REPORT

NOVEMBER 2021

CONTINUOUS FILAMENT GLASS FIBRE AND HUMAN HEALTH

SUMMARY

Continuous filament glass fibres (CFGF) produced by Glass Fibre Europe member companies are not respirable. These fibres have filament diameters above the respirable size of 3 microns thus minimising the potential for any chronic pulmonary effects associated with exposure to fibres. They are not "WHO fibres".

Customers can confirm the diameter of the fibre that they purchase from their supplier. Irritation that can possibly be caused by these fibres is the result of mechanical abrasion, which can be minimised by good industrial hygiene practices.

Manufacturers and their customers should continue to use approved safety and health practices to ensure safe use of our products. Work practices and procedures should be in place to minimise dust generation. Local exhaust ventilation should be used when necessary to minimise and/or keep airborne dust levels below recommended limits. A government approved dust respirator should be used if airborne concentrations exceed regulatory and recommended limits, if irritation occurs, or if the workers choose to do so for personal comfort. Exposure assessments should be conducted, as appropriate, to ensure exposures are within recommended limits.

1. CHARACTERISTICS

1.1. Introduction

Glass fibres have been manufactured and placed on the market since 1940. During this time, they have become one of the world's most useful and beneficial man-made materials.

While they have numerous uses and applications, glass fibres are generally produced in two basic forms: wool-type fibres, referred to most commonly as glass wool, mineral wool or glass fibre insulation (produced by flame attenuation and rotary process), and CFGF, produced by the drawing of continuous filaments through a "bushing". The drawing process allows a tight control of the filament diameter.

1.2. Continuous Filament Glass Fibre (CFGF) Products and Applications

CFGF products are produced and supplied in a variety of forms: roving, chopped strands, yarns, mats, fabrics, tissues, milled fibres etc. The main end-use is the reinforcement of thermosetting and thermoplastic resins. These composite materials are used in a wide variety of applications.

The main markets and applications for Glass Fibre Reinforced Plastic are automotive and transport including marine, aerospace, construction, infrastructure, industrial applications like pipes, tanks, wind-turbine blades, electrical and electronics as well as sport and leisure. Another important end-use is the manufacture of textiles (yarn and yarn fabrics) that are used in similar markets to composites, though clearly for different applications. The main market for glass textiles in the electronics industry is in the production of printed wiring boards.

1.3. Man-Made (Synthetic) Vitreous Fibres (MMVF / SVF)

Glass fibres are categorised within a group of man-made materials historically referred to as man-made mineral fibres (MMMF). However, a more appropriate name is man-made vitreous fibres (MMVFs) or synthetic vitreous fibres (SVFs), reflecting the glassy, non-crystalline nature of the material. The glass

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used to produce the fibres is made by melting sand and other inorganic materials under highly controlled conditions.

1.4. Composition of CFGF

The predominant glass composition for continuous filament glass fibre is known as E-glass. E-glass is a member of the family calcium-aluminium-silicate glasses.

Boron is generally a major element of E-glass, with sodium and potassium maintained at low levels to give acceptable electrical properties. In recent years, however, alternative E-glass formulations, without boron and fluorine, have been developed for use in most industrial applications, except for printed wiring boards or aerospace applications.

For some applications requiring specific properties, such as higher mechanical strength, higher temperature resistance, improved resistance to corrosion, resistance to alkali in cement, or high dielectric properties, other glass families like A, C, D, R, AR, ECR and S glasses are also used to manufacture CFGF.

1.5. Manufacturing CFGF

Glass fibres are a high technology product. CFGF is produced by a continuous drawing process through calibrated holes or bushings at constant speed, thus leading to a very narrow variation in filament diameter.

The diameter of the filaments does not differ significantly from the nominal diameter. The standard deviation of the filament diameter of CFGF products is typically less than 10% of the nominal diameter. By design, the manufacturing process and associated controls does not produce respirable fibers.

