WORKING FOR A HEALTHY FUTURE

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Health, socio-economic and environmental aspects of possible amendments to the EU Directive on the protection of workers from the risks related to exposure to carcinogens and mutagens at work

Hexavalent Chromium

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SUMMARY

Workplace exposure to hexavalent chromium is associated with increased risks of lung cancer and sinonasal cancers. This report considers the likely health, socioeconomic and environmental impacts associated with possible changes to the Carcinogens Directive, in particular the possible introduction of an Occupational Exposure Limit (OEL) for hexavalent chromium of 0.1, 0.05 or 0.025 mg/m^3

Hexavalent chromium compounds are no longer manufactured in Europe and the use of imported hexavalent chromium is reducing. The main use of hexavalent compounds is in wood preservatives, metal coatings, chromium production and catalyst manufacture. Other uses include Montan wax manufacture, vitamin K manufacture and use as a mordent in wool dying. We estimate that in 2006 about 917,000 workers in the EU were exposed to hexavalent chromium across a wide range of industries. There were estimated to be about 552,000 workers with relatively high levels of exposure who were employed in chemicals manufacture, basic metals production, manufacture or machinery and equipment, manufacture of other transport equipment and the manufacture of furniture. Since 2006, the manufacture of hexavalent chromium compounds and the use of copper chrome arsenate wood preservatives has ceased in the EU, hexavalent chromium has been banned in new vehicles or electronic/electrical equipment and plating processes are increasingly replacing hexavalent chromium with trivalent chromium or chrome-free substances. The number of workers in sectors with relatively high levels of exposure is likely to have declined substantially since 2006.

We estimate that in 2010 in the EU there will be about 336 deaths from lung cancer and a similar number of registrations that might be attributable to past exposure to hexavalent chromium, which corresponds to about 0.12% of all lung cancer deaths amongst the exposed workers. We estimate that there will also be about 39 deaths from sinonasal cancers (118 registrations) that might be attributable to past exposure to hexavalent chromium, which corresponds to about 3.3% of all sinonasal cancer deaths in the group of workers exposed. If no specific actions are taken to reduce exposure to hexavalent chromium, based on the assumption that current trends in employment and exposure continue until 2030, the predicted numbers of cancer deaths in 2060 would be 105 and 95, for lung and sinonasal cancer respectively. The increased number of sinonasal cancer deaths reflects the increasing prevalence of this type of cancer in the general population. The introduction of an OEL of 0.025, 0.05 or 0.1 mg/m^3 would lead to reductions in the number of lung cancer registrations in 2060 of 80, 57 or 20 respectively and reductions in the number of sinonasal cancer registrations of 8, 6 and 2 respectively.

The total net health benefits from setting an OEL at 0.1 mg/m^3 are estimated to be between €157m and €445m, compared with benefits of between €339m and €966m associated with an OEL of 0.05 mg/m^3 or benefits of between €453m and €1,294m associated with an OEL of 0.025 mg/m^3.

Most EU countries already have an OEL in place for hexavalent chromium and we estimate that nearly 90% of exposed workers already have exposures that are below the most stringent proposed EU-wide OEL. The majority of these workers are employed in larger organisations. Only 4% of workers are believed to have current exposures that exceed this level. The main additional risk management measures

required are local ventilation systems in companies that do not already have adequate systems. It is estimated that the proportion of enterprises that will require additional control measure to meet the proposed OELs of 0.1, 0.05 and 0.025 mg/m^3 is 9%, 16% and 27% respectively. Total compliance costs over the period 2010-2069 (Net Present Value) are estimated to be € 7bn to € 37 bn, € 18bn to € 67 bn and € 30 bn to € 115 bn respectively.

We consider that the costs of compliance with the OEL will disproportionately affect small firms employing less than 20 people, particularly in the manufacture of fabricated metal products where 91% of businesses fall into this category. It is possible that some could either close or cease to use hexavalent chromium containing components.

There are no significant environmental impacts foreseen.

1 PROBLEM DEFINITION

1.1 OUTLINE OF THE INVESTIGATION

Exposure to hexavalent chromium in workplace air is associated with increased risks of lung and sinonasal cancers. Hexavalent chromium has been classified as a group 1 carcinogen (Carcinogenic to humans) carcinogen by IARC and as Cat 2 carcinogens in the EU under the classification and labelling legislation[1]. Hexavalent chromium compounds are therefore already regulated as a carcinogen throughout the EU. In this assessment we consider the impacts of introducing an OEL for hexavalent chromium within the Directive.

The key objectives of the present study are to identify the technical feasibility and the socioeconomic, health and environmental impacts of introducing a regulatory OEL for hexavalent chromium. Three OEL options are considered: 0.1, 0.05 or 0.025 mg/m^3

1.2 OELS/EXPOSURE CONTROL

Existing national Occupational Exposure Limits (OELs) in EU member states are presented in Table 1.1. These are expressed as long-term limits, averaged over an 8-hour working day or short-term exposure limits (STELs), i.e. 15 minutes. OELs from selected countries outside the EU are also presented for comparison.

Table 1.1 Occupational Exposure Limits in various Member States and selected countries outside the EU

Country	OEL – long-term (mg/m^3)	OEL - STEL (mg/m^3)
Austria	0.05 inhalable aerosol	0.2 inhalable aerosol
Belgium	0.05	-
Denmark	0.005	0.01
France	0.05	-
Hungary	-	0.005
The Netherlands	0.025	0.05
Spain	0.05 insoluble compounds 0.01 soluble compounds	-
Sweden	0.005 total aerosol	0.015 total aerosol
United Kingdom	0.05	-
Japan	0.05	-
Switzerland	0.05 inhalable aerosol	-
USA - OSHA	0.005	-

Source: http://www.dguv.de/bgia/en/gestis/limit_values/index.jsp

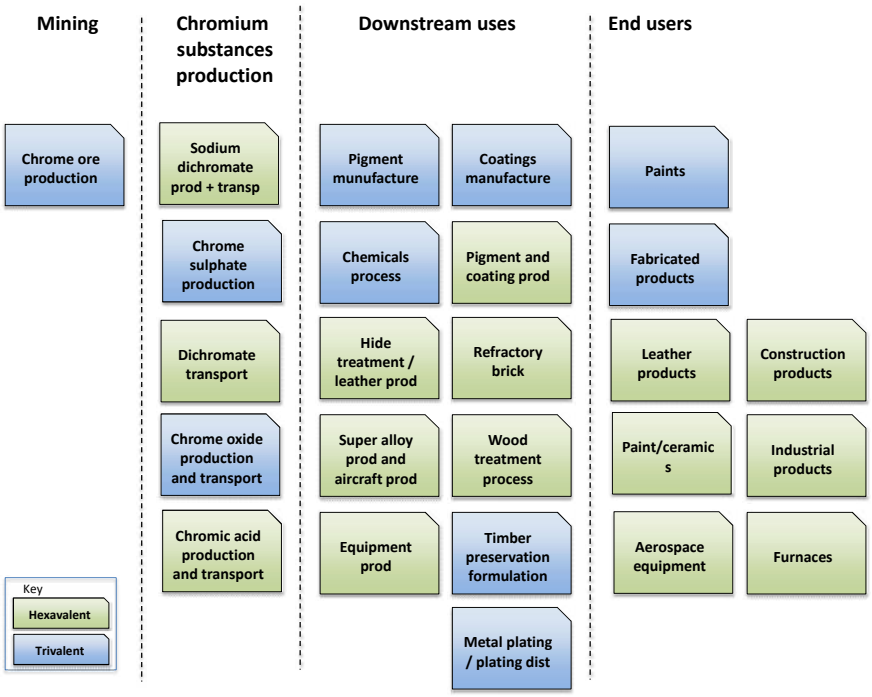
The long term OEL from the EU member states and outside jurisdictions ranges from 0.005 mg/m^3 to 0.05 mg/m^3. For the purposes of this report the European Commission suggested investigation of the impact of OELs of 0.025, 0.05 or 0.1 mg/m^3.

[1] Available at: http://monographs.iarc.fr/ENG/Classification/ClassificationsAlphaOrder.pdf

1.3 DESCRIPTION OF DIFFERENT USES

The five most widely used compounds that contain chromium in the hexavalent oxidation state are sodium chromate (Na_2CrO_4), sodium dichromate ($Na_2Cr_2O_7$), chromium trioxide (CrO_3), potassium dichromate ($K_2Cr_2O_7$) and ammonium dichromate ($NH_4Cr_2O_7$). These compounds are produced from chromite ore, which contains chromium (III) oxide and is mined in Russia, the Philippines, southern Africa and Finland. The chromite ore is oxidized to sodium chromate, which is then converted to sodium dichromate by acidification and evaporation. The other hexavalent chromium compounds are produced from sodium dichromate. Chromite ore is also used in the production of stainless steel.[2]

Figure 1.1 shows the changes in the valence state of chromium at all stages of industrial use from mining to production, to downstream industry activity and to end use. Hexavalent chromium and trivalent chromium have been colour coded to emphasise the different valence states of chromium at the different stages of use.



Source: HSE (2007) Human Health Risk Reduction Strategy for Chromates

Figure 1.1 Overview of chromium valence state in chromium applications

The main uses of the hexavalent chromium compounds, as outlined in the EU Risk Assessment Report on Chromates[2] are listed in Table 1.2. This information was compiled in 2005 and since then the manufacture of chromium compounds has ceased in the EU.

[2] EU Risk Assessment Report on chromates. Vol 53, 2005. Publication EUR 21508 EN. Available at : http://ecb.jrc.ec.europa.eu/documents/Existing-Chemicals/RISK_ASSESSMENT/REPORT/chromatesreport328.pdf

Table 1.2 Main uses of the five hexavalent chromium compounds (in 2005)

Cr (VI) compound	Use
sodium chromate	manufacture of other chromium compounds (in 2010, no longer undertaken)
sodium dichromate	manufacture of other chromium compounds (no longer undertaken in 2010) manufacture of wood preservation products vitamin K manufacture mordant in dyeing wax manufacture metal finishing
chromium trioxide	metal finishing manufacture of wood preservation products catalyst manufacture chromium dioxide manufacture pigment manufacture
potassium dichromate	pigment manufacture manufacture of wood preservation products dye manufacture catalyst manufacture chromium metal manufacture colouring agent in ceramics
ammonium dichromate	magnetic tape manufacture catalyst manufacture mordant in dyeing pigment manufacture

Source: HSE (2007) Human Health Risk Reduction Strategy for Chromates

Manufacture of hexavalent chromium compounds

All of the hexavalent chromium compounds used in the EU are now imported. In the past, hexavalent chromium compounds were produced in the EU; however, in 2007 the last EU producer of hexavalent chromium compounds, located in the UK, closed down following declines in the market.[3] This work all falls within NACE 24.

Manufacture of chromium containing products

The manufacture of chromium containing products falls within NACE 24 and includes the manufacture of pigments, chrome tanning salts, copper chrome arsenate (CCA), and the formulation of metal treatment compounds. The manufacture of chromium metal falls within NACE 27.

[3] HSE (2007) Human Health Risk Reduction Strategy for Chromates

As far as possible the pigment and chrome tanning salt end products are reduced to trivalent chromium compounds. Most chromium pigments and tanning salts used by end users now contain little to no hexavalent chromium; however, exposure to hexavalent chromium still occurs during the manufacture of these products.

As of 2004 there were approximately 150 workers involved in the manufacture of CCA wood preservation products in the EU; however, the use of CCA stopped in the EU in 2003 (see below).[4]

Chromium metal is produced from chromium (III) oxide and potassium dichromate is used as an oxidising agent. As of 2007 there were two known EU companies that produced chromium metal and it was estimated that approximately 50 workers were involved in this work in the EU.[4]

Hexavalent chromium compounds (most commonly, chromium trioxide) are used in the formulation of metal treatment products. The companies that conduct this work are usually SMEs.

Use of hexavalent chromium containing wood preservatives

Hexavalent chromium containing wood preservatives include copper chrome arsenate (CCA), copper chrome (CC), cooper chrome boron (CCB) and copper chrome phosphate (CCP). High-pressure treatment is used to apply these preservatives to the wood. Inhalation exposures are typically highest during removal of wood from the treatment vessel.

In 2003 in European Commission Directive 2003/02/EC, the Commission of the European Communities restricted the use of arsenic containing wood preservatives. According to the Directive, arsenic compounds may not be used in the preservation of wood and wood treated with arsenic compounds may not be put on the market unless the structural integrity of the wood is required for safety reasons and dermal contact with the wood by the general public is unlikely.[5] This directive has meant that the use of CCA in wood preservatives has effectively ceased in the EU.

The restrictions on the use of CCA may have resulted in increased use of CC, CCB and CCP in some member states. However, in the UK chromate containing wood preservatives have been banned since September 2006 and while other member states may still allow the use of these substances, their use is likely to decrease in the future.[4]

Most exposure to hexavalent chromium containing wood preservatives occurs in NACE 20.

Metal treatment

Metal treatment involving hexavalent chromium includes the following:

[4] HSE (2007) Human Health Risk Reduction Strategy for Chromates
[5] Commission of the European Communities (2003). Commission Directive 2003/02/EC: relating to the restrictions on the marketing and use of arsenic

1. *Electroplating* – deposition of a metallic coating on a base material;

2. *Conversion coatings* – chemical treatment of a metallic surface to place a complex chromium barrier layer which protects against corrosion; and

3. *Brightening* – the use of chromium salt solutions to remove scale or oxide films from metal substrates

Both trivalent and hexavalent chromium are used in these processes. When hexavalent chromium compounds are used, inhalation exposure to hexavalent chromium can occur in all three types of processes. The HSE Human Health Risk Reduction Strategy for Chromates reports that industry is increasingly substituting hexavalent chromium with trivalent chromium or chrome free substances in these processes.[6]

Since 2007 coatings containing hexavalent chromium have not been permitted under the EU End of Life Vehicles Directive and the Waste from Electrical and Electronic Equipment Directive.[6]

Exposure to hexavalent chromium in metal treatment occurs primarily in NACE 28 but also in NACE 29, 35 and 36.

Magnetic tape manufacture

Magnetic chromium dioxide tape manufacturing no longer takes place in the EU. The EU based manufacturer of this product ceased production in 2004.[6]

Montan wax manufacture

Sodium dichromate is used in the manufacture of Montans wax, a hard wax made from solvent extraction of lignite or brown coal. The EU RAR on chromates reported on only one known EU wax manufacturer.[7] However, the HSE Human Health Risk Reduction Strategy for Chromates reported that there may be other companies in the EU manufacturing Montans wax but it is unknown how many. The procedure used in the production of Montans wax is completely enclosed and exposure to hexavalent chromium is likely to occur only intermittently during product sampling and equipment maintenance.[6] Montans wax manufacturing is included in NACE 24.

Vitamin K manufacture

Sodium dichromate is used in the manufacture of Vitamin K. As of 2008 there was one EU manufacturer of Vitamin K.[8] This process is included in NACE 24.

Use as a mordant in wool dyeing

[6] HSE (2007) Human Health Risk Reduction Strategy for Chromates
[7] EU Risk Assessment Report on chromates. Vol 53, 2005. Publication EUR 21508 EN. Available at : http://ecb.jrc.ec.europa.eu/documents/Existing-Chemicals/RISK_ASSESSMENT/REPORT/chromatesreport328.pdf
[8] HSE (2007) Human Health Risk Reduction Strategy for Chromates

Sodium dichromate is used as a mordant in wool dyeing (i.e. it is used to fix dyes to wool). Communication with industry in the UK has indicated that many textile finishers have either completely stopped the use of sodium dichromate as a mordant or have heavily reduced their use. Some SMEs (small and medium enterprises) continue to use sodium dichromate in varying quantities (tens of kilos to over a tonne per year).[8] This work is included in NACE 17.

Catalyst manufacture

As of 2004 there were at least eight companies that had EU sites involved in catalyst manufacture using sodium dichromate. The catalysts produced are primarily chromium/iron catalysts used in the conversion of carbon monoxide and water to carbon dioxide and hydrogen during the manufacture of ammonia and hydrogen. The production of these chromium/iron catalysts is highly automated and exposure to hexavalent chromium may only occur during unloading of sodium dichromate and sampling of the reaction mix. The final product catalysts contain only reduced trivalent chromium.[8] The manufacture of catalysts is included in NACE 24.

Exposure in welding and foundries

Welding or melting of chromium metal or chromium containing metals (including stainless steel) results in the oxidation of trivalent chromium to produce fumes containing hexavalent chromium.[9] Exposure in foundries occurs primarily in NACE 27 but exposure to welders occurs in diverse industries including NACE 15, 21, 24, 28, 29, 31, 32, 33, 35, 36, 40, 41, 45, 50, 51, 52, 60, 63, 64, 75 and 85.

1.4 RISKS TO HUMAN HEALTH

1.4.1 Introduction

Occupational exposure to hexavalent chromium compounds has been associated in several different industries with an increased risk of lung cancer and sinonasal cancer.

Lung cancer is the most common malignant neoplasm among men in most countries and incidence has been steadily increasing among women. The main environmental cause is cigarette smoking, although other factors, such as genetic susceptibility, poor diet, and indoor air pollution, may act in conjunction with tobacco consumption as risks for lung cancer. Among both men and women, the incidence of lung cancer is low in individuals aged less than 40 years and increases up to age 70 or 75 (Quinn *et al*, 2001). In most European countries, the risk of lung cancer among men is two to three times higher in low socio-economic classes as compared to high socio-economic classes (Quinn *et al*, 2005).

Lung cancer is highly fatal, so the trends in incidence and mortality are closely similar. In Europe about 10% of lung cancer patients survive for more than 5-years post diagnosis (Verdecchia *et al*, 2007). Lung cancer accounted for 15.5% of all cancers in men in Europe, and 6.9% of cancers in females (Ferlay *et al*, 2007).

[9] OSHA Safety and Health Topics: Hexavalent Chromium. Available at: http://www.osha.gov/SLTC/hexavalentchromium/index.html

There are a number of occupational agents that are known or suspected of causing lung cancer. Rushton *et al*, (2010) estimated that in Great Britain occupational exposures account for about 21% of male lung cancers and 5% of female lung cancers.

Sinonasal cancers may cause a range of problems with the senses of smell and sight, perhaps involving the loss or partial loss of vision. Patients may also suffer from a lump or growth anywhere on the face, nose or roof of the mouth, with associated pain or numbness on the face.

Overall, about 50 to 60% of patients diagnosed with sinonasal cancer will survive for at least 5 years after diagnosis. Almost everyone who is diagnosed with a very early stage sinonasal cancer will live for at least 5 years, but only about 11% of people who are diagnosed with advanced stage cancers will live for more than 5 years after their diagnosis[10].

1.4.2 Summary of the available epidemiological literature on risk

Lung cancer

There have been a large number of epidemiological studies of production workers (Alderson *et al*, 1981, Bidstrup, 1951, Bidstrup and Case, 1956, Davies *et al*, 1991, Enterline, 1974, Hayes *et al*, 1979, Mancuso and Hueper, 1951, Mancuso, 1975, Mancuso, 1997, Pastides *et al*, 1991, Pastides *et al*, 1994, Rosenman and Stanbury, 1996). Three recently published studies have been undertaken. Gibb *et al* (2000) in a study of 2,357 US workers observed a total of 122 lung cancer deaths (SMR=1.80, 95%CI=1.49-2.14). A significant exposure-response relationship was observed with cumulative exposure (mg/m^3 years) (<0.0015 SMR 0.96 (95%CI 0.63, 1.40), 0.0015-0.0089 SMR 1.42 (95% CI 0.94-2.05), 0.009-0.0768 SMR 1.57 (95%CI 1.06, 2.24), >0.077 SMR 2.28 (95%CI 1.62, 3.14)). Excess lung cancer risk was not confounded by smoking status. Luippold *et al* (2003) in a mortality study of workers at a US chromate production plant found an SMR of 2.41 (95%CI=1.80-3.17) when compared to local rates, and 2.68 (95%CI=2.00-3.52) when compared to national rates. A highly significant exposure-response relationship was observed with cumulative exposure, the risk at exposures greater than 2.70 mg/m^3-years being 4.63 (95%CI=2.83-7.16). In a German study of two plants there were 130 deaths, 47 from cancer including 22 from lung cancer SMR = 1.48 (95%CI=0.93-2.25) (Birk *et al*, 2006). A statistically significant two-fold increase in mortality was observed among employees with a cumulative concentration of hexavalent chromium in their urine of 200 or more µg/L-years (SMR=2.09, 95%CI=1.08-3.65).

Crump *et al* (2003) evaluated the exposure-response relationship between hexavalent chromium exposure and lung cancer in the Luippold cohort and estimated that the lifetime additional risk of lung cancer mortality associated with 45 years of occupational exposure to 1µg/m^3 (0.001 mg/m^3) hexavalent chromium was 0.002 (90%CI=0.001-0.003). They thus concluded that hexavalent chromium is a weak carcinogen.

[10] Available at: http://www.cancerhelp.org.uk/type/nasal-cancer/treatment/statistics-and-outlook-for-nasal-cavity-and-paranasal-sinus-cancer

Studies of workers engaged in the production of chromate pigments have also consistently shown an association with increased risk of lung cancer. A study of the causes of death among 1,296 white and 650 non-white males who had worked at some time between 1940 to 1969 at a plant in New Jersey manufacturing lead and zinc chromate pigments showed an SMR for lung cancer of 1.60 (95%CI=1.06-2.38) for white males compared with U.S. rates (Sheffet *et al*, 1982). A follow-up of this study to 1982 gave 453 deaths, 41 of which were due to lung cancer, resulting in a non-significant SMR of 1.16 (95%CI=0.83-1.58) (Hayes *et al*, 1989). Variable results were found between 3 chromate pigment production plants in the US with one, where lead chromate was the only chromate produced, finding an SMR=1.64 for respiratory cancer (95%CI=0.45-4.27) and another where both lead and zinc chromate were produced finding an SMR=2.31 for cancer of the bronchus, trachea, and lung (95%CI=1.06-4.38) (EEH, 1976, EEH, 1983). In a third plant, zinc chromate, strontium chromate, and barium chromate had also been produced at various times during the facility's operation. Two respiratory cancer deaths were observed (one expected).

Three chromate pigment manufacturing plants in the United Kingdom have been studied (Davies, 1979, Davies and Kirsch, 1984). At Factory A, both lead and zinc chromate were produced from 1932 to 1964, after which lead chromate production ceased. For workers exposed to "high" and "medium" levels of chromates before 1955, when industrial hygiene improvements had been introduced, 22 cases of lung cancer death were observed (SMR=2.32, 95%CI=1.45-3.51). No excess of lung cancer was found in the group exposed after 1955 or in workers exposed to "low" levels. At Factory B, both lead and zinc chromate were produced until 1976, and strontium chromate from 1950 to 1968. For lung cancer deaths in workers exposed to "high" and "medium" levels of chromates before 1961, when industrial hygiene improvements were introduced, the SMR was 3.73 (95%CI=1.37-8.11), based on six deaths. For workers exposed to "high" and "medium" levels from 1961 to 1967, the SMR was 5.62 (95%CI=1.82-13.1). At Factory C, where only lead chromate had been produced, no excess death from lung cancer was found (Davies, 1979), and meaningful analysis by subgroups was precluded (Davies and Kirsch, 1984). The results suggested that exposure to both zinc chromate and lead chromate posed more of a risk for lung cancer than exposure to lead chromate alone.

In other studies of chromate pigment producing workers significant excesses of lung cancer was observed in Norway (Langard and Norseth, 1975, Langard and Vigander, 1983), Germany (Frentzel-Beyme, 1983), and France (Haguenoer *et al*, 1981).

Studies on the risk of cancer in chrome platers have produced both positive and negative results, but they generally support the conclusion that hexavalent chromium is carcinogenic. In a study of employees engaged for at least 10 years in die-casting and electroplating at an automobile hardware manufacturing plant in the US, statistically significant SMRs were found for respiratory system cancers in men (SMR=1.95, 95%CI=1.32-2.79; 30 cases) and women (SMR=3.57, 95%CI=1.71-6.57), and for lung cancer specifically in men (SMR=1.91, 95%CI=1.27-2.76) and women (SMR=3.70, 95%CI=1.78-6.81) (Silverstein *et al*, 1981). In contrast no excess was found in a study of electroplaters exposed to chromic acid at two U.S. military aircraft maintenance bases (Dalager *et al*, 1980) nor in a UK study of chrome platers (Royle, 1975a, Royle, 1975b). However, another mortality study of a cohort of chrome platers employed for at least 6 months in a different plant in the UK found an excess risk for cancer of the

lungs and bronchus (SMR=1.58, 95%CI=1.21-2.02) (Sorahan *et al*, 1987). In a follow-up to this study, Sorahan *et al,* (1998) refined the job history data and workers with no exposure to chromium were removed from the analyses. Significant excess risks of lung cancer were observed among males and females working in the chrome bath area for <1 year (SMR=1.72, 95%CI=1.12–2.77) or greater than 5 years (SMR=3.20, 95%CI=1.28–6.58), females working in the chrome bath area for <1 year (SMR=2.45, 95%CI=1.18–4.51), males starting chrome work in the period of 1951–1955 (SMR=2.10, 95%CI=1.32–3.17), and in male chrome workers 10–19 years after first chrome work (SMR=2.03, 95%CI=1.21–3.21). A significant ($p<0.01$) positive trend for lung cancer mortality and duration of exposure was found for the male chrome bath workers, but not for the female workers.

Sorahan and Harrington (2000) investigated mortality in a cohort of 1,087 chrome platers between 1972 and 1997, who were employed for three months or more during this period. Among the exposed workers there were 109 deaths, whereas in a similar unexposed group of workers there were 85. Among men, there were 60 lung cancer deaths among platers compared to 47 among the comparison group. This resulted in SMRs of 1.85 (95%CI=1.41-2.38) and 1.27 (95%CI=0.94-1.69), respectively, and an SMR ratio of 1.45 (95%CI=0.97-2.17). There was no trend of risk increasing with duration of exposure among platers, and the risk was similar among current and former workers. The RR was slightly reduced after adjustment for smoking. In a matched analysis a RR of 1.92 (95%CI=1.14-3.28) was obtained.

Cole and Rodu (2005) reviewed 84 papers of 49 epidemiologic studies published since 1950, and undertook a range of meta-analyses relating hexavalent chromium exposure to mortality. A total of 47 studies examined lung cancer with a total of 2,454 deaths, whereas 1,741 were expected. This resulted in an overall SMR of 1.41 (95%CI=1.35-1.47). In 26 studies that controlled for smoking the SMR was reduced to 1.18 (95%CI=1.12-1.25) based on 1,325 cases whereas 1,118 were expected. Analysis of studies that did not control for smoking indicated that about 75% of the excess risk is probably due to smoking. The authors stated that these findings suggested the accepted causal relationship between hexavalent chromium exposure and lung cancer is valid but somewhat weaker than generally has been considered. It has been postulated that the relationship is weak because of the lung's capacity to reduce hexavalent chromium to the non-carcinogenic trivalent chromium (de Flora, 2000), and that only very heavy exposure to hexavalent chromium could overwhelm the lungs reducing capacity and produce cancer.

Sinonasal cancer

Davies *et al*, (1991) in a study of UK chromate production workers found four deaths from nasal cancer giving a significant excess (SMR=15.38, n=4). A mortality study of chromium smelter workers in New Jersey by Rosenman and Stanbury (1996) found a significantly elevated risk of nasal cavity/sinus cancer in white men (PMR=6.85, 95%CI=3.14-14.94, n=6). Increases in risk were also seen by duration of work (1-10yrs: PMR=6.87; 10-20yrs: PMR=23.62; >20yrs: PMR=15.38), and by latency, both from time since first employed (0-10yrs: PMR=28.99; 10-20yrs: PMR=5.32; >20yrs: PMR=4.85) and latency from time since last employed (0-10yrs: PMR=24.27; 10-20yrs: PMR=5.24).

In the study by Sorahan and Harrington (2000) of Yorkshire chrome platers there was one male death from cancer of the nose and sinuses (SMR=6.87, 95%CI=0.17-38.30).

1.4.3 Choice of risk estimates to assess health impact

The meta-analysis by Cole and Rodu (2005) of 26 studies that controlled for smoking gave a meta-SMR of 1.18 (95%CI=1.12-1.25) and has been used for the estimate for the high group for lung cancer. Crump *et al* (2003) also concluded that hexavalent chromium is a weak carcinogen, estimating that the lifetime additional risk of lung cancer mortality associated with 45 years of occupational exposure to 0.001 mg/m^3 hexavalent chromium was 0.002. This is only about 5% of the minimum exposure that consistently was associated with an increased lung cancer risk. This corresponds to a RR of about 1.0, which has been used for the low (background) risk group for lung cancer.

The study of a cohort of workers at four former chromate producing facilities in the US (Rosenman and Stanbury, 1996), found a PMR of 5.18 (95% CI 2.37, 11.30) for sinonasal cancer; this has been used for the high exposure group for sinonasal cancer. Due to the absence of sufficient dose-response data specific to chromium and sinonasal cancer RR = 3.34 (95% CI 0.4, 10.5) has been estimated for the low exposure level category. This was based on a harmonic mean of the high/low ratios across all other cancer-exposures pairs for which data were available in the UK cancer burden project (Rushton *et al*, 2010).

2 BASELINE SCENARIOS

2.1 STRUCTURE OF THE SECTOR

For this study we have considered the sectors in which exposure is known or predicted to occur. These sectors have been matched to sectors that are described by NACE code and for which statistical data is reported in EUROSTAT. For hexavalent chromium the following sectors have been identified:

- Manufacture of chemicals and chemical products (NACE 24);
- Manufacture of Basic Metals (NACE 27);
- Manufacture of fabricated metal products (NACE 28);
- Manufacture of machinery and equipment (NACE 29);
- Manufacture of Other Transport Equipment (NACE 35);
- Other Manufacturing Industries (NACE 36).

Table 2.1 summaries the number or employees and the number of firms in each sector in the EU.

