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Recommendations of the German Social Accident Insurance Institutions for a chemical safety assessment ("EGU") in accordance with the Hazardous Substances Ordinance

Flour dust in bakeries

Dezember 2017

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Preliminary remarks

The so called „Empfehlungen Gefährdungsermittlung der Unfallversicherungsträger nach der Gefahrstoffverordnung“ (Recommendations of the German Social Accident Insurance Institutions for a chemical safety assessment in accordance with the Hazardous Substances Ordinance) are elaborated by:

- The German „Unfallversicherungsträger“ (Social Accident Insurance Institutions),
- The “Institut für Arbeitsschutz der Deutschen Gesetzlichen Unfallversicherung“ (Institute for Occupational Safety and Health of the German Social Accident Insurance),
- The „Bundesanstalt für Arbeitsschutz und Arbeitsmedizin“ (Federal Institute for Occupational Safety and Health),
- And where applicable, further test bodies, for example those of the German regional authorities.

„Empfehlungen Gefährdungsermittlung der Unfallversicherungsträger nach der Gefahrstoffverordnung“ (EGU) have the purpose of helping companies in conducting the parts of the risk assessment that deal with tasks involving hazardous substances. They form part of the German Social Accident Insurance (DGUV) body of rules and regulations and are listed as “DGUV Information” under order number 213-701 ff.

The EGU „Flour dust in bakeries“ were developed by the „Berufsgenossenschaft Nahrungsmittel und Gastgewerbe“ (German Social Accident Insurance Institution for the foodstuffs and catering industry) in Mannheim and the leading industrial medical inspector of the Saarland.

1 General

According to Section 6 of the „Gefahrstoffverordnung“ (German Hazardous Substances Ordinance)[1] companies have to determine the nature and extent of exposure of their employees. This can be achieved by workplace measurements or other, equivalent assessment methods.

The EGU „Flour dust in bakeries“ constitute a suitable non-measuring identification method for assessing the exposure arising during the processing of grain flour in bakeries. It can be used in accordance with Sections 6 and 7 of the German Hazardous Substances Ordinance to perform a risk assessment and to implement protective measures. Furthermore it may also serve as a useful reference concerning risk assessment in accordance with Section 5 of the „Arbeitsschutzgesetz“ (German Occupational safety act)[2] and Section 3 of the „Betriebssicherheitsverordnung“ (German Ordinance on industrial safety and health).[3]

However, the use of substances and/or methods representing a lower risk in accordance with the `Technische Regel für Gefahrstoffe´ (Technical rule for hazardous substance) 600[4], observance of the ranking of protective measures, and provision of instruction to employees or operators (etc.) continue to be mandatory.

2 Scope of application

These recommendations apply to low-dust-generating working procedures in bakeries, pastry shops and manufacturing companies for other bakery products in which a potential risk of exposure to flour dust exists. They are based on measurements of the inhalable fraction in the workplace air and refer exclusively to the inhalative hazards of flour dust.

Corresponding working areas are flour stores, areas in which dough is produced and handled, and other working areas having relevant flour dust exposure. Grain mills are not in the scope of these recommendations.

These recommendations provide examples for technical, organizational and personal protective measures for cited operations. If these measures are implemented, the control of airborne flour dust exposure level can be renounced.

1) Gefahrstoffverordnung (Ordinance on hazardous substances) of 26 November 2010 (Federal Gazette I pp. 1643, 1644), amended by Article 2 of the Ordinance of 3 February 2015 (Federal Gazette I p. 49)

2) Arbeitsschutzgesetz (German Occupational safety and health act) of 7 August 1996 (Federal Gazette I p. 1246), last amended by Article 8 of the Act of 19 October 2013 (Federal Gazette I p. 3836)

3) Betriebssicherheitsverordnung (German Ordinance on industrial safety and health) of 27 September 2002 (Federal Gazette I p. 3777), last amended by Article 5 of the Act of 8 November 2011 (Federal Gazette I p. 2178)

4) TRGS 600 – Substitution (Technical rule for hazardous substances – Substitution), August 2008 edition

3 Definitions

3.1 Flour dust

In this document flour dust refers to grain flour dust arising in bakeries. The flour mainly used is wheat, rye or spelt flour.

