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TNO report

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General report on Roadmap on Carcinogens Challenge 4.2: Process Generated Carcinogens

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Contents

1 Introduction

The Roadmap on Carcinogens aims to create awareness on occupational exposure to carcinogens, and ultimately provide innovative approaches to reduce exposure. One of the challenges of this roadmap (Challenge 4.2) is to get more grip on carcinogens created as a by-product during a work process, so called process-generated carcinogens (PGCs). As PGCs are usually not considered by REACH and therefore not labelled and not referred to in Safety Data Sheets, these PGCs need special attention in OSH practice.

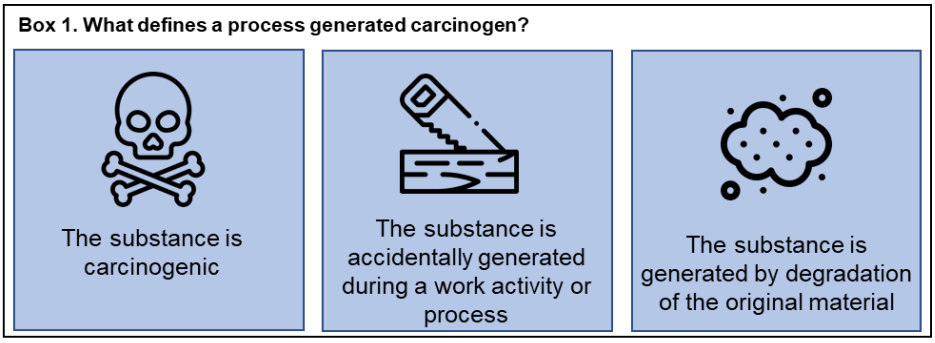
To date, millions of workers in Europe are daily exposed to PGCs; the overall cancer burden attributed to occupational exposures is estimated to be 2-5% since the 1980s (Olsson & Kromhout, 2021).

In order to get more grip on PGCs, the primary need is to draw a clear definition for PGCs. Furthermore, detailed information is needed on the size of the problem: the prevalence of worker's exposure, sectors and occupations involved, the processes by which PGCs are generated, current elimination and control strategies and barriers for the implementation of these strategies. This report provides an overview of the state-of-the-art on PGCs, exposure levels, dust extraction tools, lesson learned from an inspection campaign in Austria on silica dust at construction sites, and summaries of two workshops held within the context of Challenge 4.2 of the roadmap.

2 Definition of process generated carcinogens

At present, there is not a formal and universally recognized definition of a process-generated substance (OSH Wiki, 2020). Although a clear definition for PGCs is not readily available, there are criteria that could help to define a process-generated carcinogen, i.e.: 1) the carcinogenic substance is accidentally generated during a work activity or process (i.e. not manufactured or intentionally used in manufacturing), and 2) the carcinogenic substance is generated by physical or chemical degradation of the original material. These criteria are explained in more detail below.

Box 1. What defines a process generated carcinogen?



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A carcinogenic substance or carcinogen is a substance or mixture which induces cancer or increase its incidence (OSH Wiki, 2017). Carcinogens are chronically toxic and have serious impact on human health.
A criterium to define a PGC is that the substance is accidentally generated during a work activity or process (OSH Wiki). For example, when chromium-6 is intentionally added to products such as paint and wood to prevent rust and rotting, it is not considered a PGC. Yet, if chromium-6 is released upon abrasion by sawing wood, it is considered a PGC.
Compounds that are unintentionally released yet with a functional result (such as evaporation of VOCs that leads to drying of paint) are usually not considered as PGCs.

Another criterium is the manner of release of a substance. A substance can be defined as a PGC if it is generated by physical or chemical degradation or transformation of the original material, which can occur for example during emission or combustion/heating processes and abrasion.
Furthermore, the following exclusion criterium applies to a PGC: a substance should physically or chemically transform during a process, and therefore emission processes such as evaporation of volatile agents from a mixture or particles released from handling of powders are not considered as PGCs.

In short, a PGC should be defined as a carcinogenic substance that is accidentally generated and released during physical or chemical degradation of the original material, and released in a form other than the original material.

3 Process generated carcinogens: types and composition

3.1 Types of PGCs

Numerous types of PGCs have been described in literature. Respirable crystalline silica in mineral dust, hardwood dust, diesel engine exhaust emissions and welding fumes are among the most common process-generated substances (Olsson & Kromhout, 2021). Substances described on the website of Roadmap on Carcinogens that are considered PGCs are asbestos, chromium VI abrasive dust, polyaromatic hydrocarbons (PAHs).

Furthermore, occupational carcinogens and mutagens are described in the Carcinogens and Mutagens Directive of which the following could be considered as PGCs: refractory ceramic fibres, 1,3-butadiene (contaminated air, tobacco smoke), arsenic acid, inorganic arsenic compounds, salts of arsenic acid and mineral oils used before in internal combustion engines.

Other PGCs (i.e. not described in the roadmap or Directive) are e.g. coal tar fumes/creosotes[1] (coke production), wood tar creosotes, oil tar creosotes, leather dust (benzene and other fumes), pitch volatiles (aluminum production), radon daughters (hematite mining) and textile dust. (EU OSHA, 2014).

In Table 1, a variety of PGCs are listed including the ones mentioned above. Table 2 provides an overview of the processes that generate PGCs.

3.2 Composition

The composition of a PGC can vary substantially, depending on the parameters of the underlying process. For instance: differences in recipes for rubber compounding may produce vulcanization or curing fumes that differ dramatically in composition and in levels of the individual chemicals present in these fumes. Similarly, the composition of organic dusts can differ dramatically when working with organic material with different moisture content. For PGCs such as diesel motor emissions, the composition and intensity will differ among the various generations of diesel engines and environments where human exposure occurs (e.g. surface or underground mining) Olsson & Kromhout, 2021.

Additionally, PGCs can be present in multiple forms, i.e. gases, vapours, mists, fumes and/or particles (fibres and non-fibrous). Health risks of PGCs vary due to intrinsic properties of the compound and depend on the form of the compound when released. Furthermore, PGCs often exist as mixtures, which makes them more complex to track and measure than single chemical compounds, as they are not traded and tracked along a supply chain (Olsson & Kromhout et al., 2021).

[1] Creosote is a category of carbonaceous chemicals formed by the distillation of various tars and pyrolysis of plant-derived material, such as wood or fossil fuel.

It should also be mentioned that dust can contain nanosized or ultrafine particles, making them invisible. Process generated nanoparticles (PGNPs) may occur by emission in e.g. sparks of electric motors. Also, PGNPs may be released upon the processing of hardwood and brick/concrete (silica dust). The fact that particles are invisible can be dangerous, as workers may not be aware of exposure and fail to use risk management measures to reduce exposure.

Table 1. Overview of PGCs: exposure numbers in Europe, relevant sectors/occupations and the process by which a PGC is generated. Where empty cells are present, information was not readily present.