Table 2.1 The composition of the hexavalent chromium sector for this study

Sector (NACE code)	No. of firms	No. of employees
Manufacture of chemicals and chemical products (NACE 24)	30,990	1,856,966
Manufacture of Basic Metals (NACE 27)	16,892	964,803
Manufacture of fabricated metal products (NACE 28)	3,974,551	399,509
Manufacture of machinery and equipment (NACE 29)	3,649,088	173,913
Manufacture of Other Transport Equipment (NACE 35)	904,237	26,742
Other Manufacturing Industries (NACE 36)	231,307	1,773,891

The data presented in Table 2.1 represents the total numbers of employees and firms in the sectors, clearly not all of these firms will be users of chromium. However, within this study the exposure of workers within these sectors are estimated.

2.2 PREVALENCE OF HEXAVALENT CHROMIUM EXPOSURE IN THE EU

The estimated exposure prevalence for the EU member states based on 2006 employment data is shown in Table 2.2. We have estimated that approximately 917,000 workers in the EU were potentially exposed to hexavalent chromium in 2006.

The prevalence of exposure to hexavalent chromium was estimated from the Finnish CAREX estimate of 2007, the Spanish CAREX estimate of 2004 and the Italian CAREX estimate of 2000 – 2003 (Mirabelli and Kauppinen, 2005). The proportion of exposed workers in each industry was taken from each of these three CAREX estimates and the average proportion exposed across all three countries was found for each industry. The average proportion of exposed workers was applied to information on the number of employees in each industry obtained from the structural business statistics and the labour force survey available on the Eurostat database.[11] The average proportion of exposed workers was multiplied by the number of workers employed in each industry in each country in 2006 to estimate the number of exposed workers in each industry in each country. For Finland, Spain, and Italy the proportion of exposed workers from their respective CAREX updates were used rather than the average proportion.

The number of employees in some industry groups and countries was not available on the Eurostat database. Where possible, missing data have been substituted with 2005 data for the applicable industry and country. When the 2005 data were also unavailable we have indicated that data were unavailable for the industry and country.

[11] Available at: http://epp.eurostat.ec.europa.eu/

The estimated number of male and female employees in each industry group in each EU member state is shown in Appendix 8.1. These estimates were obtained by applying the average male to female employee ratio for the industry group for each country to the total number of employees. Male to female employee ratios were calculated with data from the Labour Force Survey. Managers, salespeople and office clerks were excluded from these calculations as they were assumed to be unexposed.

Table 2.2 Number of workers exposure to hexavalent chromium by country and NACE code

	NACE Rev1												
	1	**11**	**15**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**
Austria	6	NK[1]	499	71	39	64	494	294	179	NK	586	507	202
Belgium	2	NK	632	150	36	23	177	238	240	191	1525	487	184
Bulgaria	8	3	720	165	681	289	256	184	120	154	566	429	167
Cyprus	0	0	83	3	6	3	40	13	17	NK	41	21	19
Czech Republic	5	NK	NK	222	163	153	940	334	311	98	903	1529	438
Denmark	2	NK	NK	28	11	NK	193	125	254	NK	651	374	103
Estonia	1	NK	113	44	52	23	248	31	45	35	65	93	33
Finland	0	0	NK	0	0	0	9	312	6	84	224	107	76
France	27	15	NK	368	328	414	1115	1310	1322	888	5993	4168	789
Germany	25	41	5399	487	265	271	1833	2398	2545	674	9978	6828	1378
Greece	16	NK	563	89	182	78	186	125	198	133	395	212	146
Hungary	6	7	800	95	188	184	345	287	240	208	698	741	163
Ireland	3	NK	NK	15	7	4	89	57	108	NK	540	181	62
Italy	0	264	NK	3347	3427	4428	4311	1657	3307	651	3945	8041	2306
Latvia	4	0	231	36	64	8	411	27	67	1	95	83	36
Lithuania	6	3	338	86	157	24	423	38	85	NK	134	172	68
Luxembourg	0	0	NK	NK	NK	0	8	NK	NK	0	23	111	17
Malta	0	NK	NK	NK	NK	NK	NK	NK	NK	NK	NK	NK	NK
Netherlands	8	37	834	68	20	26	255	362	563	215	1389	589	167
Poland	69	16	2943	401	747	500	1763	737	681	484	2354	2713	805
Portugal	18	0	704	363	542	NK	597	200	255	NK	468	466	344
Romania	85	453	1353	341	1253	1295	1033	272	259	226	1063	849	344
Slovakia	3	NK	NK	69	118	NK	189	127	78	NK	280	376	120
Slovenia	3	NK	128	48	52	77	155	89	68	3	305	245	55
Spain	89	0	2028	8	19	654	1302	1066	125	257	4613	852	641
Sweden	3	0	NK	35	8	18	544	686	351	106	948	516	116
United Kingdom	11	204	2895	373	184	151	1093	1228	2306	781	4671	3753	642
Total	**400**	**1043**	**20262**	**6911**	**8550**	**8686**	**18007**	**12197**	**13730**	**5190**	**42452**	**34444**	**9421**

	NACE Rev1												
	27	**28**	**29**	**31**	**32**	**33**	**35**	**36**	**40**	**41**	**45**	**50**	**51**
Austria	938	5026	2989	151	116	143	519	340	223	3	664	380	34
Belgium	957	4763	1603	99	73	73	432	184	129	7	691	349	39
Bulgaria	636	2925	2574	119	25	61	517	267	297	22	487	222	25
Cyprus	10	268	38	2	0	2	7	19	NK	NK	91	39	3
Czech Republic	1628	11710	5987	627	149	314	996	521	286	24	1034	396	41
Denmark	152	3326	2298	130	29	154	361	200	107	4	534	270	29
Estonia	12	907	204	34	28	17	130	92	51	2	132	54	7
Finland	690	1987	1729	65	35	31	422	43	156	0	300	214	41
France	2830	30104	11215	818	503	1186	6798	1101	1236	42	4344	1957	184
Germany	7292	55304	38739	2819	627	2835	6385	1792	1814	50	3942	3125	218
Greece	389	2822	836	44	20	19	640	NK	NK	NK	815	465	58
Hungary	543	5228	2518	375	225	174	370	241	254	25	631	350	29
Ireland	70	919	425	41	38	225	174	NK	NK	0	191	179	15
Italy	1580	51659	19745	2161	942	2567	3763	5637	454	0	4059	12056	0
Latvia	102	682	266	19	5	16	249	110	101	2	192	93	9
Lithuania	26	1291	400	36	26	34	330	221	150	7	328	200	13
Luxembourg	172	298	88	NK	NK	19	NK	2	7	0	94	36	2
Malta	NK	NK	NK	NK	NK	NK	NK	NK	NK	NK	NK	NK	NK
Netherlands	593	6904	3285	94	129	227	1153	285	148	6	1265	653	81
Poland	2038	19475	7604	582	179	441	3256	1595	1213	57	1842	1153	124
Portugal	273	6186	1747	134	56	61	486	446	81	16	1298	563	50
Romania	1719	7206	3791	456	41	136	2765	824	742	42	1124	474	60
Slovakia	751	2419	1663	250	59	64	335	136	200	15	190	71	15
Slovenia	258	2388	996	82	23	60	122	116	60	5	189	69	7
Spain	2613	35399	8830	79	22	146	3672	102	267	110	10071	40288	0
Sweden	1326	5967	4302	134	128	232	1019	367	225	1	714	373	39
United Kingdom	2070	23318	10198	679	297	963	6742	1301	855	31	3665	2618	202
Total	**29670**	**288480**	**134067**	**10031**	**3777**	**10200**	**41643**	**15942**	**9057**	**473**	**38885**	**66650**	**1329**

	NACE Rev1											
	60	**61**	**62**	**63**	**64**	**73**	**74**	**75**	**80**	**85**	**90[2]**	**TOTAL**
Austria	156	2	146	96	1	41	144	430	123	41	427	**16076**
Belgium	123	7	88	86	2	47	203	718	212	59	352	**15182**
Bulgaria	121	24	39	67	1	3	61	382	122	20	294	**13052**
Cyprus	6	21	36	12	0	0	7	51	13	2	40	**913**
Czech Republic	272	NK	NK	71	2	47	176	553	158	39	376	**30503**
Denmark	101	64	89	56	2	48	124	283	120	61	374	**10656**
Estonia	30	5	11	19	0	3	20	66	33	5	77	**2721**
Finland	22	0	0	67	0	26	120	389	133	36	153	**7477**
France	942	73	1137	461	13	318	1189	4092	1001	361	2520	**91163**
Germany	866	143	872	858	19	714	1617	4890	1172	495	4555	**173266**
Greece	164	78	60	69	1	68	137	647	170	25	299	**10147**
Hungary	210	5	42	53	2	49	159	486	179	34	377	**16521**
Ireland	39	NK	NK	34	1	18	70	178	73	25	229	**4011**
Italy	1230	355	1106	0	0	0	0	0	0	0	0	**142998**
Latvia	62	3	17	28	0	9	21	150	50	6	115	**3372**
Lithuania	84	8	13	26	0	6	28	129	75	13	148	**5126**
Luxembourg	17	1	59	5	0	NK	20	38	8	2	15	**1042**
Malta	NK	NK	NK	NK	NK	NK	NK	24	7	1	13	**46**
Netherlands	253	NK	NK	152	4	257	616	959	303	155	677	**22732**
Poland	632	17	87	131	5	31	333	1559	639	105	1228	**58540**
Portugal	135	10	152	66	1	10	231	602	176	41	335	**17114**
Romania	268	17	55	116	3	175	144	825	233	48	558	**30650**
Slovakia	80	3	13	18	1	34	35	275	94	19	180	**8280**
Slovenia	41	1	11	15	0	20	27	97	42	7	91	**5953**
Spain	761	0	0	638	17	245	1200	2077	948	328	4283	**123750**
Sweden	175	66	117	100	2	NK	175	429	273	90	526	**20112**
United Kingdom	728	69	1415	637	14	784	1602	3466	1429	429	3389	**85192**
Total	**7515**	**973**	**5565**	**3881**	**93**	**2952**	**8459**	**23795**	**7785**	**2447**	**21633**	**916595**

[1] NK = Not Known

[2] Data for NACE 90 was not available on the Eurostat database. These figures estimate the number of workers exposed in NACE O – Other Community and Personal Service Activities. It is assumed that all the exposed workers in NACE O are employed in NACE 90.

Classification of Industries by Exposure Level

Industries in which exposure to hexavalent chromium occurs have been classified as high or low exposure based on an evaluation of the peer-reviewed literature, information from industry and expert judgement. The industries, grouped by NACE code, were identified from the CAREX data. The exposure classification by industry is presented in Table 2.3.

Table 2.3 Classification of industries by exposure level

Industry	NACE (rev 1.1)	Historical Exposure Classification[1]	Number of People Exposed 2006[2]
Agriculture, hunting and related service activities	1	Low	400
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	11	Low	1043
Manufacture of food products and beverages	15	Low	20262
Manufacture of textiles	17	Low	6911
Manufacture of wearing apparel; dressing and dyeing of fur	18	Low	8550
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	19	Low	8686
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	20	Low	18007
Manufacture of pulp, paper and paper products	21	Low	12197
Publishing, printing and reproduction of recorded media	22	Low	13730
Manufacture of coke, refined petroleum products and nuclear fuel	23	Low	5190
Manufacture of chemicals and chemical products	24	High	42452
Manufacture of rubber and plastic products	25	Low	34444
Manufacture of other non-metallic mineral products	26	Low	9421
Manufacture of basic metals	27	High	29670
Manufacture of fabricated metal products, except machinery and equipment	28	High	288480
Manufacture of machinery and equipment n.e.c.	29	High	134067
Manufacture of electrical machinery and apparatus n.e.c.	31	Low	10031
Manufacture of radio, television and communication equipment and apparatus	32	Low	3777

Industry	NACE (rev 1.1)	Historical Exposure Classification[1]	Number of People Exposed 2006[2]
Manufacture of medical, precision and optical instruments, watches and clocks	33	Low	10200
Manufacture of other transport equipment	35	High	41643
Manufacture of furniture; manufacturing n.e.c.	36	High	15942
Electricity, gas, steam and hot water supply	40	Low	9057
Collection, purification and distribution of water	41	Low	473
Construction	45	Low	38885
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	50	Low	66650
Wholesale trade and commission trade, except of motor vehicles and motorcycles	51	Low	1329
Land transport; transport via pipelines	60	Low	7515
Water Transport	61	Low	973
Air Transport	62	Low	5565
Supporting and auxiliary transport activities; activities of travel agencies	63	Low	3881
Post and telecommunications	64	Low	93
Research and development	73	Low	2952
Other business activities	74	Low	8459
Public administration and defence, compulsory social security	75	Low	23795
Education	80	Low	7785
Health and Social Work	85	Low	2447
Sewage and refuse disposal	90	Low	21633
TOTAL			917 000

[1] Relevant to 1975 exposure levels
[2] Prevalence estimation methods are described in section 2.2

The prevalence estimates presented are relevant to 2006. Since 2006 manufacturing of chromate compounds has ceased in the EU, therefore the number of workers exposed to hexavalent chromium in NACE 24 is expected to decrease significantly. Although exposure during the manufacture of chromate compounds no longer occurs, some low level exposure during catalyst manufacture, chrome tanning salt manufacture, and pigment and dye manufacture continues. This work also falls within NACE 24. It is unknown how many workers in the EU are exposed to hexavalent chromium during

these processes. In 2004 there were at least eight multinational companies that manufactured catalysts using sodium dichromate at sites in the EU. The number of sites and the number of workers employed at each site is unknown.[12]

European Commission Directive 2003/02/EC has restricted the use of arsenic containing wood products, which has stopped the use of CCA in the EU. As a result, the prevalence of exposure to hexavalent chromium in NACE 20 is expected to have decreased significantly or disappeared completely.

2.3 LEVEL OF EXPOSURE TO HEXAVALENT CHROMIUM

2.3.1 Estimation of exposure levels

The available scientific literature was reviewed for hexavalent chromium occupational exposure data. No current European hexavalent chromium exposure data are available. Exposure data for high exposure NACE industries 24, 27, 28 and 35 from the mid 1980's to the late 1990's are available. The data for NACE 27, 28 and 35 are from the UK National Exposure Database (NEDB) and the data for NACE 24 were compiled for the EU Risk Assessment Report for Chromates using data from industry and the HSE NEDB. No data were found that were specific to and representative of NACE 29 and 35 however, exposures in these groups are likely to be very similar to exposures in NACE 28 since exposures in all three groups arise chiefly from welding and other hot work with stainless steel. We have assumed that exposures in NACE 28 are representative of exposures in NACE 29 and 35.

As the majority of the samples were taken between 1990 and 1999 we have assumed that the geometric mean exposure is representative of 1995. We extrapolated the 1995 geometric mean exposures to 2010 based on an estimated decrease in exposure of 7% per year. Creely *et al* (2007) analysed temporal trends in exposure in 38 published datasets of long-term trends in aerosol exposure and found that, over time, exposures typically reduced by 5 to 10% per year. The median decrease in exposure level seen by Creely *et al* (2007) was 7% per year. Except where exposure has ceased (i.e. CCA production and use, chromate production), we have found no evidence to suggest that the temporal trend in hexavalent exposure level differs from the typical trend seen by Creely *et al* (2007).

The exposure estimates for high exposure industries are presented in Table 2.4.

[12] HSE (2007) Human Health Risk Reduction Strategy for Chromates

Table 2.4 Estimated 1995 and 2010 hexavalent chromium exposure levels for high exposure NACE codes

NACE Code	Industry	Estimated Geometric Mean 1995[1] mg/m^3	Estimated Geometric Mean 2010[2] mg/m^3	Estimated Geometric Standard Deviation
24	Manufacture of chemical and chemical products	0.0050	0.002	NK[3]
27	Manufacture of basic metals	0.0060	0.002	3.8
28	Manufacture of fabricated metal products, except machinery and equipment	0.0047	0.002	9.3
29[4]	Manufacture of machinery, except electrical	0.0047	0.002	9.3
35	Manufacture of other transport equipment	0.0160	0.005	14.0
36[4]	Other Manufacturing Industries	0.0047	0.002	9.3

[1] The majority of the data were from 1990 – 2000 therefore the data was assumed to be representative of 1995

[2] 1995 levels were extrapolated to 2010 assuming an annual decrease in concentration of 7%.

[3] NK = Not Known

[4] No data were available for NACE 29 and 35 however because the exposure scenarios in these groups resemble those in NACE 28 we have used the exposure levels for NACE 28 to represent estimated exposures levels in NACE 29 and 35.

European data for low exposure NACE groups were not known. In 2007 Blade *et al* (2007) conducted 21 field surveys in the United States to characterise exposures to hexavalent chromium in selected industries. Several low exposure industries were included in this study (NACE 22, 45, 26, 31, 61). The estimated geometric means range from <0.00002 mg/m^3 (for NACE 22 and 31) to 0.00063 mg/m^3 (for NACE 45). The estimated geometric means for NACE 22, 45, 26, 31 and 61 are presented in Table 2.5.

Table 2.5 Estimated Geometric Means for low exposure industries from US data

NACE		N	Estimated Geometric Mean mg/m^3	Estimated Geometric Standard Deviation	Monitored Tasks
22	Publishing, printing and reproduction of recorded media	4	<0.00002	Not Calculated	Use of chromate pigments
31	Manufacture of electrical machinery and apparatus n.e.c.	2	<0.00002	Not Calculated	Chromate conversion treatment
26	Manufacture of other non-metallic mineral products	14	0.00002	3.8	Use of chromate pigments
45	Construction[1]	19	0.00063	35.2	Stainless steel welding, abrasive blasting of chromate paint, crushing of concrete, Cr-alloy spray-coating
61	Water Transport	14	0.00035	5.4	Metal cutting

[1] Insufficient detail existed in the paper to calculate a GM and GSD for NACE 45, the values presented are approximated from the GMs presented for the companies within NACE 45 that were evaluated.
Source: Blade *et al* (2007)

Although exposure data were not known for the remaining low exposure industries, the exposure estimates presented for NACE 45 likely represent a reasonable approximation for most groups since a variety of tasks are represented in the data for NACE 45, including stainless steel welding. Occasional stainless steel welding and presence in a room where stainless steel welding is performed is responsible for a great deal of the exposure in low exposure industries.

Due to the limited availability of exposure data we are unable to determine whether there are systematic differences in exposures across the EU. We have assumed that the extrapolated 2010 exposures presented for high exposure groups in Table 2.4 are typical of exposures throughout the EU. The overall weighted geometric mean (GM) and geometric standard deviation (GSD) was estimated across all high exposure industries across the EU using @Risk © (Palisade Corporation, New York). Exposures were simulated using the GM and GSD for each country. The number of values each country contributed was weighted according to the number of workers exposed in that country.

The estimated overall weighted geometric mean exposure across all industries in the EU is 0.002 mg/m^3 and the estimated geometric standard deviation is 10. Based on these data and assuming a log-normal distribution then 90% of exposures would be less than about 0.04 mg/m^3.

2.3.2 Temporal change in exposure

For the reasons outlined in section 2.3.1, we believe that it would be appropriate to assume that hexavalent chromium exposures have generally decreased by 7% per year in the past 20 years. We have extrapolated 1995 exposure levels to 2010 exposure levels based on that assumption. The 1995 exposures presented in Table 2.4 exclude exposures in chromate manufacturing and the use of CCA since these exposures are no longer present in the EU. However, chromate manufacturing existed in the EU until 2007 and CCA was used in the EU until 2006.

Chromate manufacturing is included in NACE 24, which has an estimated 1995 exposure level of 0.005 mg/m^3. The EU Risk Assessment Report for chromates reports a geometric mean exposure level of 0.004 mg/m^3 for chromate manufacturing.[13] The majority of the data used to calculate this GM were taken from industry measurements taken between 1994 and 1997. There were only a few chromate manufacturers in the EU prior to 2007 and the 1995 exposure level of 0.005 mg/m^3 likely remains a reasonable estimate of average exposure in NACE 24 if chromate manufacturing is included in the exposure estimate.

Use of CCA occurred primarily in NACE 20. The EU Risk Assessment Report for chromates has estimated a GM exposure level of 0.001 mg/m^3 during CCA use. The measurements used to calculate this GM were taken by HSE between 1996 and 1998.

2.4 HEALTH IMPACT FROM CURRENT EXPOSURES

2.4.1 Background data

The occupational cancers associated with exposure to hexavalent chromium are shown in Table 2.6, along with a summary of the information used in the health impact assessment.

[13] EU Risk Assessment Report on chromates. Vol 53, 2005. Publication EUR 21508 EN. Available at : http://ecb.jrc.ec.europa.eu/documents/Existing-Chemicals/RISK_ASSESSMENT/REPORT/chromatesreport328.pdf

Table 2.6 Occupational cancers associated with exposure to hexavalent chromium

Cancer site	**Lung**		**Sinonasal**	
ICD-10 code	C33-C34		C30-C31	
IARC group for carcinogen	1		1	
Strength of evidence for cancer site [1]	Strong		Suggestive	
Latency assumption	10-50 yrs		10-50 yrs	
Source of forecast numbers - deaths	Eurostat, 2006			
Source of forecast numbers - registrations	GLOBOCAN[14], 2002			
Exposure levels	***Relative Risk (RR)***	***Source of RR***	***Relative Risk (RR)***	***Source of RR***
"High"	1.18 (1.12, 1.25)	Cole and Rodu meta-analysis	5.18 (2.37, 11.3)	Rosenman and Stanbury, 1996
"Low"	1	Crump *et al*, 2003	3.42 (0.42, 10.52)	'harmonic mean' estimate

[1] Based on Siemiatycki *et al*, 2004

2.4.2 Exposed numbers and exposure levels

Industry sectors, their NACE codes, classifications to exposure categories High/Medium/Low/Background exposure as applicable for the mid 1970's and the numbers exposed in 2006 are given by country in Table 2.3 in the previous section on the exposure, along with estimated average exposure levels (GM) and geometric standard deviations (GSD) in Table 2.4 for high exposure industries and in Table 2.5 for low exposure industries. The estimated average exposure level (GM) and measure of variability (GSD) for all NACE industries used were 0.002 mg/m^3 and 10, respectively.

We present data for a "baseline" scenario, which for all industries assumes a 7% annual decline in exposure levels and standard change in employed numbers up to the 2021-2030 estimation interval and constant levels thereafter.

2.4.3 Forecast cancer numbers

Separate estimates for total numbers of deaths for lung and sinonasal cancers by age band are available from EUROSTAT for the 27 countries of the EU, for 2006, and for registrations from GLOBOCAN for 2002. The forecast numbers of deaths and registrations by country used to estimate attributable numbers are in Appendix 8.2.

2.4.4 Results

The cancer deaths and registrations attributed to occupational exposure to hexavalent chromium for the baseline scenario are presented per year for the target years given and are based on the working age cohort of currently (2006) exposed workers. Attributable fractions and numbers of deaths and registrations, and Years of Life Lost

[14] IARC, GLOBOCAN database, available at: http://globocan.iarc.fr/

(YLLs), Years Lived with Disability (YLDs) and Disability Adjusted Life Years (DALYs), are estimated.

As the exposure data suggests that exposure declines over time, a dynamic baseline scenario has been used.

A summary of the results for lung cancer and sinonasal cancers for the total EU is in Table 2.7 below.

Table 2.7 Results for the baseline forecast scenario, total EU (27 countries), men plus women

Scenario	**All scenarios**		**Baseline scenario (2) - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005**			
EU Total	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Numbers ever exposed	3,516,219	3,625,337	3,753,120	3,822,184	3,847,407	3,872,920
Proportion of the population exposed	0.97%	0.95%	0.97%	0.97%	0.98%	1.01%
Lung cancer						
Attributable Fraction	0.12%	0.10%	0.08%	0.05%	0.03%	0.02%
Attributable deaths	336	334	296	227	155	105
Attributable registrations	368	362	315	237	158	106
'Avoided' cancer registrations						
YLLs	5,164	4,981	4,217	3,075	2,004	1,325
DALYs	5,390	5,200	4,405	3,214	2,096	1,387
Sinonasal cancer						
Attributable Fraction	3.28%	3.13%	3.01%	2.82%	2.68%	2.66%
Attributable deaths	39	44	48	50	51	52
Attributable registrations	118	129	139	143	144	145
'Avoided' cancer registrations						
YLLs	654	697	721	707	687	673
DALYs	881	866	914	889	845	819

The attributable deaths in the EU 2010 from previous hexavalent chromium exposures were 336 deaths from lung cancer and 39 deaths from sinonasal cancer. The

estimated deaths and cancer registrations decrease steadily over the following 50 years for lung cancer to 105 attributable deaths in 2060 and increase steadily over time for sinonasal cancer to 52 attributable deaths in 2060. The corresponding estimated attributable fraction (AF) for lung cancer decreases from 0.12% in 2010 to 0.02% in 2060, and there is a smaller decrease in AF for sinonasal cancer from 3.29% to 2.66% over the same time period. DALYs are also expected to decrease for lung cancer in the baseline scenario from 5,299 years in 2010 to 1,362 years in 2060. Over the same time period, DALYs are predicted to initially increase for sinonasal cancer with 881 years in 2010 and then decrease by 2060 with 819 years in 2060.

2.5 POSSIBLE COSTS ASSOCIATED WITH NOT MODIFYING THE DIRECTTIVE

2.5.1 Health impacts – possible costs under the baseline scenario

Introduction

The health data (cancer registrations and Years of Life Lost - 'YLL') for the baseline in which there are no further modifications to the Carcinogens Directive are shown in section 2.4 of this report. These data show that there are predicted to be a significant number of cancer registrations and YLLs from both lung and sinonasal cancer resulting from future exposure to chromium. There is a predicted decline in registrations and YLLs over time as a result of predicted exposure reduction owing to implementation of existing and ongoing risk management measures across the EU.

Method in brief

Using this data, it is possible to monetise the costs under the baseline by estimating the:

- Life years lost – This is calculated by using the YLL and multiplying this by a valuation of the Value of Life Year Lost (VLYL). This gives a value for the time (in years) lost as a result of premature death.
- Cost of Illness (COI) – This is a monetary cost of the time spent with cancer. In this study, a unit COI estimate is multiplied by the number of cancer registrations to give a total value for COI. (COI is often the main market-based approach in relation to health impact).[15] COI includes the direct and indirect costs of cancer but not the intangible costs (see below).
- Willingness to Pay (WTP) to avoid cancer – WTP is used as an alternative method (high cost scenario) based on publically available, peer reviewed studies on what people would be willing to pay to avoid having cancer. This includes various intangible costs (e.g. disfigurement, functional limitations, pain and fear) and in some cases also includes the costs associated with life years lost.

The cost variables used in this study are presented in Table 2.8 in 2010 prices. For the purposes of this study, valuations are increased by 2% each year in the future in part to

[15] ECHA (2008) "Applying SEA as part of restriction proposals under REACH" Available at: http://echa.europa.eu/doc/reach/sea_workshop_proceedings_20081021.pdf

present costs in real terms (i.e. adjusting for inflation in prices) and to reflect the increasing value society's attaches to its health (as economic growth typically increases over a long period of time).[16]

Table 2.8 Summary of cost variables used in this study (€2010 prices)

Cost/benefit elements	Low scenario	High scenario
VLYL - Each year lost	€ 50,393	€ 0 (note 1)
COI or WTP - Unit cost (per cancer registration)	€ 49,302 (COI)	€ 1,793,776 (WTP)

(Note 1) – By using WTP (€1.8m) in the high scenario instead of COI, the WTP can include the costs of premature death and therefore there was a risk of double counting benefits if VLYL costs were included.

All costs and benefits over time in this study are discounted using a 4% discount rate as recommended by the European Commission's Impact Guidelines[17]. In order to assess the effect that discounting has on the results ('sensitivity analysis'), we have also presented estimates that take into consideration a declining discount rate for impacts occurring after 30 years and no discounting.

The health data shown in section 2.4 are snap-shots (i.e. estimation for the initial year of a ten year period) of the number of cancer registrations, deaths, YLLs in future years at 10 year intervals. In calculating the costs associated with these effects, each snap-shot result is multiplied by 10 in order to derive an estimate for the whole assessment time period (for example, 2020 results are multiplied by 10 to give results over the period 2020-2029). This assumes that each snap-shot year is representative of the following 10 years.

The method to valuing health benefits is explained in more detail in the method paper titled *"Valuing health benefits – Method paper".*

Results

The health costs under the baseline scenario are presented in Table 2.9. Health-related costs are predicted to decline over time and are predominately the result of past exposure. In Section 2.4 the number of cancer registrations and YLLs are estimated to decline over time, accounted for by risk management measures (RMMs) already imposed (as applied at production and end use) over the past 10-20 years.

The introduction of an EU-wide OEL is not expected to have a significant impact in the short term given that the main Member States already have a national OEL in place (the stringency varies by Member States). Table 2.9 sets out the ranges of health costs for each representative decade. The ranges are based on the high and low cost scenarios (see Table 2.8). The results are also illustrated in Figure 2.1.

[16] This is consistent with some other European Commission studies and is standard practice for air quality under the Clean Air for Europe (CAFE) programme.
[17] European Commission Impact Assessment Guidelines (Jan 2009) - http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf

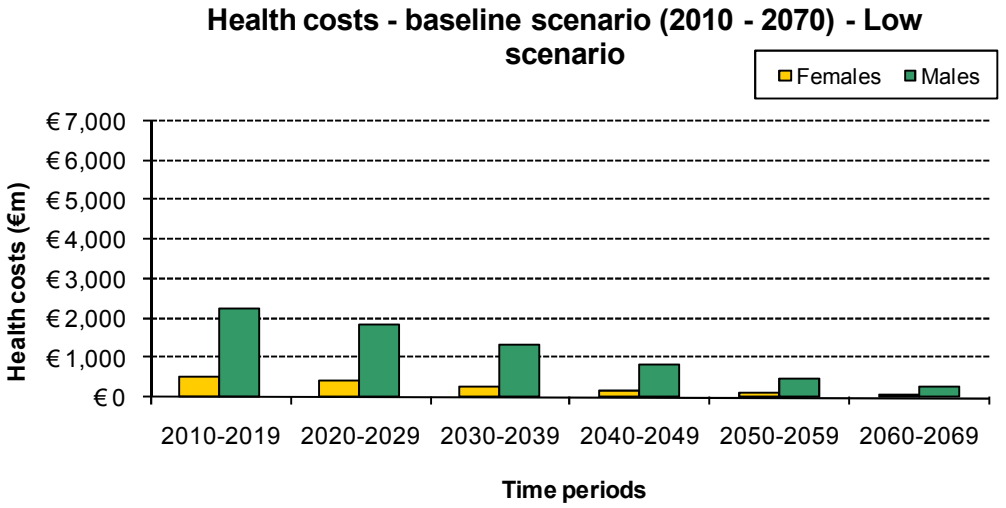
Table 2.9 Health costs-baseline scenario – 2010 to 2070 (Present Value – 2010 €m prices)

Costs by Gender (€m)	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069	TOTAL
Female	526 to 1,328	417 to 1,099	297 to 860	194 to 638	122 to 468	81 to 356	1,636 to 4,749
Male	2,252 to 6,649	1,827 to 5,535	1,322 to 4,191	843 to 2,848	496 to 1,819	302 to 1,211	7,042 to 22,253
Total	2,778 to 7,977	2,243 to 6,634	1,619 to 5,051	1,037 to 3,486	617 to 2,287	383 to 1,566	8,678 to 27,002

Notes:

- All costs are presented in present value using a discount rate of 4%. The low range is based on low estimates for costs of illness and life years lost. The upper range of costs relate to WTP estimates to avoid having cancer, which include intangible costs associated with having cancer.

