mixture there during the introduction into the open metal foaming molds heated to about 50-60°C. After the molds have been closed, the reaction mixture expands in the mold provided with ventilation openings in the lid of the mold to form PUR molded foam. The mold carriers mounted on continuous chain conveyor equipment pass through a heating tunnel for the following approximately 10-15 minutes, in which the molds are heated to a mold wall temperature of about 120°C. The foam in the mold completely finishes reacting. The hot, soft molded foam articles are removed from the molds outside the hot air tunnel, placed on suspended conveyor holders or hurdle stillages and transported to storage for cooling. The mold is sprayed with release agent for the next foaming and cooled and holding devices or wire reinforcements may be installed.

Product area WS:	**Soft foam systems**		
Application area WS 1:	**Soft mold foam (hot foam) TDI system**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 1.2 Foaming facility	**WS 1.2.1** Introduction of the reaction mixture and withdrawal of the mixing head *Exhaust applied to the whole introduction area in the molds and at the resting position of the mixing head*	AD2 AA0 H1	• Optimize the exhaustion of air from the whole introduction area in the molds • Extension of the suspension device on the hand mixing head in order to gain space to the molds when introducing the reaction mixture • Protective gloves • Protective goggles
	WS 1.2.2 Closing and locking of the foaming mold *Exhaust applied to the object*	AD2 AA0 H1	• Air displaced through the lid by closing operation to be exhausted specifically in the direction in which air is moving but away from personnel • Protective gloves
	WS 1.2.3 Degassing of the mold nests by the foaming reaction mixture[10] *Enclosure with exhaust applied to the object*	AD2 AA0 H1	• Specific veil of fresh air on both sides of the mold track to steer the hot air convection into the exhaust

[10] Emission from the molds continues until the mold cavity has been completely filled with foam.

Product area WS:	**Soft foam systems**		
Application area WS 1:	**Soft mold foam (hot foam) TDI system**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 1.2 Foaming facility (continuation)	**WS 1.2.4** Heating of the molds in the heating tunnel *Enclosure with exhaust applied to the object*	AD1 AA1 H0	• Slight negative pressure in the heating tunnel and possibly laminar fresh air veil at the entrance and exit of the heating tunnel
	WS 1.2.5 Cleaning the mold lid of flash *Exhaust applied to the object*	AD2 AA0 H1	• Protective gloves • Exhaustion of air over the molds away from personnel
	WS 1.2.6 Unlocking and opening the foaming mold *Exhaust applied to the object*	AD2 AA0 H1	• Unlocking and opening of the mold lid with specific exhaustion of air laterally and in front of the mold a little above the separating level of mold lid and mold cavity • Protective gloves
	WS 1.2.7 Removal of the molded part and placement in transport stands for storage *Exhaust applied to the object*	AD2 AA0 H1	• Short residence time of the removed article to the area of exhaustion in order to evaporate the hot cell gases • Place transport stands under exhaust equipment • Protective gloves

Product area WS:	**Soft foam systems**		
Application area WS 1:	**Soft mold foam (hot foam) TDI system**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 1.3 Maintenance and repair work	On flexible connection tubes, flanges, seals, storage containers, pipes, valves, (drum) pumps, filters, foaming machines, mixing heads and other parts of foaming machine and foaming facility in direct contact with isocyanates[11]	AD2-3 AA1 H2	• If possible, carry out maintenance and repair work in exhaust area • Rinse and decontaminate pipes, containers, filters, pumps and mixing head before dismantling • Cordon off and mark the maintenance and repair area if there is a possibility of isocyanates being released • Protective gloves • Protective goggles • Respirator with supply of fresh air • Face mask when carrying out work overhead

[11] Pumps or other parts of the facility contaminated with isocyanates or amines must not be given to third parties for repair or maintenance without first being rinsed or decontaminated.

