

Occupational cancer risk factors in Europe – first findings of the Workers' Exposure Survey

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The European Agency for Safety and Health at Work (EU-OSHA) has conducted a large worker survey, the *Workers' Exposure Survey on cancer risk factors in Europe (WES)*, in six EU Member States: Germany, Ireland, Spain, France, Hungary and Finland.

The aim of this first publication is to present initial findings from the survey and provide an overview of the type of information that can be obtained from WES. Future publications will go deeper into detailed data analysis.

WES estimates probable exposure of workers during the last working week to 24 known cancer risk factors, including industrial chemicals, process-generated substances and mixtures, and physical risk factors. Many of these risk factors are addressed in European worker protection legislation. WES data complement other data sources, such as workplace measurements, and provide information on the workers exposed and the most frequent circumstances of exposure, to enable better prevention at workplaces. WES results will provide additional valuable data in the context of future amendment proposals to the carcinogens, mutagens or reprotoxic substances at work directive¹ and thereby contribute to the fight against work-related cancer. Updated information on occupational exposures to selected cancer risk factors, comparable across countries, will also support one of the key objectives of the [EU Strategic Framework on Health and Safety at Work 2021-2027](#) on improving the prevention of work-related diseases, in particular cancer, and will contribute to [Europe's Beating Cancer Plan](#) and the [EU Roadmap on Carcinogens](#) initiative.

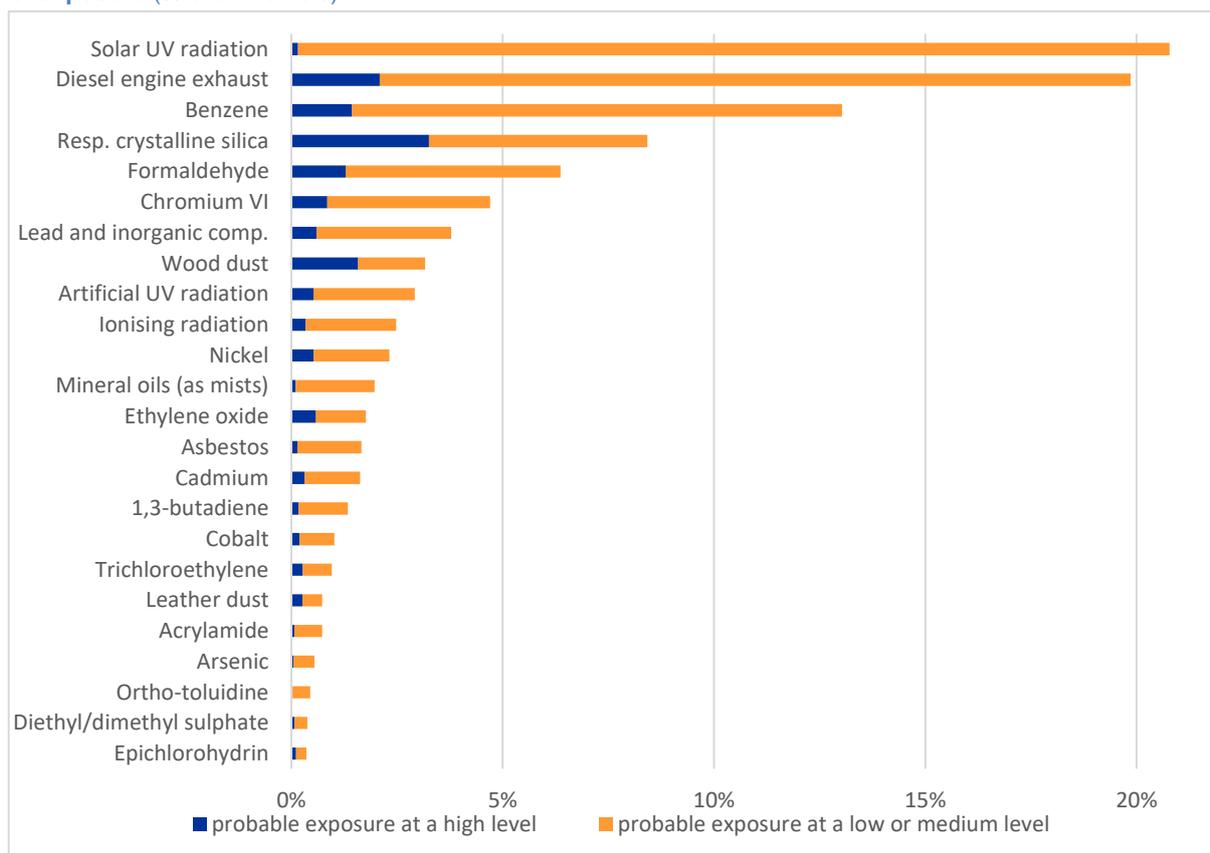
¹ Directive 2004/37/EC. See: <https://eur-lex.europa.eu/eli/dir/2004/37>