- Totals may not match to sums of females and male costs due to underlying small differences in raw data and rounding to whole number



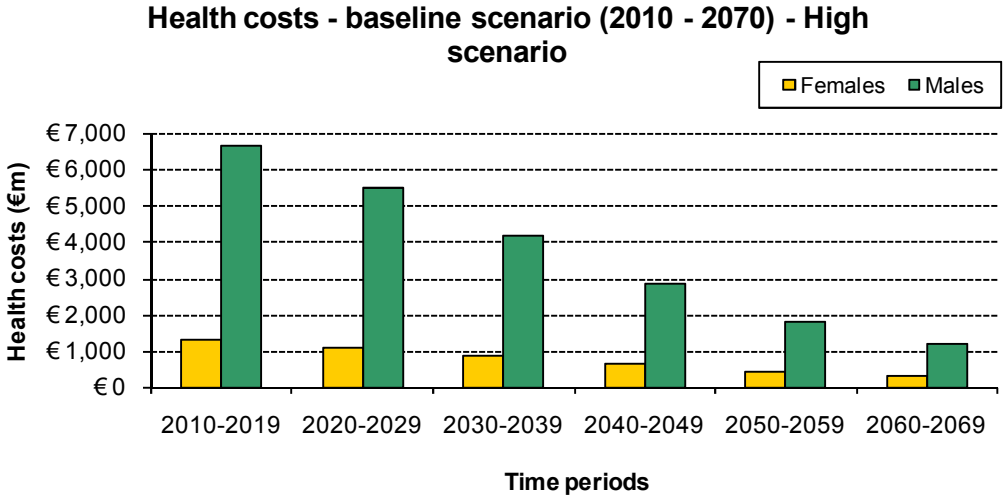


Figure 2.1 Health costs - baseline scenario – 2010 to 2070 (Present Value – 2010 €m prices)

These predicted health costs will affect Member States differently depending upon the overall number of workers within affected industry groups, existing risk management measures and the proportion of males and females within these groups. Figure 2.3 shows that France, Germany, Italy, Poland, Spain and the UK are predicted to have relatively high health costs. The industrial sector estimated to be most affected under the baseline is the manufacturing sector. There are notable impacts in the manufacture of fabricated metal products and the manufacture of machinery and equipment. This is shown in Figure 2.5.

Detailed tables are included in Appendix 8.3.

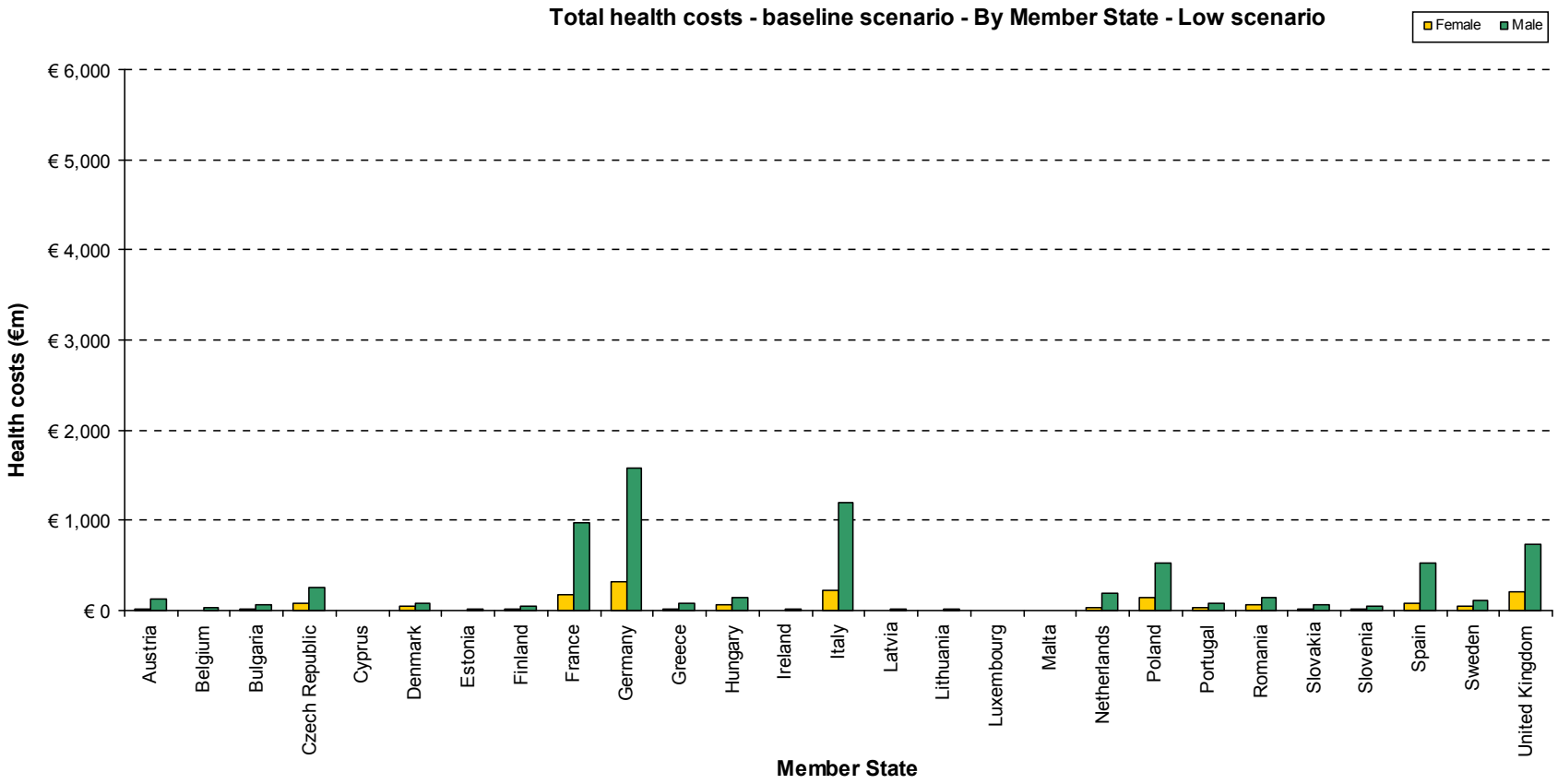


Figure 2.2a Total health costs-baseline scenario – By Member State (Present Value – 2010 €m prices)

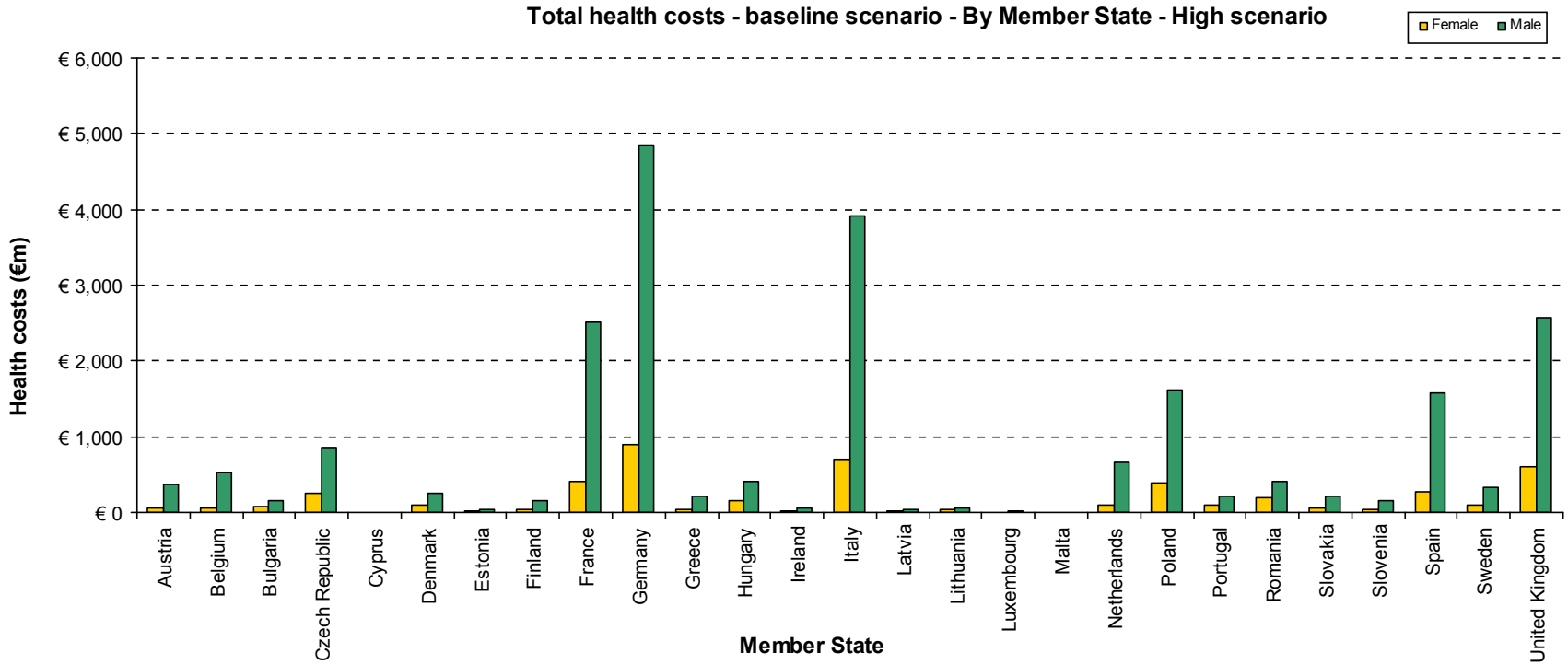


Figure 2.3b Total health costs-baseline scenario – By Member State (Present Value – 2010 €m prices)

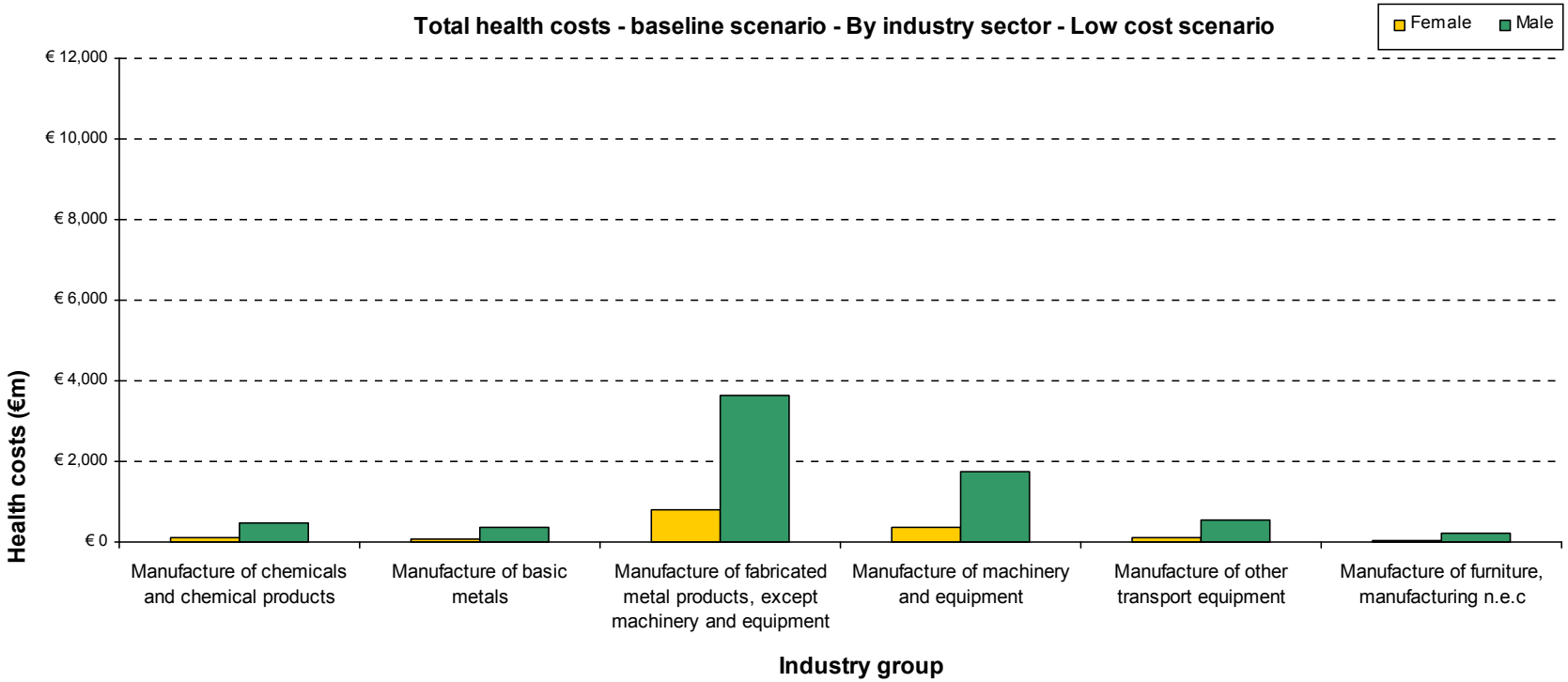


Figure 2.4a Total health costs-baseline scenario – by industry group (Present Value – 2010 €m prices)[18]

[18] Note only the most significantly affected industry sectors are included. Several industries are thought to be affected but are not shown in the graph. These sectors can be seen in Appendix 8.3

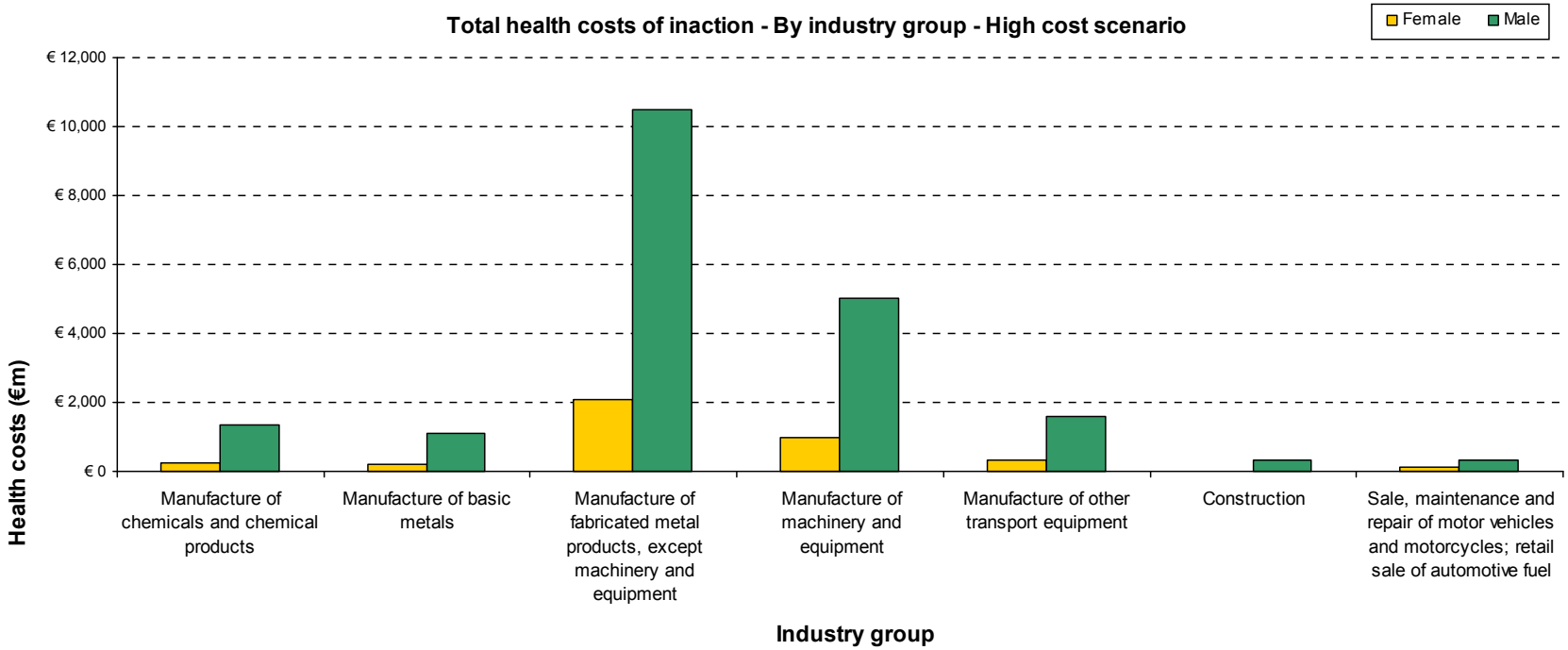


Figure 2.5b Total health costs-baseline scenario – by industry group (Present Value – 2010 €m prices)[19]

[19] Note only the most significantly affected industry sectors are included. Several industries are thought to be affected but are not shown in the graph. These sectors can be seen in Appendix 8.3

In order to present all socio-economic costs and benefits consistently in present value terms, all future costs and benefits have been discounted. The primary approach was to apply the European Commission IA recommended 4% discount rate. Since most health impacts occur over a long period of time relative to costs, the impacts of discounting are significant. In Figure 2.6 the effects of different discount rates on the overall results are shown, indicating that the impacts of discounting become more pronounced the further in the future that the impact occurs.

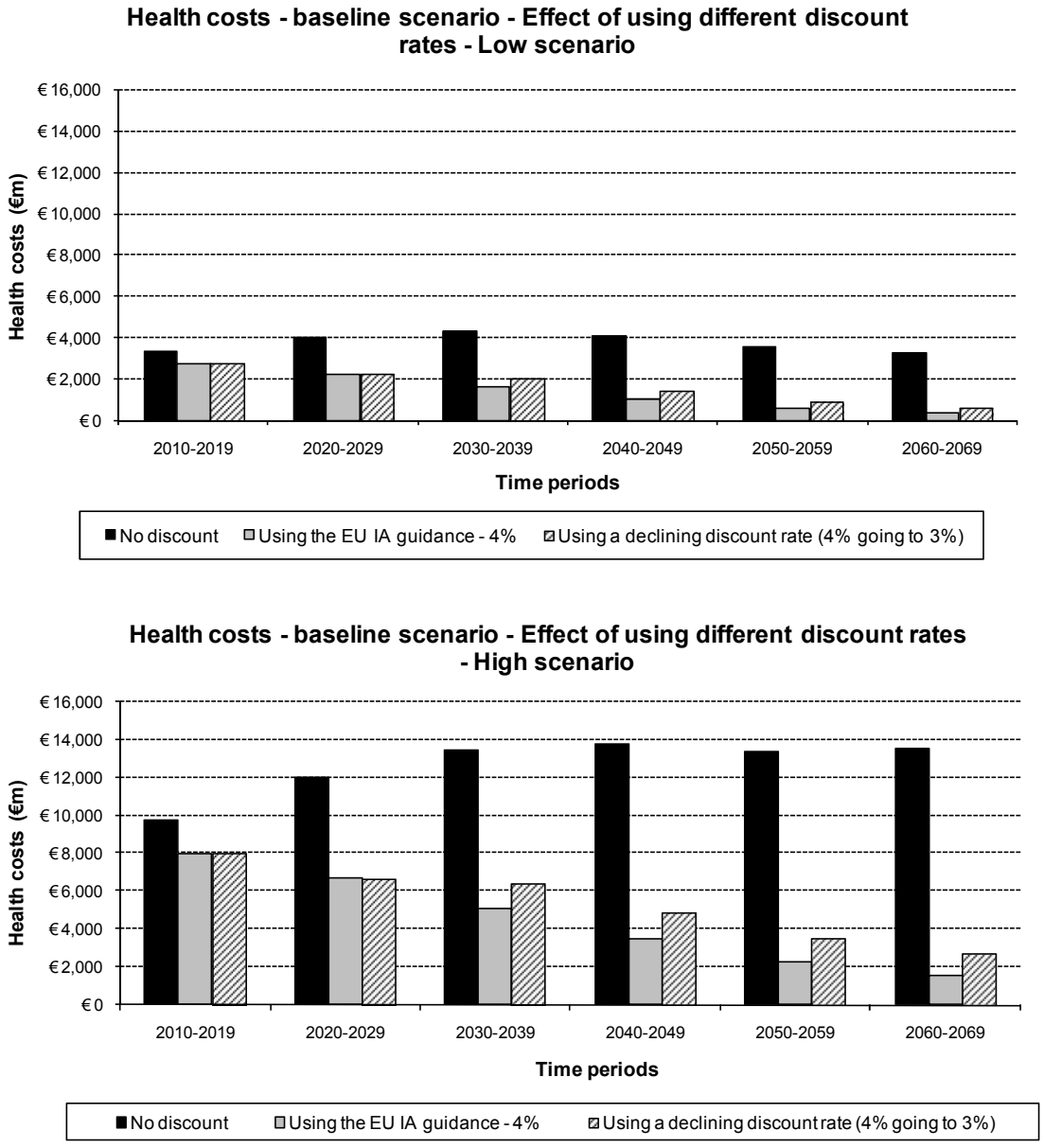


Figure 2.6 Impact of discounting

3 POLICY OPTIONS

3.1 DESCRIPTION OF MEASURES

The policy options investigated in this report concern the potential implementation of an EU-wide OEL of 0.1, 0.05 or 0.025 mg/m^3.

The specific control measures required to reduce exposure to hexavalent chromium depend on the nature of the operations conducted. Examples of controls are summarised in Table 3.1.

Table 3.1 General recommendations to reduce exposure to hexavalent chromium

Organisational measures	Personnel measures	Technical measures
Separate activities with little exposure from activities resulting in higher exposure	Regular medical check-ups for employees	Adequate local exhaust ventilation (LEV) with HEPA filters. Air sampling to assess the effectiveness of the ventilation controls.
Substitution of hexavalent chromium with other substances where possible	Use of appropriate respiratory protective equipment (RPE)	Use of appropriate and appropriately maintained PPE
	Use of personal protective equipment (PPE)	Use high-efficiency particulate air (HEPA) vacuums to clean equipment
		Mist suppressants in electroplating industries
		Enclose processes
		Automate processes where hexavalent chromium is used

3.2 LEVEL OF PROTECTION ACHIEVED (OELS)

The estimated geometric mean exposures in the high and low exposure industries were all below the typical EU OELS of 0.025, 0.05 or 0.1 mg/m^3. The estimated GM and GSDs for the high exposure industry were used to simulate the exposure distribution in these industries. The percentage of workers within each industry who are currently exposed above the proposed OELs was estimated using these distribution simulations (Table 3.2). Exposures above all proposed OELs occurred in all industries. It is estimated that NACE 27 (Manufacture of basic metals) has the fewest workers exposed at concentrations above the OELs and NACE 35 (Manufacture of transport equipment) has the most.

Table 3.2 Estimated percentage of workers with exposures exceeding the proposed OELS in high exposure industries

OEL (mg/m^3)	NACE CODE					
	24	27	28	29	35	36
0.025	13.6%	3.0%	10.8%	10.8%	28.0%	10.8%
0.05	8.1%	0.8%	6.1%	6.1%	19.9%	6.1%
0.1	4.5%	0.2%	3.1%	3.1%	13.4%	3.1%

The Human Health Risk Reduction Strategy for Chromates provides information on controls used in a variety of industries and processes to limit exposure to hexavalant chromium.[20] In most cases the controls described by the Risk Reduction Strategy are not representative of the industry or process in general but rather demonstrate examples used in one or more companies who provided information on the controls used at their worksites. Typical exposure measurements from the worksites that use the described controls were also provided. We have compiled the information from the Risk Reduction Strategy in Table 3.3 in order to demonstrate examples of controls that have been used and the exposure concentrations that are achievable with the use of these controls. In some of the assessed industries HSE reported that the use of control varied between companies. Small companies were thought to be at particular risk of lacking adequate control especially in the manufacture of pigments and dyes, the formulation of metal treatment products electroplating and wool dyeing. In the Risk Reduction Strategy these industries were identified as requiring further consideration in order to ensure that the risk of overexposure was adequately managed.[20]

[20] HSE (2007) Human Health Risk Reduction Strategy for Chromates

Table 3.3 Example controls and achieved exposure measurements

Industry	Example Controls Used	Exposures achieved (mg/m^3)
Manufacture of pigments and dies	• Automation of bulk sodium dichromate • Automated manufacturing process with exhaust ventilation • Process shuts down if filter system isn't working • RPE, protective clothing, goggles and PVC gloves used during maintenance and repair work	0.0026 - 0.005
Manufacture of chrome tanning salts	• Full enclosure of automated process • LEV at sampling and packing points • RPE, protective clothing, goggles and PVC gloves used during maintenance and repair work	0.002
Manufacture of chromium metal	• LEV and worker PPE at chromate input points • Impermeable overalls, gloves, face and eye protection, RPE to at least P3 standard • Annual biomonitoring program	<0.02
Manufacture of formulations for use in metal treatment	• Chromic acid manually poured into a mixer fitted with LEV • Mixing takes place within sealed system finished product dropped automatically from mixer to containers • When and if chromic acid is handled disposable respirator, rubber gauntlets, work overalls, hat and protective footwear are used	<0.0001
Electroplating	• Mist suppressants • LEV not widely used because the solutions involved are corrosive • flaked chromic acid used instead of powder • PPE including rubber gloves, aprons, dust masks, wellingtons	0.001 - 0.006
Conversion coating	• "Dry in place" roller coater application - this method produces minimal emissions	<0.001
Manufacture of Montans Wax	• Closed piping • Exhaust gas systems fitted with security systems • PPE and RPE available in case of accident • regular medical checkups for employees	<0.0055 - <0.003
Manufacture of Vitamin K	• Not well studied, it is though that automated enclosed processes are used	0.0025 (predicted)
Use as a mordant in wool dyeing	• Substitution of hexavalent chromium with other substances • Automated systems where hexavalent chromium is used • RPE used during weighing	unknown

Industry	Example Controls Used	Exposures achieved (mg/m^3)
Use in catalyst manufacture	• Offloading of sodium dichromate from tanker directly to bulk storage tank using dry-break coupling to minimise the risk of spillage • Inventory is kept only to the level needed for meeting production requirements • Sodium dichromate pumped directly from the storage tank to the manufacturing plant via sealed pipework • Conversion to Cr(III) immediately upon entrance to reaction vessel • Availability of PPE and RPE in case of spillage	<0.005

The Risk Reduction Strategy does not cover exposure from welding and hot-work as workers involved in these processes do not work directly with chromates. The HSE includes guidance on general good practice during these processes as part of their information for the COSHH (Control of Substances Hazardous to Health) Regulations, which if followed is thought to reduce all exposures below thee UK OEL (0.05 mg/m^3). Although the guidance provided varies with the individual process, in general the following principles are recommended for all hot-work processes:

- Good general ventilation with a through draught (5 – 10 air changes per hour);
- Use of local exhaust ventilation adequate to remove all fumes (e.g. extracted welding booth, extracted workbench, moveable capture hood);
- Air sampling to assess the effectiveness of the ventilation controls; and
- Respiratory protective equipment if necessary.

Blade *et al* (2007) measured hexavalent chromium exposures ranging from 0.00002 to 0.03 mg/m^3 during welding and hot-work on stainless steel in the United States. The geometric mean exposures at the sites monitored ranged from 0.00035 to 0.06 mg/m^3. The highest measurements were taken at sites where local exhaust ventilation was not used. These results suggest that exposures well below 0.025 mg/m^3 are achievable during hot work with sufficient use of appropriate controls (Blade *et al*, 2007).

4 ANALYSIS OF IMPACTS

4.1 HEALTH IMPACTS FROM CHANGES TO THE EU DIRECTIVE

4.1.1 Health information

For hexavalent chromium, the existing European OELs of 0.025, 0.05 and 0.1 mg/m^3 are to be tested. Lung and sinonasal cancer numbers were therefore estimated given current (baseline) and full compliance[21] to these OELs. Baseline for all industries assumes a 7% annual decline in exposure levels and standard change in employed

[21] Full compliance is assumed in the intervention scenarios; however, due to modelling restrictions full compliance is modelled as 99% compliance.

numbers up to the 2021-30 estimation interval, except for NACE 20 and 24 industries which are assumed to have closed in 2005, and constant levels thereafter.

We present data for three “intervention” scenarios as described in Table 4.1 below, compared to the baseline trend scenario described in section 2.4.1.

Table 4.1 Baseline and intervention scenarios

Carcinogen	**Chromium**
Intervention scenarios[1]	
Baseline scenario (2)	Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005 (fully described in Section 2 of the report)
Intervention scenario (3)	Full compliance for OEL = 0.025 mg/m^3
Intervention scenario (4)	Full compliance for OEL = 0.05 mg/m^3
Intervention scenario (5)	Full compliance for OEL = 0.1 mg/m^3

[1] All intervention scenarios are estimated as change to (2) the baseline scenario

Results for the baseline scenario (2) and three intervention scenarios compared to the baseline scenario are in Figure 4.1 (for attributable registrations), Figure 4.2 (for attributable fractions) and Figure 4.3 (DALYs) for men plus women for the total EU (27 countries) for lung cancer, and in Figure 4.4, Figure 4.5 and Figure 4.6 for sinonasal cancer. A summary of the results for lung and sinonasal cancers for the total EU is in Table 4.2 below. Due to cancer latency, no effect is seen from interventions in 2010 until 2030.