3.2 Release agents

Release agents are substances like release flours, release oils or release waxes which prevent dough from sticking on work tables or parts of the machinery.

3.3 Low-dust release agents

Release agents with dust suppressed properties are:
- Hydrothermal (HT) flours,
- Other low-dust flours,
- Coarse-grained wheat flour and semolina,
- Release oil and release wax,
- Water.

3.4 HT-flours

Hydrothermal flours (HT-flours) are wheat and rye flours whose dust-raising property is minimized by special hydrothermal methods.

3.5 Functional ingredients

Functional ingredients are mixtures of foodstuffs including additives, which have the function of facilitating or simplifying the production of bakery products, to compensate for different processing properties of raw materials, and to improve therefore the quality of the bakery products. Functional ingredients may contain substances which may be able to sensitize the respiratory tract.

4 Working procedures

These recommendations describe working procedures in which flour dust formation may occur; particularly including:
- Dough mixing and kneading,
- Applying of release flour during the handling of dough,
- Cleaning.

The „Arbeits-Sicherheits-Information“ (Work Safety Information) 8.80 [5)] deals with the prevention of baker's asthma and describes procedures in bakeries in order to reduce the risk of getting baker's asthma and rhinitis to a minimum.

The protective measures required for this purpose are specified in part as so called basic protective measures. They have to be applied in consideration of the local conditions of a specific bakery. These basic protective measures should be applied to reduce the inhalation exposure to flour dust/sensitizing substances in accordance with the technical rule for hazardous substance 406 (TRGS 406) [6)]. They take into account also microbiological, chemical and physical influences and those of the work organization and the structural design of the bakery.

5 ASI 8.80 – Vermeidung von Bäckerasthma (avoidance of baker's asthma; bakeries – efficient and safe management; sectoral guide for good work organization), 2014 edition

6 TRGS 406 – Sensibilisierende Stoffe für Atemwege (Technical rule for hazardous substances – Substances with a sensitizing effect upon the respiratory tract), June 2008 edition

5 Hazardous substances

According to Article 20 paragraph 4 of the German Hazardous Substances Ordinance (GefStoffV) no occupational exposure limit for flour dust has been announced. However, according to the technical rule for hazardous substances 907 (TRGS 907)[7], flour dust is sensitizing to the respiratory tract. The rule states that up to now occupational exposure limits which are toxicologically justified can be stated neither for the induction of an allergy (sensitization), nor for the triggering of an allergic reaction for a sensitized individual. The higher the concentration of an allergen during exposure is, the greater the risk of sensitization must be assumed, see also the technical rule for hazardous substances 900 (TRGS 900)[8] number 2.8 concerning occupational exposure limits and sensitizing substance.

6 Exposure to flour dust

6.1 Exposure measurements

A total of 109 personal sampling measurements of the inhalable fraction were performed between 2009 and 2014 in the production areas of 81 bakeries (mostly craft-bakeries). In accordance with the technical rule for hazardous substances 402 (TRGS 402)[9], the measurements were performed over an entire shift, primarily in dough areas, where dough mixing, shaping and dusting took place. These tasks are those in which the highest exposures to flour dust are expected.

The basic measures relevant to flour dust in accordance with the Work Safety Information 8.80 were implemented in all the companies concerned.

6.2 Results and interpretation

The results of the personal sampling (mean shift values) are shown in Table 1:

Table 1: Results of measurements of flour dust in bakeries (inhalable fraction, mean shift values)

Type of exposure measurement	n	50th percentile (mg/m³)	75th percentile (mg/m³)	95th percentile (mg/m³)
personal sampling	109	1,9	2,7	3,5

The measurement results show that in all bakeries using the latest methods of good working practice and engineering control for minimizing flour dust, the concentration of flour dust could be reduced to less than 3.5 mg/m³ (95th percentile).