The manufacturing process also provides a parallel orientation to the continuous filaments constituting the fibre bundles.

Further processing of CFGF products does neither generate a change in diameter, nor in the parallel orientation of filament bundles.

Note: The CFGF manufacturing process differs totally from glass wool manufacturing process. Glass wool fibers are formed when molten glass is either forced through mechanical spinners by centrifugal force (rotary process) and separated with a blast of air or when molten glass filaments are attenuated by steam (steam blowing) or a circular burner flame (flame attenuation) and forced air that breaks the fibres into shorter lengths.

Special purpose glass fibers are also produced with a flame attenuation process. The hot, molten glass is poured in front of a high temperature gas flame; this results in fibres with a mean diameter of less than 3 µm.

2. HEALTH AND SAFETY ASPECTS OF CFGF

2.1. Inhalation

Airborne dust of CFGF can be inhaled. However, the potential for inhaled glass fibres to cause any health hazard depends on its “respirability”, i.e., its potential to enter the lower regions of the lung. Indeed, the essential feature of a health and safety assessment for the product is to determine whether it is possible for the product to cause lung disease through respiration.

According to the WHO definition, respirable fibres have a diameter (d) smaller than 3 microns, a length (l) larger than 5 microns and an l/d-ratio greater than or equal to 3. Fibres with diameters greater than 3 microns, which is the case for continuous filament glass fibre, do not reach the lower respiratory tract and, therefore have no possibility of causing serious pulmonary disease.

CFGF do not possess cleavage planes which would allow them to split length-wise into fibres with smaller diameters, rather they break across the fibre, resulting in fibres which are of the same diameter as the original fibre with a shorter length and a small amount of dust. However, in the specific case of the milled fibre product, the amount of dust can be more significant and specific respiratory protection equipment (dust mask) is recommended.

Microscopic examination of dust from highly chopped and pulverised glass showed the presence of small amounts of respirable dust particles. Among these respirable particles, some were fibre-like in terms of l/d ratio (so-called “shards”). Under the microscope, however, it can be clearly observed that they are not regularly shaped fibres but irregularly shaped particles with fibre-like dimensions. To the

best of our knowledge, the exposure levels of these fibre-like dust particles measured in the GlassFibre*Europe* member companies' manufacturing plants are in an order of magnitude of 50 to 1000 times below existing applicable limits.

Customers can confirm the nominal diameter of the fibre that they purchase from their supplier.

2.2. Effects on skin and mucous membranes

CFGF products may cause skin and mucous membranes itching due to the mechanical abrasion effect of fibres. This is definitely not an allergic reaction.

When sufficient amounts of CFGF are released into the air during manufacture and handling, some workers may experience temporary upper respiratory tract discomfort. Like skin itching, upper respiratory irritation is a mechanical reaction to the fibres. It is not an allergic reaction and the irritation generally does not persist. Such exposures to high concentrations of airborne fibres may result in temporary coughing and/or sneezing.

By respecting the manufacturers' safe use and handling instructions, these mechanical effects can readily be avoided.

Generally, the mechanical irritation caused by glass fibres disappears when the person ceases to be exposed to the product. These effects should have no further impact on his or her health or well-being.

2.3. Human Epidemiology Studies

An important method for assessing the effects of a substance on humans is through epidemiological studies. Such studies typically examine large groups of people who have been exposed to the substance being studied.

Two major studies involving 21500 workers in the USA and Europe, conducted respectively by the University of Pittsburgh, School of Public Health, and the International Agency for Research on Cancer (IARC), showed no increase in lung cancer or non-malignant respiratory disease among persons working in glass fibre production. A smaller study was conducted among workers in a CFGF manufacturing facility in Canada with the same results.