1 Main findings²

1.1 Most common exposures

The most frequent assessed occupational exposures among the 24 cancer risk factors considered in the survey were: solar ultraviolet (UV) radiation, diesel engine exhaust emissions, benzene, respirable crystalline silica (RCS) and formaldehyde, followed by hexavalent chromium, lead and its inorganic compounds, and wood dust. RCS, diesel engine exhaust emissions and wood dust stand out with higher proportions of workers probably exposed to these risk factors at a high level, as Figure 1 shows.

Figure 1: Percentage of workers probably exposed to the 24 cancer risk factors included in WES, by level of exposure (% of all workers)



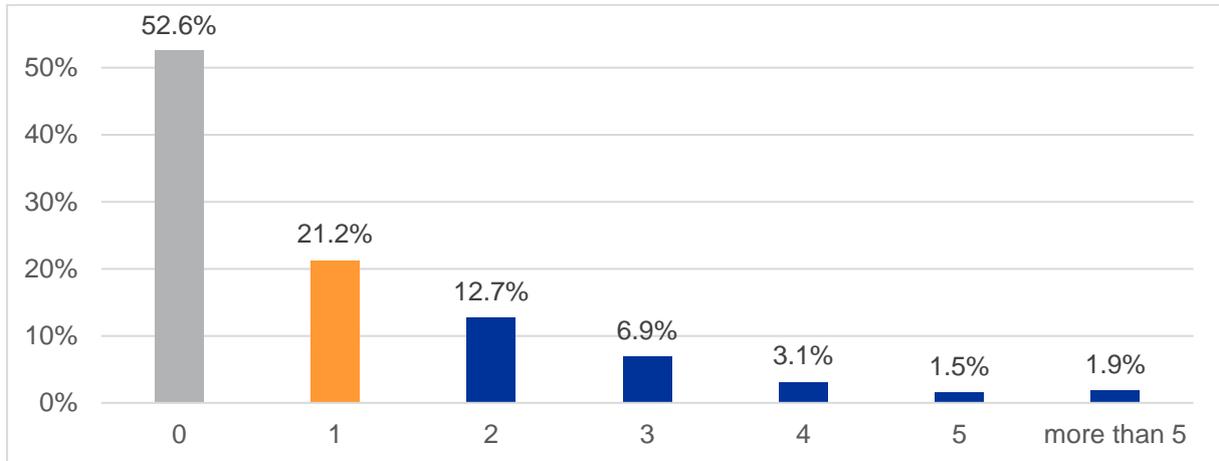
Base: all workers in the six countries, WES 2023, EU-OSHA.

WES also provides information on workers' exposure to several risk factors assessed in the survey during the last working week. Workers probably exposed to at least two cancer risk factors were considered as having multiple exposures, although exposures may not necessarily occur at the same time and through the same work process.

The majority of the workers were not exposed to any of the 24 cancer risk factors considered in WES (52.6%) in their last working week, while 21.2% were assessed to be exposed to one of them and 1.9% to more than five (Figure 2). Among the workers exposed to one cancer risk factor, 14% worked in manufacturing activities (NACE C), 14% worked in wholesale and retail trade (NACE G), and 13% worked in the human health and social work activities (NACE Q).

² All results presented in this section are weighted, meaning that the sample of respondents has been weighted to be representative of the working population of the six countries together. For additional details on the weighting, see *Occupational cancer risk factors in Europe – summary of the methodology of the Worker's Exposure Survey* (<https://osha.europa.eu/en/publications/occupational-cancer-risk-factors-europe-summary-methodology-workers-exposure-survey>) and future publications.