7 TRGS 907 (Technical rule for hazardous substances – Index of sensitizing substances and of tasks involving sensitizing substances), November 2011 edition

8 TRGS 900 (Technical rule for hazardous substances – Occupational exposure limits), January 2006 edition

9 TRGS 402 (Technical rule for hazardous substances – Identification and assessment of hazards associated with tasks involving hazardous substances: inhalative exposure), February 2010 edition

7 Protective measures

Recommendations for minimizing the flour dust concentration
It is assumed that the flour dust concentration in bakeries would be minimized, if the following protective measures are implemented. These measures constitute a substantial part of the basic protective measures stated in the Work Safety Information 8.80. They are considered to be sufficient to cause a decisive reduction in the risk of inducing baker's asthma.

7.1 Storage, handling and addition of flour

Flour storage and transport must be carried out in such a way that the formation of flour dust is as low as possible.

7.2 Silo feeding

Dust emission into enclosed areas from silos during the filling process must be held low.

7.3 Removal of flour from the silo

The various methods for delivering flour from the silo into the bakery include vacuum, pneumatic and spiral conveyor systems. Regarding vacuum systems, the conveyed air is returned to the silo installation or chamber, so that the breathing air is not contaminated with flour dust.

Where pneumatic systems are used, they must be operated in such a way that they generate a minimal amount of dust. In these systems, the conveyed air leaves the flour scale through a filter cloth and enters the atmosphere in the bakery. Leaks in the installation or the filter cloth can increase the level of flour dust in the breathing zone close to the flour scale. Therefore the area above the flour scale has to be inspected and cleaned regularly. If leaks are detected, they must be eliminated immediately. Filter systems with automatic cleaning do not require a filter cloth.

7.4 Removal of flour from sacks

During the open transfer of flour from sacks to containers, for example to mixing bowl or storage containers, measures must always be taken to reduce dust emission. Dust is largely avoided when a suitable working procedure is carried out, for example:

- Carefully cutting the sack at the top and bottom with a suitable cutting tool,
- Observing little drop heights and tipping the bag gently,
- Using flour scoops,
- Handling of empty sacks in such a way that they do not cause any further dust emissions.

7.5 Removal from the flour scale

Flour must be transferred from the flour scale to a mixing bowl or other container in such a way that dust generation is kept low. This can be achieved by one of the following methods:

- The flour scale and mixing bowl must be tightly connected and the displaced air must be controlled so that as little flour dust as possible will be released into the working environment, for example by means of a suitable dust extraction,
- The flour must be transferred by means of a filling tube extending to the bottom of the bowl or in a controlled manner with a low drop height.

7.6 Dough production

The kneading machine for the production of dough has to be featured and operated so that flour dust emission is reduced to a minimum.

The mixing bowls must be fitted with tightly closing lids.

An access opening and, depending upon the type of kneading machine, an additional opening for the kneading tool are permissible. In this case, kneading must start at lowest speed level.

Functional ingredients must be added in a manner that generates little dust, for example as granulate, liquid or paste.

7.7 Dough handling

7.7.1 Manual dough handling

Low-dust release agents must be used during manual handling of the dough. Owing to its high dust development, starch is not recommended as a release agent.

Flour may be used as a release agent only in the following manner:

- Carefully applying and rubbing down,
- Carefully applying with a sieve,
- Carefully applying with a roller suitable for food.

Do not apply hand throwing of flour.

7.7.2 Mechanical dough handling

The raising of dust must also be reduced to a minimum when dough is handled by machines.

Mechanical dough handling is possible by any of the following:

- Use of low-dust release agents,
- Use of automatic flour sprinklers dispensing flour in the right quantity,
- Use of suitable systems of dust extraction.