Introducing full compliance with the three current OELs in 2010 will avoid cancers occurring but only from 2040 onwards, with the most substantial decrease seen for full compliance with an OEL of 0.025 mg/m^3 (scenario 5) (Figure 4.1 and Figure 4.2).

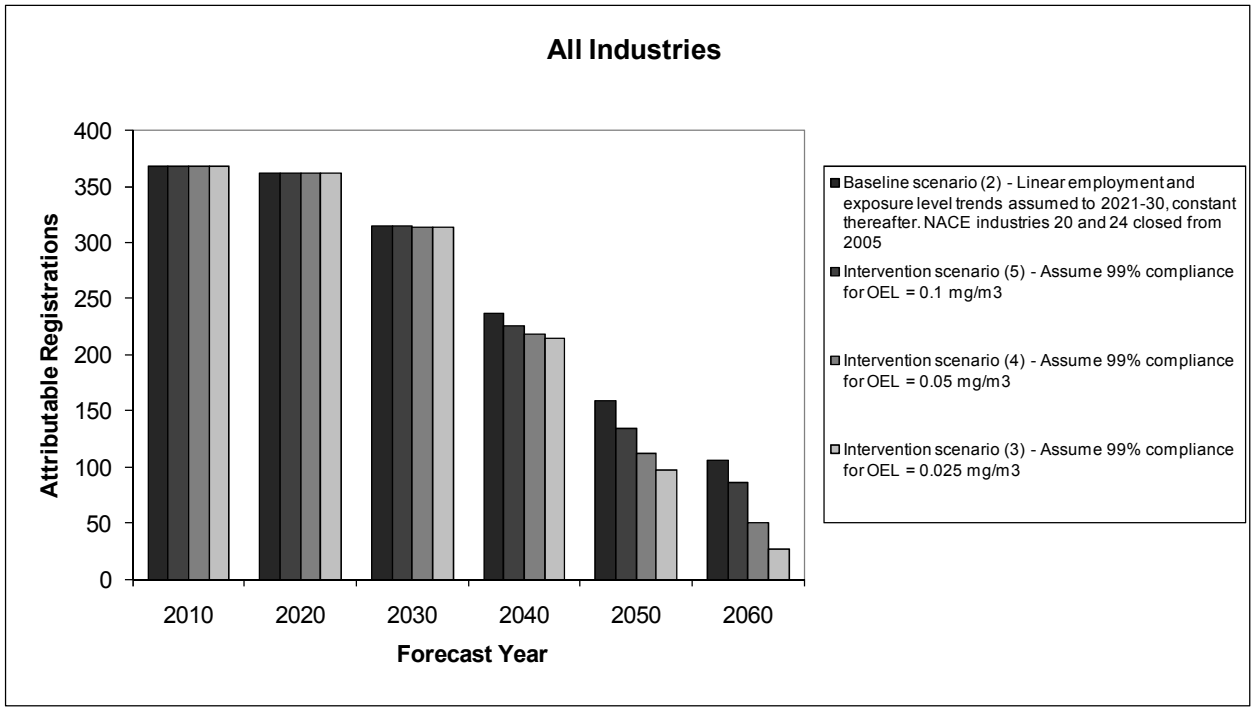


Figure 4.1 Results for baseline (2) and intervention scenarios (3) to (5) compared to the baseline scenario – Occupational Attributable cancer registrations, Lung cancer, men plus women

Figure 4.1 shows the estimated number of registrations for lung cancer attributable to hexavalent chromium exposure decreasing steadily for all four scenarios over the next 50 years.

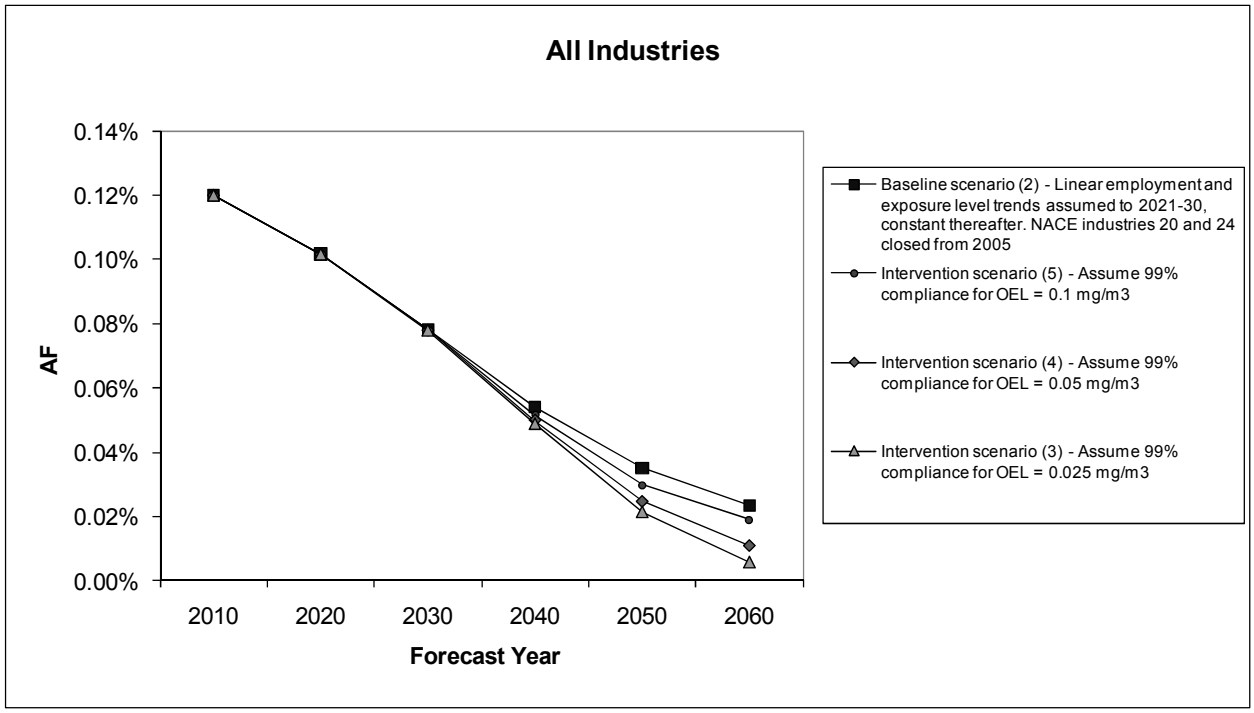


Figure 4.2 Occupation Attributable Fractions, Lung cancer

Figure 4.2 shows that in addition to the number of lung cancer registrations the attributable fraction (AF) also decreases over the period up to 2060. By 2060, it is predicted that less than 0.04% of all lung cancer could be attributed to hexavalent chromium exposure, regardless of which scenario is followed.

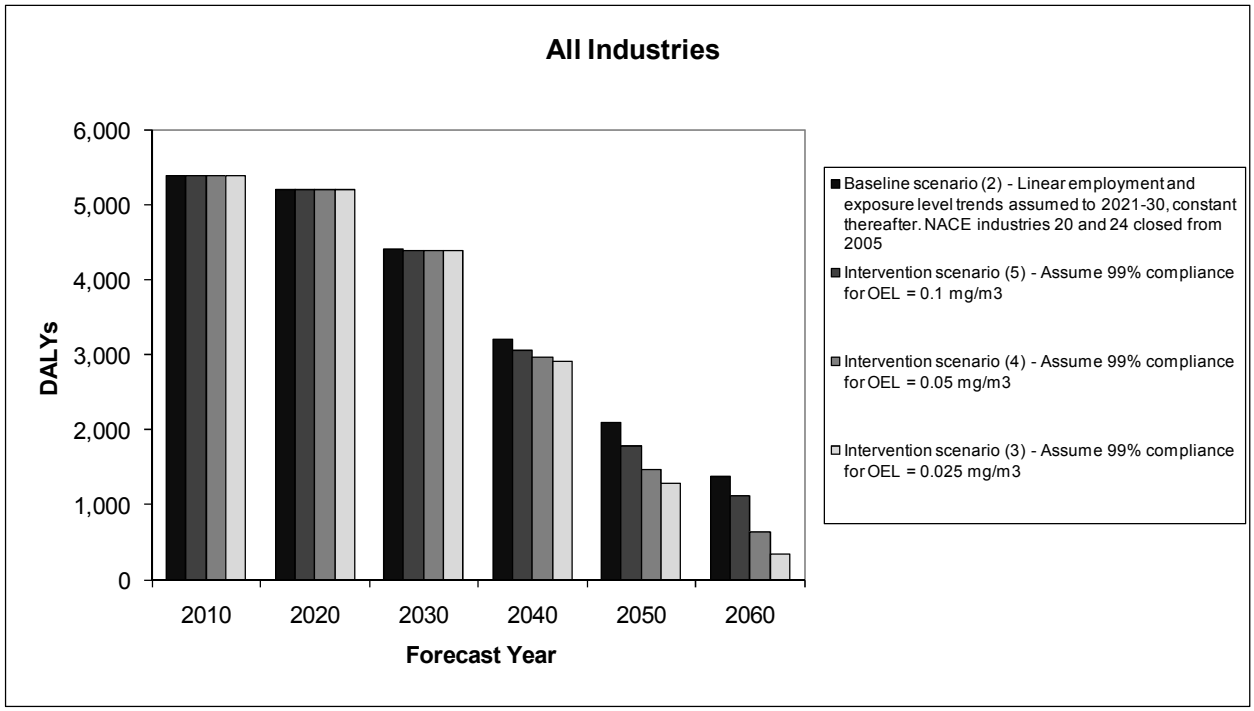


Figure 4.3 Occupation Attributable DALYs, Lung cancer

The estimated DALYs drop from over 5,000 years in 2010 to less than 1,500 years in 2060.

Data for sinonasal cancer follows a different pattern to that of lung cancer, and these data are shown below in Figure 4.4, Figure 4.5 and Figure 4.6.

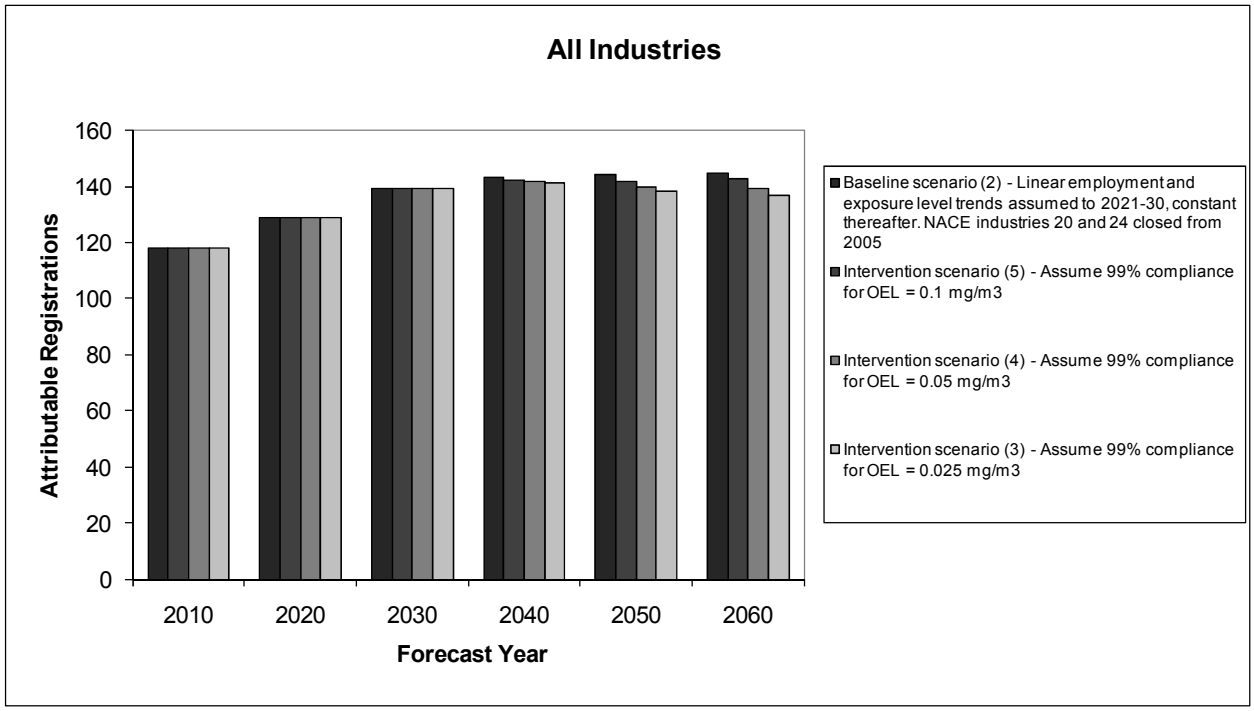


Figure 4.4 Results for baseline (2) and intervention scenarios (3) to (5) compared to the baseline scenario - Occupation Attributable cancer registrations, Sinonasal cancer, men plus women

Figure 4.4 shows the estimated number of registrations for sinonasal cancer attributable to hexavalent chromium exposure increasing steadily for the baseline scenario over the next 50 years. Cancer registrations initially increase for the three intervention scenarios and then beginning to decrease in 2050.

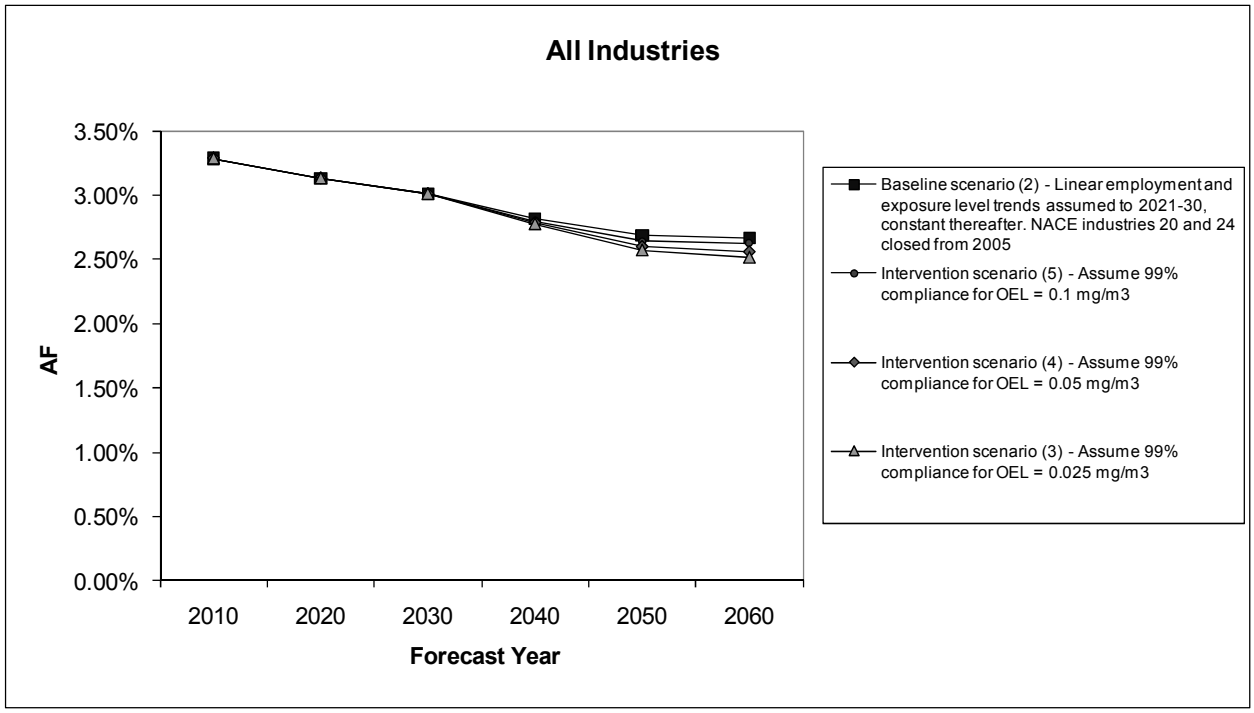


Figure 4.5 Occupation Attributable Fractions, Sinonasal cancer

Contrary to Figure 4.4, Figure 4.5 shows that the attributable fraction (AF) for sinonasal cancer decreases slightly over the period up to 2060. By 2060, it is predicted that less than 3% of all sinonasal cancer could be attributed to hexavalent chromium exposure, regardless of which scenario is followed.

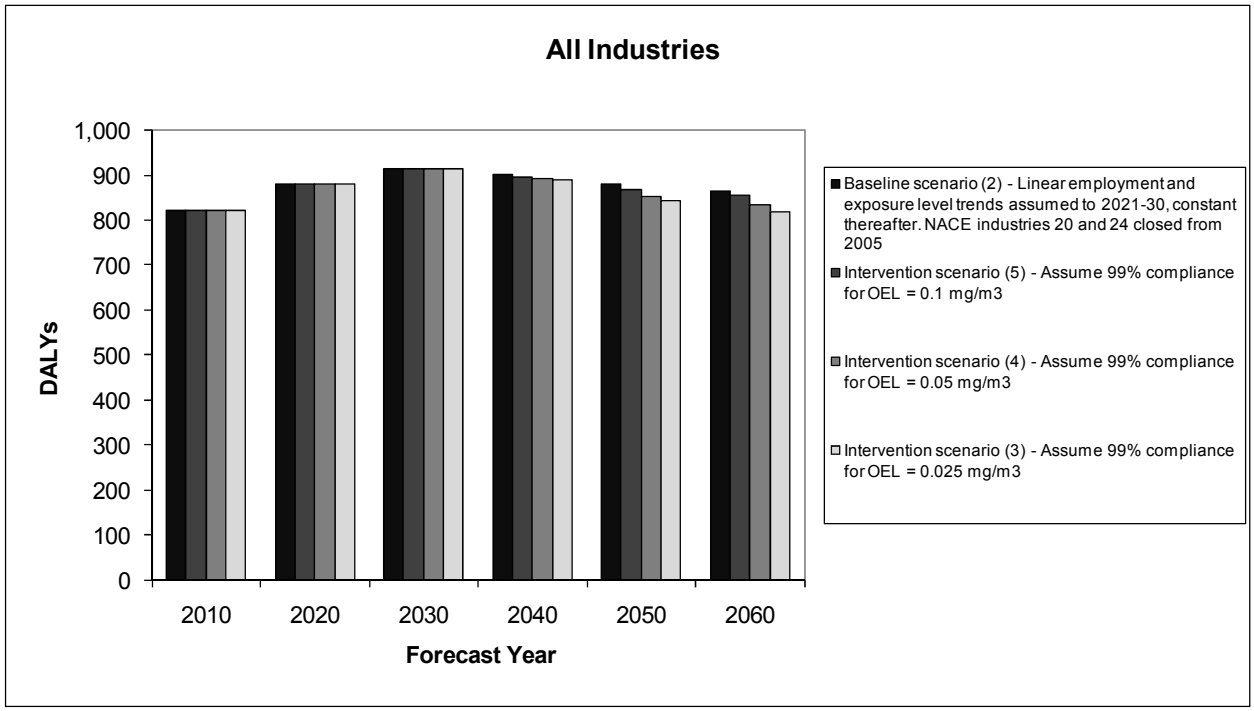


Figure 4.6 Occupation Attributable DALYs, Sinonasal cancer

Figure 4.6 follows a similar pattern to Figure 4.4 and shows that the estimated DALYs initially increase for all four of the scenarios and then begin to decrease in 2040.

Table 4.2 summarises the data shown in the previous figures. The data for the first two time periods (2010, 2020) are identical for all scenarios, and then the data for each of the three interventions are shown in the next three groups of four columns (2030-2060). Attributable deaths for lung cancer are predicted to decrease from 336 deaths in 2010 to 85 deaths for scenario 5 (full compliance with OEL of 0.1 mg/m^3), 49 deaths for scenario 4 (full compliance with OEL of 0.05 mg/m^3) and 26 deaths for scenario 3 (full compliance with OEL of 0.025 mg/m^3). Estimated attributable deaths for sinonasal cancer increase from 39 deaths in 2010 to 51 deaths for scenario 5 (full compliance with OEL of 0.1 mg/m^3), 50 deaths for scenario 4 (full compliance with OEL of 0.05 mg/m^3) and 49 deaths for scenario 3 (full compliance with OEL of 0.025 mg/m^3).

In Table 8.4.1 in Appendix 8.4 are the estimated proportions and numbers exposed above the OELs to be tested, currently and as estimated under the baseline forecast scenario (2). Under the alternative change scenarios they behave as determined by the scenarios.

Full results are given in Appendix 8.4 for men plus women by country in Table 8.4.3. A breakdown of attributable numbers by industry is in Table 8.4.5. Estimates of numbers of cancer registrations 'avoided' in each of the forecast target years from 2030 onwards relative to the baseline scenario can be obtained by subtraction. Data for men and women separately, and by industry within country, are available in supplementary spreadsheets (*Chromium Report data.xls)* if required.

Table 4.2 Results for intervention scenarios (3) to (5), total EU (27 countries), men plus women

Scenario	All scenarios		Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m^3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m^3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m^3			
EU Total	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Numbers ever exposed	3,516,219	3,625,337	3,753,120	3,822,184	3,847,407	3,872,920	3,753,120	3,822,184	3,847,407	3,872,920	3,753,120	3,822,184	3,847,407	3,872,920
Proportion of the population exposed	0.97%	0.95%	0.97%	0.97%	0.98%	1.01%	0.97%	0.97%	0.98%	1.01%	0.97%	0.97%	0.98%	1.01%
Lung cancer														
Attributable Fraction	0.12%	0.10%	0.08%	0.05%	0.02%	0.01%	0.08%	0.05%	0.02%	0.01%	0.08%	0.05%	0.03%	0.02%
Attributable deaths	336	334	295	206	95	26	295	210	109	49	295	217	132	85
Attributable registrations	368	362	314	214	97	26	314	219	112	50	314	226	135	86
'Avoided' cancer registrations			1	23	61	80	1	18	47	57	0	11	24	20
YLLs	5,164	4,981	4,206	2,780	1,229	328	4,208	2,840	1,413	617	4,212	2,936	1,706	1,077
DALYs	5,390	5,200	4,393	2,906	1,285	343	4,395	2,969	1,478	645	4,399	3,068	1,784	1,127
Sinonasal cancer														
Attributable Fraction	3.28%	3.13%	3.01%	2.78%	2.57%	2.52%	3.01%	2.78%	2.60%	2.56%	3.01%	2.80%	2.64%	2.68%
Attributable deaths	39	44	48	49	49	49	48	49	50	50	48	50	50	51
Attributable registrations	118	129	139	141	138	137	139	142	140	139	139	142	142	143
'Avoided' cancer registrations			0	2	6	8	0	2	5	6	0	1	2	2
YLLs	654	697	721	696	659	637	721	698	666	647	721	702	676	664
DALYs	881	866	915	892	853	833	915	896	867	854	881	866	914	889

4.1.2 Monetised health benefits

The possible health benefits (i.e. avoided healthcare costs and effects of having cancer and avoided life years lost) for the introduction of an EU-wide OEL at either 0.1 mg/m^3, 0.05 mg/m^3 or 0.025 mg/m^3 are shown in Table 4.3.

The change in cancer impacts over the first 30 years (2010-2040) are predominately the result of impacts from past exposure that are predicted to continue to occur in the future (these are relatively small).

The benefits of introducing an OEL in 2010 are most apparent from 2040 onwards. Table 4.3 shows that the most stringent OEL (0.025mg/m^3) results in the greatest health benefits. The impacts of introducing an OEL at 0.1 mg/m^3 are estimated to have limited benefits as there is already considered to be a reduction in exposure towards 0.1 mg/m^3 under the baseline scenario. The results are also illustrated in Figure 4.7.

Table 4.3 Health benefits of intervention over time (Present Value – 2010 €m prices)

Costs by Gender (€m)	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069	Totals
Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m^3							
Female	0	0 to 0	1 to 1	13 to 29	28 to 65	29 to 70	71 to 165
Male	0	0	3 to 9	69 to 200	151 to 443	159 to 477	382 to 1,129
Total	0	0	4 to 10	82 to 228	179 to 508	189 to 547	453 to 1,294
Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m^3							
Female	0	0	0 to 1	10 to 23	21 to 50	21 to 50	53 to 123
Male	0	0	3 to 7	55 to 159	115 to 338	113 to 339	286 to 843
Total	0	0	3 to 8	65 to 182	136 to 388	134 to 389	339 to 966
Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m^3							
Female	0	0	0 to 1	6 to 13	11 to 25	7 to 17	25 to 57
Male	0	0	2 to 4	33 to 94	58 to 170	40 to 119	132 to 388
Total	0	0	2 to 5	39 to 108	69 to 196	47 to 136	157 to 445

Notes:

- All costs are presented in present value using a discount rate of 4%
- Totals may not match to sums of females and male costs due to underlying small differences in raw data and rounding to nearest million

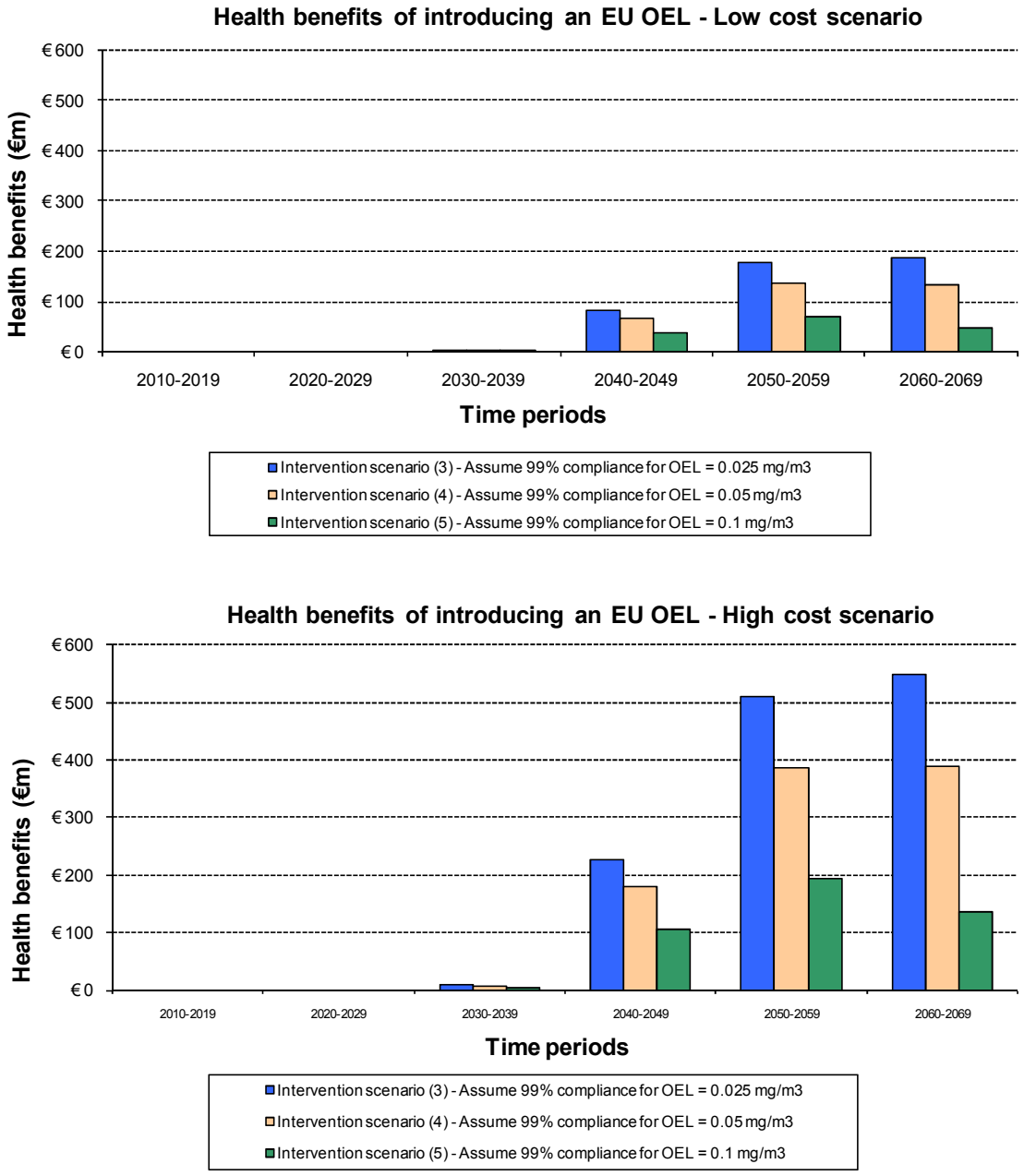


Figure 4.7 Health benefits over time of introducing an EU wide OEL (Present Value – 2010 €m prices)

These benefits will affect Member States differently depending upon the overall number of workers within affected industry groups, existing risk management measures and the proportion of males and females within these groups. The total benefits by Member State are shown in Figure 4.8 (low scenario) and Figure 4.9 (high scenario), where France, Germany, Italy, Poland, Spain and the UK are predicted to particularly benefit

from an OEL, assuming full compliance[22]. There seems to be a proportional relationship between Member States that would incur health costs and those that would benefit from the introduction of an EU-wide OEL. For instance, Figure 2.3 shows that Germany is predicted to have the highest health costs without further intervention (~€2bn in total under the low scenario) followed by Italy (~€1.4bn under the low scenario) and Figure 4.8 indicates that Germany is expected to benefit the most from the introduction of an EU-wide OEL (scenarios 3, 4 and 5), followed by Italy.

The monetised benefits of a proposed OEL for chromium are likely to affect men more than women given the industrial sectors most exposed to chromium. The industrial sector estimated to benefit most from a proposed OEL (and full compliance) is the manufacturing sector. There are notable impacts in the manufacture of fabricated metal products and the manufacture of machinery and equipment. This is shown in Figure 4.10 (low scenario) and Figure 4.11 (high scenario).

The Member State and industry groups that are predicted to benefit most from a revised OEL also vary at a gender level. This analysis is presented in Appendix 8.5.

[22] The assumption of full compliance is a standard assumption used in EU Impact Assessments.