Figure 2: Distribution of workers by number of probable exposures to the 24 selected cancer risk factors (% of all workers)

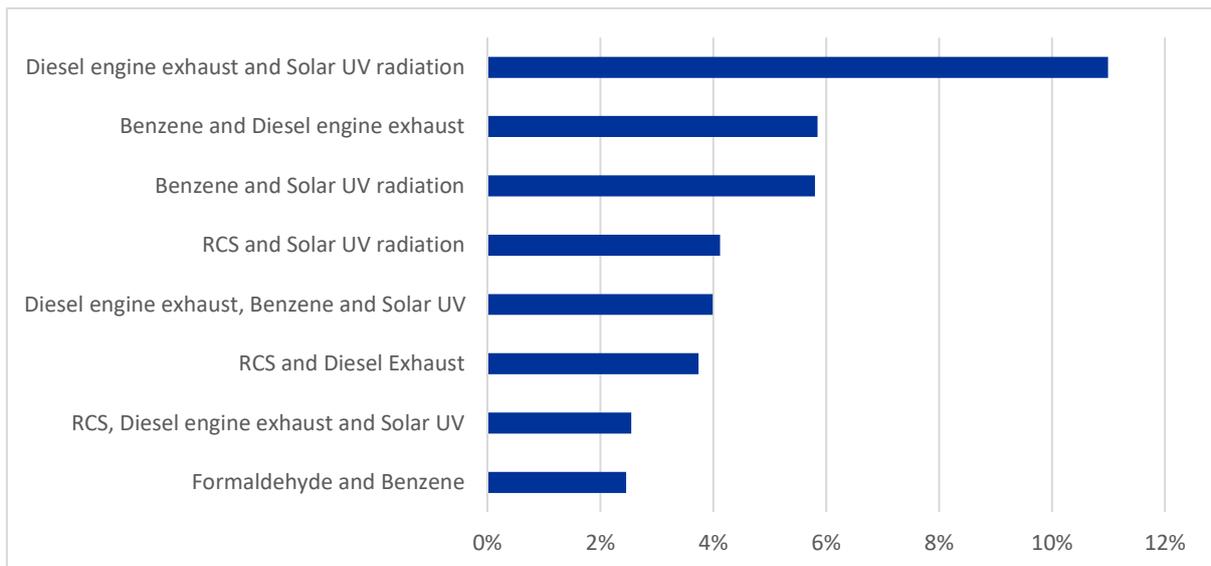


Base: all workers in the six countries, WES 2023, EU-OSHA.

More than 60% of the workers had multiple exposures in the mining and quarrying activities (NACE B) and in the construction activities (NACE F), as well as in 10 out of the 50 job categories defined in the survey, namely mine and quarry workers, petrol and gas station workers, road construction and maintenance workers, upholstery industry workers, forestry and wood workers, welders and boilermakers, construction trade workers, firefighters, drivers and transport workers, and rubber and plastic industry workers. While the results may be linked to the risk factors selected in WES for the concerned sectors and jobs, the fact that multiple exposures were frequent among these categories of workers gives rise to concern. Addressing multiple exposures seems to be an important issue for prevention of exposures to cancer risk factors.

Figure 3 shows the estimated occurrence of multiple exposures to cancer risk factors at work, with combined exposure to both chemical (including process-generated substances and mixtures) and physical risk factors that may warrant very different prevention measures at the workplace level. Protection from exposure to solar UV radiation, for example, calls for very different measures than the prevention of exposure to diesel engine exhaust emissions.

Figure 3: Most frequent probable combined exposures (% of all workers)



Base: all workers in the six countries, WES 2023, EU-OSHA.

1.2 Circumstances of exposure

WES provides information on the groups of workers exposed but also on the different circumstances of exposure to each cancer risk factor in the last working week. For five of the most frequent occupational exposures assessed in WES, some details about the population and the circumstances of exposure are provided below.

20.8% of workers were assessed to be exposed to **solar UV radiation** (including ocular exposure), which is the most common exposure among the respondents of the survey (Figure 1). Exposure was spread across all types of jobs, in particular among outdoor workers such as construction trade workers, farm workers, drivers and transport workers, and protective service workers. Working with or near the snow without eye protection (such as sunglasses) in the last working week is a circumstance resulting in a probable exposure to solar UV radiation at a high level.