Three epidemiological studies have been published on cohorts of people working in MMVF factories. The first one in Europe by Boffeta & al. (1997) on different types of MMVF concluded for two plants in Northern Ireland and Italy that there was no significant increase of different types of cancer compared to reference cohorts. The two other studies by Chiazze al. (1997) were specifically made in one plant producing CFGF in the USA. Chiazze concluded that there was no evidence of excess of cancer in the populations working in this plant for a long time (more than 15 years). References are mentioned below.

2.4. Hazard Classification and Regulatory Aspects

Europe Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures (CLP Regulation).

Continuous Filament Glass Fibre (CFGF) are not classified as hazardous neither carcinogenic according to the criteria of the CLP Regulation.

Some "Man-Made Vitreous Fibres" have a Harmonized Classification and are included in the Annex VI of the CLP Regulation, CFGF are not included.

CLP Note Q and Note R (exemption criteria application to the classification and labelling of Man-Made Vitreous Fibres) are not applicable to Continuous Filament Glass Fibre as they are not included in Annex VI of CLP. (see attachment 1 for reference to Annex VI).

Note: CFGF do not meet the dimension criteria of nanomaterial according to the current EU recommended definition: *"Nanomaterial" means: A natural, incidental or manufactured material containing particles, in an unbound state or as an aggregate or as an agglomerate and where, for 50 % or more of the particles in the number size distribution, one or more external dimensions is in the size range 1 nm - 100 nm.*

IARC – International Agency for Research on Cancer.

Several major reviews have been undertaken by various international expert organizations on the health and safety aspects of glass fibres. The first of these was conducted by the International Agency for Research on Cancer (IARC 1987). The purpose of the IARC review was to determine whether these fibres are carcinogenic to humans. At that time, IARC concluded that continuous filament glass fibres are not classifiable as to their carcinogenicity to humans (IARC classification Group 3). In October 2001,

after a comprehensive review of more recent human epidemiology and animal toxicity data, IARC concluded that the classification of CFGF in Group 3 *("not classifiable as to their carcinogenicity to humans")* is appropriate, confirming that there is no evidence for the carcinogenicity of continuous filament glass fibres to humans (IARC 2002).

IARC groups man-made vitreous fibres (MMVF) into categories based on raw materials, production process, and end use. IARC noted, in its 2001 reclassification of MMVFs, that an additional category had been added to group those durable glass fibres produced by flame attenuation for special applications. IARC retained the Group 2B classification for what IARC termed "Special Purpose Fibres." IARC gave as examples of these SPF: E-and 475 respirable glass fibres. IARC retained the Group 3 classification for continuous filament fibres, regardless of chemical composition. Continuous filament fibres differ from Special Purpose Fibres (SPF) in their method of manufacture and end use. They may also have different composition. Thus, continuous filament glass fibres (made from E-glass and other glass compositions) are still classified as Group 3; they should not be confused with E-glass microfibers.

Environment Canada.

Environment Canada also completed a review of the scientific data for glass fibres. The purpose of the review was to assess both the hazards of glass fibres and the risk to humans and the environment presented by those fibres. It concluded for continuous filament glass fibres:

"Based principally on the likelihood that few respirable fibres are generated in the production and use of continuous filament and that concentrations in the general environment should be extremely small, it has been concluded that continuous glass filament is not entering the environment in quantities or under conditions that may constitute a danger in Canada to human life or health" (Environment Canada 1993).

ACGIH – American Conference of Governmental Industrial Hygienists / NTP – National Toxicology Program / OSHA – US Occupational Safety and Health Agency.

The American Conference of Governmental Industrial Hygienists (ACGIH) has classified continuous filament glass fibres as not classifiable as human carcinogen. The ACGIH has established a TLV (Threshold Limit Value or recommended exposure limit) for glass fibre of 1 fibre per cubic centimetre of air for respirable fibres and 5 mg per cubic meter of air for inhalable glass fibre dust. These levels were established to prevent mechanical irritation of the upper airways. NTP (US National Toxicology Program) and OSHA (US Occupational Safety and Health Administration) do not list continuous filament glass fibres as a carcinogen.