PGC	IARC Classification	Number of exposed workers in Europe	Sectors/Occupations	Process	References
Asbestos	Group 1 carcinogen		Shipyards and construction (industries). Home renovation, flooring, roofing or mechanics in industry. Other occupations at risk are fire-fighters and power-plant workers.	Asbestos fibres are released into the air during activities that disturb asbestos-containing materials.	RoC factsheets
Beryllium	Group 1 carcinogen	66,000	Beryllium miners, beryllium alloy makers and fabricators, phosphorus manufacturers, ceramics workers, missile technicians, nuclear reactor workers, electric and electronic equipment workers, and jewellers.		RoC factsheets
Bitumen (asphalt) fumes		>500,000	Road paving, roofing, siding, and concrete work.		https://www.osha.gov/asphalt-fumes
1,3-Butadiene		31,600	Synthetic elastomer (rubber and latex) production, petroleum refining, secondary lead smelting, water treatment, agricultural fungicides, production of raw material for nylon, and the use of fossil fuels. Also present in tobacco smoke.	Processing of petroleum (EU OSHA), production of various butadiene-based rubber and plastic polymers and other derivatives, and manufacture of rubber and plastic products, such as tires, hoses and a variety of moulded objects.	https://www.osha.gov/butadiene https://monographs.iarc.who.int/wp-content/uploads/2018/06/mono100F-26.pdf
Cadmium	Group 1 carcinogen	10,000	Cadmium production and refining, Ni-Cd battery manufacture, electroplating, pigment manufacture and welding operations. Exposed workers are mainly found in construction, manufacture of metal products (especially batteries), non-ferrous base metal industries and manufacture of plastic products.		RoC factsheets
Chromium VI	Group 1 carcinogen	900,000	Welding and other types of ”hot work” on stainless steel and other metals that	Welding on steels containing chromium metal and abrasive	RoC factsheets

PGC	IARC Classification	Number of exposed workers in Europe	Sectors/Occupations	Process	References
			contain chromium, during the use of pigments, spray paints and coatings, operating chrome plating baths. Industries where exposure occurs are shipyards, construction, repair and painting of auto bodies, trucks, trains and airplanes.	blasting, sanding and grinding Cr(VI)-coated materials.	
Coal tar fumes/creosotes			Coke production, coal gasification, and aluminium production. Other workers who may be exposed to coal-tar pitches include those who produce or use pavement tar, roofing tar, coal-tar paints, coal-tar enamels, other coal-tar coatings, or refractory bricks.		https://www.cancer.gov/about-cancer/causes-prevention/risk/substances/coal-tar
Diesel engine exhaust	Group 1 carcinogen	3,600,000	Mechanics in bus garages and truck terminals, truck drivers, firefighters (also in fire stations), construction workers and forklift operators in several settings, people working with fixed power sources like compressors, generators, workers loading and unloading ships or airplanes, oil and gas workers, toll-booth workers.	Emission from combustion	RoC factsheets
Hardwood dust	Group 1 carcinogen	3,000,000	Sander operators, press operators in the wood products industry, lathe operators, construction workers and carpenters. Industries where exposure occurs are the furniture industry, construction, forestry and carpentry industries.	Hardwood dust is created when machines or tools are used to cut or shape hardwood. High amounts of wood dust are for instance produced in sawmills. The biggest risk is from fine dust, as you can breathe this deep into your nose and lungs where it will do the most damage. Fine dust will also spread further	RoC factsheets

PGC	IARC Classification	Number of exposed workers in Europe	Sectors/Occupations	Process	References
				from the cutting process. The quantity and type of wood dust will depend on the wood being cut and the machine that is used.	
Lead	Group 2B carcinogen	1,500,000	Construction, mining, and manufacturing	Lead fumes are produced during metal processing, when metal is being heated or soldered. Lead dust is produced when metal is being cut or when lead paint is sanded or removed with a heat gun.	RoC factsheets
Leather dust (benzene and other fumes)		NA	Footwear industry, leather-tanning and processing industry	Footwear industry: cutting, fitting, lasting, making and finishing departments. Scouring (shoe repair). Machining of shoes. Leather-tanning and processing: loading of hide-tanning drums, buffing.	https://monographs.iarc.who.int/wp-content/uploads/2018/06/mono100C-13.pdf
Nickel	Group 1 carcinogen (Metallic Nickel as Group 2B)	Several millions	Manufacture of fabricated metal products, manufacture of machinery, except electrical and manufacture of transport equipment.	Mining, smelting, welding, casting, spray-painting and grinding of nickel and nickel compounds.	RoC factsheets
Polyaromatic hydrocarbons (PAHs)	Group 1 carcinogen		Industries or trades using or producing coal or coal products (main exposure): asphalt workers, coal-gas workers, fishermen (coal tar on nets), graphite electrode workers, mechanics (auto and diesel engine), road (pavement) workers and tire and rubber manufacturing workers.		RoC factsheets
Radon daughters			Hematite mining		EU OSHA, 2014

PGC	IARC Classification	Number of exposed workers in Europe	Sectors/Occupations	Process	References
Respirable crystalline silica dust	Group 1 carcinogen	5,000,000	Construction industry, abrasive blasting workers, brick, concrete or tile manufacturing operators, bricklayers, ceramics and pottery workers, concrete workers, crushing and grinding operators.	Cutting, sawing, drilling and crushing stone, rock, concrete, brick, block and mortar; or when using industrial sand. Activities such as abrasive blasting with sand; sawing brick or concrete; sanding or drilling into concrete walls; grinding mortar; manufacturing brick, concrete blocks, or ceramic products; and cutting or crushing stone generates respirable dust. Or handling, mixing or shovelling dry materials that include silica.	RoC factsheets
Rubber curing fumes		170,000	Rubber manufacturing	Cutting, milling, heating (fumes from heated rubber products), curing, processing	https://monographs.iarc.who.int/wp-content/uploads/2018/06/mono100F-36.pdf OSH Wiki (exposure)
Textile dust			Wool and cotton industry	Dusty operations such as opening, blending, carding, and backwinding of wool/cotton	RoC factsheets
Vinyl chloride	Group 1 carcinogen		Vinyl chloride/ PVC plants and in PVC-processing plants (including packaging, storage and handling of vinyl chloride). Industries at risk are manufacture of industrial chemicals, plastic products, fabricated metal products or machinery. But also in occupations or services allied to	Vinyl chloride is produced as a combustion product in tobacco smoke.	RoC factsheets

PGC	IARC Classification	Number of exposed workers in Europe	Sectors/Occupations	Process	References
			transport and construction.		
Welding fumes	Group 1 carcinogen		Metal industry, shipyards, construction and transportation. Occupations are mainly welders and metal workers.	The fume emitted by welding and hot cutting processes is a varying mixture of toxic airborne gases and very fine particles which can be inhaled. Welding techniques that generate the highest amounts of carcinogenic substances are: MAG (flux-cored wire), flux-cored wire welding without shield gas and autogenous flame cutting.	RoC factsheets

Table 2. PGC generating processes.

Process / Activities	PGC examples
Emission from combustion	Engine exhaust fumes
• Engine combustion	Tobacco smoke
• Welding	Bitumen fumes
• Smelting	Tar creosotes (wood, oil, coal)
• Ablation (2D laser technique)	Curing fumes (e.g. rubber)
	(2D) Welding fumes
	Metal fumes (e.g. Cd, Be, Pb, Ni)
Emission from abrasion	(Hard)wood dust
• Blasting	Leather dust
• Sanding	Metal dust
• Grinding	Crystalline silica dust
• Cutting	Textile dust
• Milling	
• Sawing	
• Crushing	
• Backwinding (textile)	

4 Exposure to PGCs in Europe

A large proportion of workers in the EU are potentially exposed to PGCs. For many PGCs, exposed populations are considerably larger when compared to single (chemical) substances (Olsson & Kromhout, 2021). Yet, the exact prevalence of PGCs in the majority of countries including low- and middle-income countries is largely unknown because few studies have been conducted locally and most countries do not have a clear registration of this information.

For several PGCs, the number of workers exposed in Europe is estimated. It is estimated that over 5 million workers in the EU are potentially exposed to respirable silica (RoC factsheet). About 4 million workers are potentially exposed to diesel exhaust fumes above background levels found in cities (RoC factsheet). In addition, it is estimated that approximately 170,000 workers are exposed to rubber fumes (IARC 100F), approximately 1 million workers to used engine oils and 3 million workers to hardwood dust (OSH Wiki, 2020). Furthermore, over half a million workers are exposed to bitumen fumes (NIOSH 1981-1983), 900,000 workers to chromium VI (yet not all process generated) and 2,100,000 workers to lead (lead fumes) (RoC factsheets). Also environmental tobacco smoke is a PGC with high exposure levels amongst workers (Olsson & Kromhout, 2021), yet no estimation of the number of workers exposed to tobacco smoke was found.
From the figures it is clear that a large number of workers in the EU are exposed to PGCs and that respirable silica, diesel exhaust fumes, environmental tobacco smoke and hardwood dust are among the highest numbers of workers exposed, with a total of 16 million workers, which is 55% of the total number of workers exposed to 80 known or suspected carcinogenic substances considered (Olsson & Kromhout, 2021).