Product area WS:	**Soft foam systems**		
Application area WS 2:	**Soft mold foam (cold foam) TDI system**[12]		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 2.1 Metering machine	**WS 2.1.1** Vent filters and metering pumps, adjust flow rate and check (measure volume) *Enclosure with exhaust applied to the object*	AD2 AA1 H1	• When handling the open equipment (e.g. elimination of disturbances), use respirator with supply of fresh air • Enclosure necessary also because of noise protection • Protective gloves • Protective goggles • Possibly spray protection
	WS 2.1.2 Release pressure in day container, open, introduce raw materials, check pressure relief valve and seals *Exhaust applied to the object when releasing pressure and filling open container*	AD2 AA1 H1	• Avoid counterpressure filling when releasing pressure • When releasing pressure, apply exhaust to the object at the ventilating valve • Draw in raw materials with vacuum and filling pipe • When handling the open equipment (e.g. elimination of disturbances), use respirator with supply of fresh air • Protective gloves • Protective goggles • Possibly spray protection

[12] The two components of polyol and MDI mixture, maintained at a temperature of about 22°C, are fed separately from the pressurized day containers of the foaming machine to the mixing head, mixed into the reaction mixture there and introduced into the open or closed metal foaming molds, which are at a temperature of about 45-50°C and mounted on round table devices or single mold carriers in chain conveyor equipment and moved continuously or in phases. The reaction mixture expands to the PUR foam in the molds provided with ventilation openings and finishes hardening in the mold in the course of the following approximately 10-15 minutes. Then the molds are unlocked and opened, the foamed article that has been produced and is still hot is removed, the foam cells are completely opened by means of a roll mill, and the molds are transported to storage for cooling. For the next foaming operation, the mold is sprayed with release agent, and possibly holding devices are installed and may be closed.

Product area WS:	**Soft foam systems**		
Application area WS 2:	**Soft mold foam (cold foam) TDI system**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 2.2 Foaming facility	**WS 2.2.1** Introduction of the reaction mixture with the hand mixing head Swinging away/depositing of the mixing head *Exhaust applied to the whole introduction area in the molds and at the resting position of the mixing head*	AD2 AA1 H1	• Optimize the exhaustion of air from the whole introduction area in the molds • Extension of the suspension device on the hand mixing head in order to gain space to the molds when introducing the reaction mixture • Protective gloves • Protective goggles • Possibly spray protection
	WS 2.2.2 Introduction of the reaction mixture with mechanically guided mixing head Swinging away/depositing of the mixing head *Exhaust applied to the whole introduction area in the molds and at the resting position of the mixing head*	AD1 AA1 H1	• Optimize the exhaustion of air from the whole introduction area in the molds • Protective gloves • Protective goggles
	WS 2.2.3 Manual and mechanical closing and locking of the foaming molds *Exhaust applied to the object*	AD1 AA1 H1	• Air displaced through the lid by closing operation to be exhausted specifically in the direction in which air is moving, but away from personnel • Protective gloves

Product area WS:	**Soft foam systems**		
Application area WS 2:	**Soft mold foam (cold foam) TDI system**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 2.2 Foaming facility (continuation)	**WS 2.2.4** Ventilation of the mold nests by means of foaming reaction mixture[13] *Enclosure with exhaust applied to the object*	AD2 AA1 H0	• In the exhaustion area of the molds (in the case of circular table or chain conveyor equipment, at least 2-3 mold cycle positions or stretch that are covered by molds in 1.5 min.) specifically exhaust air escaping from molds; take note of direction and rate of flow • Avoid diffuse distribution of contaminated air • Specific veil of fresh air on both sides of the mold track to steer the hot air convection into the exhaust
	WS 2.2.5 Cleaning of the mold lid from flash *Exhaust applied to the object*	AD2 AA0 H1	• Protective gloves • Exhaustion of air over the molds away from personnel
	WS 2.2.6 Unlocking and opening of the foaming mold *Exhaust applied to the object*	AD2 AA0 H1	• Unlocking and opening of the mold lid with specific exhaustion of air laterally and in front of the mold a little above the separating level of the mold lid and mold cavity • Protective gloves

[13] Emission from the molds continues until the form cavity has been completely filled with foam.