One out of five workers was assessed to be exposed to **diesel engine exhaust emissions**, most of them at a low level (Figure 1). The majority of the petrol and gas station workers, mine and quarry workers, road construction and maintenance workers, and drivers and transport workers were probably exposed to this cancer risk factor (from 76% to 99% of each job category). The main circumstances resulting in probable exposure to diesel engine exhaust emissions at a high level include driving diesel vehicles as part of the work inside a building (or underground in a mine) and not using appropriate protection measures when maintaining a diesel vehicle (for example, not attaching a hose to the exhaust pipe of the vehicle to lead the exhaust fumes outside).

13% of workers were assessed to be exposed to **benzene** (Figure 1). Many of the petrol and gas station workers (98%), road construction and maintenance workers (68%), and firefighters (51%) were probably exposed to this cancer risk factor. The main circumstances resulting in probable exposure to benzene were fuelling vehicles with petrol as part of the work, performing maintenance work on vehicles using petrol (such as tune-ups, exhaust pipe work, or engine overhauls, and/or draining fuel tanks or changing fuel filters), followed by working near petrol-powered vehicles with their engine running.

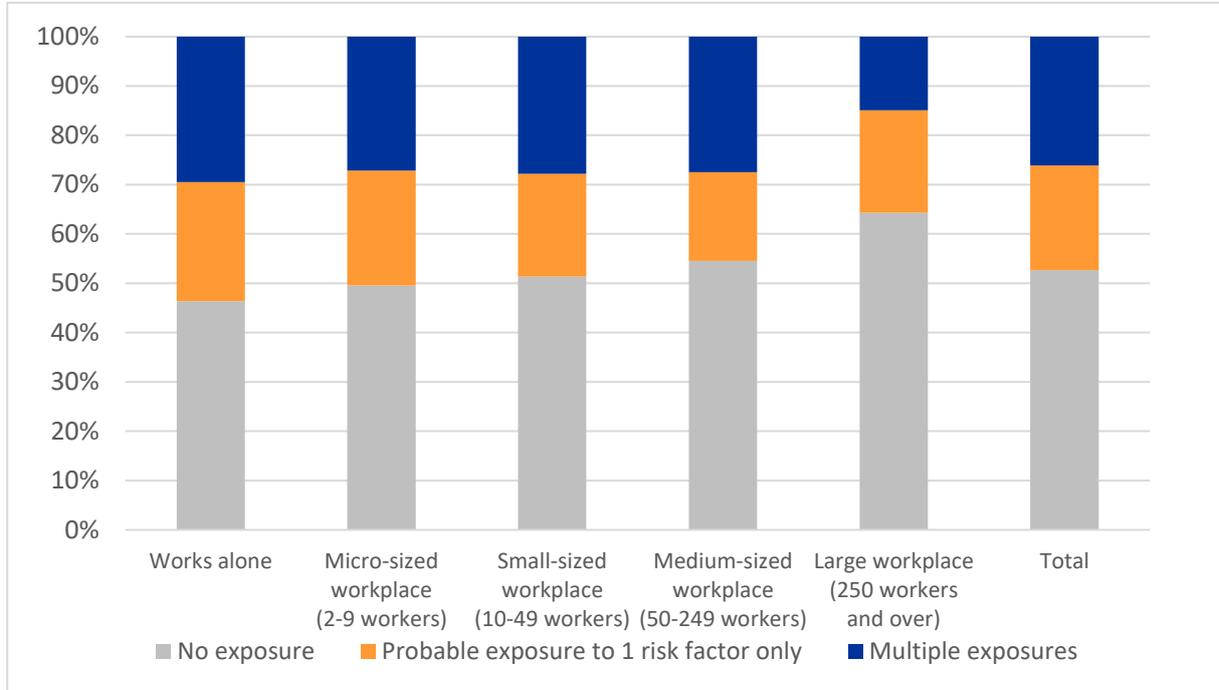
8.4% of workers were assessed to be exposed to **respirable crystalline silica (RCS)** (see Figure 1). Among all workers probably exposed to RCS, more than two out of five were construction trade workers. More than 90% of the mine and quarry workers and road construction and maintenance workers were probably exposed to RCS during the last working week, as well as 79% of the ceramics production workers. The main circumstances resulting in probable exposure to RCS at a high level were inappropriate ways of cleaning sand dust at the work site, mixing concrete or cement, working with artificial stone (cutting, grinding, etc.), and inappropriate protection measures when working with natural stone, concrete or bricks (cutting, grinding, etc.).