Exposure levels for other sectors can be found in Table 3. From the table it becomes clear that for many sectors or occupations, exposure levels are not yet known. Yet, exposure to these less well investigated PGCs may significantly contribute to the occupational cancer burden in Europe. Unfortunately, due to limited insight in exact exposure prevalence, precise estimates of the number of workers exposed and turnover rates in workforces are generally not available. Therefore, the estimates on burden of cancer due to these exposures will remain rather imprecise and will either overestimate or (more likely) underestimate the importance of carcinogenic exposure at the workplace.

From Table 3, it becomes clear that a profession with high risk of exposure to PGCs is construction work. Dependent on the type of material a construction worker deals with during the activity, there is a risk of exposure to e.g. chromium VI, wood dust or metal fumes. Detailed information on professions and sectors where exposure to PGCs takes place is presented Table 1.

EU OSHA presented an overview of exposed jobs (to all carcinogens; not only PGC) by economic sector (Table 3).

Table 3. Proportion of exposed jobs by economic sector (EU OSHA, 2014).

Economic sector	**Exposed[1] (%)**
Construction	86.3
Metal industry and tool manufacture	79.0
Car business and repair	75.9
Printing, chemicals and rubber industries	70.8
Clothing and textile industry	47.7
Other industries (tobacco, food, wood, furniture, electricity etc.)	43.4
Transport and communications	42.5
Services to companies	38.0
Health, education, public administration	31.0

[1] Please note that the overview is focused on carcinogens, either processed generated or not.

TNO identified the construction industry, the wood processing industry and the metalworking industry as the main sectors with highest exposure levels to carcinogenic substances (TNO, 2018).

5 Elimination and control strategies

5.1 STOP strategy

The STOP-strategy describes the hierarchy to control exposure. STOP stands for Substitution, Technical measures, Organizational measures and Personal protective equipment (PPE). The best way to prevent exposure at the workplace is full elimination or substitution of the substance by a less harmful alternative, which means that the source needs to be eliminated. When replacement is (technically) not yet possible, other measures could be taken such as technical control measures or PPE.

5.2 Label Dustfreeworking – TNO

5.2.1 Background

For years, TNO intensively focused on innovations of tools, processes and workplaces in the industrial work environment, primarily focused on reducing exposure to PGCs (Technical measures). The most important aim was to realize dust free processes and efficient risk management measures to mitigate the emission to PGCs at the source.
To achieve this aim, TNO started a label called Dustfreeworking and the corresponding website www.dustfreeworking.tno.nl. Within Dustfreeworking, hundreds of tools and vacuum cleaners were tested via exposure measurements in the so-called 'Worst case room' test facilities of TNO or via equivalence tests. In addition, successful innovations were developed like a welding torch with an integral welding fume extraction and an angle grinder with a special dust cover.

Also, TNO developed the Performance Test, in which a process/tool is assessed by functionality in practice and shows that by means of these processes and tools, the relevant public or private limit values of process generated carcinogens (like quartz dust, wood dust, chrome VI) in the breathing zone of workers will not be exceeded. Using Dustfreeworking (Worst case room or Equivalence tests), it can be demonstrated whether a tool or vacuum cleaner meets the criteria of the TNO performance test. The Dutch Labour Inspection explicitly included the TNO Performance Test in the Basic inspection module for quartz dust.

5.2.2 Overview of the Dustfreeworking website

The Dustfreeworking website offers a comprehensive overview of different dust control/extraction tools that were tested by the TNO Performance Test. The tools contain a label representing the performance of the tool, which enable easy comparison of different tools. The tools contain an A/B/C/D-label and an hour-label, allocated after testing the dust extractor by the Performance Test. The A/B/C/D-label represents the operational capacity (airflow in m^3/h) of the extractor. The hour-label represents the total "responsible operating time" in hours – between one and eight – per eight-hour working day. That is the length of the time for which the system can be operated without exceeding the occupational exposure limit for hazardous substances.

The dust control solutions contain a wide range of different tools applicable for various types of material. On the website, an easy to use filter system enables to select tools

on the basis of the material that needs to be processed, the tool manufacturer, the A/B/C/D-label, the hour-label and type of dust control solution (e.g. extraction adapter, hollow drill) (see Figure 1). Dependent on the type of materials the tool can be applied for, hour-labels are allocated (see Figure 2).

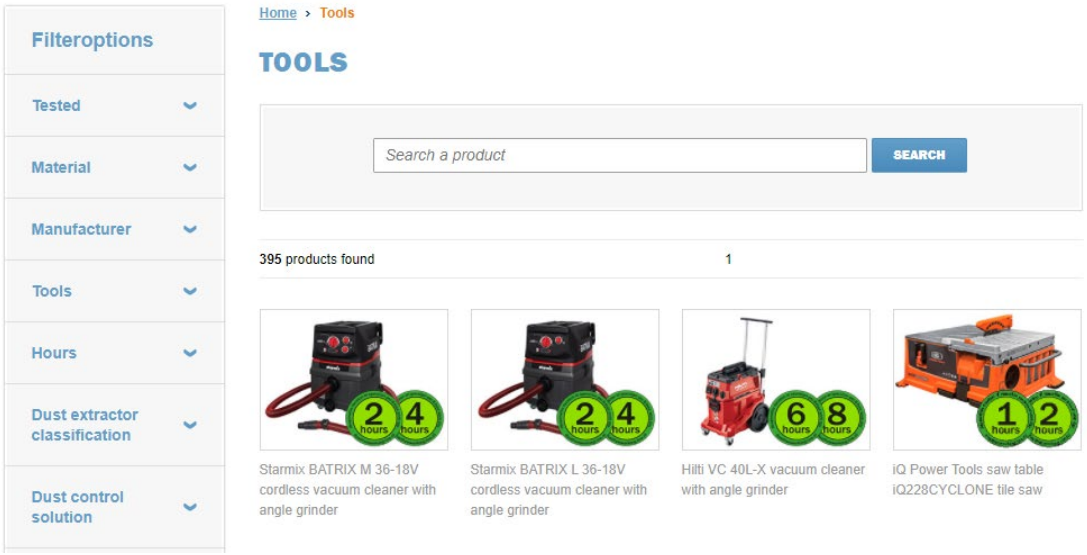


Figure 1. Snapshot from the Dustfreeworking website (www.dustfreeworking.tno.nl/tools), presenting a selection of dust control solutions including hour-labels. The filter options (left) enable quick selection and comparing of dust extraction tools.

Figure 2. Example of information for a dust extraction tool available on the Dustfreeworking platform. Two labels are allocated to the product displayed, indicating the duration to which the tool can be used safely (i.e. exposure remains below occupational health limit values) dependent on the type of material being processed, in this case sand-lime blocks or concrete/brick.

In Table 4, the types and number of tools presented on the Dustfreeworking website are shown. As shown, most dust extraction systems are applicable for dust released upon processing wood, concrete and stone. Furthermore, the wide range of dust extraction tools cover all types of processes such as grinding, milling, sanding, drilling, cutting, sawing and planing. Therefore, the Dustfreeworking website is a useful platform for employers and workers in sectors dealing with release of dust during these processes.

Table 4. Overview of dust control tools presented on the Dustfreeworking website (www.dustfreeworking.tno.nl).