Product area WS:	**Soft foam systems**		
Application area WS 2:	**Soft mold foam (cold foam) TDI system**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 2.2 Foaming facility (continuation)	**WS 2.2.7** Removal of the molded article, pressing on of the cells, and deposition onto transport stands for storage *Exhaust applied to the object*	AD2 AA1 H1	• Short residence time of the removed article to an area of exhaustion in order to evaporate the hot cell gases • Exhaustion of the cell gases displaced in the roll mill • Place transport stands under exhaust hood • Protective gloves
WS 2.3 Maintenance and repair work	On flexible connection pipes, flanges, seals, storage containers, pipes, valves, (drum) pumps, filters, foaming machines, mixing heads and other parts of foaming machines and foaming facility in direct contact with isocyanatess[14]	AD2-3 AA1 H2	• If possible, carry out maintenance and repair work in exhaust area • Rinse and decontaminate pipes, containers, filters, pumps and mixing head before dismantling • Cordon off and mark the maintenance and repair area if there is a possibility of isocyanates being released • Protective gloves • Protective goggles • Ensure sufficient supply of fresh air • Face mask when carrying out work overhead

[14] Pumps or other parts of the equipment contaminated with isocyanates or amines must not be given to third parties for repair or maintenance without first being rinsed or decontaminated.

Product area WS:	**Soft foam systems**		
Application area WS 3:	**Soft mold foam (cold foam) TDI/MDI system[15]**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 3.1 Metering facility	**WS 3.1.1** Vent filters and metering pumps, adjust flow rate and check (measure volume) *Enclosure with exhaust applied to the object*	AD2 AA1 H1	• When handling the open equipment (e.g. elimination of disturbances), use respirator with supply of fresh air • Protective gloves • Protective goggles • Spray protection
	WS 3.1.2 Release pressure in day container, open, introduce raw materials, check pressure relief valve and seals *Exhaust applied to the object when releasing pressure and filling open container*	AD2 AA1 H1	• Avoid counterpressure filling when releasing pressure • When releasing pressure, apply exhaust to the object at the ventilating valve • Draw in raw materials with vacuum and filling pipe • When handling the open equipment (e.g. elimination of disturbances), use respirator with supply of fresh air • Protective gloves • Protective goggles • Possibly spray protection

[15] The two components of polyol and MDI mixture are fed separately from the pressurized day containers of the foaming machine to the mixing head, mixed into the reaction mixture there and introduced into the open or closed metal foaming molds, which are at a temperature of about 45-50°C and mounted on round table devices or single mold carriers in chain conveyor equipment and moved continuously or in phases. The reaction mixture expands to the PUR foam in the molds provided with ventilation openings and finishes hardening in the mold in the course of the following approximately 10-15 minutes. Then the molds are unlocked and opened, the foamed article that has been produced and is still hot is removed, the foam cells are completely opened by means of a roll mill, and the molds are transported to storage for cooling. For the next foaming operation, the mold is sprayed with release agent, and possibly holding devices are installed and may be closed.

Product area WS:	**Soft foam systems**		
Application area WS 3:	**Soft mold foam (cold foam) TDI/MDI system**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 3.2 Foaming facility	**WS 3.2.1** Introduction of the reaction mixture with the hand mixing head Swinging back/depositing of the mixing head *Exhaust applied to the whole introduction area in the molds and at the resting position of the mixing head*	AD2 AA1 H1	• Optimize the exhaustion of air from the whole introduction area in the molds • Extension of the suspension device on the hand mixing head in order to gain space to the molds when introducing the reaction mixture • Protective gloves • Protective goggles • Possibly spray protection
	WS 3.2.2 Introduction of the reaction mixture by means of mechanically guided mixing head Swinging away/depositing of the mixing head *Exhaust applied to the object in the whole introduction area in the molds and at the resting position of the mixing head*	AD2 AA1 H0	• Optimize the exhaustion of air from the whole introduction area in the molds • Protective gloves • Protective goggles
	WS 3.2.3 Manual and mechanical closing and locking of the foaming molds *Exhaust applied to the object*	AD2 AA1 H1	• Air displaced through the lid by closing operation to be exhausted specifically in the direction in which air is moving but away from personnel • Protective gloves when closing manually