6.4% of workers were assessed to be exposed to **formaldehyde** (Figure 1). More than two out of five workers in the following job categories were probably exposed to formaldehyde: upholstery industry workers (62%); florists (50.7%); firefighters and workers manufacturing/repairing shoes or finished leather goods (both 45.3%); and rubber, rubber goods, plastic or resin manufacture workers (42.5%). The main circumstances resulting in probable exposure to formaldehyde were the use of epoxy two-part or plastic resin wood glues, and working with plywood, particle board, marine ply or medium-density fibreboard (MDF).

1.3 Exposure and working conditions

Considering exposure versus no exposure, workers in a micro or small-sized workplace (with fewer than 50 workers) were 1.3 times more likely to be exposed to one or more cancer risk factor than workers in medium-sized or large workplaces (Figure 4).

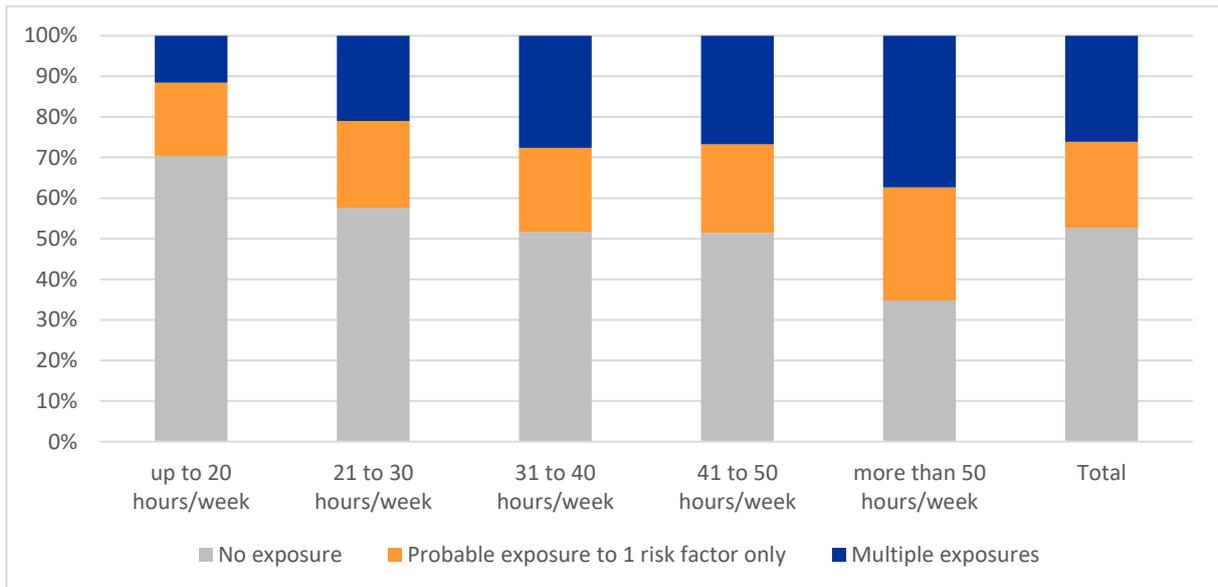
Figure 4: Percentage of workers probably exposed to no, one or at least two cancer risk factors, by workplace size (% within each category)



Base: all workers in the six countries, WES 2023, EU-OSHA.

While workers working part-time (fewer than 30 hours a week) had fewer multiple exposures than the average, the proportion of workers with multiple probable exposures increased considerably for those working more than 50 hours a week (Figure 5).

Figure 5: Percentage of workers probably exposed to no, one or at least two cancer risk factors, by weekly number of working hours (% within each category)



Base: all workers in the six countries, WES 2023, EU-OSHA.

2 Profile of interviewed workers

In total, 24,402 respondents replied to the survey questions. Interviews were distributed in the six participating countries according to fixed targets defined beforehand, considering the different sizes of the working population: from 2,500 respondents in Ireland to 7,486 in Germany³.

The survey population included individuals working in all sectors of economic activity during the week preceding the interview, aged 15 years or more, and whose usual place of residence and employment was in the territory of the country where the survey took place.