German TRGS 905 – "Verzeichnis krebserzeugender, keimzellmutagener oder reproduktionstoxischer Stoffe". *(https://www.baua.de/DE/Angebote/Rechtstexte-und-Technische-Regeln/Regelwerk/TRGS/TRGS-905.html)*

According to the German Technical Rules for Hazardous Substances TRGS 905 (list of CMR substances), only WHO fibres (diameter less than 3 µm, length greater than 5 µm and a length/diameter ratio of greater than 3) are considered (suspected) carcinogens.

CFGF product manufactured and sold by GlassFibre*Europe* member companies do not meet these criteria they have a filament diameter larger than 3 µm and hence are not to be considered as (suspected) carcinogens under the definitions of the German TRGS. The KI-index criteria given in the TRGS 905 does not apply to continuous filament glass fibre products.

2.5. Industry Recommended Work Practices

While CFGF are safe to manufacture and handle, a number of general work practices should nevertheless be followed by those who are involved in these operations. In addition to preventive measures aiming to reduce the possibilities of generating dust or broken filaments, a series of protective measures in areas of high exposure are recommended: gloves, long-sleeved cloths, long-legged trousers, and dust masks especially for workers involved in cutting operations, cleaning or discharging of containers. It is furthermore recommended to measure, as appropriate, the number of fibres in the air to prevent high exposure levels to fibre or dust, in order to ensure compliance with existing exposure limits.

Years of airborne fibre sampling at GlassFibre*Europe* manufacturing facilities confirm that very low concentrations of respirable fibres may be present, but the concentrations are well below current recommended exposure limits. GlassFibre*Europe* member companies will continue to conduct exposure monitoring to ensure proper work practices, engineering controls, and personal protective equipment (PPE) are in place to eliminate or minimise exposure risk.

GlassFibre*Europe* product information will continue to be reviewed and updated as needed, based upon the evaluation of work by different laboratories studying these subjects and the ongoing analysis of our products.

3. REFERENCES

Boffeta, P & al (1997) Cancer mortality among man-made vitreous fibre production workers. *Epidemiology*, **8**, 259-268

Chiazze, L & al. (1997) Historical cohort mortality study of a continuous filament fibreglass manufacturing plant. I. White men. J. occup. Environ. Med., 39, 432-441

Chiazze, L & al. (1997) Historical cohort mortality study of a continuous filament fibreglass manufacturing plant. II. Women and minorities. J. occup. Environ. Med., 39, 548-555

Environment Canada (1993) Mineral fibres (man-made vitreous fibres). Priority Substances List Assessment Report. ISBN 0-662-21068-9. http://www.hc-sc.gc.ca/ewh-semt/pubs/contaminants/psl1-lsp1/mineral_fibres_minerale/index-eng.php#a4

IARC (International Agency for Research on Cancer) (1987) Man-Made Vitreous Fibres. Monographs on the Evaluation of Carcinogenic Risks to Humans, **81**

IARC (International Agency for Research on Cancer) (2002) Man-Made Vitreous Fibres. Monographs on the Evaluation of Carcinogenic Risks to Humans, **81** https://monographs.iarc.who.int/wp-content/uploads/2018/06/mono81.pdf

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Attachment 1: CLP Regulation: Continuous Filament Glass Fibres are not included in the list of substances/fibres with harmonised classification and labeling.

Reference: REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 and amendments.

Man Made Vitreous Fibre Classification: Extract from CLP Regulation - Annex VI.

DISCLAIMER:

This is an unofficial excel table containing the substances with harmonised classification and labelling up until the **15th Adaptation to Technical Progress**, i.e. Commission Delegated Regulation (EU) No 2020/1182 amending, for the purposes of its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures and correcting that Regulation.