Product area WS:	**Soft foam systems**		
Application area WS 3:	**Soft block foam (cold foam) TDI/MDI system**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 3.2 Foaming facility (continuation)	**WS 3.2.4** Ventilation of the mold nests by means of foaming reaction mixture[16] *Enclosure with exhaust applied to the object*	AD2 AA1 H0	• In the exhaustion area of the molds (in the case of circular table or chain conveyor equipment, at least 2-3 mold cycle positions or stretch that are covered by molds in 1.5 min.), specifically exhaust air escaping from molds • Avoid diffuse distribution of contaminated air • Specific veil of fresh air on both sides of the mold track to steer the hot air convection into the exhaust
	WS 3.2.5 Cleaning the mold lid of mold flash *Exhaust applied to the object*	AD2 AA0 H1	• Protective gloves • Exhaustion of air over the molds away from personnel
	WS 3.2.6 Unlocking and opening of the foaming mold *Exhaust applied to the object*	AD2 AA1 H1	• Unlocking and opening of the mold lid with specicifc exhaustion of air laterally and in front of the mold a little above the separating level of the mold lid and mold cavity • Protective gloves

[16] Emission from the molds continues until the form cavity has been completely filled with foam.

Product area WS:	**Soft foam systems**		
Application area WS 3:	**Soft block foam (cold foam) TDI/MDI system**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 3.2 Foaming facility (continuation)	**WS 3.2.7** Removal of the molded article, pressing on of the cells and depositing onto transport stands for storage *Exhaust applied to the object*	AD2 AA1 H1	• Short residence time of the removed article to an area of exhaustion in order to evaporate the hot cell gases • Exhaustion of the cell gases displaced in the roll mill • Place transport stands under exhaust hood • Protective gloves
WS 3.3 Maintenance and repair work	On flexible connection tubes, flanges, seals, storage containers, pipes, valves, (drum) pumps, filters, foaming machines, mixing heads and other parts of foaming machine and foaming facility in direct contact with isocyanatess[17]	AD2-3 AA1 H2	• If possible, carry out maintenance and repair work in exhaust area • Rinse and decontaminate pipes, containers, filters, pumps and mixing head before dismantling • Cordon off and mark the maintenance and repair area if there is a possibility of isocyanates being released • Protective gloves • Protective goggles • Ensure sufficient supply of fresh air • Face mask when carrying out work overhead

[17] Pumps or other parts of the equipment that have been contaminated with isocyanates or amines must not be given to third parties for repair or maintenance until they have first been rinsed or decontaminated.

Product area WS:	**Soft foam systems**		
Application area WS 4:	**Soft block foam**[18]		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 4.1 Foaming area of the block facility	**WS 4.1.1** Checking and setting of the foaming machine (day containers, pumps, filters and seals) *Exhaust applied to the machine container ventilators (also for amine catalysts), pumps and seals*	AD2 AA0 H1	• When handling the open equipment (e.g. elimination of disturbances), use respirator with supply of fresh air • Protective gloves • Protective goggles
	WS 4.1.2 Adjusting of the mixing head and application area *Exhaust applied to the foaming tunnel*	AD2 AA0 H1-2	• Use foaming tunnel exhaust even when adjusting equipment • When handling the open equipment (e.g. elimination of disturbances), use respirator with supply of fresh air • Protective gloves • Protective goggles

[18] Rigid foam blocks are produced on quasi continuously operating foaming equipment. The streams of raw materials (up to 330 kg/min.) are generally conveyed and metered by means of high-pressure pumps through permanently installed pipes into a stirred mixing chamber, from which the reaction mixture is applied to a folded paper web moving continuously away from the mixing head, this web forming a U shape with lateral paper webs. There, the mixture expands continuously to form an endless block. After the foam gas has escaped from the block, the cover web is peeled off completely and the paper webs are peeled off from the PE films of the lateral webs and from the bottom paper and rolled up; the PE film remains on the foam block. After the block strand has been cut up into individual sections, these are put into reaction storage until they have finally hardened and for the foaming reactions to subside.

Product area WS:	**Soft foam systems**		
Application area WS 4:	**Soft block foam**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 4.1 Foaming area of the block facility (continuation)	**WS 4.1.3** Foaming operation (also start-up operation) Block check in the foaming tunnel *Exhaust applied to the object by foaming tunnel exhaustion*	AD2 AA2 H1	• Prerun and afterrun of the foaming tunnel exhaust coupled to the control of the foaming machine • Automatically closing control windows or strip curtains on the foaming tunnel • Respirator with supply of fresh air when working in the foaming tunnel • Protective gloves when working in the foaming tunnel
	WS 4.1.4 Termination of the foaming process (closing down) *Exhaust applied to the object by foaming tunnel exhaustion*	AD2 AA0 H1	• Leave foaming tunnel exhaust to run • First switch off isocyanate feed • Rinse mixing head and outlet pipe with polyol • Use protective gloves, protective goggles and respirator with gas filter A2 during cleaning work