When spraying release oil, it must be avoided that the aerosol enters the respiratory tract.

7.8 Proofing carrier for pieces of dough

When proofing carriers with a suitable surface are used, the use of release agent often is unnecessary.

Examples are:

- Flipping boards or trays manufactured from plastic with a special surface structure (e.g. microcolumn pattern) or a coating that prevents the dough from sticking,
- Disposable plastic and paper sheets,
- Sheets with a treated surface,
- Proofing baskets with a treated or specially structured surface.

7.9 Recommendations for the prevention of other hazards

7.9.1 Rooms

Areas in which flour dust occurs must be separated from other areas.

Silos and storage areas for flour must be set up in such a manner that:

- They are well vented and kept cool and dry,
- The equipment within has sufficient distance to the wall and the floor to make easy cleaning possible.

7.9.2 Cleaning

The floor must be easy to clean.

Machines, tools, equipment and rooms, particularly the floors, must be cleaned by means of suitable cleaning equipment that does not lead to the generation of dust. Suitable cleaning equipment includes:

- A central dust vacuum system,
- Suitable vacuum cleaners (with dust class H-filters) with suitable attachments,
- Wet scrubbers,
- Manual low-dust cleaning equipment (e.g. scrapers, brooms with short, synthetic bristles).

The use of compressed air for cleaning purposes is not permissible.

7.10 Instruction

Operating instructions are to be drawn up for all working areas. These instructions must also specify the method and intervals of the cleaning and the use of personal protective equipment.

The employees have to be trained at least once a year with an instruction in relation to their specific workplace and tasks in a comprehensible manner and language.

8 Information on application

EGU provide the companies with practical information how flour dust can be minimised according to the state of the art.

If these recommendations are applied, it can be assumed for the purpose of the risk assessment that the level of airborne flour dust can be kept below 3,5 mg/m³.

The user of these recommendations must review the validity of the assumptions and document the results of this review immediately when changes to the working procedures/ conditions have occurred and otherwise at least once a year.

Following these recommendations the other requirements of the Hazardous Substances Ordinance, particularly sections 6 (covering the gathering of information) and 7 (covering the obligation to observe the ranking of protective measures) continue to be mandatory.

9 Review

These recommendations were elaborated in March 2014. They are reviewed at least every five years. Should amendments be necessary, they will be published.

Annex 1

Operating instruction (German and Turkish)

BTA 0094	**Betriebsanweisung** gemäß § 14 GefStoffV **Geltungsbereich und Tätigkeiten** Tätigkeiten mit Mehl	**Stand 10/14** Freigabe

Gefahrstoffbezeichnung

Atemwegssensibilisierende Stoffe in Backbetrieben
(Mehlstäube, Backmittelstäube)

Gefahren für Mensch und Umwelt

Mehlstaub und Backmittelstaub können zur Sensibilisierung und zur Auslösung von allergisch bedingtem Schnupfen und Asthma führen (Berufskrankheit Nr. 4301).

Schutzmaßnahmen und Verhaltensregeln

Generell sind sensibilisierende Stoffe, hauptsächlich Stäube, in der Atemluft zu vermeiden!
Handhabung
Das wird erreicht durch:

- Anwendung staubarmer Arbeitspraktiken bei Befüllvorgängen
  - Handhabung von Sackware: möglichst die Doppelschlitzmethode anwenden. Die Säcke müssen, unter Berücksichtigung ergonomischer Gesichtspunkte, möglichst tief in die zu befüllenden Gefäße gehalten und entleert werden.
  - Mehlentnahme aus der Silowaage: möglichst bis zum Boden reichender Füllschlauch oder Verminderung der Fallenergie durch geschickte Handführung des Schlauches.
  - Verwendung von granulierten, pastösen oder flüssigen Backmitteln.
  - Abdeckung der Knetmaschinen mit einem dicht schließenden Deckel.
- Anwendung staubarmer Arbeitspraktiken bei der Teigbereitung
  - Trennmehl nicht werfen, stattdessen verreiben, mit Rolle auftragen oder sieben.
  - Verwendung von staubarmen Trennmehlen (z. B. HT-Mehl, Weizendunst, Hartweizengrieß) oder von Trennölen.
- Anwendung staubarmer Reinigungsverfahren
  - Schaber, zugelassene Staubsauger, Nassreinigung.