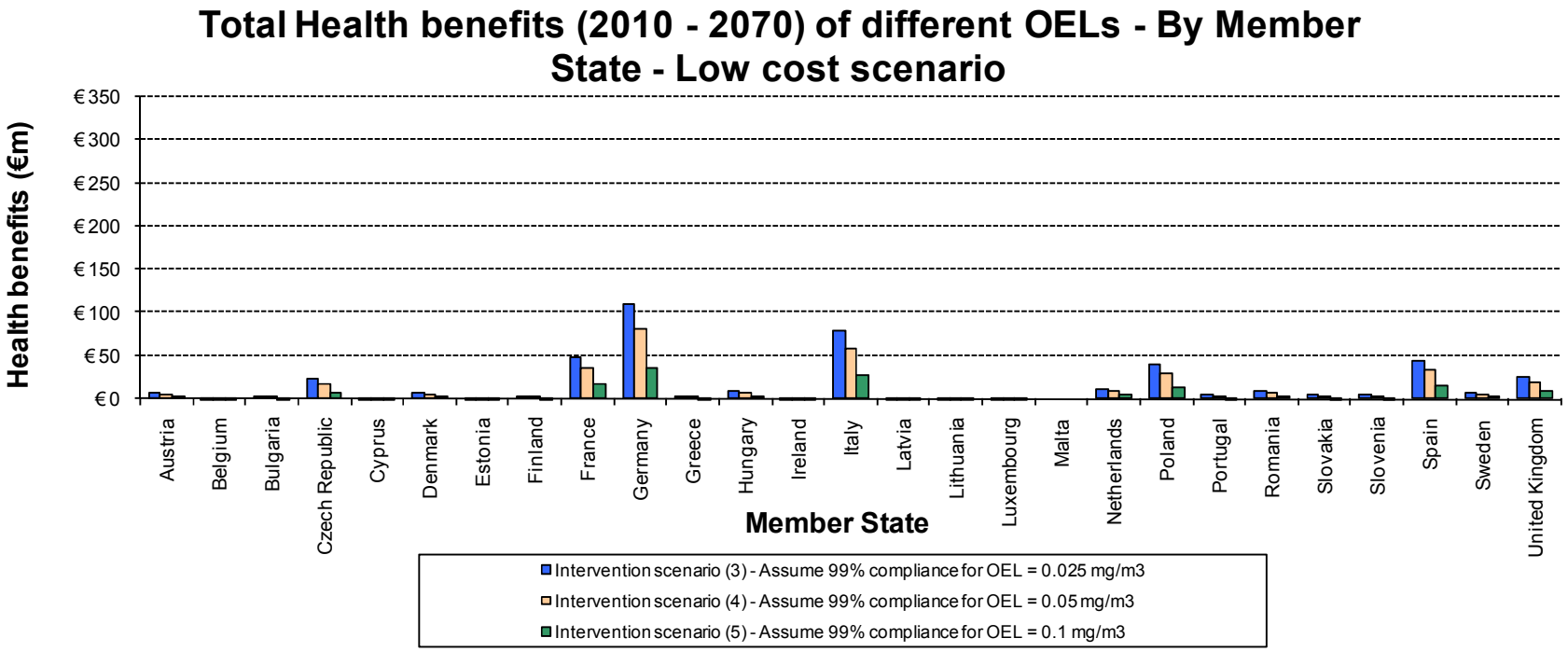


Figure 4.8 Total health benefits of introducing an EU-wide OEL – By Member State – Low Scenario (Present Value – 2010 €m prices)

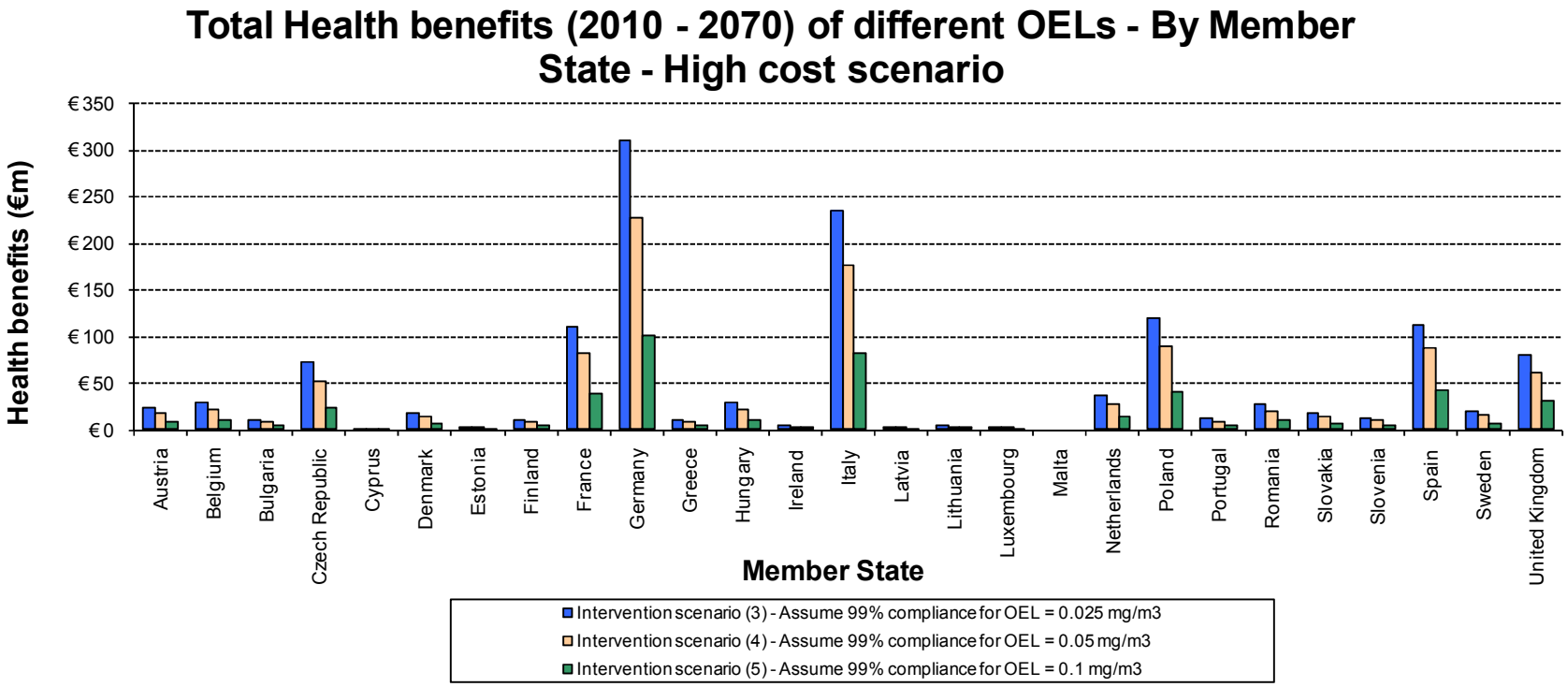


Figure 4.9 Total health benefits of introducing an EU-wide OEL – By Member State – High Scenario (Present Value – 2010 €m prices)

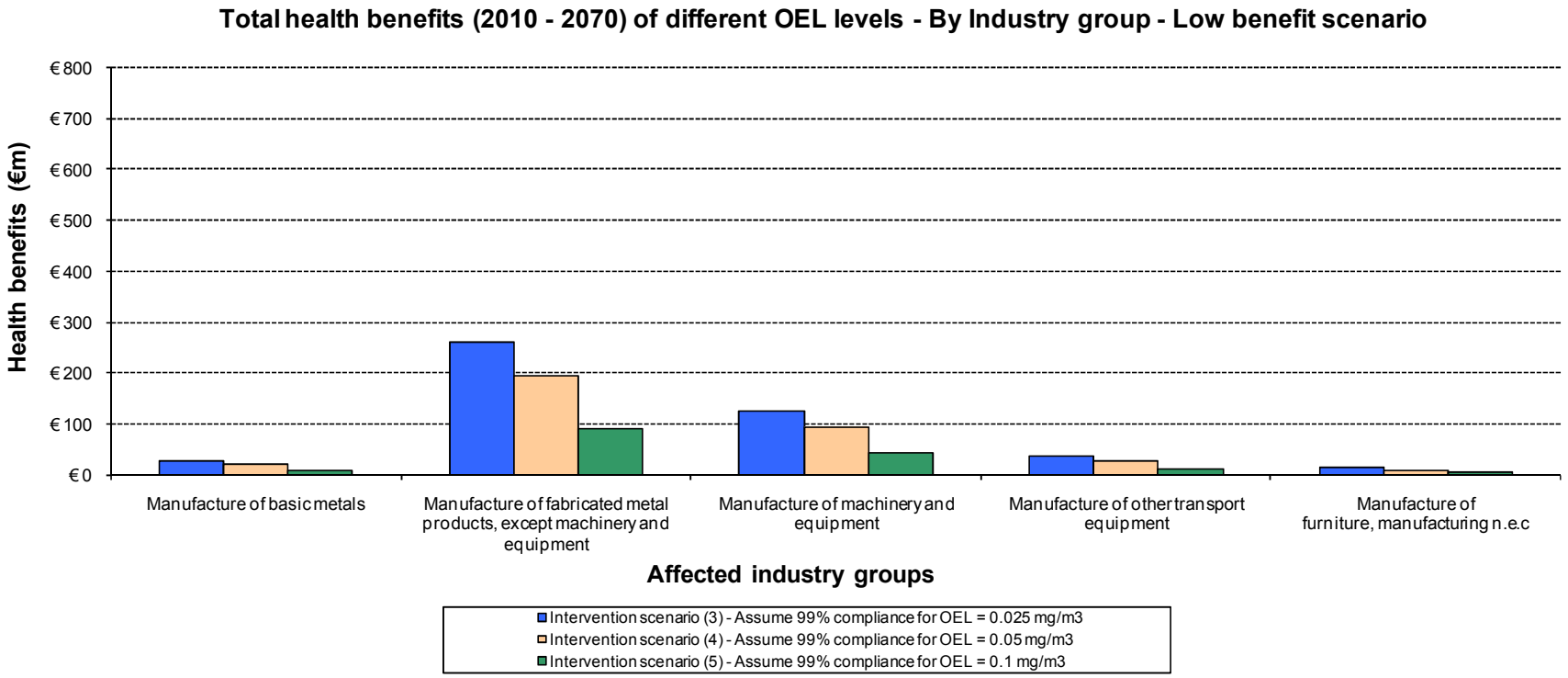


Figure 4.10 Total health benefits of introducing an EU-wide OEL – By Industry Group – Low Scenario (Present Value – 2010 €m prices)

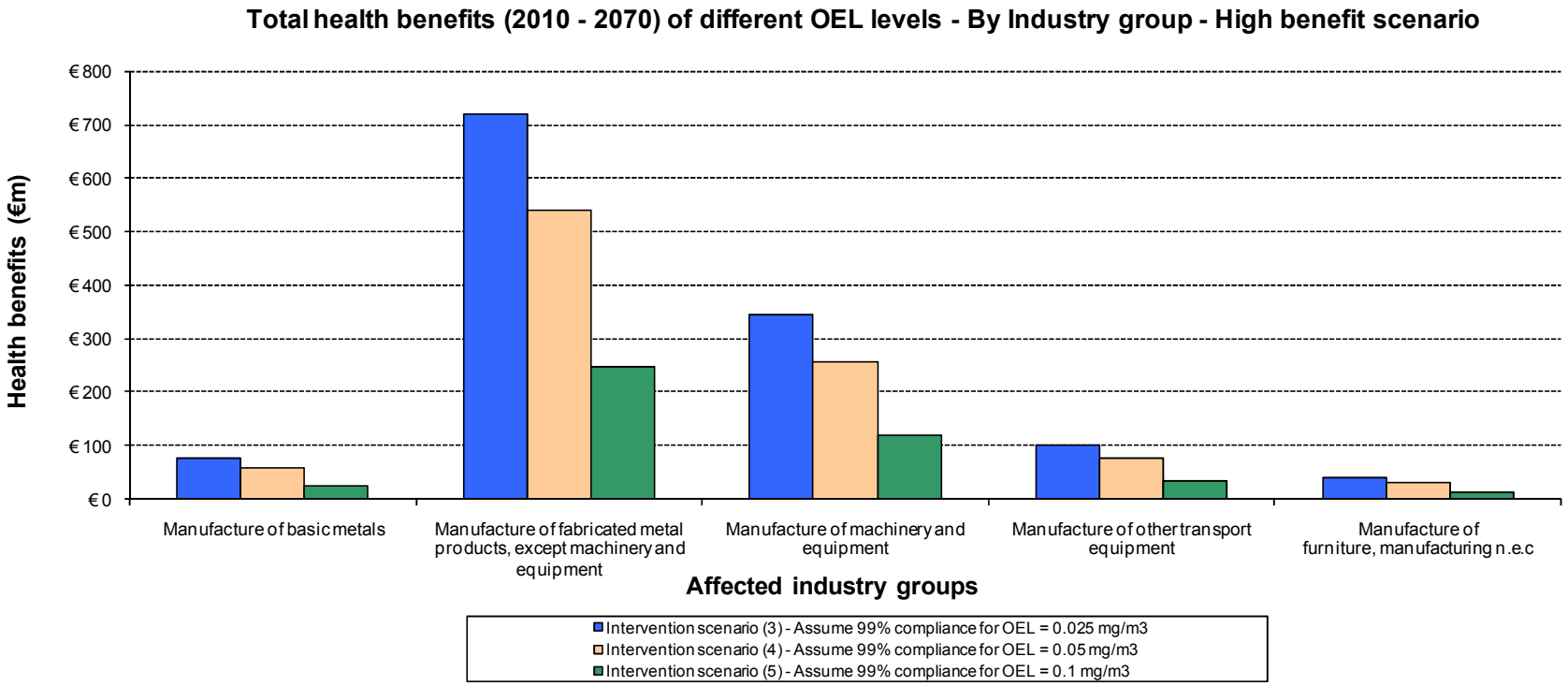


Figure 4.11 Total health benefits of introducing an EU-wide OEL – By Industry Group – High Scenario (Present Value – 2010 €m prices)

As with the baseline scenario, in order to present all costs and benefits consistently in present value terms, it is necessary to discount all future costs and benefits. This was done using the EU IA guidelines recommended 4% discount rate. Since most health impacts occur over a long period of time relative to costs, the impacts of discounting are significant. As a means of sensitivity testing, different discount rates are also used. The overall impact of discounting can be seen in:

- Figure 4.12 for introducing an OEL of 0.025mg/m^3 (Scenario 3)
- Figure 4.13 for introducing an OEL of 0.05mg/m^3 (Scenario 4)
- Figure 4.14 for introducing an OEL of 0.1mg/m^3 (Scenario 5)

Detailed tables are included in Appendix 8.6, with results presented using different discount rates.

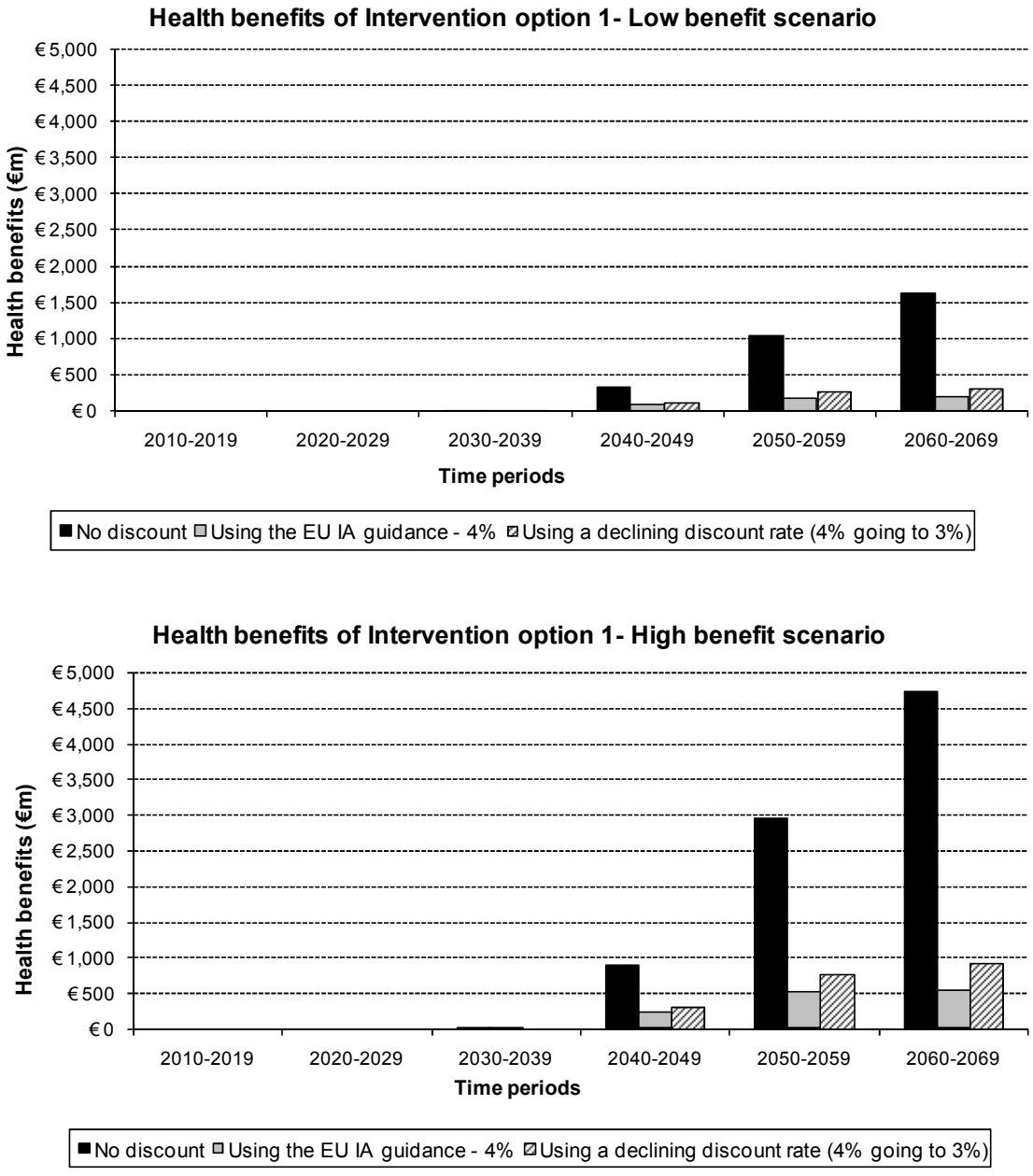


Figure 4.12 Impacts of discounting – Introducing an OEL of 0.025 mg/m^3

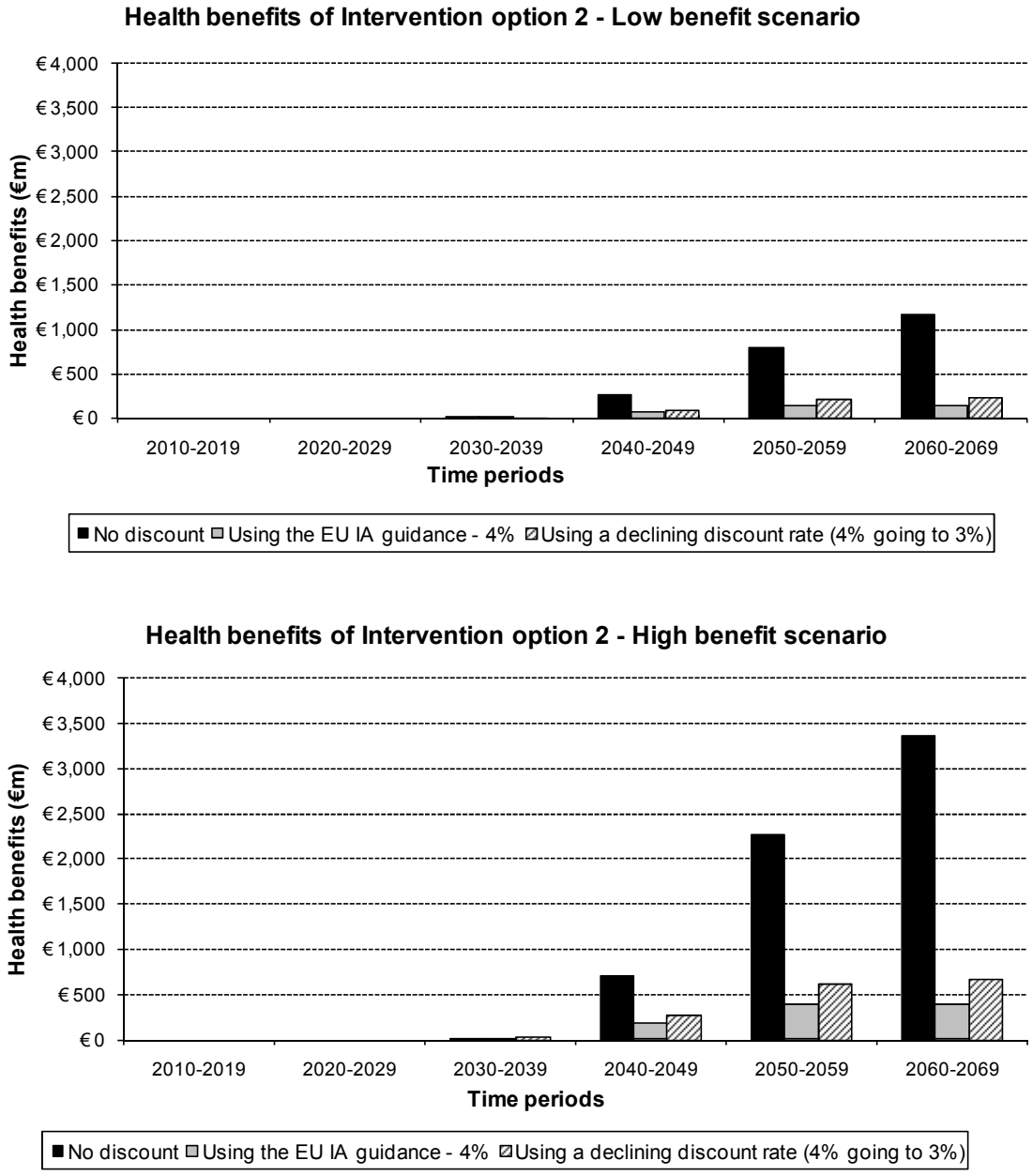


Figure 4.13 Impacts of discounting – Introducing an OEL of 0.05 mg/m^3

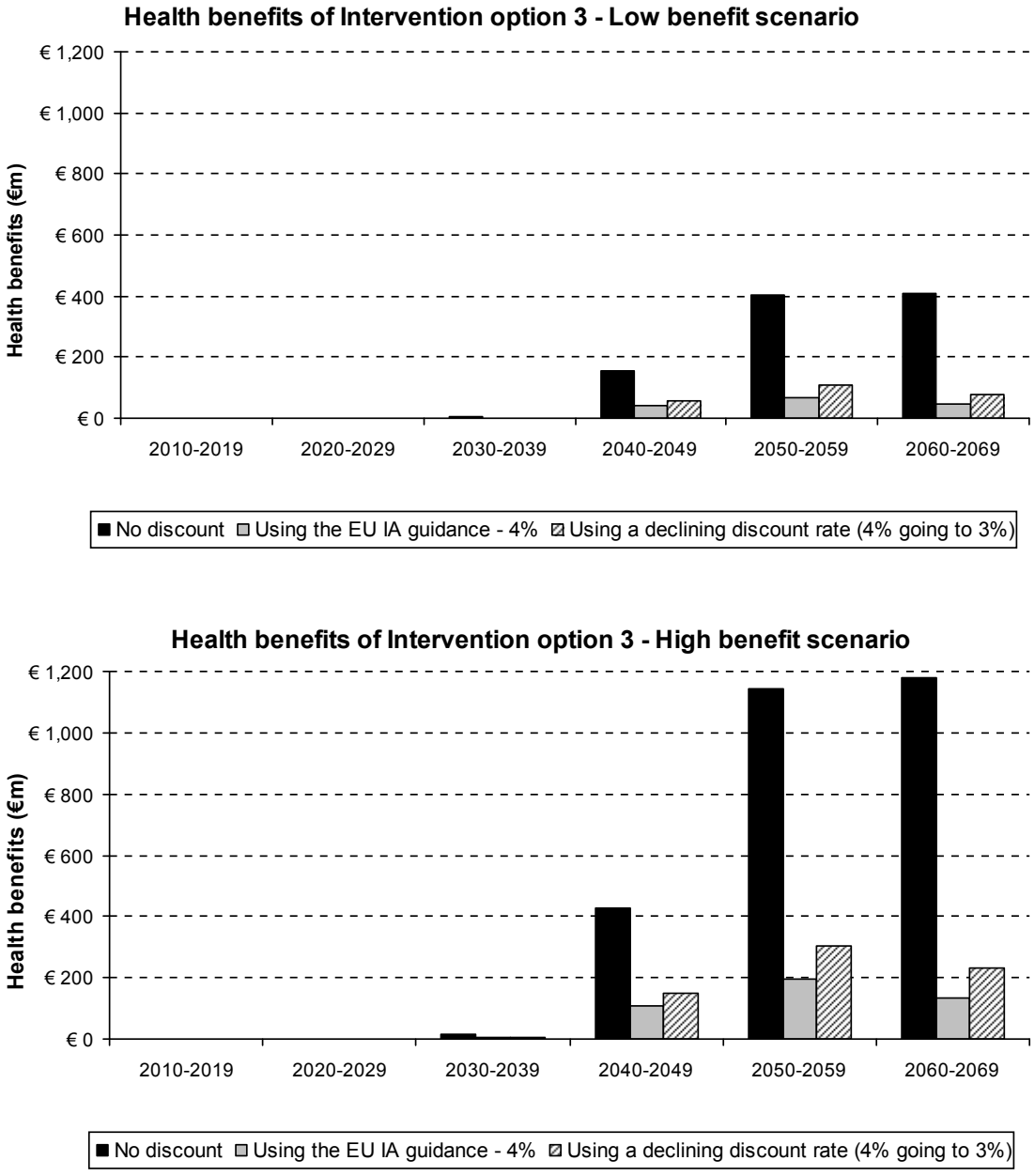


Figure 4.14 Impacts of discounting – Introducing an OEL of 0.1 mg/m^3

Since the benefits of introducing an EU-wide OEL are mostly realised from 2040, the level of discounting has a significant impact on the overall size of health benefits. A limitation is that the benefits of any risk management measures undertaken post 2040 will not be included in this study, since the benefits of these measures to reduce occupational exposure in 2040-2070 are unlikely to be realised until after 2070 (due to the lag period in the development of cancer) and impacts after 2020 are not estimated in this study.

4.2 ECONOMIC IMPACTS

4.2.1 Operating costs and conduct of business

Compliance costs

Based on exposure data presented in Section 2.3 it is reasonable to assume that:

- Most firms within affected industries would meet the most stringent proposed OEL (0.025mg/m^3) given that the estimated geometric mean (2010) is between 0.002-0.005mg/m^3.
- Some firms within affected industries would require further control measures to meet each proposed OEL given that estimated geometric standard deviations range from 3.8-14.

The mean exposure values have been used to simulate the exposure distribution across these industries revealing that exposures above the proposed OELs would be expected in all six sectors. It is estimated that the sector 'manufacture of basic metals' (NACE 27) has the fewest workers exposed at concentrations above the OEL, whilst the sector 'manufacture of other transport equipment' (NACE 35) has the most. This information has been used to help determine the percentages of enterprises that will comply with the proposed OELs (see Table 4.4).

Table 4.4 Estimated number of enterprises with exposure exceeding the proposed OELs in affected industries

Sector (NACE Code)	Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m^3			Intervention scenario (4) – Full compliance for OEL = 0.05 mg/m^3			Intervention scenario (5) – Full compliance for OEL = 0.1 mg/m^3		
	No. of workers affected	**No of. enterprises affected**	**No of. enterprises not affected**	**No. of workers affected**	**No of. enterprises affected**	**No of. enterprises not affected**	**No. of workers affected**	**No of. enterprises affected**	**No of. enterprises not affected**
Manufacture of chemicals and chemical products (24)	252,547	20,000	10,990	150,414	11,000	19,990	83,563	6,500	24.499
Manufacture of basic metals (27)	28,944	3,811	13,081	7,718	1,016	15,876	1,930	254	16,638
Manufacture of fabricated metal products (28)	429,252	73,025	326,484	242,448	41,246	358,263	123,211	20,961	378,548
Manufacture of machinery, except electrical (29)	394,102	63,107	110,806	222,594	35,644	138,269	113,122	18,114	155,799
Manufacture of other transport equipment (35)	253,186	43,101	125,168	179,943	30,632	143,281	121,168	20,627	153,286
Other manufacturing industries (36)	191,580	35,041	138,872	108,207	19,792	154,121	54,991	10,058	163,855
TOTALS	**1,549,611**	**238,085**	**725,401**	**911,324**	**139,330**	**829,800**	**497,985**	**76,514**	**868,150**
Proportion of total impacted (%)	**12%**	**27%**	**73%**	**7%**	**16%**	**84%**	**4%**	**9%**	**91%**

Notes: The number of EU enterprises are based on Eurostat classification of economic activities – NACE code (rev 1.1) 24, 27, 28, 29, 35, 36. The number of firms affected has been calculated using IOM estimated percentages of workers with exposures exceeding the proposed OELs and Eurostat data on size of firms.

It is estimated that an EU-wide OEL of 0.1mg/m^3 would affect only 9% of all enterprises in affected industries, whilst an OEL of 0.025mg/m^3 would affect just over a quarter of all enterprises (27%)

The Human Health Reduction Strategy for Chromates provides information on controls used in a variety of industries and processes to limit exposure to hexavalent chromium. General control measures used to limit exposure to hexavalent chromium include[23]:

- Enclosure of processes and separation of personnel;
- Dust suppression methods, such as the use of substances in tablet or pellet form;
- Local exhaust ventilation (LEV);
- Mist suppressants;
- Respiratory protective equipment (RPE);
- Protective personal equipment (PPE) (including full body suit or overalls; gloves, hat and shoes or disposable shoe coverlets; face shields or vented goggles);
- Housekeeping – Cleaning work surfaces and equipment is critical to prevent the spread of dust and fumes[24]; and
- Automation of certain operations (e.g. automated manufacturing process in the manufacture of pigment and dies).