Tool type	Subtypes	Material
Dust extractors (84)	Dust extractor / Vacuum cleaner	Concrete/stone (79) Wood (5)
Other tools with integrated extraction systems (309)	Belt sander (9) Buzz saw (16) Combination hammer (26) Combination hammer with hollow drill (5) Combination hammer with integrated extraction (8) Cross-cut saw (20) Diamond drill (5) Diamond sander (10) Dust extractor (84) Eccentric sander (37) Electric demolition hammer (11) Jigsaw (19) Multi hammer (2) Multitool (1) Nail gun (2) Orbital sander (17) Planer (11) Plunge cut saw (3) Right angle grinder (61) Rotary hammer (48) Rotary hammer (2) Router (18) Sanding machine (parquet) (2) Stone cutting machine (4) Tile cutter (1) Tile drill machine (1) Triangle sander (3) Wall chaser (9) Welding torch (4)	Cedral (1) Concrete/stone (139) Metal (6) Parquet (2) Tiles (10) Wood (151)

5.2.3 Future plans – Risk management platform

The label Dustfreeworking including the website was recognized to be of great value, among others by the Ministry of Social Affairs and Employment and Labour Inspection in the Netherlands. Therefore, a further updating was initiated to launch a broader Risk Management platform. This platform aims to become a place where suppliers of tools and vacuum cleaners can go to for the label Dustfreeworking and where different stakeholders with control issues at the workplace can find solutions. The development of innovations is being stressed, for existing but also for new substance control issues. The website will be elaborated with Substitution, Organizational measures and PPE to complement the entire STOP-strategy (Dustfreeworking is currently primarily aimed at Technical measures). Also, there will be attention for the effect of behaviour on exposure and the successful implementation of new measures.

6 Workshops

6.1 Workshop 23 November 2021 - Summary

On Tuesday the 23rd of November 2021, around 50 experts and stakeholders affiliated with carcinogens gathered for an interactive online expert seminar on process-generated carcinogens (PGCs). The workshop was hosted by TNO. The goal of the seminar was to bring stakeholders together to contribute to a way forward in regards to PGCs in Europe. Different experts shared knowledge on elimination and control strategies. An additional goal was to explore how to accelerate tackling exposure to process-generated carcinogens. The seminar included plenary and breakout sessions. During the breakout sessions, the experts were divided into smaller groups to discuss innovations and solutions to minimize exposure, including current and future control and elimination strategies and techniques as well as drivers for implementation of measures to reduce exposure. Moreover, they discussed strategies to accelerate preventing exposure, focusing on drivers and barriers for the implementation of exposure reduction as well as stakeholder roles in improving implementation of exposure reduction and elimination strategies.
Prior to the seminar, a survey was sent to those who signed up, to gain preliminary insight. Insights from the survey were used as the base for the breakout sessions.

In the breakout sessions, implementation and control strategies, drivers and barriers to implementation, and stakeholder actions were discussed. In general, drivers and barriers mentioned by the participants were often similar. For example, (lack of) awareness was mentioned as both a driver (awareness) and a barrier (lack of awareness). Some trends were observed as well, such as how conservative culture can limit the potential to reduce exposure to PGCs. Moreover, a broad list of actions was mentioned throughout the different sessions, for many different stakeholder groups. Although some drivers and barriers were mentioned multiple times and some were mentioned occasionally in relation to a specific field or industry, follow-up stakeholder actions will be discussed in the next workshop in further detail.

Several trends were observed: an example of a factor that was mentioned multiple times was how a conservative company culture can limit the potential to reduce exposure to PGCs. Moreover, awareness was one such factor that has been mentioned multiple times as being needed to reduce exposure to PGCs, which was also clearly visible in the survey results. Also, lack of inspection and monitoring was mentioned to be an important barrier. A broad list of actions was already mentioned throughout the different sessions, for many different stakeholder groups (Table 3). Although some drivers and barriers were mentioned multiple times and some were mentioned occasionally in relation to a specific field or industry, follow-up stakeholder actions shall be discussed in the next workshop in further detail.

For both the preliminary survey as well as the discussion in the breakout rooms, there was no full consensus on what currently needs the most attention. This shows that the issue of PGCs is a versatile problem which needs to be tackled on multiple sides and from multiple perspectives.

This expert seminar in the context of the Roadmap of Carcinogens provided the opportunity to bring stakeholders together to explore how to accelerate reducing

exposure to PGCs. The actions identified during this workshop have been made more specific, and hereafter be appointed to the responsible persons during the next workshop in 2022 (see description below). For instance instead of 'creating awareness' it needs to be indicated who needs to gain more awareness, and how this should be achieved. This next seminar in 2022 should result in a detailed action plan, including a timeline presenting when the action will take place and who will perform which tasks to reduce exposure to PGCs in European countries.

6.2 Workshop 11 April 2022 – Summary

On Monday the 11th of April 2022, around 40 experts and stakeholders affiliated with exposure to carcinogens gathered for an interactive online expert seminar on PGCs. The workshop was hosted by TNO. The goal of the seminar was to bring stakeholders together to contribute to a way forward in regards to PGCs in Europe, and to build on the workshop held in November 2021. The main topics discussed were 'awareness on the health risk of PGCs', 'a safe company culture' and the Austrian inspection campaign on silica dust at construction sites. The research for the topics awareness and safe company culture was mainly based on a TNO investigation in 2018 to the prevention of occupational diseases due to exposure to harmful substances (TNO 2018, R11394, TNO repository).
The seminar included plenary sessions and breakout sessions. During the breakout sessions, the experts were divided into smaller groups to discuss the topics of awareness and safe company culture. Each breakout group discussed its own subtopic (see Table 5). It should be mentioned that during the breakout sessions, participants provided input from their own perspective and with specific examples from their field of expertise and therefore must not all be interpreted as generalizable experiences.
Prior to the seminar, a survey on the topics of awareness was sent to those who signed up, to gain preliminary insight on the experience with awareness from the participants. Insights from the survey were used as the base for the breakout sessions. The survey results showed that for 'awareness' the most interesting topics to discuss were: 1) Underestimation of health risks by workers, 2) Employer perception/attitude, 3) Lack of media attention / societal knowledge. For 'safe company culture' the most interesting topics to discuss were: 1) Supervisory leadership / Accountability, 2) Safety as a value/safety alignment, Owner/client involvement, 3) Employee empowerment, Involvement and Training (Table 5). Additionally, the original and complete questionnaire output is present in Appendix 8.1.

Table 5. Topics discussed during the breakout sessions.

	Group 1	Group 2	Group 3
Session 1 - Awareness	Underestimation of health risks by workers	Employer perception/attitude	Lack of media attention / societal knowledge
Session 2 – Safe company culture	Supervisory leadership Accountability	Safety as a value/safety alignment Owner/client involvement	Employee empowerment Involvement and Training

Appendix 8.2 present the notes of the discussion during the breakout session. An important goal of the breakout session was to appoint who (e.g. employers, policy makers) should take action for specific issues, and how to tackle the issues.
It should be noted that the information provided was quite divergent and not a direct answer to the question asked, and might lack background information.

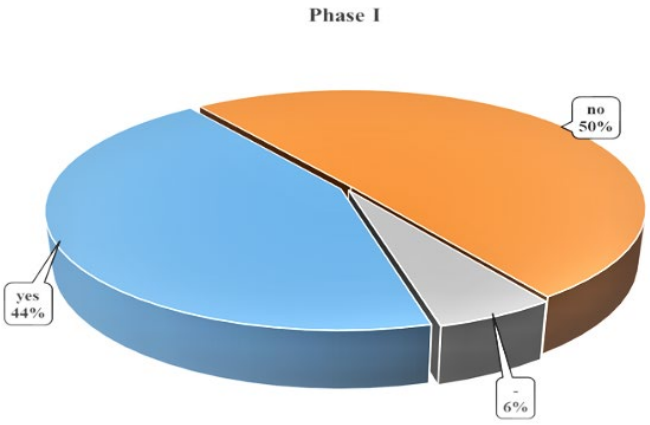
7 Results of an advisory and inspection campaign in Austria: silica dust in construction and mining

In order to sensitise employers to the new lower limit value for silica dust (0.05 mg/m^3), an advisory and control focus on low-dust (dust-free) working methods on construction sites and in surface mines was carried out in Austria. Special attention was paid to advising employers on possible measures for low-dust (dust-free) working practices. The action was divided into two phases, an advisory phase (Phase I) and a control phase (Phase II).