Die Reinigung der Maschinen und Fußböden mit Druckluft und Borstenbesen ist verboten!

Lagerung
Behälter möglichst dicht geschlossen halten.

Verhalten bei erhöhtem Staubaufkommen

Bei staubintensiven Arbeiten (z. B. Reinigung von Mehlsilos, Reinigung von Absaugvorrichtungen) ist die persönliche Schutzausrüstung zu tragen. Hierbei sind partikelfiltrierende Halbmasken zu verwenden, mindestens der Stufe FFP1.
Bei der Auswahl ist auf einen möglichst geringen Atemwiderstand zu achten (z. B. Unterstützung durch Ausatemventil).

Unfalltelefon:

Erste Hilfe

Bei Atembeschwerden Backstube verlassen bzw. weitere Mehlstaubexposition (auch von verschmutzter Arbeitskleidung) unterbinden, Betroffenen beruhigen und ggf. einengende Kleidung lockern oder entfernen.
Arzt aufsuchen. Bei ausgeprägter Atemnot Rettungsdienst/Notarzt verständigen.
Ersthelfer:

Sachgerechte Entsorgung

Mehlreste, leere Verpackungen und Reinigungsrückstände sind so zu behandeln, dass von ihnen keine neue Staubentwicklung ausgeht.

Datum, Unterschrift: .....

BTA 0094	**ÇALIŞMA YÖNERGESI** Madde 14 GefStoffV yasasina göre **Uygulama alani ve çalişma** Un ile çalişma	**Tarih 12/13** Tasdik

Tehlikeli Madde Tanimi

Firincida solunum organi hassaslaştirilan maddeler
(Un tozlari, yardimci maddelerinin tozlari)

Insan ve Çevre için Tehlikeleri

Un tozlari ve yardimci maddelerinin tozlari alerjik nezleye ve astima neden olabilir ve hassaslastirabilir (Meslek hastaliği no. 4301).

Önlemler ve Davranis Kurallari

Genel olarak hassaslaştirici maddelerden, başlica tozlardan, solunan havada kaçinilmalidir!
Yöntemler
Bu şekilde elde edilir:

- Toz dağilimini minimize eden doldurma işlemleri
  - Çuval içerisinde saklanan mamulleri mümkünse çift kesme metodunu kullanma. Ergonomik yönlerini dikkate alarak çuvallar mümkün oldukça kaplarin içerisine derin tutulmali ve bosaltilmalidir.
  - Silo tartisindan alinan un: mümkünse yere kadar uzanan hortum ile veya dirayetli şekilde hortum kullanimi suretiyle düşme enerjisini minimize etmek.
  - Granül, hamur veya sivi halinde olan yardimci maddeler kullanmak.
  - Yoğurma makinesini kapaklar ile siki kapatmak.
- Toz dağilimini minimize eden hamur işlemleri
  - Ayirma unu atilmamalidir. Bunun yerine unu yoğurun, oklava yardimi ile sürün veya elekten geçirin.
  - Toz dağilimi az olan ayirma unlari kullanmak (örneğin HT-Unu, ‘Weizendunst’, durum buğdayli irmik) veya ayirma yağlari.
- Toz dağilimini minimize eden temizleme işlemleri
  - Kaziyici, onayli elektrikli süpürge makineleri, islak temizleme.

Basinçli hava ve süpürge ile makineleri ve yerleri temizlemek yasaktir!