The specific control measures required depend on the nature of the operations conducted. For instance, LEV is often not suitable for electroplating industries because during this process chromic acid is electrolysed leading to the formation of mists (fine droplets of electrolyte) across a wide area. Chroffels (plastic balls which float on the surface of the electrolyte) may be used to reduce mist formation but they are not as effective as mist suppressants[25]. Mist suppressants are commonly used in conjunction with fluorinated surfactants such as perfluorooctane sulfonate (PFOS). A wide ranging restriction applies to the use of PFOS (Annex XVII of REACH). However, a derogation currently applies to the use of PFOS in mist suppressants for non-decorative hard chromium (VI) plating, but the further implementation of such restrictions may result in chromium platers having to adopt alternative processes/operations and/or emissions control e.g. additional extract ventilation or the provision of greater tank enclosure[26].

Other production processes such as chromate production, welding, chrome pigment manufacture and spray painting may result in hexavalent chromium fumes and dusts that may be inhaled. Efficient ventilation is a common method used to reduce the risk of exposure. The two methods of ventilation used are dilution ventilation and LEV.

[23] HSE (2007) Human Health Risk Reduction Strategy for Chromates

[24] SAIF Corporation (2009) Hexavalent Chromium Safety Guides. Accessed here: http://www.saif.com/_files/SafetyHealthGuides/SS-835.pdf. Vacuuming by use of a HEPA (high efficiency particulate air filter) is the preferred method. Using compressed air for blowing hexavalent chromium dust from surfaces is not recommended.

[25] HSE (2007) Human Health Risk Reduction Strategy for Chromates

[26] RPA (2004) Risk Reduction Strategy and Analysis of Advantages and Drawbacks for Perfluorooctane Sulphonate (PFOS)

Dilution ventilation is the dilution of contaminated air with uncontaminated air. LEV is the most desirable method for removal of hexavalent chromium fumes and dust in the work place[27]. Local exhaust systems capture and remove process emissions at or close to their source of generation and prior to their escape into the workplace environment. Cost data for ventilation units are based on estimates from ventilation suppliers. Costs per unit for chromium processing industries are increased as exhaust equipment requires a high efficiency particulate air (HEPA) filter[28], which is more costly than a standard filter. The range of costs is shown in Table 4.5.

Table 4.5 Capital costs per enterprise for ventilation units for stationary LEV

	Stationary LEV
Capital Cost ('000)	€42 – 252
Annual Maintenance ('000)	€1
Annual Testing ('000)	€1 - 5
Filters changes every 5 years ('000)	€3
Total annualised cost* ('000)	€5.7 - 25

Notes: It is assumed that ventilation equipment last for 20 years and filters last 5 years.
Costs are based on a 4% discount rate as recommended by the EC IA guidelines (2009)

Appropriate personal protective equipment (PPE) and respiratory equipment (RPE) also have an impact on the magnitude of workplace exposure to hexavalent chromium fume and dust. There are not expected to be any significant costs associated with enclosure, housekeeping, RPE/ PPE, which in any case would be considered to be good practice. It is assumed that costs range between €1,000-2,000/year per enterprise (including costs of equipment and the cost of time spent of labour, e.g. cleaning, and administration).

This cost data has been used alongside the estimates of number of enterprises affected by the proposed OELs (Table 4.4) to estimate total compliance costs. We do not have sufficient information to determine more accurately which measures might be required to achieve each OEL. Therefore it is assumed that companies would tend to adopt techniques that are already applied in other parts of the industry in order to comply. We know that LEV is the most common method of control therefore it is assumed that LEV is the most cost-efficient measure to achieve the most stringent OEL. Compliance costs have been estimated based on the assumption that firms affected by the imposition of an EU-wide OEL would need to install an LEV system in order to comply. These costs are set out in Table 4.6.

[27] SAIF Corporation (2009) Hexavalent Chromium Safety guide. Accessed here: http://www.saif.com/_files/SafetyHealthGuides/SS-835.pdf

[28] Based on information from LEV suppliers such as Industrial Maid (website: www.industrial-maid.com/hex%20chromium.htm) and Industrial Air Solutions (website: www.industrialairsolutions.com/hexavalent-chromium-osha.htm)

Table 4.6 Costs of compliance (€bn in present value - €2010 prices)

Compliance route	Number of EU enterprises	Cost per enterprise over the period 2010-2069 (NPV in €k)		Total cost over the period 2010-2069 (NPV in €bn)	
		Low	High	Low	High
Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m^3					
No additional action required	641,269	-	-	-	-
Ventilation system required	238,084	€ 126k	€ 483k	€ 30bn	€ 115bn
Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m^3					
No additional action required	740,024	-	-	-	-
Ventilation system required for	139,329	€ 126k	€ 483k	€ 18bn	€ 67bn
Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m^3					
No additional action required	802,839	-	-	-	-
Ventilation system required	76,514	€ 126k	€ 483k	€9bn	€37bn

Notes: This takes into consideration that ventilation systems are assumed to be replaced every 20 years and filters every 5 years (except for years where new ventilation systems are purchased). Costs are based on a 4% discount rate as recommended by the EC IA guidelines (2009).

The number of EU enterprises are based on Eurostat classification of economic activities – NACE code (rev 1.1) 24, 27, 28, 29, 35, 36

As shown in Table 4.6 the total cost of compliance in present value terms (i.e. in today's price as Net Present Value, NPV) is estimated to be €9-37bn over the assessment period 2010-2069 for an OEL of 0.1mg/m^3. However, the total cost for the most stringent proposed OEL is estimated to be higher at €30-115bn.

Conduct of employers

As discussed in the section above it is perceived that the introduction of an EU-wide OEL will require certain enterprises to reorganise their workplace and implement additional control measures to ensure that exposure to airborne particulates is minimised. There may also be additional training required to ensure that employees minimise their exposure by adhering to good practice in order to reduce exposure (e.g. good personal hygiene and wearing protective clothing).

Potential for closure of companies

Table 4.4 shows that the vast majority of enterprises are not expected to need to take any further action to comply with a 0.1 or 0.05mg/m^3 OEL and are therefore unlikely to close down as a result of its introduction at the EU level.

However a significant proportion of enterprises (27%) would require further action to comply with a 0.025mg/m^3 OEL. It is assumed that these enterprises would need some

form of ventilation systems to comply. For those enterprises, there is a significant cost to consider (see Table 4.6). The estimated annualised cost varies from about €5.7k - 25k (Table 4.5), which is significant, but may not necessarily trigger a decision to close production. However, the up-front capital cost (i.e. not annualised over its lifetime) of a ventilation system is estimated to be in the region of €42k - 252k[29].

It is possible that some firms might be able to pass through additional costs in the form of higher prices for their final products since the OEL would be applied consistently across the EU. This should create a 'level playing field' for firms across the EU and reduce competitiveness distortions created by differences in OELs across the EU.

Using the average annual operating surplus for specific sectors available from Eurostat, it is possible to compare the initial capital cost of purchasing an LEV against the operating surplus to understand whether firms are likely to be able to afford to invest in a ventilation system (or obtain a loan at a competitive rate) or might opt to close the business or at least the part of their businesses that depends on the use of hexavalent chromium. Tables 4.7 - 4.11 show the operating surplus compared with the capital cost for LEV (the measure required to meet the OEL) for firms with different employee numbers for firms in affected sectors: manufacture of basic metals, manufacture of fabricated metal products, manufacture of machinery and equipment, manufacture of other transport equipment and other manufacturing industries respectively. Operating surplus is a measure of profitability of the enterprise prior to payment of interest and tax (i.e. pre-tax profit income). The average surplus varies considerably according to the number of employees.

Table 4.7 Manufacture of basic metals (NACE 27)

Size of Enterprise by number of employees:	Number of enterprises (%)	Average operating surplus (€)	Capital cost / operating surplus (%)
Between 1 & 9	59	63,415	66-397
Between 10 & 19	13	343,860	12-73
Between 20 & 49	10	748,599	6-34
Between 50 and 250	13	3,435,102	1-7
Greater than 250	4	44,460,553	0-1

Source: Eurostat classification of economic activities - NACE Rev.1.1. Summary of average Operating Surplus (Euros) per enterprise by Size of Enterprise (number of Employees). Capital cost % of operating surplus is based on data from Table 4.7. Data is for year 2006.

[29] Based on discussion with LEV suppliers

Table 4.8 Manufacture of fabricated metal products (NACE 28)

Size of Enterprise by number of employees:	Number of enterprises (%)	Average operating surplus (€)	Capital cost / operating surplus (%)
Between 1 & 9	80	8,196	512 - 3075
Between 10 & 19	11	37,500	112 – 672
Between 20 & 49	6	71,883	58 - 351
Between 50 and 250	3	376,858	11 – 67
Greater than 250	0	7,539,299	1 – 3

Source: Eurostat classification of economic activities - NACE Rev.1.1. Summary of average Operating Surplus (Euros) per enterprise by Size of Enterprise (number of Employees). Capital cost % of operating surplus is based on data from Table 4.7. Data is for year 2006.

Table 4.9 Manufacture of machinery and equipment (NACE 29)

Size of Enterprise by number of employees:	Number of enterprises (%)	Average operating surplus (€)	Capital cost / operating surplus (%)
Between 1 & 9	74	44,914	94-561
Between 10 & 19	11	209,163	20 -120
Between 20 & 49	8	497,985	8 - 51
Between 50 and 250	6	1,725,069	2 - 15
Greater than 250	1	14,144,019	0 - 2

Source: Eurostat classification of economic activities - NACE Rev.1.1. Summary of average Operating Surplus (Euros) per enterprise by Size of Enterprise (number of Employees). Capital cost % of operating surplus is based on data from Table 4.7. Data is for year 2006.

Table 4.10 Manufacture of other transport equipment (NACE 35)

Size of Enterprise by number of employees:	Number of enterprises (%)	Average operating surplus (€)	Capital cost / operating surplus (%)
Between 1 & 9	80	25,582	164-985
Between 10 & 19	8	105,442	40-239
Between 20 & 49	6	402,668	10-63
Between 50 and 250	5	1,077,162	4-23
Greater than 250	2	20,398,641	0-1

Source: Eurostat classification of economic activities - NACE Rev.1.1. Summary of average Operating Surplus (Euros) per enterprise by Size of Enterprise (number of Employees). Capital cost % of operating surplus is based on data from Table 4.7. Data is for year 2006.

Table 4.11 Other manufacturing industries (NACE 36)

Size of Enterprise by number of employees:	Number of enterprises (%)	Average operating surplus (€)	Capital cost / operating surplus (%)
Between 1 & 9	89	19,386	217-1300
Between 10 & 19	6	132,983	32-189
Between 20 & 49	3	277,789	15-91
Between 50 and 250	1	828,326	5-30
Greater than 250	0	4,381,170	1-6

Source: Eurostat classification of economic activities - NACE Rev.1.1. Summary of average Operating Surplus (Euros) per enterprise by Size of Enterprise (number of Employees). Capital cost % of operating surplus is based on data from Table 4.7. Data is for year 2006.

Tables 4.7 – 4.11 indicate that the costs of capital as a percentage of annual profits are relatively small for those companies employing more than 250 people. However, the costs of capital as a percentage of annual profits are substantial for those employing fewer than 50 people. For those firms employing fewer than 10 people the costs of capital is, in some instances, more than one year's profit.

For affected small and medium sized enterprises (i.e. those SMEs that do not already have a ventilation system) it is likely to be very difficult to finance investment in a ventilation system using profits and given the size of capital required. Therefore, for affected SMEs the costs could be sufficiently high to force these companies to shut down or stop using hexavalent chromium compounds. The 'manufacture of fabricated

metal products' sector is expected to have notable health impacts (see Figure 4.10 and Figure 4.11) and Table 4.8 indicates that this sector is composed largely of SMEs and so may be at particular risk in complying with the OEL.

Potential impacts for specific types of companies

As indicated in Table 4.7 – 4.11, SMEs are likely to be particularly affected by an EU-wide OEL. A study conducted by the UK Health and Safety Executive (HSE) supports this argument. They found that there are wide variations in the use of control measures between companies[30]. Small companies were thought to be at particular risk of lacking adequate control especially in the manufacture of pigments and dyes, the formulation of metal treatment products electroplating and wool dyeing. An inspection of 29 chrome plating facilities in the UK found that those that used hexavalent chromium were considered to not be adequately controlling the risks and most were not complying with the relevant legislation. It was found that none of the chrome platers visited had adequate systems in place for monitoring, health surveillance or exposure control.

Companies that require ventilation systems and do not already have one will be affected more than other firms.

Administrative costs to employers and public authorities

The following table (Table 4.12) describes the administrative burden to employers already subject to the Carcinogens Directive but will now incur costs of introducing an EU wide OEL on to Annex III.

[30] HSE (2007) Human Health Risk Reduction Strategy for Chromates

Table 4.12 Administrative burdens to employers

Type of administrative cost	Relevant article(s)	Type of cost	Significance
1. Change in practice to use closed systems when using the substance.	5 – Prevention and reduction of exposure	These costs are already estimated in the cost of compliance section - This will only affect those firms that do not have or use closed systems	Estimated elsewhere
2. Develop/update health and safety and best practice guidance for: ○ Minimising use and exposure to workers to the substance ○ Redesign work processes and engineering controls to avoid/minimise release of carcinogens or mutagens ○ Hygiene measures, in particular regular cleaning of floors, walls and other surfaces ○ Information for workers ○ Warnings and safety signs ○ Drawing up plans to deal with emergencies likely to result in abnormally high exposure	5 – Prevention and reduction of exposure 7 – Unforeseen exposure 8 – Foreseeable exposure 9 – Access to risk areas 10 – Hygiene and individual protection	Firms will already have been required to develop/update health and safety and best practice guidance. The guidance and procedures may be required to be updated as control measures may change in light of a more stringent OEL. Some firms may need to redesign work practices to minimise exposure to workers and the number of workers exposed. The costs of implementing controls on exposure (such as LEV or PPE) are already estimated in the costs of compliance section.	Low
3. Additional costs of training new and existing staff in line with requirements of the Directive 4. Additional costs of making information available to employees 5. Consultation with employees on compliance with the Directive	11 – Information and training of workers 12 – Information for workers 13 – Consultation and participation with workers	Firms will already have been required to ensure training and adequate aware of risks and control measures to reduce/minimise exposure. Largely one-off cost if the revised OEL requires a change in control measures/working practice.	Low

Note: Readers should consult the Directive for the official wording around specific requirements. This table provides only a summary of what are perceived to be the most significant administrative requirements of the Directive. Grading of the significance of impacts is subjective and is based on professional judgement.

The following table (Table 4.13) describes the administrative burden to competent authorities already enforcing the Carcinogens Directive but will now incur costs of introducing an EU wide OEL on to Annex III.

Table 4.13 Administrative burdens to Competent Authorities

Type of administrative cost	Relevant article(s)	Type of cost	Significance
1. Communication with the Commission on provisions in national law to enforce the revised OEL. 2. Time and costs of implementing revised OEL into national law (consultation process)	19 – Notifying the commission 20 – Repeal	Largely one-off cost of transposing the revised OEL into national law	Low - Medium (one-off cost)

Note: Readers should consult the Directive for the official wording around specific requirements. This table provides only a summary of what are perceived to be the most significant administrative requirements of the Directive. Grading of the significance of impacts is subjective and is based on professional judgement.

4.2.2 Impact on innovation and research

The average expenditure per enterprise on research and development (R&D) based on Eurostat data for each sector group is:

- Manufacture of basic metals (NACE 27) - €43,150
- Manufacture of fabricated metal products, except machinery and equipment (NACE 28)- €3,735
- Manufacture of machinery and equipment (NACE 29)- €61,022
- Manufacture of other transport equipment (NACE 35) - €206,538
- Other manufacturing industries (NACE 36) - €1,815

According to Eurostat, there is a total of 182,681 personnel (from five sector groups combined) involved in R&D which accounts for 2% of the total number of people employed in the five sector groups. Given that the industry is predominately made up of smaller companies (employing fewer than 10 people) it is considered likely that these companies would tend to adopt products and techniques that are already being applied within other parts of the industry in order to comply with an EU-wide OEL. An EU-wide OEL could, however, be expected to increase the dissemination of improved technologies and production methods[31]. The potential volume of ventilation systems being required across the EU may also simulate investment in R&D to produce more cost-effective systems.

[31] There is insufficient information available to assess if this has occurred in Member States when OELs have been introduced at a national level

4.2.3 Macroeconomic impact

Chromium is mined as chromite ($FeCr_2O_4$) ore. World resources are estimated as greater than 12 billion tonnes of shipping-grade chromite[32]. About 95% of the world's chromium resources are geographically concentrated in Kazakhstan and southern Africa. Total world production of chromium in 2009 was about 23,000 tonnes. Demand for chromium chemicals has declined in recent years; as environmental concerns have seen tightening legislation limit its use in the two main end-uses, leather tanning and metal finishing.

Based on Eurostat data the five sector groups spent approximately €146bn in 2007 on goods and services within the EU economy. This compares to the total GDP in the EU of €12,305 billion in 2007 and so is considered to be a significant contribution to the EU economy.

Short term spending on risk management measures may also be good for the economy as equipment manufacturers (ventilation systems and mist suppressants), installers and others will benefit with money flowing through the economy, if the alternative is that profits are retained (by shareholders or the company and not spent e.g. on R&D, meaning the wider economy would not benefit from increased spending).

With fewer life years lost and cancer registrations, there should be a benefit to the economy through avoided loss of output and consumption in the future (post 2040), for example due to greater productivity from fewer sick days as well as greater consumption due to fewer premature deaths and greater taxes raised.

4.3 SOCIAL IMPACTS

4.3.1 Employment and labour markets

As demonstrated in Section 4.2 and in Tables 4.7 – 4.11 there appears to be a disproportionate burden on SMEs since they make up a large proportion of the affected firms in the affected sectors - according to the ratio of costs to operating surplus the fitting of the equipment in order to achieve the OEL is not financially feasible for these companies.

The use of ventilation systems for some enterprises would require behavioural change amongst workers and employees to ensure that, once installed, ventilation systems are being correctly used and maintained. This may require updating health and safety training.

There are not expected to be any noticeable changes to jobs skills, patterns or the numbers of workers required as a result of using of ventilation systems. In terms of working conditions, the use of mechanical local ventilation may be better for workers than natural ventilation as air change rates and flow can be controlled, and thermal environmental conditions maintained at more acceptable levels. One of the disadvantages of using mechanical ventilation is heat loss, especially in colder regions. If the mechanical ventilation includes a heat exchanger with high efficiency, this might

[32] Available at: http://minerals.usgs.gov/minerals/pubs/commodity/chromium/

typically reduce the ventilation heat loss by 80-90% and the total heat loss by 30-60%, depending on the insulation level[33].

4.3.2 Changes in end products

The proposed OEL is not expected to result in any changes to end products using hexavalent chromium

4.4 ENVIRONMENTAL IMPACTS

The five hexavalent chromium compounds[34] that were assessed under the Existing Substances Regulation (Council Regulation (EEC) No 793/93) are classified as dangerous to the environment N R50/53 *Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment* (under the provisions of 2004/73/EC 29th adaptation to the technical progress of Directive 67/548/ EEC).

In the European Risk Assessment Report (RAR) a risk to the environment was identified for a number of uses of hexavalent chromium compounds, Table 4.14 below shows the risk to the environment and sectors that are relevant to this study (i.e. sectors that were identified to have a high prevalence of exposure for workers).

Table 4.14 Risks to environmental compartments from uses in high exposure sectors

Sector/use[2]	**Environmental Compartment – Risk indicated: ✓ = risk identified in RAR**[1]		
	Aquatic	**Terrestrial**	**Wastewater**
NACE - Manufacture of chemical and chemical products RAR - Chrome III oxide production	✓	✓	✓
RAR – Metal treatment formulation	✓	✓	✓
NACE - Manufacture of fabricated metal products, except machinery and equipment RAR- Metal treatment – electroplating/passivating anodising/brightening	✓	✓	✓

Notes: 1 European Union Risk Assessment Report chromium trioxide, sodium chromate, sodium dichromate, ammonium dichromate and potassium dichromate CAS-No.: 1333-82-0, 7775-11-3, 10588-01-9, 7789-09-5 and 7778-50-9 EINECS-No.: 215-607-8, 231-889-5, 234-190-3,232-143-1 and 231-906-6. European Communities, 2005
2 The NACE sector descriptors are used in this report, the uses described in the EU RAR assessment of risks to the environment are more specific, where possible these have been matched for the purposes of this table only.

[33] "Mechanical ventilation with heat recovery in cold climates" - http://web.byv.kth.se/bphys/reykjavik/pdf/art_157.pdf. (Note that this is in relation to housing rather than industrial buildings.)

[34] Sodium chromate, sodium dichromate, potassium dichromate, ammonium dichromate and chromium trioxide

A 'risk reduction strategy' (RRS) was conducted by the rapporteur for the substances conducted under Council Regulation (EEC) No 793/93, in this case Defra for the UK[35]. The RRS is a risk management phase of the risk assessment and considers the controls in place for the identified risks (in this case to the environment) as well as the need to additional controls to manage the risks that are not already controlled by existing measures. For the risks identified above, the risk reduction strategy reports that sufficient controls are in place to control aerial emissions and that for emissions to water for specific sites, methods are employed to remove chromium prior to discharge.

The risk reduction strategy recommends that for IPPC regulated plants the possible risk to the aquatic environment at local scale[36] is taken into account in the issuing of permits by Member State competent authorities. In addition the RRS recommends that the review of priority substances under the Water Framework Directive (2008/150/EC) considers whether an environment quality standard (EQS) should be set for hexavalent chromium compounds (chromium trioxide was considered but has not been taken forward) and also that where relevant Member States should identify pollution reduction programmes for chromium.
The RRS reports that all but two EU Member States have emission limit values for hexavalent chromium to water that range from 0.1 to 1 mg/l, with those in the metal finishing sector ranging from 0.05 to 0.5 mg/l (11 Member States reporting).

It is considered that the controls in place to control environmental emissions are sufficient to control the potential risk to the environment. Any additional releases of hexavalent chromium as a result of additional controls on workplace exposure should not lead to increased risk for the environment.

5 COMPARISON OF OPTIONS

The main identified impacts of introducing an OEL of 0.1 or 0.05 or 0.025 mg/m^3 are shown in the tables below.

[35] Environmental Risk Reduction Strategy and Analysis of the Advantages and Drawbacks for Hexavalent Chromium. Risk and Policy Analysis for DEFRA, October 2005
[36] As noted in the RRS, CrVI releases into the environment from any source is expected to be reduced to CrIII in most situations in the environment; therefore the impacts of CrVI is likely to be limited to the local environment around the source.

Table 5.1 Comparison of heatlh impacts by scenario (Present Value – 2010 €m prices)

Type of impact	Baseline scenario		Introduce OEL=0.1 mg/m^3		Introduce OEL=0.05 mg/m^3		Introduce OEL=0.025 mg/m^3	
	Costs	**Benefits**	**Costs**	**Benefits**	**Costs**	**Benefits**	**Costs**	**Benefits**
Health	As set out in section **Error! Reference source not found.**, the health costs of cancer (l lung cancer and sino-nasal cancers) over the period 2010-70 are estimated to be: • Females: €1.6 – 4.7bn • Males: €7 –22bn • Total: €8.6-27bn This range takes into consideration tangible costs (e.g. lost income, lost output from reduced productivity, medical costs, life years lost) and intangible costs (e.g. emotional and physical suffering from having cancer). A large proportion of costs occurs prior to 2030 and is the result of past exposure. This is unlikely to change significantly with further invention.	It is assumed that exposures fall by 7% per year in the future, continuing the historical trend in reduced exposure. Therefore there is expected to be a significant reduction in health costs going forward in the absence of further regulatory intervention.	None - There is expected to be a cost saving from avoided health care and reduced cost of illness due to reductions in cancer registrations. This has been estimated as a benefit.	The benefits of introducing an OEL in 2010 are most apparent from 2040 onwards. It was also found that the monetised benefits are likely to affect men more than women given the industrial sectors most exposed to hexavalent chromium. The monetised benefits were estimated as: • Females: €25-57m • Males - €132-388m • Totals - €157-445m The impacts of introducing an OEL at 0.1 mg/m^3 are estimated to have limited benefits as there is already estimated to be a reduction towards 0.1 mg/m^3 and below under the baseline scenario.	None - There is expected to be a cost saving from avoided health care and reduced cost of illness due to reductions in cancer registrations. This has been estimated as a benefit.	The benefits of introducing an OEL in 2010 are most apparent from 2040 onwards. It was also found that the monetised benefits are likely to affect men more than women given the industrial sectors most exposed to hexavalent chromium. The monetised benefits were estimated as: • Females: €53-123m • Males - €286-843m • Totals - €339-966m	None - There is expected to be a cost saving from avoided health care and reduced cost of illness due to reductions in cancer registrations. This has been estimated as a benefit.	The benefits of introducing an OEL in 2010 are most apparent from 2040 onwards. It was also found that the monetised benefits are likely to affect men more than women given the industrial sectors most exposed to hexavalent chromium. The monetised benefits were estimated as: • Females: €71-165m • Males - €382-1,129m • Totals - €453-1,294m These results show that introducing an OEL at 0.025 mg/m^3 would result in the greatest health benefits of all three proposed EU-wide OELs.

Table 5.2 Comparison of economic impacts by scenario (Present Value – 2010 €m prices)

	Baseline scenario		Introduce OEL=0.1 mg/m^3		Introduce OEL=0.05 mg/m^3		Introduce OEL=0.025 mg/m^3	
Type of impact	**Costs**	**Benefits**	**Costs**	**Benefits**	**Costs**	**Benefits**	**Costs**	**Benefits**
Economic	It is assumed that exposures will fall by 7% per year in the future. Therefore, there are expected to be some costs to firms where hexavalent chromium exposure requires firms to put into place ventilation measures to reduce inhalation exposure. These would occur regardless of further intervention over the period 2010-2070.	-	It is estimated that 9% of enterprises will require some form of control measure to meet the proposed OEL. The remainder are assumed to already be meeting the proposed OEL and therefore will require no further action. It is assumed that the majority of those that cannot comply will require ventilation systems to reduce exposure levels to meet the OEL. Cost per enterprise over the period 2010-2069 (NPV) is estimated at: • No additional action: €0 • New ventilation system: €126-483k The total costs over the period 2010-2069 (NPV) is estimated at between €9-37bn.	Having an EU-wide OEL should remove any EU competitive distortions between EU Member States with different OELs.	It is estimated that 16% of enterprises will require some form of control measure to meet the proposed OEL. The remainder are assumed to already be meeting the proposed OEL and therefore will require no further action. It is assumed that the majority of those that cannot comply will require ventilation systems to reduce exposure levels to meet the OEL. Cost per enterprise over the period 2010-2069 (NPV) is estimated at: • No additional action: €0 • New ventilation system: €126-483k The total costs over the period 2010-2069 (NPV) is estimated at between €18-67bn.	Having an EU-wide OEL should remove any EU competitive distortions between EU Member States with different OELs.	It is estimated that 27% of enterprises will require some form of control measure to meet the proposed OEL. The remainder are assumed to already be meeting the proposed OEL and therefore will require no further action. It is assumed that the majority of those that cannot comply will require ventilation systems to reduce exposure levels to meet the OEL. Cost per enterprise over the period 2010-2069 (NPV) is estimated at: • No additional action: €0 • New ventilation system: €126-483k The total costs over the period 2010-2069 (NPV) is estimated at between €30-115bn.	Having an EU-wide OEL should remove any EU competitive distortions between EU Member States with different OELs.

Table 5.3 Comparison of social impacts by scenario

	Baseline scenario		Introduce OEL=0.1 mg/m^3		Introduce OEL=0.05 mg/m^3		Introduce OEL=0.025 mg/m^3	
Type of impact	**Costs**	**Benefits**	**Costs**	**Benefits**	**Costs**	**Benefits**	**Costs**	**Benefits**
Social	It is assumed that exposures will fall by 7% per year in the future. Therefore, there are expected to be some costs to firms where hexavalent chromium exposure requires firms to put into place ventilation measures. These are likely to be firms who can afford ventilation systems which minimises the risks of plant closures under the baseline scenario.	In terms of working conditions, the use of mechanical local ventilation may be better for workers than natural ventilation as air change rates and flow can be controlled, and thermal environmental conditions maintained at more acceptable levels.	It is estimated that an EU-wide OEL of 0.1mg/m^3 would affect only 9% of all enterprises in affected industries (~76,500 enterprises). However, there appears to be a disproportionate burden on SMEs - according to the ratio of costs to operating surplus the fitting of the equipment in order to achieve the OEL is not financially feasible. The up-front capital cost of a ventilation system is estimated to be in the region of €42k - 252k. This is likely to be a significant cost, which may potentially result in those companies stopping their use of chromium or forcing the closure of some companies, if they are dependent upon the use of hexavalent chromium.	In terms of working conditions, the use of mechanical local ventilation may be better for workers than natural ventilation as air change rates and flow can be controlled, and thermal environmental conditions maintained at more acceptable levels.	It is estimated that an EU-wide OEL of 0.05mg/m3 would affect 16% of all enterprises in affected industries (~139,000 enterprises). however there appears to be a disproportionate burden on SMEs - according to the ratio of costs to operating surplus the fitting of the equipment in order to achieve the OEL is not financially feasible. The up-front capital cost of a ventilation system is estimated to be in the region of €42k - 252k. This is likely to be a significant cost, which may potentially result in those companies stopping their use of chromium or forcing the closure of some companies, if they are dependent upon the use of hexavalent chromium.	In terms of working conditions, the use of mechanical local ventilation may be better for workers than natural ventilation as air change rates and flow can be controlled, and thermal environmental conditions maintained at more acceptable levels..	It is estimated that an EU-wide OEL of 0.025mg/m3 would affect nearly one quarter of all enterprises in affected industries (~238,000 enterprises). However, there appears to be a disproportionate burden on SMEs - according to the ratio of costs to operating surplus the fitting of the equipment in order to achieve the OEL is not financially feasible. The up-front capital cost of a ventilation system is estimated to be in the region of €42k - 252k. This is likely to be a significant cost, which may potentially result in those companies stopping their use of chromium or forcing the closure of some companies, if they are dependent upon the use of hexavalent chromium.	In terms of working conditions, the use of mechanical local ventilation may be better for workers than natural ventilation as air change rates and flow can be controlled, and thermal environmental conditions maintained at more acceptable levels.