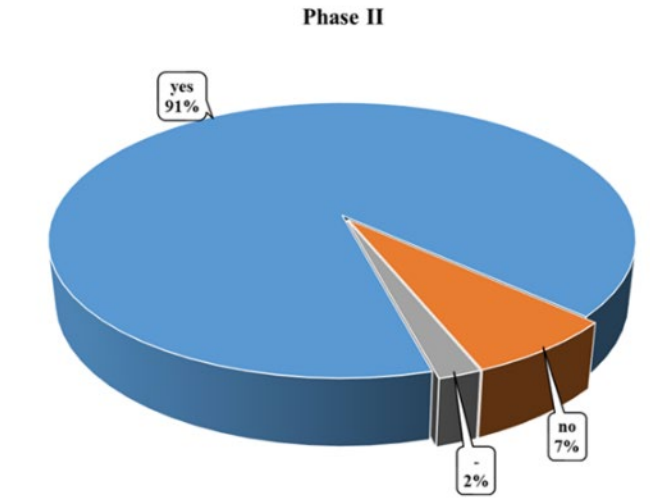
7.1 Main results and scope of the action

In the period of 2021-2022, almost 2000 companies on construction sites and about 250 surface mines were advised and inspected.

On construction sites, employers' awareness of workers' exposure to mineral dust has been increased significantly through this campaign. The level of knowledge that silica dust is classified as carcinogenic, and is therefore a hazardous working substance, was more than doubled: from 44% in Phase I to 91% in Phase II (see Figure 3).



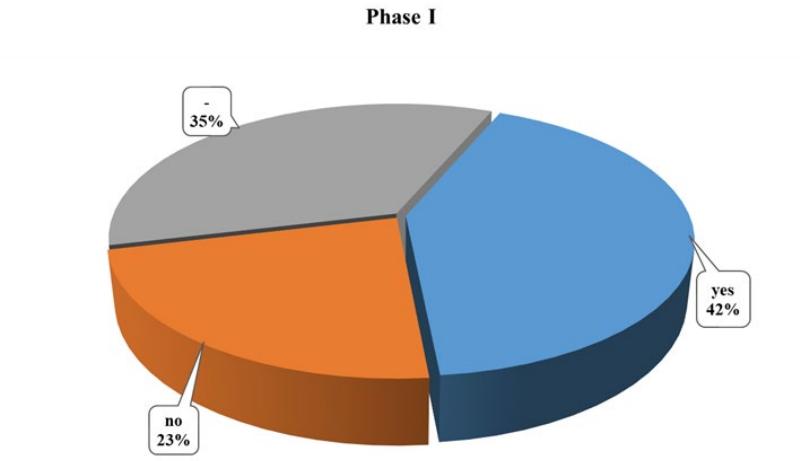
Source: Austrian Labour Inspection 2022



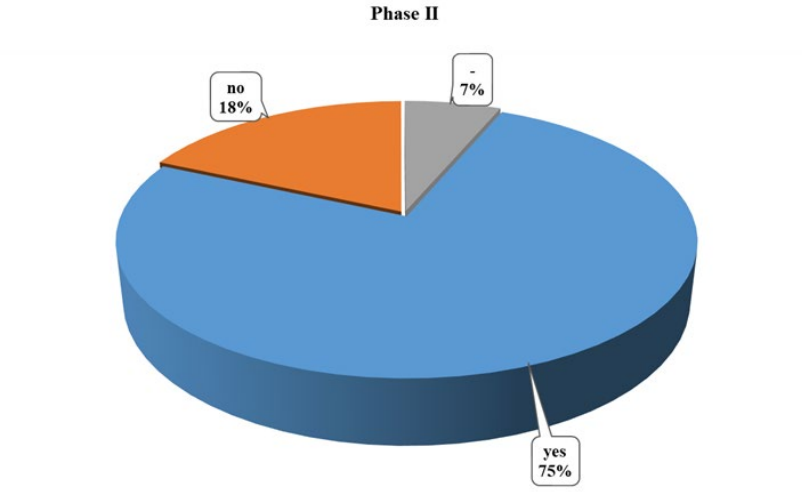
Source: Austrian Labour Inspection 2022

Figure 3. Employers' awareness on the fact that silica dust is carcinogenic was significantly increased through the campaign.

The proportion of companies that have taken technical measures against exposure to fine dust has doubled as well: from 42% in Phase I to 75% in Phase II (Figure 4).



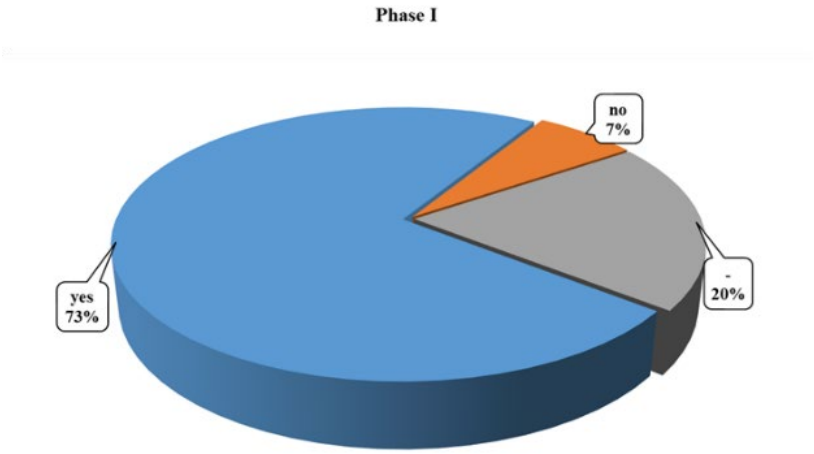
Source: Austrian Labour Inspection 2022



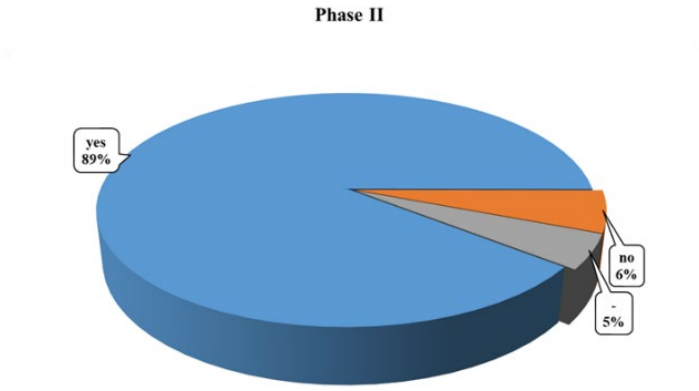
Source: Austrian Labour Inspection 2022

Figure 4. Results of the Austrian Labour Inspection campaign. Companies that take technical measures against exposure to fine dust have doubled through the campaign.

A comparison between Phase I and Phase II showed that employers are increasingly informed about the building products and their composition: from 75% in Phase I to 89% in Phase II (see Figure 5). This also increased workers' knowledge that they may come into contact with air enriched with silica dust.



Source: Austrian Labour Inspection 2022



Source: Austrian Labour Inspection 2022

Figure 5. Results of the Austrian Labour Inspection campaign. Employers' knowledge on building products and their composition increased through the campaign.

In mining, measured values were checked and assessed in 250 companies: 80% of the measured values were already below the permissible limit value of 0.05 mg/m³, i.e. 20% are still exceeding the limit value and further control measures are required (Figure 6).