Almost 62% of the respondents were male workers, and 38% female. A small proportion of participants described their gender in another way (0.1%). The unbalanced gender distribution may be due to some extent to a limitation of the survey: many of the 24 cancer risk factors addressed by WES were mainly relevant to male-dominated industrial jobs and sectors (see Figure 1 for the list of the cancer risk factors). All working age categories are represented in WES, as described in Table 1. However, respondents between 15 and 17 years old represented the smallest age group in the survey (0.1%).⁴ Most of the respondents were born in the country where they were interviewed, 5% of them in another EU Member State and 8% in a country outside the EU.

Table 1: Age distribution of WES respondents (in %)

Age category	Share of WES respondents
15-24 years old	4.4%
25-34 years old	21.9%
35-44 years old	29.6%
45-54 years old	28.4%
55-64 years old	14.6%
65 years old or over	1.1%
Total	100.0%

Base: all workers surveyed in the six countries, WES 2023, EU-OSHA.

The respondents spread over the different sets of questions,⁵ which were especially adapted to the EU context and reflected 50 different categories of jobs. The job categories gathering most of the respondents were health workers, construction trade workers, and food-related jobs (such as cooks, bakers, butchers, food processing plant workers and food retail outlet workers). Some of the least common job categories were mine and quarry workers, production workers in the foundry or metal casting industry, and florists.

³ In this section the tables and figure present the survey respondents of the six countries, before weighting. For additional details on the sampling and weighting, see *Occupational cancer risk factors in Europe – summary of the methodology of the Worker's Exposure Survey* (<https://osha.europa.eu/en/publications/occupational-cancer-risk-factors-europe-summary-methodology-workers-exposure-survey>) and future publications.

⁴ Young people tend to be underrepresented in telephone surveys, as described in the EU-OSHA [Feasibility study on the development of a computer-assisted telephone survey to estimate workers' exposure to carcinogens in the European Union](#) (2017).

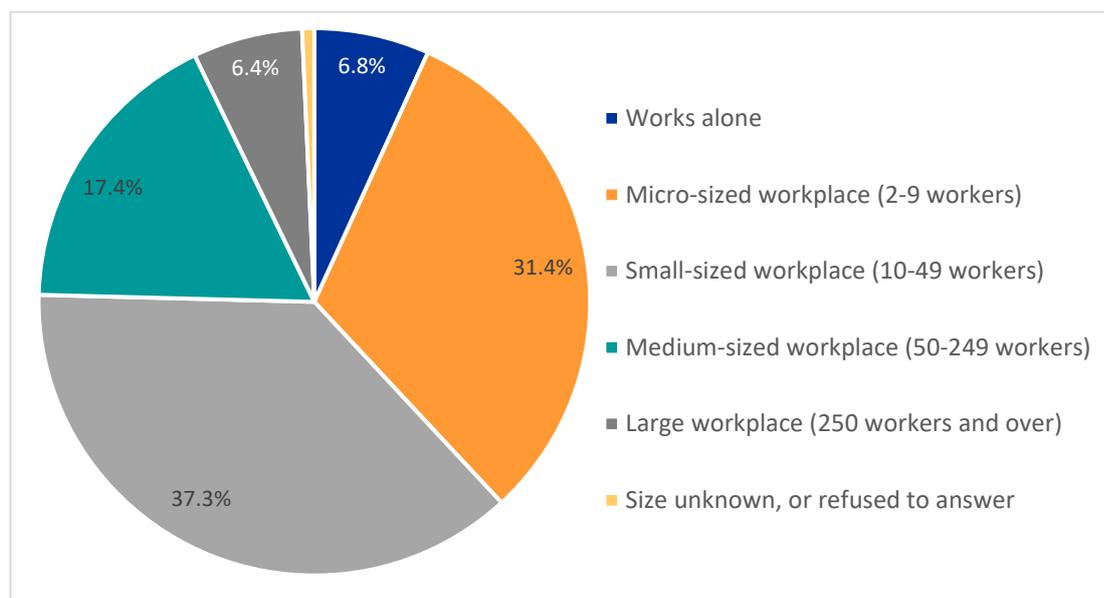
⁵ The survey questionnaire is operationally divided into specific sets of questions (or modules): 50 job modules and 41 task modules, which include simple and factual questions about the tasks that workers carry out in their day-to-day jobs, supporting the assessment of potential exposure of workers to the selected cancer risk factors.