Table 5.4 Comparison of environmental impacts by scenario

Type of impact	Baseline scenario		Introduce OEL=0.1 mg/m^3		Introduce OEL=0.05 mg/m^3		Introduce OEL=0.025 mg/m^3	
	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits
Environmental	It is considered that the controls in place to control environmental emissions are sufficient to control the potential risk to the environment.		Any additional releases of hexavalent chromium as a result of additional controls on workplace exposure should not lead to increased risk for the environment.					

Table 5.5 Comparison of macro-economic impacts by scenario

Type of impact	Baseline scenario		Introduce OEL=0.1 mg/m^3		Introduce OEL=0.05 mg/m^3		Introduce OEL=0.025 mg/m^3	
	Costs	Benefits	Costs	Benefits	Costs	Benefits	Costs	Benefits
Macroeconomic	Based on Eurostat data the five sector groups spent approximately €146bn in 2007 on goods and services within the EU economy. This compares to the total GDP in the EU of €12,305 billion in 2007 and so is considered to be a significant contribution to the EU economy.		Since compliance with an OEL would not involve changing the current manufacturing process there is unlikely to be any significant change to macro-economic impacts.					

6 CONCLUSIONS

We estimate that in 2010 in the EU there will be about 336 deaths from lung cancer and a similar number of registrations that might be attributable to past workplace exposure to hexavalent chromium, which corresponds to about 0.12% of all lung cancer deaths. We estimate that there will also be about 118 registrations and 39 deaths from sinonasal cancers that might be attributable to past exposure to hexavalent chromium, which corresponds to about 3.3% of all sinonasal cancer deaths. If no specific actions are taken to workplace reduce exposure to hexavalent chromium, the predicted numbers of lung cancer and sinonasal cancer deaths in 2060 would be 105 and 95 respectively. The increased number of sinonasal cancer deaths reflects the increasing prevalence of this type of cancer in the general population. The introduction of an OEL of 0.025, 0.05 or 0.1 mg/m^3 would lead to reductions in the number of lung cancer registrations in 2060 of 80, 57 or 20 respectively and reductions in the number of sinonasal registrations of 8, 6 and 2 respectively.

The total net health benefits from setting an OEL at 0.1 mg/m^3 are estimated to be between €157m and €445m, compared with benefits of between €339m and €966m associated with an OEL of 0.05 mg/m^3 or benefits of between €453m and €1,294m associated with an OEL of 0.025 mg/m^3. The associated compliance costs are estimated to be €7bn to €37bn, €18bn to €67bn and €30bn to €115bn respectively. It is estimated that the proportion of enterprises that will require additional control measure to meet the proposed OELs of 0.1, 0.05 and 0.025 mg/m^3 is 9, 16 and 27% respectively. The costs of achieving any of the proposed OELs greatly exceed the estimated benefits, but the cost/benefit ratio is most favourable for a proposed OEL of 0.05 mg/m^3.

We consider that the costs of compliance with the OEL will disproportionately affect small firms employing less than 20 people, particularly in the manufacture of fabricated metal products where 91% of businesses fall into this category. It is possible that some could either close or cease to use hexavalent chromium containing components.

There are no significant environmental impacts foreseen.

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8 APPENDIX

8.1 ESTIMATED NUMBER OF EMPLOYEES IN EACH INDUSTRY GROUP – MEMBER STATE BREAKDOWN – MALES AND FEMALES

Table 8.1.1 Number of workers exposed to beryllium by Member State and NACE code – males and females

	NACE CODE											
	22			23			24			25		
	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females
Austria	179	145	34	Not Available			586	475	111	507	411	96
Belgium	240	194	46	191	155	36	1525	1235	290	487	395	93
Bulgaria	120	62	57	154	80	74	566	294	272	429	223	206
Cyprus	17	13	4	Not Available			41	31	10	21	16	5
Czech Republic	311	202	109	98	63	34	903	587	316	1529	994	535
Denmark	254	185	69	Not Available			651	475	176	374	273	101
Estonia	45	25	20	35	19	16	65	36	29	93	51	42
Finland	6	4	1	84	62	22	224	165	58	107	79	28
France	1322	1018	304	888	684	204	5993	4615	1378	4168	3209	959
Germany	2545	1985	560	674	526	148	9978	7782	2195	6828	5326	1502
Greece	198	150	47	133	101	32	395	301	95	212	161	51
Hungary	240	151	89	208	131	77	698	440	258	741	467	274
Ireland	108	81	27	Not Available			540	405	135	181	136	45
Italy	3307	2481	827	651	488	163	3945	2959	986	8041	6031	2010
Latvia	67	39	28	1	1	1	95	55	40	83	48	35
Lithuania	85	44	41	Not Available			134	70	64	172	89	82
Luxembourg	Not Available			0	0	0	23	20	3	111	97	14
Malta	Not Available			Not Available			Not Available			Not Available		
Netherlands	563	468	96	215	178	37	1389	1153	236	589	489	100
Poland	681	456	225	484	324	160	2354	1577	777	2713	1818	895
Portugal	255	151	105	Not Available			468	276	192	466	275	191
Romania	259	140	119	226	122	104	1063	574	489	849	458	391

	NACE CODE											
	22			23			24			25		
	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females
Slovakia	78	50	28	Not Available			280	179	101	376	241	135
Slovenia	68	45	23	3	2	1	305	201	104	245	162	83
Spain	125	97	27	257	201	57	4613	3598	1015	852	665	188
Sweden	351	274	77	106	83	23	948	739	209	516	403	114
UK	2306	1868	438	781	633	148	4671	3784	887	3753	3040	713
Total	**13730**	**10328**	**3402**	**5190**	**3854**	**1336**	**42452**	**32026**	**10426**	**34444**	**25555**	**8889**

	NACE CODE											
	26			27			28			29		
	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females
Austria	202	163	38	938	760	178	5026	4071	955	2989	2421	568
Belgium	184	149	35	957	776	182	4763	3858	905	1603	1298	304
Bulgaria	167	87	80	636	331	305	2925	1521	1404	2574	1339	1236
Cyprus	19	14	5	10	8	3	268	201	67	38	28	9
Czech Republic	438	285	153	1628	1058	570	11710	7612	4099	5987	3891	2095
Denmark	103	75	28	152	111	41	3326	2428	898	2298	1677	620
Estonia	33	18	15	12	6	5	907	499	408	204	112	92
Finland	76	56	20	690	511	179	1987	1471	517	1729	1279	449
France	789	607	181	2830	2179	651	30104	23180	6924	11215	8636	2580
Germany	1378	1075	303	7292	5688	1604	55304	43137	12167	38739	30217	8523
Greece	146	111	35	389	296	93	2822	2145	677	836	635	201
Hungary	163	103	60	543	342	201	5228	3293	1934	2518	1586	932
Ireland	62	47	16	70	52	17	919	689	230	425	319	106
Italy	2306	1729	576	1580	1185	395	51659	38744	12915	19745	14809	4936
Latvia	36	21	15	102	59	43	682	396	287	266	154	112
Lithuania	68	35	33	26	14	13	1291	671	620	400	208	192
Luxembourg	17	15	2	172	149	22	298	259	39	88	76	11

	NACE CODE											
	26			27			28			29		
	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females
Malta	Not Available			Not Available			Not Available			Not Available		
Netherlands	167	139	28	593	492	101	6904	5730	1174	3285	2727	558
Poland	805	539	265	2038	1366	673	19475	13048	6427	7604	5094	2509
Portugal	344	203	141	273	161	112	6186	3650	2536	1747	1031	716
Romania	344	186	158	1719	928	791	7206	3891	3315	3791	2047	1744
Slovakia	120	77	43	751	481	270	2419	1548	871	1663	1064	599
Slovenia	55	36	19	258	170	88	2388	1576	812	996	657	338
Spain	641	500	141	2613	2039	575	35399	27611	7788	8830	6887	1943
Sweden	116	90	25	1326	1035	292	5967	4654	1313	4302	3355	946
UK	642	520	122	2070	1677	393	23318	18887	4430	10198	8261	1938
Total	**9421**	**6881**	**2540**	**29670**	**21872**	**7798**	**288480**	**214771**	**73709**	**134067**	**99809**	**34258**

	NACE CODE											
	31			32			33			35		
	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females
Austria	151	123	29	116	94	22	143	115	27	519	420	99
Belgium	99	80	19	73	60	14	73	59	14	432	350	82
Bulgaria	119	62	57	25	13	12	61	31	29	517	269	248
Cyprus	2	2	1	0	0	0	2	1	0	7	5	2
Czech Republic	627	408	220	149	97	52	314	204	110	996	648	349
Denmark	130	95	35	29	21	8	154	113	42	361	263	97
Estonia	34	19	15	28	15	12	17	9	8	130	72	59
Finland	65	48	17	35	26	9	31	23	8	422	312	110
France	818	630	188	503	387	116	1186	913	273	6798	5234	1563
Germany	2819	2199	620	627	489	138	2835	2211	624	6385	4980	1405
Greece	44	33	10	20	15	5	19	15	5	640	486	154
Hungary	375	236	139	225	142	83	174	110	64	370	233	137
Ireland	41	31	10	38	29	10	225	169	56	174	130	43

	NACE CODE											
	31			32			33			35		
	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females
Italy	2161	1621	540	942	707	236	2567	1925	642	3763	2822	941
Latvia	19	11	8	5	3	2	16	9	7	249	144	105
Lithuania	36	19	17	26	14	13	34	18	17	330	171	158
Luxembourg	Not Available			Not Available			19	17	3	Not Available		
Malta	Not Available			Not Available			Not Available			Not Available		
Netherlands	94	78	16	129	107	22	227	188	39	1153	957	196
Poland	582	390	192	179	120	59	441	295	145	3256	2182	1075
Portugal	134	79	55	56	33	23	61	36	25	486	287	199
Romania	456	246	210	41	22	19	136	74	63	2765	1493	1272
Slovakia	250	160	90	59	37	21	64	41	23	335	215	121
Slovenia	82	54	28	23	15	8	60	40	20	122	80	41
Spain	79	62	17	22	17	5	146	114	32	3672	2864	808
Sweden	134	104	29	128	100	28	232	181	51	1019	795	224
UK	679	550	129	297	241	56	963	780	183	6742	5461	1281
Total	**10031**	**7339**	**2692**	**3777**	**2805**	**973**	**10200**	**7692**	**2508**	**41643**	**30875**	**10768**

	NACE CODE											
	36			40			41			45		
	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females
Austria	340	275	65	223	194	29	3	3	0	664	631	33
Belgium	184	149	35	129	112	17	7	6	1	691	671	21
Bulgaria	267	139	128	297	258	39	22	19	3	487	463	24
Cyprus	19	14	5	Not Available			Not Available			91	87	4
Czech Republic	521	339	182	286	243	43	24	20	4	1034	962	72
Denmark	200	146	54	107	85	21	4	3	1	534	502	32
Estonia	92	51	41	51	46	5	2	2	0	132	120	12
Finland	43	32	11	156	134	22	0	0	0	300	285	15
France	1101	848	253	1236	989	247	42	34	8	4344	4170	174

	NACE CODE											
	36			40			41			45		
	Total	**Males**	**Females**	**Total**	**Males**	**Females**	**Total**	**Males**	**Females**	**Total**	**Males**	**Females**
Germany	1792	1398	394	1814	1578	236	50	43	6	3942	3823	118
Greece	Not Available			Not Available			Not Available			815	798	16
Hungary	241	152	89	254	213	41	25	21	4	631	612	19
Ireland	Not Available			Not Available			0	0	0	191	189	2
Italy	5637	4228	1409	454	395	59	0	0	0	4059	3937	122
Latvia	110	64	46	101	82	19	2	2	0	192	179	13
Lithuania	221	115	106	150	115	34	7	6	2	328	309	20
Luxembourg	2	2	0	7	7	1	0	0	0	94	93	1
Malta	Not Available			Not Available			Not Available			Not Available		
Netherlands	285	237	49	148	119	30	6	5	1	1265	1228	38
Poland	1595	1069	526	1213	1031	182	57	48	9	1842	1768	74
Portugal	446	263	183	81	71	11	16	14	2	1298	1285	13
Romania	824	445	379	742	616	126	42	35	7	1124	1034	90
Slovakia	136	87	49	200	170	30	15	13	2	190	182	8
Slovenia	116	76	39	60	50	10	5	4	1	189	179	9
Spain	102	80	22	267	235	32	110	96	13	10071	9668	403
Sweden	367	286	81	225	180	45	1	1	0	714	686	29
UK	1301	1054	247	855	744	111	31	27	4	3665	3592	73
Total	**15942**	**11547**	**4395**	**9057**	**7668**	**1389**	**473**	**404**	**69**	**38885**	**37451**	**1434**

	NACE CODE											
	50			51			60			61		
	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females
Austria	380	236	145	34	21	13	156	128	28	2	2	0
Belgium	349	262	87	39	29	10	123	108	15	7	7	1
Bulgaria	222	200	22	25	23	3	121	110	11	24	21	2
Cyprus	39	32	7	3	3	1	6	5	1	21	16	5
Czech Republic	396	277	119	41	29	12	272	225	46	Not Available		

	NACE CODE											
	50			51			60			61		
Denmark	270	211	59	29	23	6	101	81	19	64	52	12
Estonia	54	34	20	7	4	3	30	23	7	5	4	1
Finland	214	137	77	41	26	15	22	18	4	0	0	0
France	1957	1409	548	184	133	52	942	772	169	73	60	13
Germany	3125	2250	875	218	157	61	866	728	139	143	120	23
Greece	465	367	98	58	45	12	164	151	13	78	72	6
Hungary	350	126	224	29	10	18	210	187	23	5	5	1
Ireland	179	142	38	15	12	3	39	36	4	Not Available		
Italy	12056	9042	3014	0	0	0	1230	1045	184	355	302	53
Latvia	93	46	48	9	5	5	62	49	13	3	3	1
Lithuania	200	124	76	13	8	5	84	69	15	8	6	1
Luxembourg	36	27	9	2	2	1	17	15	2	1	1	0
Malta	Not Available			Not Available			Not Available			Not Available		
Netherlands	653	464	189	81	58	24	253	210	43	Not Available		
Poland	1153	796	358	124	85	38	632	556	76	17	15	2
Portugal	563	265	298	50	23	26	135	119	16	10	9	1
Romania	474	318	156	60	40	20	268	236	32	17	15	2
Slovakia	71	48	24	15	10	5	80	69	11	3	3	0
Slovenia	69	43	26	7	5	3	41	36	6	1	1	0
Spain	40288	29813	10475	0	0	0	761	662	99	0	0	0
Sweden	373	298	75	39	31	8	175	147	28	66	56	11
UK	2618	1937	681	202	150	53	728	634	95	69	60	9
Total	**66650**	**48902**	**17748**	**1329**	**933**	**395**	**7515**	**6416**	**1099**	**973**	**828**	**145**

	NACE CODE											
	62			63			64			73		
	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females
Austria	146	120	26	96	79	17	1	1	0	41	28	13
Belgium	88	77	11	86	76	10	2	2	0	47	31	15

	NACE CODE											
	62			63			64			73		
	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females
Bulgaria	39	35	3	67	61	6	1	1	0	3	2	1
Cyprus	36	28	8	12	9	3	0	0	0	0	0	0
Czech Republic	Not Available			71	59	12	2	2	0	47	28	19
Denmark	89	72	17	56	45	11	2	1	0	48	32	17
Estonia	11	9	3	19	15	4	0	0	0	3	2	1
Finland	0	0	0	67	54	13	0	0	0	26	15	11
France	1137	932	205	461	378	83	13	10	2	318	210	108
Germany	872	733	140	858	720	137	19	16	3	714	457	257
Greece	60	55	5	69	64	6	1	1	0	68	40	28
Hungary	42	37	5	53	47	6	2	2	0	49	32	17
Ireland	Not Available			34	31	3	1	1	0	18	12	6
Italy	1106	940	166	0	0	0	0	0	0	0	0	0
Latvia	17	14	4	28	22	6	0	0	0	9	5	4
Lithuania	13	11	2	26	22	5	0	0	0	6	3	3
Luxembourg	59	52	7	5	4	1	0	0	0	Not Available		
Malta	Not Available			Not Available			Not Available			Not Available		
Netherlands	Not Available			152	126	26	4	3	1	257	182	74
Poland	87	77	10	131	115	16	5	5	1	31	20	11
Portugal	152	134	18	66	58	8	1	1	0	10	6	4
Romania	55	49	7	116	102	14	3	2	0	175	114	61
Slovakia	13	11	2	18	16	3	1	1	0	34	20	14
Slovenia	11	9	1	15	13	2	0	0	0	20	12	8
Spain	0	0	0	638	555	83	17	14	2	245	159	86
Sweden	117	99	19	100	84	16	2	2	0	Not Available		
UK	1415	1231	184	637	554	83	14	12	2	784	533	251
Total	**5565**	**4723**	**842**	**3881**	**3309**	**572**	**93**	**80**	**14**	**2952**	**1943**	**1009**

	NACE CODE											
	74			75			80			85		
	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
Austria	144	98	46	430	271	159	123	36	88	41	10	32
Belgium	203	136	67	718	452	266	212	66	146	59	15	45
Bulgaria	61	41	20	382	275	107	122	39	83	20	5	14
Cyprus	7	4	3	51	34	17	13	4	9	2	1	1
Czech Republic	176	106	70	553	293	260	158	40	119	39	8	31
Denmark	124	81	44	283	156	127	120	50	69	61	11	50
Estonia	20	11	9	66	26	40	33	5	28	5	0	4
Finland	120	71	49	389	187	202	133	44	89	36	4	32
France	1189	785	404	4092	2210	1882	1001	340	660	361	87	274
Germany	1617	1035	582	4890	2543	2347	1172	234	937	495	94	401
Greece	137	81	56	647	440	207	170	63	107	25	9	16
Hungary	159	105	54	486	238	248	179	45	134	34	8	26
Ireland	70	47	23	178	123	55	73	20	53	25	5	20
Italy	0	0	0	0	0	0	0	0	0	0	0	0
Latvia	21	11	10	150	75	75	50	9	41	6	1	5
Lithuania	28	15	13	129	68	60	75	13	61	13	2	11
Luxembourg	20	12	8	38	28	9	8	3	6	2	1	2
Malta	Not Available			24	17	7	7	2	5	1	0	1
Netherlands	616	438	179	959	604	355	303	121	182	155	28	127
Poland	333	213	120	1559	826	733	639	153	486	105	21	84
Portugal	231	136	95	602	391	211	176	47	128	41	7	33
Romania	144	94	50	825	503	322	233	63	170	48	11	37
Slovakia	35	20	14	275	135	140	94	19	75	19	4	15
Slovenia	27	16	10	97	53	44	42	9	33	7	1	6
Spain	1200	780	420	2077	1350	727	948	351	597	328	79	250
Sweden	175	119	56	429	202	227	273	68	205	90	15	75
UK	1602	1089	513	3466	1975	1490	1429	414	1014	429	90	339
Total	**8459**	**5543**	**2915**	**23795**	**13476**	**10319**	**7785**	**2259**	**5526**	**2447**	**516**	**1930**

	NACE CODE					
		90[1]			TOTAL	
	Total	Males	Females	TOTAL	MALES	FEMALES
Austria	427	201	226	16076	12718	3359
Belgium	352	183	169	15182	12009	3173
Bulgaria	294	185	109	13052	7391	5661
Cyprus	40	18	22	913	685	228
Czech Rep	376	184	192	30503	20044	10459
Denmark	374	202	172	10656	7733	2924
Estonia	77	27	50	2721	1541	1180
Finland	153	61	92	7477	5343	2134
France	2520	1109	1411	91163	68522	22642
Germany	4555	3006	1549	173266	132916	40350
Greece	299	135	165	10147	7707	2439
Hungary	377	177	200	16521	10460	6061
Ireland	229	115	115	4011	2949	1061
Italy	0	0	0	142998	108509	34488
Latvia	115	47	68	3372	2005	1366
Lithuania	148	47	101	5126	2846	2279
Lux.	15	8	7	1042	894	148
Malta	13	6	7	46	25	20
Netherlands	677	298	379	22732	18160	4572
Poland	1228	651	577	58540	39465	19075
Portugal	335	144	191	17114	10584	6530
Romania	558	335	223	30650	17632	13018
Slovakia	180	85	96	8280	5308	2971
Slovenia	91	51	40	5953	3962	1991
Spain	4283	1970	2313	123750	94490	29259
Sweden	526	247	279	20112	15343	4769
UK	3389	1728	1660	85192	66506	18687
Total	**21633**	**11221**	**10412**	**916595**	**675750**	**240845**

8.2 ESTIMATED DEATHS AND REGISTRATIONS IN THE EU FROM NASOPHARYNGEAL CANCER AND SINONASAL CANCER

Table 8.2.1 Forecast number of lung and sinonasal cancers in ages 25+ (ages 15+ for lung cancer registrations), based on projected EU country populations

Lung cancer deaths	*MEN*						*WOMEN*					
FTY	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060
Austria	2,698	3,346	3,956	4,483	4,711	4,745	1,129	1,290	1,459	1,611	1,705	1,687
Belgium	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	3,127	3,202	3,344	3,500	3,456	3,149	590	604	627	634	624	588
Cyprus	146	199	257	320	389	456	38	50	66	82	96	113
Czech Republic	4,741	5,771	6,660	7,492	8,086	8,078	1,582	1,790	2,024	2,204	2,278	2,323
Denmark	2,342	2,915	3,363	3,606	3,695	3,745	1,819	2,137	2,380	2,529	2,552	2,563
Estonia	610	666	751	847	937	982	154	166	172	182	189	183
Finland	1,686	2,167	2,617	2,783	2,822	2,923	592	693	786	824	818	817
France	24,854	29,288	33,628	36,549	38,217	39,689	6,697	7,502	8,353	9,042	9,293	9,389
Germany (including ex-GDR from 1991)	33,102	39,458	44,318	48,341	48,129	46,049	12,629	14,018	14,868	15,581	15,458	14,585
Greece	5,779	6,593	7,578	8,628	9,275	9,333	1,070	1,265	1,388	1,542	1,665	1,705
Hungary	6,068	6,634	7,398	8,125	8,599	8,624	2,437	2,557	2,746	2,803	2,814	2,785
Ireland	1,175	1,595	2,112	2,691	3,299	3,759	720	932	1,209	1,512	1,815	2,051
Italy	29,397	34,515	40,206	46,091	49,731	49,259	7,857	8,917	9,911	10,930	11,683	11,548
Latvia	1,025	1,091	1,220	1,355	1,483	1,502	220	231	239	256	265	264
Lithuania	1,384	1,538	1,764	1,982	2,138	2,164	267	286	313	344	352	350
Luxembourg	176	228	291	350	386	413	52	61	75	89	96	102
Malta	146	192	235	255	275	299	20	21	22	23	24	23
Netherlands	7,177	9,325	11,423	12,679	12,877	12,754	3,444	4,079	4,583	4,835	4,782	4,720
Poland	19,813	24,204	28,329	31,413	34,266	34,929	5,717	6,552	7,274	8,001	8,124	7,952
Portugal	3,111	3,600	4,173	4,708	5,070	5,188	677	778	878	977	1,046	1,073
Romania	8,342	9,179	10,368	11,480	11,726	11,057	1,935	2,100	2,335	2,521	2,626	2,589
Slovakia	1,963	2,488	3,057	3,508	3,884	3,932	438	508	608	709	742	773
Slovenia	944	1,168	1,406	1,545	1,581	1,552	282	317	353	379	379	370

Lung cancer deaths	*MEN*						*WOMEN*					
FTY	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060
Spain	20,051	24,629	30,491	36,512	40,400	40,734	2,942	3,503	4,051	4,536	4,903	5,021
Sweden	2,078	2,503	2,886	3,122	3,340	3,542	1,659	1,862	2,064	2,198	2,302	2,390
United Kingdom	21,915	26,107	30,805	34,784	38,234	41,219	15,291	17,180	19,778	22,297	24,098	25,562
European Union (27 countries)	210,064	249,072	289,493	323,680	342,919	348,763	70,053	79,186	88,770	96,845	100,598	100,564

Lung cancer registration	*MEN*						*WOMEN*					
FTY	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060
Ages 15+												
Austria	3,195	3,838	4,514	4,960	5,120	5,164	1,214	1,357	1,526	1,653	1,691	1,679
Belgium	7,322	8,692	10,013	10,852	11,262	11,628	1,292	1,445	1,593	1,703	1,753	1,779
Bulgaria	2,684	2,717	2,857	2,967	2,899	2,741	513	529	545	553	541	514
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	5,691	6,740	7,663	8,472	8,896	8,764	1,447	1,647	1,808	1,937	2,003	1,988
Denmark	2,325	2,806	3,129	3,278	3,289	3,392	1,648	1,877	2,063	2,137	2,166	2,201
Estonia	630	684	762	847	921	949	142	148	156	161	163	163
Finland	1,681	2,142	2,375	2,420	2,462	2,527	609	716	780	795	789	788
France	26,745	31,101	34,491	36,630	37,854	39,219	5,039	5,699	6,221	6,585	6,689	6,754
Germany (including ex-GDR from 1991)	38,324	44,013	49,121	51,188	50,140	48,059	11,541	12,457	13,257	13,586	13,278	12,593
Greece	6,094	6,934	7,896	8,787	9,161	8,965	1,059	1,189	1,307	1,413	1,454	1,415
Hungary	6,802	7,380	8,170	8,966	9,417	9,471	2,371	2,499	2,628	2,710	2,719	2,683
Ireland	1,252	1,689	2,180	2,721	3,274	3,530	716	932	1,193	1,470	1,747	1,894
Italy	34,941	40,490	46,453	51,486	52,717	51,737	7,555	8,466	9,366	10,142	10,308	9,994
Latvia	951	1,015	1,110	1,226	1,296	1,278	181	183	191	198	200	196
Lithuania	1,385	1,524	1,745	1,956	2,094	2,138	226	238	261	277	279	278
Luxembourg	252	326	405	467	507	544	60	73	86	97	107	114
Malta	146	186	213	228	246	256	25	30	34	35	37	38
Netherlands	8,745	11,124	12,938	13,657	13,484	13,607	2,635	3,038	3,312	3,421	3,423	3,370

Lung cancer registration	*MEN*						*WOMEN*					
FTY	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Poland	22,877	27,302	31,024	34,644	36,831	36,566	5,119	5,745	6,372	6,806	6,831	6,624
Portugal	2,875	3,318	3,829	4,280	4,552	4,608	628	711	793	859	897	892
Romania	7,766	8,440	9,584	10,539	10,779	10,354	1,701	1,842	2,018	2,197	2,264	2,208
Slovakia	2,512	3,125	3,739	4,299	4,667	4,649	456	534	616	676	706	697
Slovenia	988	1,219	1,418	1,534	1,555	1,485	284	317	347	361	357	341
Spain	21,064	25,941	31,814	36,979	39,486	38,712	2,341	2,769	3,238	3,632	3,854	3,807
Sweden	1,965	2,314	2,570	2,754	2,899	3,067	1,342	1,479	1,609	1,701	1,772	1,816
United Kingdom	27,363	32,395	37,148	40,910	43,779	47,708	16,430	18,564	21,109	23,352	24,834	26,443
European Union (27 countries)	234,922	275,404	314,082	343,072	356,383	358,425	66,807	75,248	83,431	89,518	91,591	90,888

Sinonasal deaths	*MEN*						*WOMEN*					
FTY	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Austria	11	13	16	17	19	19	9	10	12	13	15	15
Belgium	14	17	19	22	23	24	12	13	15	17	18	18
Bulgaria	10	10	11	12	12	13	8	9	9	10	10	10
Cyprus	1	1	2	2	2	3	1	1	1	1	2	2
Czech Republic	13	15	18	20	21	22	11	12	14	16	16	17
Denmark	7	9	10	10	11	11	6	6	7	8	8	9
Estonia	1	2	2	2	2	2	2	2	2	2	2	2
Finland	7	9	10	10	11	11	6	7	8	9	9	8
France	81	96	112	124	131	136	70	80	90	102	108	109
Germany (including ex-GDR from 1991)	119	143	158	170	176	166	98	112	118	127	137	127
Greece	16	19	21	24	26	26	12	15	16	18	19	19
Hungary	12	13	14	16	18	19	11	12	13	15	15	16
Ireland	5	6	8	10	11	13	3	4	6	7	8	9

Sinonasal deaths	*MEN*						*WOMEN*					
FTY	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060
Italy	89	103	118	131	140	141	74	86	95	103	112	115
Latvia	2	3	3	3	3	4	3	3	3	3	3	3
Lithuania	3	4	4	5	5	6	4	4	4	5	5	5
Luxembourg (Grand-Duché)	1	1	1	1	1	1	0	1	1	1	1	1
Malta	1	1	1	1	1	1	0	0	1	1	1	1
Netherlands	21	26	30	33	34	34	16	19	22	25	26	26
Poland	40	49	57	66	70	75	37	43	48	58	59	60
Portugal	14	16	19	22	24	25	12	14	15	17	19	20
Romania	24	27	30	35	39	40	20	22	25	29	30	32
Slovakia	5	7	8	9	10	11	5	6	7	8	8	9
Slovenia	2	3	4	4	4	4	2	3	3	3	3	3
Spain	60	73	89	106	119	123	48	59	69	80	89	95
Sweden	13	15	18	19	20	21	10	11	13	14	15	16
United Kingdom	80	93	108	119	131	140	63	70	80	89	101	105
European Union (27 countries)	653	770	890	993	1067	1090	543	623	697	778	839	852