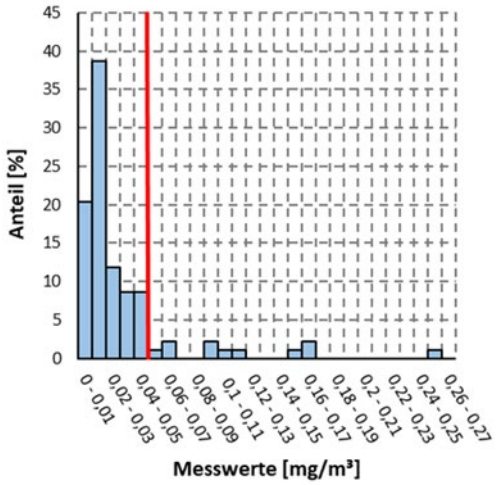


Figure 6. Exposure values compared to the limit value (indicated with a red line) as measured at 250 mining surface during the campaign.

7.2 Lessons learned

In some areas, appropriate measurements still showed high levels of fine dust. Also, companies were not able to use measured values for comparable workplaces and associated activities. Thus, there is still considerable need for action and investigation on the part of the companies. Recommendations could be 1) more comparative measurements of limit values to be carried out by the companies for activities that produce silica dust and 2) expand the pool of comparable activities for which limit value comparison measurements are available.

Efforts need to be made throughout Europe to achieve a consolidation of data. Best practice examples should be brought together in a pool of comparable workplaces and associated activities that are to be documented by limit value comparison measurements.

Detailed notes of the workshop presentation on 11 April 2022 on the Austrian Inspection Campaign can be found in Appendix 10.3. Furthermore, several good practices identified during the campaign are presented in Appendix 10.4.

7.3 Online closing event

Based on the Austria-wide consultation and inspection campaign on silica dust and within the framework of the EU Roadmap on Carcinogens, the Austrian Federal Ministry of Labour and Economy, with support of EU-OSHA, organised a virtual and interactive closing event. On 27 September 2022 the virtual event "Silica Dust - Fight Against Work-Related Cancer!" was held, focusing on low-dust (dust-free) work practices on construction sites and in mining and focusing on reduction or avoidance of silica dust. Approximately 170 people from all over Europe participated, inter alia from the Netherlands, Belgium, Great Britain, Greece, Spain, Portugal.
In Europe, there are common legally binding minimum OSH requirements to avoid or minimize exposure to silica dust. On the other hand, there are also EU-wide common non-binding guidelines to support labour inspections in monitoring compliance with these occupational health and safety regulations on silica dust. This supports OSH requirements to be implemented at national level.

During the event, illustrative presentations of France, Ireland and Austria enabled an exchange of good practices and an exchange of experiences of Labour Inspectorates.

8 Summary of results and future work

Millions of workers in Europe are exposed to PGCs. Despite the high number of exposed workers, relatively little attention has been paid to the issue. The aim of Challenge 4.2 of Roadmap on Carcinogens was to create more awareness on the health risks upon exposure to PGCs to reduce workers' exposure and finally prevent PGC related cancer. To realise this aim, the following tasks were performed: a brief literature search was carried out to collect information on exposure levels, occupations of risk and processes that lead to PGC release. Furthermore, PGC-specific elimination and control strategies were described. Two interactive workshops were held with around 45 stakeholders. The first workshop was focused on (implementation of) elimination and control strategies. The second workshop was directed towards 'awareness on the health risks of PGCs' and 'a safe company culture'. Also, the results of an Austrian inspection campaign on silica dust in the construction sector were presented.

8.1 What did we learn?

The main results of Challenge 4.2 are briefly summarised below. Results were either gained from the literature search, discussions among project partners, the inspection campaign on silica dust in Austria and/or the two workshops.

As a universally recognized definition for PGCs was lacking, the first achievement was to draw up a clear definition for PGCs. Hence, in- and exclusion criteria were formulated to facilitate the allocation of a substance as a PGC; namely, a PGC should be accidentally generated during a work activity and be generated by degradation of the original material. The definition provided focus and clarity for the succeeding challenge tasks.
Processes that lead to the release of and exposure to PGCs were listed, for example welding and blasting. Although a variety of processes was identified, it was observed that all processes could be allocated to two main activities: combustion (i.e. release of fumes and smoke containing PGCs) or abrasion (abrasive techniques produce abrasive dusts containing PGCs).
Although for most PGCs exposure levels in Europe were drawn from literature, for several PGCs, clear exposure figures were lacking. In addition, information on exposure levels per occupation was not readily available; only exposure levels for carcinogenic substances in general were found. To obtain a clear view on the magnitude of the issue, more exposure data should be collected.

A broad range of dust extraction tools is available on the market. The application of these tools as a technical solution is the immediate extraction of dust during processing of material. Yet, it became clear that these tools are still insufficiently used, especially within small-medium enterprises.

The Austrian inspection campaign focused on silica dust at construction sites, showed that inspection campaigns help to create awareness. The campaign significantly contributed to increased employers' awareness on workers' exposure to silica dust. Also, the application of technical measures were increased considerably at the inspected companies. A point of attention, however, was that more comparable activities should be gathered to support limit value comparison measurements.

During Challenge 4.2 of the Roadmap on Carcinogens, multiple barriers were identified that hamper the reduction of exposure to PGCs. Most of these barriers were collected during the workshops. An overview of the barriers is presented in Box 2. Please notice that these barriers were predominantly collected during the workshops and thus based on individual knowledge and insights of workshop participants.

Box 2. Barriers identified that hamper the reduction of exposure to PGCs.

Awareness
- Lack of media attention and campaigns
- Lack of awareness on the danger of PGCs, mainly due to long latency
- Downplay of risk by workers as a coping strategy to reduce stress levels
- Large companies do not recognise cancer by exposure to PGCs as an occupational disease
- Workers do not know which substances they work with
- Attention in the workplace is rather focused on acute danger such as accidents, which overshadow the attention to PGCs

Company culture
- Conservative company culture: e.g. stick to existing measures such as personal protective equipment instead of application of dust extraction tools.
- Ascendency of older or more experienced workers (e.g. “we always worked like this, why should we change? We did not get ill”).
  Hierarchical culture: workers do not dare to speak to the employers / lack of communication between workers and employers
- Macho culture: workers do not want to complain, do not want to be treated as children

Finance
- Insufficient financial means, especially among small-medium enterprises (SMEs)
- Strong lobby of machine manufacturers
- Unwillingness to invest in prevention due to lack of immediate results, i.e. no health effect and return of investment
- Conflicting priorities – price and time competitiveness
- No insight in the costs of technical measures
- Lack of monitoring due to high sampling costs

Enforcement / Inspection / Monitoring
- Lack of enforcement for workplace limits
- Lack of active control (inspection) and penalties
- Lack of rewarding good practices
- Conservative attitude of inspectors
- Lack of safety engineers for SMEs

Data collection
- Incorrect methods are used to gather exposure data
- Low quality of exposure data due to immature technology
- Little use of real-time sensors as dust might be invisible

Education
- Information provided to workers is often too difficult and unclear
- Information provided does not fit well with practice
- exchange of knowledge between sectors

8.2 Who is responsible?

From the overview in Box 2 it becomes clear that the issue of PGCs is multifactorial. Thus, to prevent or reduce workers' exposure to PGCs, changes and effort from all stakeholder groups on various levels are required: authorities, inspectors, safety engineers, manufacturers, sector representatives, employers and workers. In Box 3, recommended actions to decrease exposure to PGCs per stakeholder group are

Box 3. Tasks that support the reduction of PGC exposure, allocated to responsible stakeholder groups.