Product area WS:	**Soft foam systems**		
Application area WS 4:	**Soft block foam**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 4.2 Foaming tunnel	**WS 4.2.1** Check: • Of the foaming operation • Of the rising block • Correction of the separating track and paper run *Exhaust applied to the object by foaming tunnel exhaustion*	AD2 AA2 H1	• Prerun and afterrun of the foaming tunnel exhaust coupled to the control of the foaming machine • Automatically closing control windows or strip curtains on the foaming tunnel • Respirator with supply of fresh air when working in the foaming tunnel • Protective gloves when working in the foaming tunnel
	WS 4.2.2 Peeling off and rolling up of separation paper *Exhaust applied to the reeling site with air supply*	AD2 AA0 H1	• Roll up the paper webs with the side facing the foam inward • Arrange working platform with closed floor; no gratings • Protective gloves
WS 4.3 Cross cutter	**WS 4.3.1** Operation, checking, weighing or labeling of blocks *Exhaust applied above the cross cutter*	AD2 AA1 H1	• Exhaustion of air over cross cutter with limits on both sides in continuous operation • Protective gloves in contact with the foam
	WS 4.3.2 Manual transport of blocks *Natural room ventilation*	AD2 AA1 H1	• Protective gloves in contact with the foam

Product area WS:	**Soft foam systems**		
Application area WS 4:	**Soft block foam**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
WS 4.4 Maintenance and repair work	On flexible connection tubes, flanges, seals, storage containers, pipes, valves, (drum) pumps, filters, foaming machines, mixing heads and other parts of foaming machine and foaming facility in direct contact with isocyanatess[19]	AD2-3 AA1 H2	• If possible, carry out maintenance and repair work in exhaust area • Rinse and decontaminate pipes, containers, filters, pumps and mixing head before dismantling • Cordon off and mark the maintenance and repair area if there is a possibility of isocyanates being released • Protective gloves • Protective goggles • Ensure sufficient supply of fresh air • Face mask when carrying out work overhead

[19] Pumps or other parts of the equipment that have been contaminated with isocyanates or amines must not be given to third parties for repair or maintenance until they have first been rinsed or decontaminated.

Product area BB:	**Uses in mining underground**		
Application area BB1:	**Rock compacting, mechanical injection with long-distance feed pump and multipath container**[20]		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**[21]
BB 1.1 Long-distance feed pump	Transferring the resin component from the transport container to the feed container *Ventilation*	AD2 AA2 H1	• Stay on fresh air side • Protective goggles, protective gloves, skin-covering clothing according to prescribed plan • Adequate visibility
BB 1.2 Preparation on site	Laying and degassing of pressure pipes, connecting the T-pieces or the mixing stretch, setting/checking the mixing ratio by gauging the capacity into empty containers *Ventilation*	AD2 AA1 H1	• Stay on fresh air side • Protective goggles, protective gloves, skin-covering clothing according to prescribed plan • Adequate visibility
BB 1.3 Pressing	Filling of the reaction mixture into the prepared drill holes and closing of the drill holes *Ventilation*	AD2 AA2 H1	• Stay on fresh air side • Protective goggles, protective gloves, skin-covering clothing according to prescribed plan • Adequate visibility • Face mask when carrying out overhead work • Regular checks for kinks in the pressure pipe (avoid uncontrolled aerosol formation)

[20] Packers with the feed pipe, injection anchor or injection drill anchor are introduced into drill holes and the reaction mixture is fed in under pressure through the outlet pipe of the T-piece or the mixing stretch of the injection machine. The mixture is prevented from flowing backward by the automatically closing packer, the back valve of the injection anchor or by knocking a wooden plug into the drill hole.

[21] Attention must always be paid to the provisions of the general approval according to the German Health Protection Mining Regulation (GesBergV) and the operating schedule approval according to the German Federal Mining Act (BBergG).