Depolama
Kaplari mümkün olduğunca siki kapali tutun.

Yoğun Toz Dağiliminda Davranis

Toz dağiliminin yoğun olduğu işlemlerde (örneğin un silosunu temizleme, emme cihazi temizleme) kişisel koruyucu gereçler kullanilmalidir. Bu işlemlerde parçacik filtreleyen yarim yüz maskeleri takmak zorunludur; minimum seviye FFP1. Maskelerinin seçiminde solunum direncinin az olmasi dikkat edilmesi gereklidir (örneğin nefes verme ventili).

Kaza telefonu:

Ilk Yardim

Solunum rahatsizliklarinda firini terk edin ve un tozunun dağiliminin devam etmesini (kirlenmiş gi-ysilerden de) engelleyin. Etkilenmiş olan şahsi sakinleştirin ve gerekirse giysisini açin veya çikartin. Doktoru ziyaret edin. Yoğun solunum krizinde ambulansi/ nöbetçi doktoru çağirin.
ilk yardim elemani:

Uygun Sekilde Imha Etmek

Un kalintilari, boş ambalajlar ve temizlik artik maddeleri tekrar toz oluşturmalari engellenecek şekilde muamele edilmelidirler.

Tarih, Imza: .....

Annex 2

Literature

A compilation is provided below of the following sources:

1. Acts and ordinances

obtainable from retail book trade and websites, e.g. www.baua.de

- German Occupational safety and health act (ArbSchG) and Hazardous Substances Ordinance (GefStoffV) with the associated technical rules for hazardous substances (TRGS), in particular:
  - TRGS 400 Risk assessment for activities involving hazardous substances
  - TRGS 401 Risks resulting from skin contact - identification, evaluation, measures
  - TRGS 402 Identification and assessment of the risks from activities involving hazardous substances: inhalative exposure
  - TRBA/TRGS 406 Sensibilisierende Stoffe für die Atemwege (only in German)
  - TRGS 600 Substitution
  - TRGS 900 Arbeitsplatzgrenzwerte (only in German)
  - TRGS 907 Verzeichnis sensibilisierender Stoffe und von Tätigkeiten mit sensibilisierenden Stoffen (only in German)

2. Rules, regulations and informative documents

obtainable from the responsible accident insurance institution or at www.dguv.de/publikationen.

Regulations:

- DGUV Vorschrift 1 „Principles of prevention“.

Rules:

- DGUV Regel 109-002 „Arbeitsplatzlüftung – Lufttechnische Maßnahmen“ (only in German)
- DGUV Regel 112-189 „Benutzung von Schutzkleidung (only in German)
- DGUV Regel 112-190 „Benutzung von Atemschutzgeräten“ (only in German)
- DGUV Regel 112-195 „Benutzung von Schutzhandschuhen“ (only in German)
- DGUV Regel 112-192 „Benutzung von Augen- und Gesichtsschutz“ (only in German)

Information:

- DGUV Information 212-017 „Allgemeine Präventionsleitlinie Hautschutz – Auswahl, Bereitstellung und Benutzung“ (only in German)

- Arbeits-Sicherheits-Informationen und Branchen-Leitfaden der BGN (only in German):
  - ASI 8.80 Vermeidung von Bäcker-Asthma,
  - Backbetriebe - effizient und sicher führen; Branchenleitfaden für gute Arbeitsgestaltung.

3. VDI standards

obtainable from the Beuth-Verlag GmbH, Burggrafenstrasse 6, 10787 Berlin, Germany, www.beuth.de

- VDI 2262 Part 3: Workplace air – Reduction of exposure to air pollutants – Ventilation technical measures

4. Other sources of information

Bezugsquelle:
obtainable from the retail book trade and via internet, e.g.:

- www.baua.de
- www.bgn.de
- www.ifa-arbeitsmappedigital.de.

Notes

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