Authorities
- Create awareness by initiating promotion campaigns
- Create media attention
- Create funds for innovation and novel equipment
- Enforce education on latest equipment
- Stimulate research to exposure to PGCs and health risks
- Enforce trade unions and workers councils to give attention to PGCs
- Intensify health surveillance
- Extend the CMD Annex with PGCs
- Simulate communication on the danger of PGCs between workers and employees e.g. by organising social dialogues
- Generate a stronger link between researchers and safety engineers
- Stimulate/Provide funding for the development of innovative ways of knowledge transfer e.g. Serious Game, virtual reality glasses
- Support a penalty/reward inspection system
- Stimulate the use of dust extraction tools

Safety engineers
- Demonstrate that an increase of monitoring is necessary
- Simulate the market to perform monitoring
- Improve transfer of data and knowledge among companies and sectors

Manufacturers
- Involve workers in the development of tailor made (dust extraction) tools
- Provide education on how to use tools
- Create financial incentive to help the promotion of best health and safety performance
- Get education on latest equipment and innovative tools

Labour inspection
- Create special attention to PGCs during inspection

Employers
- Start the conversation with employees about health risks of PGCs – make workers aware of the substances they work with
- Inform workers on training possibilities and stimulate participation in training

Employees
- Speak out to employers about PGC exposure and health risks

presented. Please note again that these tasks were predominantly collected during the workshop and thus based on individual knowledge of workshop participants.

8.3 Next steps

From Box 3 it becomes clear that most recommended tasks are the responsibility of authorities. Although employers have the prime responsibility of providing a safe and healthy workplace, and performing multiple tasks by various stakeholders would help to diminish the issue of PGCs, the bigger change and transition seems to start with authorities.
Permanent efforts need to be made to increase awareness. Although various efforts have been made already, for example this Roadmap on Carcinogens, the successful campaign on silica dust described in this report and the Dutch campaign on hazardous substances at work, awareness for employers and employees on the health hazards of PGC is still too low to lower the work-related disease burden to an acceptable level. Upon raising awareness, more stakeholder groups will be urged to take action. Key activities to raising awareness are campaigns and media attention.
Raising awareness initiatives should preferably:

1) be focused on a specific PGC – the more specific, the more a target group will feel addressed;
2) give attention to the use of innovative (dust extraction) tools – although a wide range of tools is readily available, they are not being used sufficiently;
3) be designed to share innovative ways of knowledge transfer, such as Serious Games. This will better match workers' interest compared to the currently provided (written) information, which is often too lengthy, too difficult and unclear. To this end, in 2023, short and catchy articles will be written based on the results of the Challenge. These articles will be distributed via the Roadmap website, the stakeholder network of the Roadmap and social media to maximize impact.

It is expected that when awareness is sufficiently raised and inspections are increased, it will consequently lead to changes in e.g. company culture and increase in the use of technical measures. There should, however, be an incentive for authorities to give more attention to PGCs. Parties such as focal points, the Senior Labour Inspectors' Committee (SLIC) and this Roadmap on Carcinogens can play a role to this end.

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10 Signature

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11 Appendix

11.1 Preliminary Survey on Raising Awareness on PGCs

Below, the unedited results of the survey are presented. The survey was sent out prior to the expert seminar of 11 April. Participants were asked if they had examples of actions to raise awareness on the topic of PGCs, including additional success factors and barriers to success. In total, 11 people filled out the survey.

Do you have any *drivers *to add?	Do you have any *barriers *to add?	Do you have an example of awareness raising?	What factors made this example a success?	What were barriers to success?	Do you have an example of awareness raising that you would consider a bad example?	What were the reasons for its non-success and what can we learn from this?
	Lack of awareness of employers (responsible for risk assessment)					
there is still basically too little talk about the use of chemicals in the workplace; accidents continue to be the dominant issue	there is still basically too little talk about the use of chemicals in the workplace; accidents continue to be the dominant issue	Silica-Project of the socialpartner of the european construction industry, https://www.fiec.eu/our-projects/completed-projetcs/rcsd; Diesel exhaust from construction machinery - manufacturers advertise compliance with limit values, meaning exhaust limits; construction companies are therefore convinced that everything is fine, but occupational health and safety limits are clearly exceeded, especially indoors	Whether the Silica project will have an impact in practice remains to be seen. The emissions issue has by no means been solved, and the problem may become less acute with the tightening of emissions limits.	s. answer to point 4	The exhaust gas issue is a very good example of a bad example. The manufacturers of construction vehicles and construction machinery argue that everyone is asking for exhaust emission limits, but no one is asking for workplace limits. And they are right to do so. There is practically no enforcement on this issue. The lobby of the	The big construction companies have not been interested in this issue so far, at least not in Germany. One of the reasons for this in Germany is that cancer from diesel exhaust is not recognized as an occupational disease. If large construction companies, which buy hundreds of construction machines every year, would only buy machines with particulate filters, the

Do you have any *drivers *to add?	Do you have any *barriers *to add?	Do you have an example of awareness raising?	What factors made this example a success?	What were barriers to success?	Do you have an example of awareness raising that you would consider a bad example?	What were the reasons for its non-success and what can we learn from this?
					machine manufacturers is very strong	problem would be solved.
Not related to the drivers for awareness. Just a remark that at the employee level 'awareness' on itself is insufficient motivator to drive self-protective behaviour.	Incomplete understanding and integration of knowledge about risk perception (and related - feelings of urgency)	We are currently conducting a study in which we aim to understand construction workers' risk perception of silica dust in relation to using protective equipment. We will use the study results to draft practical communication guidelines to improve workers' decision making about, for example, using protective equipment. Results are due late 2022/early 2023	Involving people who have to decide in the context of actual silica dust exposure makes that we can identify relevant theme's in risk perception and what to address in risk communication to fore example help people make informed decisions about exposure, or motivate them to apply protective measures	For example, we only involve Dutch speakers in our research (mainly due to, for example, time constraints), while the workforce is increasingly made up of non-Dutch speakers. Risk perceptions tend to be culturally dependent thus findings may lack generalizability beyond the Dutch worker population		
Education in vocational training						
specialized education at the schools	lack of motivation	when industry and legislation work together	coordination and right timing	all the factors mentioned befor		
		Best practice was control by the inspection service and penalties.	active control and penalties			
	unwillingness to use equipment	Guidance in form of a technical rule to be followed during welding-process to prevent exposure - a guidance in the sector for ventilation/suction in the processes is also currently under way (DE)	it gives legal certainty which processes are high risk welding processes and what to do to prevent exposure	process itself is difficult to substitute technically		

Do you have any *drivers *to add?	Do you have any *barriers *to add?	Do you have an example of awareness raising?	What factors made this example a success?	What were barriers to success?	Do you have an example of awareness raising that you would consider a bad example?	What were the reasons for its non-success and what can we learn from this?
Social Dialogue Agreements	Difficulties to reach out to small and micro enterprises	Information campaigns at national level with influential partners	wider dissemination to concerned parties	limited interest of concerned parties		
Clearer product labelling	Lack of awareness during education					
professional organizations more involved		asbestos exposure benefited from sustained campaigns and was eliminated; occupational diseases - asbestosis and mesothelioma benefit from the derogation as they are compensated without time limit from the end of exposure	convergence of decisions and actions	it was difficult to spread the knowledge and accept that it is a life-threatening danger; technical solutions and financing was another issue		

11.2 Highlights breakout sessions on Awareness (Seminar 2)

Session 1, group 1: How to tackle underestimation of risks by workers?

- Start from authorities, supported by Social Partners
- Promotion campaigns
- Cooperation between manufacturers and employers is needed

Session 1, group 2: How to tackle the issue of employer attitude and perception?

I.e., employers think that workers are sufficiently aware while this is not the case, and there is a lack of communication between workers and employers.

Action discussed: create a dialogue with employers (focused on dust at construction sites).