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Updated on December 2020

Index No	International Chemical Identification	EC No	CAS No	Classification		Labelling			Specific Conc. Limits, M-factors	Notes	ATP inserted/ATP Updated
				Hazard Class and Category Code(s)	Hazard Statement Code(s)	Pictogram, Signal Word Code(s)	Hazard statement Code(s)	Suppl. Hazard statement Code(s)			
014-046-00-4	e-glass microfibres of representative composition; [Calcium-aluminium-silicate fibres with random orientation with the following representative composition (% given by weight): SiO2 50,0-56,0 %, Al2O3 13,0-16,0 %, B2O3 5,8-10,0 %, Na2O < 0,6 %, K2O < 0,4 %, CaO 15,0-24,0 %, MgO < 5,5 %, Fe2O3 < 0,5 %, F2 < 1,0 %. Process: typically produced by flame attenuation and rotary process. (Additional individual elements may be present at low levels; the process list does not preclude innovation).]			Carc. 1B	H350i	GHS08 Dgr	H350i			A	ATP09
014-047-00-X	glass microfibres of representative composition; [Calcium-aluminium-silicate fibres with random orientation with the following composition (% given by weight): SiO2 55,0-60,0 %, Al2O3 4,0-7,0 %, B2O3 8,0-11,0 %, ZrO2 0,0-4,0 %, Na2O 9,5-13,5 %, K2O 0,0-4,0 %, CaO 1,0-5,0 %, MgO 0,0-2,0 %, Fe2O3 < 0,2 %, ZnO 2,0-5,0 %, BaO 3,0-6,0 %, F2 < 1,0 %. Process: typically produced by flame attenuation and rotary process. (Additional individual elements may be present at low levels; the process list does not preclude innovation).]			Carc. 2	H351 (Inhalation)	GHS08 Wng	H351 (Inhalation)			A	ATP09
650-016-00-2	Mineral wool, with the exception of those specified elsewhere in this Annex; [Man-made vitreous (silicate) fibres with random orientation with alkaline oxide and alkali earth oxide (Na2O+K2O+CaO+MgO+BaO) content greater than 18 % by weight]	-	-	Carc. 2	H351	GHS08 Wng	H351			A Q R	CLP00/ATP01
650-017-00-8	Refractory Ceramic Fibres, Special Purpose Fibres, with the exception of those specified elsewhere in this Annex; [Man-made vitreous (silicate) fibres with random orientation with alkaline oxide and alkali earth oxide (Na2O+K2O+CaO+ MgO+BaO) content less or equal to 18 % by weight]	-	-	Carc. 1B	H350i	GHS08 Dgr	H350i			A R	CLP00/ATP01

Note Q:

The harmonised classification as a carcinogen applies unless one of the following conditions is fulfilled:

— a short term biopersistence test by inhalation has shown that fibres longer than 20 µm have a weighted half-life less than 10 days; or

— a short term biopersistence test by intratracheal instillation has shown that the fibres longer than 20 µm have a weighted half-life less than 40 days; or

— an appropriate intra-peritoneal test has provided no evidence of excess carcinogenicity; or

— no relevant pathogenicity or neoplastic changes are noted in a suitable long term inhalation test

Note R:

The harmonised classification as a carcinogen applies except in the case of fibres with a Length Weighted Geometric Mean Diameter (LWGMD) minus two geometric standard errors greater than 6 µm, as measured in accordance with Test method A.22 in the Annex to Commission Regulation (EC) No 440/2008

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About Glass Fibre Europe – EU Transparency Register n°635608817518-09.

Glass Fibre Europe, founded in 1987, is the voice of the European continuous filament glass fibre industry. It is composed of 7 companies: 3B the fibreglass company, FYSOL SAS, Johns Manville, Lanxess, Nippon Electric Glass, Owens Corning and Saint-Gobain Vetrotex. Glass Fibre Europe represents over 90% of the continuous filament glass fibre production in Europe.