Table 2: Distribution of WES respondents by professional status and type of contract (in %)

Professional status, type of contract	Share of WES respondents
Self-employed	14.4%
Employed, including:	85.6%
<i>Contract of unlimited duration</i>	69.7%
<i>Contract of limited duration</i>	11.4%
<i>A temporary employment agency contract</i>	2.3%
<i>An apprenticeship or other training scheme contract</i>	1.0%
<i>Other situations (other or unknown type of contract, no contract)</i>	1.2%
Total	100.0%

Base: all workers surveyed in the six countries, WES 2023, EU-OSHA.

Almost 70% of the respondents were employed workers with a contract of unlimited duration, 14.4% were self-employed and 11.4% were employed with a contract of limited duration. The survey population also included employed workers with a different type of contract, as Table 2 shows. More than two-thirds of the respondents worked in micro and small-sized workplaces, as Figure 6 shows.

Figure 6: Distribution of WES respondents by workplace size (in %)

Base: all workers surveyed in the six countries, WES 2023, EU-OSHA.

More information on the most relevant exposures and combined exposures will become available through more in-depth analysis of the data. The WES dataset, including the final assessment of exposure to the 24 cancer risk factors and demographic and job-related information for all respondents, will be made publicly available for research purposes in 2024.

WES methodology in short

- WES is a telephone survey, based on the Australian Work Exposures Study (AWES), that estimates probable exposure of workers during the last working week to 24 known cancer risk factors, including industrial chemicals, process-generated substances and mixtures, and physical risk factors.
- The survey covers a representative selection of the working population from six European countries: Germany, Ireland, Spain, France, Hungary and Finland. The questions were translated from English to national languages. EU-OSHA developed an English glossary of technical terms to support accurate translation, using the best terminology known to workers.
- A random, population-based sample of workers aged 15 years or more participated in each country, including both employed and self-employed, and covering all the occupations and sectors of economic activity,⁶ as well as those employed in public administration.
- The sampling strategy was based on a random digit dialling strategy targeting only mobile phones. In order to over-sample occupations with an expected higher risk of exposure to the selected cancer risk factors, the agreed approach was to under-sample the occupations with an expected lower risk (e.g. office workers), which allows for robust survey estimates across all occupations, as well as subsequent granular analysis of results.
- Workers answered detailed questions about the tasks they completed at work during the last working week and information on the prevention measures applied. Based on their responses, the probability of exposure to cancer risk factors was automatically estimated using the Occupational Integrated Database Exposure Assessment System tool (OccIDEAS⁷).
- WES has been thoroughly adapted by EU-OSHA and occupational safety and health experts from the survey countries, in terms of the questions and the exposure assessment logics used by OccIDEAS, to be relevant to the EU context and considering the EU legislation related to the 24 cancer risk factors.
- Estimation of exposure in WES is provided in terms of probability of exposure to the selected cancer risk factors. Probable exposure is further divided into three categories (high, medium and low levels).
- Interviews were conducted by trained local interviewers using CATI (Computer Assisted Telephone Interviewing) between September 2022 and February 2023. The total interview duration differed for each worker, as it depends on the job and the specific tasks carried out in the last working week.
- Survey data were subject to several steps of quality control, and they were weighted to account for the socio-demographic structure and the total working population of each country included, as well as potential multiple ownership of mobile phones.
- After completion of fieldwork and several quality control stages, weighted data from 24,402 valid interviews have become available for analysis.
- For additional details on the methodology, see [Occupational cancer risk factors in Europe – summary of the methodology of the Worker's Exposure Survey](#) and future publications.

⁶ Except private households (NACE T), extraterritorial organisations (NACE U) and armed forces (ISCO sector 0).

⁷ See: <https://www.occideas.org/>

The European Agency for Safety and Health at Work (EU-OSHA) contributes to making Europe a safer, healthier and more productive place to work. The Agency researches, develops, and distributes reliable, balanced, and impartial safety and health information and organises pan-European awareness raising campaigns. Set up by the European Union in 1994 and based in Bilbao, Spain, the Agency brings together representatives from the European Commission, Member State governments, employers' and workers' organisations, as well as leading experts in each of the EU Member States and beyond.

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