The responsible people for this action are:

- Although the employer is (by law) responsible for a safe and healthy work environment, it should be a good cooperation and communication between the employer and the employee (foreman especially on construction sites, maybe clients demands).
- The cooperation and communication might differ in dependence of company size.

The first step to be taken to start this action:

- Government might initiate/make sure that the dialogue takes place (can be the result of more inspection)
  - If it is a mutual dialogue it might be successful – together with penalties that inspired the dialogue in the first place
  - Main responsibility lies with the employer

Additional remark:

- Make the problem visible by showing pictures, video, sketches when informing workers (employer to employee).

Session 1, group 3: How to tackle the issue of the lack of media attention for PGCs?

Action discussed: make use of exposure scenarios.

- Main responsible party: industry, knowledge institutes and governments.
- First step to be taken to start the action: lecture on exposure scenarios for industrialized professions (like welders, builders, part of VET).

11.2.1 Highlights breakout sessions on Safe Company Culture

Session 2, group 1: Supervisory leadership: what is necessary?

- Commitment within a company - especially the leaders of the company must be committed.
- Role model (foreman construction site); social roles (what is expected from us?, etc.).
- Trust is very important; sometimes things are silent.
- The cost should play a minor role, e.g. government funds; company can use innovation.
- Budget – company can buy technical measures for dust reduction.
  Not doing so will cost employer more money – invest in healthy environment.

Session 2, group 1: Accountability: what is necessary?

- Law, external audits and the employer are necessary to implement accountability successful;
- Employers are responsible for accountability – employees have to be aware of the law and follow the obligations.
- Law is the first step to address accountability – there should be penalties if the companies do not follow the law, there should be consequences.
- Motivation for the employers to change the company culture.
- Integrated approach of the different approaches: every employee should use safety measures, training tools, health surveillance.
- Extend health surveillance programs.

Session 2, group 2: Safety as a value: what is necessary?

- Employer needs to be aware of benefits of safety value.
- Expectation is that it is costly to install new tools (ventilated, suction included) (information can be provided during inspection).
- Show that the quality gets better with new machinery/tools.
- Raise awareness on the long-term effects; what will it cost the company if a worker gets ill?
- Reinforcement with ongoing trainings with scheduled meetings within a company (employer to employee).
- Start with a positive safety climate and bring that into guidelines (regulation to employer).

Session 2, group 2: Owner/Client involvement: what is necessary?

- If it is in the contract of a client then safety culture can be promoted – those who bid have to regard safety legislation as a second criterion next to money.
- If the employer is not behind the safety culture, we cannot expect the employee to be behind this.
- Why should the employer promote the safety culture if there is a lack of inspection (no frequent visit to be feared), lack of demand by client, lack of demand by employee?
- More awareness that employee can get sick and the responsibility to prevent this.
- Incentive to offer an attractive workplace to young people.

Session 2, group 3: Employee empowerment and involvement: what is necessary?

- Clear examples and experiences to deal with the situation.
- Medical doctors have a role in informing workers.
- Workers committee, workers representatives are important for employee empowerment.
- Strong labour union involvement, which has been proven in the past.
- Responsibility lays with both workers and employers, government has a facilitating role.
- The first step to action is to start with an inspection and survey, and with measurements in companies by inspectors.
- The gap between SMEs and bigger industry in the Austrian inspection survey is not that big.

Session 2, group 3: Training: what is necessary?

- Clear examples and experiences to deal with the situation
- Targeted training
- The good use of tools
- Examples from others
- Involve architects/designers (IE-example)
- New ways of training: use computers and virtual reality glasses that can show the hazard
- Make use of Napo (see https://www.napofilm.net/en/about-napo/napo-story)
- Real pictures/videos – Let workers upload photos of their situation (yet costs are high)

11.3 Workshop notes (11 April 2022). Update on the Austrian Inspection Campaign regarding silica dust at construction sites and in the mining industry

Below are the notes taken during the workshop presentation on the Austrian Inspection Campaign.

Due to the amendment of the Carcinogens Directive (EU) 2017/2398 and the SLIC Guidance for national labour inspectors on addressing risks from worker exposure to respirable crystalline silica (RCS) on construction sites, the Austrian Labour Inspection carries out an advisory and inspection campaign focusing on silica dust throughout Austria in the years 2020 to 2022. The inspection campaign aims at low-dust (dust-free) working methods on construction sites and in surface and underground mining and, in particular, at reducing or avoiding silica dust.
In Section B of NACE Rev. 2 (Mining and quarrying) the figures of Austrian Workers' Compensation Board give a clear picture. More than 30% of all fatal occupational disease cases of the occupational disease caused by silica dusts recognized in all economic sectors are attributable to mining. In view of these figures, it is a priority to counteract the trend in the mining industry.
The inspection campaign is divided into two phases. Currently Phase 1 has been completed, while Phase 2 is still pending. The results of Phase 1 of the construction sites are hereby presented. The results of Phase 1 of the mining industry have been presented at the workshop in November last year.
The results of the Phase 1 of the Inspection campaign on construction sites had three important goals: Firstly, the current status of the companies with regard to the problem of silica dust was to be determined. It was determined to what extent the companies or the respective persons are informed about the carcinogenic effect of silica dust, whether employees come into contact with it and whether technical measures to minimise dust have already been taken by the company. Secondly, the effectiveness of the measures taken was determined and the question was answered as to what percentage of the hazardous working substance silica dust has already found its way into the Safety and Health Protection Plan. Thirdly, Phase 1 also included an advisory campaign. All companies were informed about the topic of exposure to silica dust and the associated health hazards.
It turned out that almost half of all the companies surveyed already knew that silica dust is defined as clearly carcinogenic and is thus classified as a hazardous working substance. More than half of the companies whose workers are exposed to silica dust have already taken technical measures against it. Of course, it would be desirable for this proportion to increase to 100%. The effectiveness of the technical measures is around 50%, i.e. half of all companies that have taken technical

measures have succeeded in staying below the limit values. Accordingly, the remaining companies should optimise the technical measures in order to also achieve this goal. In order to reduce the large proportion of those who cannot assess whether the technical measures have achieved their effect or not, more data would be needed both from the company side (limit value compliance measurements) and from the industry side (limit value compliance measurements). There is also a need for optimisation in the Safety and Health Protection Plan, since the problem of silica dust is only reflected in it in 17% of all companies surveyed.
Here, the awareness of building owners should be increased so that it is already clarified in the preparation phase for a building project by means of the product composition whether silica dust is to be expected and with this knowledge, adequate work preparation with technical measures for dust minimisation can then be carried out.
In Phase 2, follow-up inspections of 15% of the companies advised in Phase 1 will determine the extent to which the consultations in Phase 1 have already led to a higher awareness of the issue of silica dust and to positive developments in worker protection.

<u>The following questions have been raised and answered:</u>

1. Surprised that the information situation in the construction industry is better than in other SMEs. What are these SMEs?
   Answer: Within this inspection campaign only companies within the construction were interviewed. So the SMEs are also working on construction sites (and smaller than 250 employees).

2. Could the downward trend also be caused by larger use of migrant workers?
   Answer: We do not have any information if migrant workers contribute to that number. Normally everyone who works should also be registered with the AUVA (Austrian Workers Compensation Board).

3. On the slides of the cases: were this absolute numbers for AU?
   Answer: Yes, absolute numbers of recognised occupational diseases.

4. What is the size small and medium-sized enterprises in this survey?
   Answer: up to 250 Employees

11.4 Good practice cases of the Austrian advisory and inspection campaign of silica dust

Photo 1	
Description	Good practice: Extracted hand machines: The illustration shows 2 extracted hand machines used for cutting and drilling work.
Photo 2	
Description	Good practice: The person on the right is using an extracted hand machine; on the left is the construction dust extractor, via which dust extraction is ensured.

Photo 3	
Description	Good practice: Wet cutting method: The illustration shows a hand-held cutting machine with water connection, which is used to cut straight grass pavers.