Product area BB:	**Uses in mining underground**		
Application area BB2:	**Rock compaction, mechanical injection with 2-comp. machine containing component canisters[21]**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
BB 2.1 Preparation	Introduce the injection pumps into opened component container, degass the pump and rinsing pipes, determine/check the flow capacity by gauging, connect T-piece or mixing stretch *Ventilation*	AD2 AA2 H1	• Stay on fresh air side • Protective goggles • Protective gloves • Skin-covering clothing • Adequate visibility • No kinks when laying the pressure pipes
BB 2.2 Filling/pressing	Filling of the reaction mixture into the prepared drill holes and filling up the suction container with the components *Ventilation*	AD2 AA2 H1	• Stay on fresh air side • Protective goggles, protective gloves and skin-covering clothing • Adequate visibility • Face mask when carrying out overhead work • Regular checks for kinks in the pressure pipe (avoid uncontrolled aerosol formation)

21 22 Packers with the feed pipe, injection anchor or injection drill anchor are introduced into drill holes and the reaction mixture is fed in under pressure through the outlet pipe of the T-piece or the mixing stretch of the injection machine. The mixture is prevented from flowing backward by the automatically closing packer, the back valve of the injection anchor or by knocking a wooden plug into the drill hole.

23 Attention must always be paid to the provisions of the general approval according to the German Health Protection Mining Regulation (GesBergV) and the operating schedule approval according to the German Federal Mining Act (BBergG).

Product area BB:	**Uses in mining underground**		
Application area BB2:	**Rock compaction, mechanical injection with 2-comp. machine containing component canisters**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
BB 2.3 Rinsing and closing down	Empty isocyanate pressure pipe into container and rinse with detergent; dispose of the waste and amounts rinsed out above ground *Ventilation*	AD2 AA2 H1	• Stay on fresh air side • Protective goggles • Protective gloves and skin-covering clothing • Adequate visibility • Face mask when carrying out overhead work • Regular checks for kinks in the pressure pipe (avoid uncontrolled aerosol formation)

Product area BB:	**Uses in mining underground**		
Application area BB3:	**Rock compaction, PUR cartridges – processes**[22]		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**[25]
BB 3.1 Prepare gluing	Removal of the PUR cartridges from the supply packaging and introduction to the bottom of the drill hole *Ventilation*	AD0 AA0 H0	• Protective gloves • Protective goggles • Closed, skin-covering clothing • Adequate visibility
BB 3.2 Gluing	Screwing in of the wooden nail through the PUR cartridge, removal of the transition piece; knocking in of the wooden sealing plug *Ventilation*	AD1 AA0 H1	• Protective gloves • Protective goggles • Closed, skin-covering clothing • Face protection when carrying out overhead work • Ensure adequate visibility • Stay on fresh air side

22 24 PUR cartridges that contain the two reaction components separate from each other in two extruded tubes fitted into each other are introduced into the deepest points of the drill holes. The reaction mixture is produced by piercing the walls of the extruded tubes and screwing in a wooden nail using drills. The wooden nail remains in the drill hole, which is then sealed by knocking in a wooden plug.

25 Attention must always be paid to the provisions of the general approval according to the German Health Protection Mining Regulation (GesBergV) and the operating schedule approval according to the German Federal Mining Act (BBergG).

Product area GS:	**Foundries**		
Application area GS1:	**Production of cold box cores**		
Work area	**Description of workplace/activity in the work area**	**Exposure stages**	**Examples of further precautions**
GS 1.1 Fully automatic sand preparation for cold box casting, using MDI prepolymers dissolved in org. solvents	**GS 1.1.1** Connecting of the supply container to the metering equipment *Natural room ventilation*	AD1 AA0 H1	• Protective gloves • Protective goggles
	GS 1.1.2 Removal of disturbances at metering facility, pipes and mixing wings *Natural room ventilation*	AD1 AA0 H2	• Protective gloves • Protective goggles
GS 1.2 Manual sand preparation for cold box casting, using MDI prepolymers dissolved in org. solvents	**GS 1.2.1** Measuring of PUR components in graduated jugs and addition to the sand mixture *Natural room ventilation*	AD1 AA0 H2	• Protective gloves • Protective goggles
	GS 1.2.2 Checking of the mixed sand by hand *Natural ventilation*	AD1 AA0 H3	• Protective gloves • Protective goggles