Sinonasal Registrations	*MEN*						*WOMEN*					
FTY	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060
Austria	33	39	45	50	52	52	28	30	35	39	43	43
Belgium	43	50	56	62	65	67	35	39	44	49	53	54
Bulgaria	30	31	32	34	35	35	24	26	27	29	29	30
Cyprus	3	4	4	5	6	7	2	3	3	4	5	5
Czech Republic	39	45	52	57	60	61	32	36	41	45	46	50
Denmark	22	26	28	30	30	31	17	18	22	23	25	25
Estonia	4	5	5	6	6	6	5	5	5	6	6	6
Finland	22	25	28	29	29	30	18	20	23	25	25	25
France	242	282	320	348	364	378	206	233	264	298	315	318
Germany (including ex-GDR from 1991)	361	417	453	479	477	454	293	328	347	371	395	367
Greece	48	55	61	68	72	72	36	43	46	51	55	56
Hungary	35	39	43	47	51	53	33	36	39	42	43	46
Ireland	14	19	23	28	32	36	10	13	17	20	24	27
Italy	263	302	338	369	386	381	221	251	276	300	327	331
Latvia	7	8	8	9	10	10	8	8	9	9	9	9
Lithuania	10	12	13	14	15	16	11	12	13	14	15	14
Luxembourg (Grand-Duché)	2	2	3	3	3	4	1	2	2	2	3	3
Malta	2	2	2	2	3	3	1	1	2	2	2	2
Netherlands	64	77	87	93	94	93	49	56	66	73	77	75
Poland	126	148	171	189	199	205	110	129	145	169	170	175
Portugal	42	48	56	62	67	69	35	41	45	51	55	58
Romania	74	82	92	103	110	111	60	67	73	82	88	92
Slovakia	17	20	24	27	29	30	14	17	20	23	24	26
Slovenia	8	9	11	12	12	12	7	8	8	9	10	9
Spain	180	219	262	304	330	332	146	174	201	233	262	277

Sinonasal Registrations	*MEN*						*WOMEN*					
FTY	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060
Sweden	39	45	50	54	57	59	30	33	38	41	44	46
United Kingdom	240	276	310	341	367	392	188	206	238	265	296	309
European Union (27 countries)	1969	2284	2582	2826	2963	2999	1619	1833	2049	2275	2444	2478

8.3 SUPPLEMENTARY TABLES - COSTS UNDER THE BASELINE SCENARIO

Table 8.3.1 Health costs – baseline scenario – Member State breakdown – Based on a 4% discount rate

Low	Female	Male	Total	High	Female	Male	Total
Austria	€ 23	€ 121	€ 143	Austria	€ 68	€ 377	€ 444
Belgium	€ 6	€ 29	€ 36	Belgium	€ 57	€ 525	€ 582
Bulgaria	€ 23	€ 59	€ 82	Bulgaria	€ 84	€ 165	€ 249
Czech Republic	€ 86	€ 263	€ 349	Czech Republic	€ 246	€ 864	€ 1,111
Cyprus	€ 1	€ 2	€ 3	Cyprus	€ 2	€ 5	€ 7
Denmark	€ 42	€ 83	€ 125	Denmark	€ 101	€ 251	€ 352
Estonia	€ 5	€ 12	€ 18	Estonia	€ 19	€ 42	€ 61
Finland	€ 13	€ 50	€ 63	Finland	€ 43	€ 158	€ 201
France	€ 171	€ 971	€ 1,142	France	€ 417	€ 2,521	€ 2,938
Germany	€ 325	€ 1,573	€ 1,898	Germany	€ 900	€ 4,848	€ 5,748
Greece	€ 10	€ 73	€ 83	Greece	€ 37	€ 217	€ 254
Hungary	€ 58	€ 137	€ 195	Hungary	€ 152	€ 415	€ 567
Ireland	€ 7	€ 18	€ 25	Ireland	€ 19	€ 58	€ 77
Italy	€ 228	€ 1,192	€ 1,420	Italy	€ 700	€ 3,918	€ 4,619
Latvia	€ 4	€ 13	€ 18	Latvia	€ 18	€ 44	€ 62
Lithuania	€ 7	€ 19	€ 27	Lithuania	€ 30	€ 64	€ 94
Luxembourg	€ 1	€ 8	€ 9	Luxembourg	€ 2	€ 28	€ 30
Malta	€ 0	€ 0	€ 0	Malta	€ 0	€ 0	€ 0
Netherlands	€ 40	€ 196	€ 235	Netherlands	€ 89	€ 669	€ 758
Poland	€ 145	€ 524	€ 669	Poland	€ 388	€ 1,626	€ 2,015
Portugal	€ 26	€ 74	€ 99	Portugal	€ 93	€ 208	€ 301
Romania	€ 59	€ 151	€ 210	Romania	€ 199	€ 415	€ 614
Slovakia	€ 15	€ 57	€ 72	Slovakia	€ 52	€ 205	€ 257
Slovenia	€ 17	€ 55	€ 72	Slovenia	€ 47	€ 156	€ 202
Spain	€ 75	€ 523	€ 598	Spain	€ 281	€ 1,579	€ 1,860
Sweden	€ 43	€ 106	€ 148	Sweden	€ 105	€ 330	€ 435
United Kingdom	€ 207	€ 732	€ 939	United Kingdom	€ 599	€ 2,564	€ 3,163
TOTAL	€ 1,636	€ 7,042	€ 8,678	**TOTAL**	€ 4,749	€ 22,253	€ 27,002

Table 8.3.2 Health costs – baseline scenario – Industry group breakdown – Based on a 4% discount rate

Low	Female	Male	Total
Agriculture, hunting and related service activities	€ 0	€ 0	€ 1
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	€ 0	€ 1	€ 1
Mining of metal ores	€ 0	€ 0	€ 0
Manufacture of food products and beverages	€ 8	€ 17	€ 25
Manufacture of textiles	€ 3	€ 6	€ 9
Manufacture of wearing apparel; dressing and dyeing of fur	€ 4	€ 7	€ 11
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	€ 4	€ 7	€ 11
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	€ 5	€ 10	€ 16
Manufacture of pulp, paper and paper products	€ 5	€ 11	€ 16
Publishing, printing and reproduction of recorded media	€ 5	€ 13	€ 18
Manufacture of coke, refined petroleum products and nuclear fuel	€ 2	€ 5	€ 7
Manufacture of chemicals and chemical products	€ 96	€ 475	€ 572
Manufacture of Rubber and Plastic Products	€ 14	€ 31	€ 45
Manufacture of other non-metallic mineral products	€ 4	€ 8	€ 12
Manufacture of basic metals	€ 85	€ 376	€ 461
Manufacture of fabricated metal products, except machinery and equipment	€ 789	€ 3,635	€ 4,424
Manufacture of machinery and equipment	€ 374	€ 1,734	€ 2,108
Manufacture of electrical machinery and apparatus	€ 4	€ 9	€ 13
Manufacture of radio, television and communication equipment and apparatus	€ 2	€ 3	€ 5
Manufacture of medical, precision and optical instruments, watches and clocks	€ 4	€ 9	€ 13
Manufacture of other transport equipment	€ 119	€ 549	€ 668
Manufacture of furniture, manufacturing n.e.c	€ 48	€ 203	€ 251
Electricity, gas, steam and hot water supply	€ 2	€ 9	€ 11
Collection, purification and distribution of water	€ 0	€ 0	€ 1
Construction	€ 2	€ 56	€ 58
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	€ 24	€ 57	€ 81
Wholesale trade and commission trade, except of motor vehicles and motorcycles	€ 1	€ 1	€ 2
Land transport; transport via pipelines	€ 1	€ 8	€ 9
Water Transport	€ 0	€ 1	€ 1
Air Transport	€ 1	€ 6	€ 7
Supporting and auxiliary transport activities; activities of travel agencies	€ 1	€ 4	€ 5
Post and telecommunications	€ 0	€ 0	€ 0
Research and development	€ 1	€ 2	€ 4
Other business activities	€ 4	€ 6	€ 10
Public administration and defence; compulsory social security	€ 14	€ 16	€ 30
Education	€ 7	€ 3	€ 10
Health and Social Work	€ 3	€ 1	€ 3
Sewage and refuse disposal, sanitation and similar activities	€ 14	€ 13	€ 27
TOTAL	€ 1,764	€ 7,579	€ 9,343

High	Female	Male	Total
Agriculture, hunting and related service activities	€ 1	€ 2	€ 3
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	€ 1	€ 7	€ 8
Mining of metal ores	€ 0	€ 0	€ 0
Manufacture of food products and beverages	€ 47	€ 100	€ 147
Manufacture of textiles	€ 17	€ 35	€ 52
Manufacture of wearing apparel; dressing and dyeing of fur	€ 24	€ 40	€ 64
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	€ 22	€ 42	€ 64
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	€ 30	€ 60	€ 90
Manufacture of pulp, paper and paper products	€ 27	€ 64	€ 90
Publishing, printing and reproduction of recorded media	€ 30	€ 74	€ 104
Manufacture of coke, refined petroleum products and nuclear fuel	€ 12	€ 28	€ 39
Manufacture of chemicals and chemical products	€ 242	€ 1,338	€ 1,579
Manufacture of Rubber and Plastic Products	€ 78	€ 181	€ 259
Manufacture of other non-metallic mineral products	€ 22	€ 48	€ 70
Manufacture of basic metals	€ 223	€ 1,086	€ 1,309
Manufacture of fabricated metal products, except machinery and equipment	€ 2,084	€ 10,503	€ 12,587
Manufacture of machinery and equipment	€ 986	€ 5,002	€ 5,988
Manufacture of electrical machinery and apparatus	€ 23	€ 52	€ 75
Manufacture of radio, television and communication equipment and apparatus	€ 9	€ 20	€ 28
Manufacture of medical, precision and optical instruments, watches and clocks	€ 22	€ 54	€ 76
Manufacture of other transport equipment	€ 314	€ 1,582	€ 1,895
Manufacture of furniture, manufacturing n.e.c	€ 127	€ 585	€ 712
Electricity, gas, steam and hot water supply	€ 12	€ 54	€ 66
Collection, purification and distribution of water	€ 1	€ 3	€ 3
Construction	€ 13	€ 331	€ 344
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	€ 138	€ 343	€ 481
Wholesale trade and commission trade, except of motor vehicles and motorcycles	€ 3	€ 7	€ 10
Land transport; transport via pipelines	€ 9	€ 45	€ 54
Water Transport	€ 1	€ 6	€ 7
Air Transport	€ 7	€ 33	€ 40
Supporting and auxiliary transport activities; activities of travel agencies	€ 4	€ 23	€ 28
Post and telecommunications	€ 0	€ 1	€ 1
Research and development	€ 8	€ 14	€ 21
Other business activities	€ 23	€ 39	€ 62
Public administration and defence; compulsory social security	€ 80	€ 94	€ 175
Education	€ 43	€ 16	€ 59
Health and Social Work	€ 15	€ 4	€ 19
Sewage and refuse disposal, sanitation and similar activities	€ 81	€ 79	€ 160
TOTAL	€ 5,232	€ 23,344	€ 28,575

Note: Industry breakdown results may not equate exactly to Member State breakdown due to differences in underlying health data.

Table 8.3.3 Health costs – baseline scenario – Member State breakdown – Based on a declining discount rate

Low	Female	Male	Total	High	Female	Male	Total
Austria	€ 27	€ 142	€ 168	Austria	€ 82	€ 449	€ 531
Belgium	€ 8	€ 35	€ 43	Belgium	€ 69	€ 615	€ 684
Bulgaria	€ 27	€ 69	€ 96	Bulgaria	€ 103	€ 197	€ 300
Czech Republic	€ 102	€ 312	€ 414	Czech Republic	€ 299	€ 1,038	€ 1,338
Cyprus	€ 1	€ 3	€ 4	Cyprus	€ 2	€ 6	€ 9
Denmark	€ 49	€ 96	€ 146	Denmark	€ 120	€ 297	€ 417
Estonia	€ 6	€ 14	€ 20	Estonia	€ 23	€ 50	€ 73
Finland	€ 16	€ 59	€ 74	Finland	€ 53	€ 189	€ 241
France	€ 198	€ 1,108	€ 1,305	France	€ 499	€ 2,919	€ 3,418
Germany	€ 383	€ 1,849	€ 2,231	Germany	€ 1,090	€ 5,782	€ 6,871
Greece	€ 11	€ 85	€ 96	Greece	€ 45	€ 257	€ 302
Hungary	€ 67	€ 159	€ 226	Hungary	€ 181	€ 490	€ 671
Ireland	€ 8	€ 21	€ 29	Ireland	€ 23	€ 69	€ 92
Italy	€ 269	€ 1,397	€ 1,666	Italy	€ 849	€ 4,645	€ 5,494
Latvia	€ 5	€ 16	€ 21	Latvia	€ 22	€ 52	€ 74
Lithuania	€ 9	€ 22	€ 31	Lithuania	€ 37	€ 77	€ 114
Luxembourg	€ 1	€ 9	€ 10	Luxembourg	€ 3	€ 33	€ 36
Malta	€ 0	€ 0	€ 0	Malta	€ 0	€ 0	€ 0
Netherlands	€ 46	€ 228	€ 274	Netherlands	€ 108	€ 790	€ 899
Poland	€ 171	€ 616	€ 786	Poland	€ 472	€ 1,940	€ 2,413
Portugal	€ 30	€ 86	€ 117	Portugal	€ 114	€ 250	€ 364
Romania	€ 69	€ 176	€ 245	Romania	€ 244	€ 497	€ 741
Slovakia	€ 18	€ 68	€ 86	Slovakia	€ 64	€ 248	€ 312
Slovenia	€ 20	€ 65	€ 85	Slovenia	€ 57	€ 187	€ 244
Spain	€ 95	€ 644	€ 739	Spain	€ 373	€ 2,002	€ 2,374
Sweden	€ 50	€ 124	€ 175	Sweden	€ 127	€ 395	€ 522
United Kingdom	€ 233	€ 822	€ 1,055	United Kingdom	€ 686	€ 2,909	€ 3,596
TOTAL	€ 1,917	€ 8,225	€ 10,142	**TOTAL**	€ 5,745	€ 26,384	€ 32,128

Table 8.3.4 Health costs – baseline scenario – Industry group breakdown – Based on a declining discount rate

Low	Female	Male	Total
Agriculture, hunting and related service activities	€ 0	€ 0	€ 1
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	€ 0	€ 1	€ 2
Mining of metal ores	€ 0	€ 0	€ 0
Manufacture of food products and beverages	€ 11	€ 21	€ 32
Manufacture of textiles	€ 4	€ 7	€ 11
Manufacture of wearing apparel; dressing and dyeing of fur	€ 5	€ 9	€ 14
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	€ 5	€ 9	€ 14
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	€ 6	€ 12	€ 18
Manufacture of pulp, paper and paper products	€ 6	€ 14	€ 20
Publishing, printing and reproduction of recorded media	€ 7	€ 16	€ 22
Manufacture of coke, refined petroleum products and nuclear fuel	€ 3	€ 6	€ 8
Manufacture of chemicals and chemical products	€ 106	€ 524	€ 630
Manufacture of Rubber and Plastic Products	€ 17	€ 39	€ 56
Manufacture of other non-metallic mineral products	€ 5	€ 10	€ 15
Manufacture of basic metals	€ 99	€ 439	€ 538
Manufacture of fabricated metal products, except machinery and equipment	€ 921	€ 4,236	€ 5,158
Manufacture of machinery and equipment	€ 437	€ 2,021	€ 2,458
Manufacture of electrical machinery and apparatus	€ 5	€ 11	€ 16
Manufacture of radio, television and communication equipment and apparatus	€ 2	€ 4	€ 6
Manufacture of medical, precision and optical instruments, watches and clocks	€ 5	€ 12	€ 16
Manufacture of other transport equipment	€ 138	€ 635	€ 774
Manufacture of furniture, manufacturing n.e.c	€ 56	€ 236	€ 292
Electricity, gas, steam and hot water supply	€ 3	€ 12	€ 14
Collection, purification and distribution of water	€ 0	€ 1	€ 1
Construction	€ 3	€ 71	€ 74
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	€ 32	€ 77	€ 109
Wholesale trade and commission trade, except of motor vehicles and motorcycles	€ 1	€ 1	€ 2
Land transport; transport via pipelines	€ 2	€ 10	€ 12
Water Transport	€ 0	€ 1	€ 2
Air Transport	€ 2	€ 7	€ 9
Supporting and auxiliary transport activities; activities of travel agencies	€ 1	€ 5	€ 6
Post and telecommunications	€ 0	€ 0	€ 0
Research and development	€ 2	€ 3	€ 5
Other business activities	€ 5	€ 9	€ 14
Public administration and defence; compulsory social security	€ 19	€ 21	€ 40
Education	€ 10	€ 4	€ 14
Health and Social Work	€ 3	€ 1	€ 4
Sewage and refuse disposal, sanitation and similar activities	€ 19	€ 18	€ 36

High	Female	Male	Total
Agriculture, hunting and related service activities	€ 2	€ 2	€ 4
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	€ 1	€ 8	€ 10
Mining of metal ores	€ 0	€ 0	€ 0
Manufacture of food products and beverages	€ 60	€ 126	€ 187
Manufacture of textiles	€ 21	€ 44	€ 66
Manufacture of wearing apparel; dressing and dyeing of fur	€ 31	€ 51	€ 81
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	€ 28	€ 54	€ 81
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	€ 34	€ 69	€ 103
Manufacture of pulp, paper and paper products	€ 34	€ 81	€ 115
Publishing, printing and reproduction of recorded media	€ 38	€ 93	€ 132
Manufacture of coke, refined petroleum products and nuclear fuel	€ 15	€ 35	€ 50
Manufacture of chemicals and chemical products	€ 269	€ 1,482	€ 1,751
Manufacture of Rubber and Plastic Products	€ 99	€ 229	€ 328
Manufacture of other non-metallic mineral products	€ 28	€ 61	€ 89
Manufacture of basic metals	€ 267	€ 1,283	€ 1,550
Manufacture of fabricated metal products, except machinery and equipment	€ 2,494	€ 12,396	€ 14,890
Manufacture of machinery and equipment	€ 1,179	€ 5,904	€ 7,084
Manufacture of electrical machinery and apparatus	€ 30	€ 65	€ 95
Manufacture of radio, television and communication equipment and apparatus	€ 11	€ 25	€ 36
Manufacture of medical, precision and optical instruments, watches and clocks	€ 28	€ 69	€ 97
Manufacture of other transport equipment	€ 373	€ 1,853	€ 2,227
Manufacture of furniture, manufacturing n.e.c	€ 151	€ 687	€ 839
Electricity, gas, steam and hot water supply	€ 16	€ 69	€ 84
Collection, purification and distribution of water	€ 1	€ 3	€ 4
Construction	€ 17	€ 425	€ 442
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	€ 187	€ 462	€ 649
Wholesale trade and commission trade, except of motor vehicles and motorcycles	€ 4	€ 9	€ 13
Land transport; transport via pipelines	€ 12	€ 61	€ 72
Water Transport	€ 2	€ 8	€ 9
Air Transport	€ 9	€ 45	€ 53
Supporting and auxiliary transport activities; activities of travel agencies	€ 6	€ 31	€ 37
Post and telecommunications	€ 0	€ 1	€ 1
Research and development	€ 11	€ 18	€ 29
Other business activities	€ 31	€ 52	€ 83
Public administration and defence; compulsory social security	€ 108	€ 127	€ 236
Education	€ 58	€ 21	€ 79
Health and Social Work	€ 20	€ 5	€ 25
Sewage and refuse disposal, sanitation and similar activities	€ 109	€ 106	€ 216

Note: Industry breakdown results may not equate exactly to Member State breakdown due to differences in underlying health data.

Table 8.3.5 Summary

Costs by Gender (€m)	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
Female	526 to 1328	417 to 1099	378 to 1095	272 to 894	188 to 723	137 to 605
Male	2252 to 6649	1827 to 5535	1683 to 5336	1183 to 3994	766 to 2810	514 to 2060
Total	2778 to 7977	2243 to 6634	2061 to 6431	1454 to 4888	954 to 3533	651 to 2665

Table 8.3.6 Health costs – baseline scenario – Member State breakdown – Based on no discounting

Low	Female	Male	Total	High	Female	Male	Total
Austria	€ 61	€ 321	€ 382	Austria	€ 203	€ 1,061	€ 1,264
Belgium	€ 20	€ 85	€ 105	Belgium	€ 169	€ 1,386	€ 1,556
Bulgaria	€ 62	€ 151	€ 213	Bulgaria	€ 263	€ 469	€ 732
Czech Republic	€ 236	€ 722	€ 959	Czech Republic	€ 746	€ 2,500	€ 3,246
Cyprus	€ 2	€ 7	€ 8	Cyprus	€ 6	€ 17	€ 24
Denmark	€ 108	€ 215	€ 323	Denmark	€ 279	€ 688	€ 967
Estonia	€ 14	€ 32	€ 46	Estonia	€ 56	€ 116	€ 172
Finland	€ 37	€ 135	€ 171	Finland	€ 132	€ 450	€ 582
France	€ 432	€ 2,328	€ 2,760	France	€ 1,203	€ 6,410	€ 7,613
Germany	€ 876	€ 4,200	€ 5,076	Germany	€ 2,698	€ 13,654	€ 16,352
Greece	€ 26	€ 186	€ 213	Greece	€ 116	€ 599	€ 715
Hungary	€ 146	€ 349	€ 495	Hungary	€ 433	€ 1,126	€ 1,559
Ireland	€ 18	€ 47	€ 65	Ireland	€ 56	€ 164	€ 220
Italy	€ 621	€ 3,143	€ 3,764	Italy	€ 2,109	€ 10,819	€ 12,928
Latvia	€ 12	€ 34	€ 46	Latvia	€ 56	€ 121	€ 177
Lithuania	€ 20	€ 50	€ 70	Lithuania	€ 95	€ 183	€ 278
Luxembourg	€ 2	€ 20	€ 22	Luxembourg	€ 7	€ 77	€ 84
Malta	€ 0	€ 0	€ 0	Malta	€ 1	€ 1	€ 1
Netherlands	€ 102	€ 507	€ 609	Netherlands	€ 268	€ 1,821	€ 2,089
Poland	€ 389	€ 1,398	€ 1,787	Poland	€ 1,181	€ 4,597	€ 5,778

Low	Female	Male	Total	High	Female	Male	Total
Portugal	€ 72	€ 193	€ 265	Portugal	€ 294	€ 605	€ 899
Romania	€ 160	€ 389	€ 549	Romania	€ 624	€ 1,192	€ 1,816
Slovakia	€ 42	€ 159	€ 201	Slovakia	€ 167	€ 608	€ 775
Slovenia	€ 45	€ 150	€ 195	Slovenia	€ 140	€ 452	€ 592
Spain	€ 264	€ 1,639	€ 1,903	Spain	€ 1,136	€ 5,485	€ 6,620
Sweden	€ 114	€ 285	€ 399	Sweden	€ 308	€ 946	€ 1,254
United Kingdom	€ 471	€ 1,648	€ 2,119	United Kingdom	€ 1,469	€ 6,016	€ 7,485
TOTAL	€ 4,353	€ 18,392	€ 22,745	**TOTAL**	€ 14,215	€ 61,562	€ 75,777

Table 8.3.7 Health costs – baseline scenario – Industry group breakdown – Based on no discounting

Low	Female	Male	Total
Agriculture, hunting and related service activities	€ 1	€ 1	€ 1
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	€ 1	€ 4	€ 4
Mining of metal ores	€ 0	€ 0	€ 0
Manufacture of food products and beverages	€ 29	€ 58	€ 87
Manufacture of textiles	€ 10	€ 20	€ 30
Manufacture of wearing apparel; dressing and dyeing of fur	€ 15	€ 23	€ 38
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	€ 13	€ 25	€ 38
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	€ 12	€ 23	€ 36
Manufacture of pulp, paper and paper products	€ 16	€ 37	€ 53
Publishing, printing and reproduction of recorded media	€ 18	€ 42	€ 60
Manufacture of coke, refined petroleum products and nuclear fuel	€ 7	€ 16	€ 23
Manufacture of chemicals and chemical products	€ 195	€ 962	€ 1,156
Manufacture of Rubber and Plastic Products	€ 47	€ 104	€ 151
Manufacture of other non-metallic mineral products	€ 13	€ 28	€ 41
Manufacture of basic metals	€ 222	€ 978	€ 1,200
Manufacture of fabricated metal products, except machinery and equipment	€ 2,066	€ 9,413	€ 11,479
Manufacture of machinery and equipment	€ 981	€ 4,497	€ 5,477
Manufacture of electrical machinery and apparatus	€ 14	€ 30	€ 44
Manufacture of radio, television and communication equipment and apparatus	€ 5	€ 11	€ 17
Manufacture of medical, precision and optical instruments, watches and clocks	€ 13	€ 31	€ 44
Manufacture of other transport equipment	€ 306	€ 1,387	€ 1,693
Manufacture of furniture, manufacturing n.e.c	€ 125	€ 518	€ 643
Electricity, gas, steam and hot water supply	€ 7	€ 31	€ 38
Collection, purification and distribution of water	€ 0	€ 2	€ 2
Construction	€ 8	€ 199	€ 207

Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	€ 99	€ 237	€ 336
Wholesale trade and commission trade, except of motor vehicles and motorcycles	€ 2	€ 5	€ 7
Land transport; transport via pipelines	€ 6	€ 31	€ 37
Water Transport	€ 1	€ 4	€ 5
Air Transport	€ 5	€ 23	€ 28
Supporting and auxiliary transport activities; activities of travel agencies	€ 3	€ 16	€ 19
Post and telecommunications	€ 0	€ 0	€ 0
Research and development	€ 6	€ 9	€ 15
Other business activities	€ 16	€ 27	€ 43
Public administration and defence; compulsory social security	€ 58	€ 65	€ 123
Education	€ 31	€ 11	€ 42
Health and Social Work	€ 11	€ 3	€ 13
Sewage and refuse disposal, sanitation and similar activities	€ 58	€ 54	€ 113
TOTAL	€ 4,846	€ 20,062	€ 24,907

High	Female	Male	Total
Agriculture, hunting and related service activities	€ 3	€ 5	€ 8
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	€ 4	€ 23	€ 26
Mining of metal ores	€ 0	€ 0	€ 0
Manufacture of food products and beverages	€ 170	€ 352	€ 521
Manufacture of textiles	€ 60	€ 122	€ 182
Manufacture of wearing apparel; dressing and dyeing of fur	€ 86	€ 142	€ 228
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	€ 79	€ 151	€ 230
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	€ 68	€ 137	€ 205
Manufacture of pulp, paper and paper products	€ 95	€ 225	€ 321
Publishing, printing and reproduction of recorded media	€ 105	€ 255	€ 360
Manufacture of coke, refined petroleum products and nuclear fuel	€ 42	€ 95	€ 137
Manufacture of chemicals and chemical products	€ 504	€ 2,757	€ 3,261
Manufacture of Rubber and Plastic Products	€ 276	€ 630	€ 906
Manufacture of other non-metallic mineral products	€ 79	€ 170	€ 248
Manufacture of basic metals	€ 641	€ 2,962	€ 3,602
Manufacture of fabricated metal products, except machinery and equipment	€ 5,987	€ 28,548	€ 34,535
Manufacture of machinery and equipment	€ 2,826	€ 13,600	€ 16,426
Manufacture of electrical machinery and apparatus	€ 83	€ 181	€ 264
Manufacture of radio, television and communication equipment and apparatus	€ 30	€ 69	€ 99
Manufacture of medical, precision and optical instruments, watches and clocks	€ 78	€ 190	€ 267
Manufacture of other transport equipment	€ 883	€ 4,190	€ 5,073
Manufacture of furniture, manufacturing n.e.c	€ 360	€ 1,566	€ 1,926
Electricity, gas, steam and hot water supply	€ 43	€ 189	€ 232
Collection, purification and distribution of water	€ 2	€ 10	€ 12
Construction	€ 48	€ 1,210	€ 1,257
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	€ 592	€ 1,457	€ 2,049
Wholesale trade and commission trade, except of motor vehicles and motorcycles	€ 13	€ 28	€ 41
Land transport; transport via pipelines	€ 37	€ 191	€ 228

High	Female	Male	Total
Water Transport	€ 5	€ 25	€ 29
Air Transport	€ 28	€ 141	€ 169
Supporting and auxiliary transport activities; activities of travel agencies	€ 19	€ 99	€ 118
Post and telecommunications	€ 0	€ 2	€ 3
Research and development	€ 34	€ 58	€ 92
Other business activities	€ 97	€ 165	€ 262
Public administration and defence; compulsory social security	€ 344	€ 401	€ 746
Education	€ 184	€ 67	€ 252
Health and Social Work	€ 64	€ 15	€ 80
Sewage and refuse disposal, sanitation and similar activities	€ 347	€ 334	€ 682
TOTAL	€ 16,043	€ 66,134	€ 82,177

Note: Industry breakdown results may not equate exactly to Member State breakdown due to differences in underlying health data.

Table 8.3.8 Summary

Costs by Gender (€m)	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
Female	640 to 1615	750 to 1979	792 to 2293	764 to 2517	710 to 2735	697 to 3076
Male	2740 to 8090	3290 to 9969	3524 to 11173	3328 to 11238	2897 to 10625	2613 to 10468
Total	3380 to 9705	4040 to 11947	4316 to 13466	4092 to 13754	3607 to 13360	3310 to 13544

8.4 VALUING HEALTH BENEFITS – INTERVENTION SCENARIOS

Table 8.4.1 Proportions exposed above the exposure limits being tested by country, forecast scenario

Forecast Scenario	1971-80	1981-90	1991-00	2001-10	2011-20	2021-30	1971-80	1981-90	1991-00	2001-10	2011-20	2021-30	1971-80	1981-90	1991-00	2001-10	2011-20	2021-30
OEL	0.025 mg/m^3						0.05 mg/m^3						0.1 mg/m^3					
Austria	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Belgium	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Bulgaria	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Cyprus	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Czech Republic	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Denmark	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Estonia	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Finland	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
France	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Germany	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Greece	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Hungary	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Ireland	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Italy	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Latvia	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Lithuania	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Luxembourg	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Malta	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Netherlands	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Poland	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Portugal	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Romania	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01

Forecast Scenario	1971-80	1981-90	1991-00	2001-10	2011-20	2021-30	1971-80	1981-90	1991-00	2001-10	2011-20	2021-30	1971-80	1981-90	1991-00	2001-10	2011-20	2021-30
OEL	**0.025 mg/m^3**						**0.05 mg/m^3**						**0.1 mg/m^3**					
Slovakia	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Slovenia	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Spain	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
Sweden	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
United Kingdom	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01
TOTAL	0.44	0.32	0.22	0.14	0.08	0.04	0.33	0.22	0.14	0.08	0.04	0.02	0.23	0.14	0.08	0.04	0.02	0.01

Table 8.4.2 Numbers and proportions of the population ever exposed for baseline, forecast and intervention [1] scenarios (2) to (5), by country, men plus women

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Numbers ever exposed																	
Austria	41,262	42,453	43,697	43,875	43,742	43,716	43,697	43,875	43,742	43,716	43,697	43,875	43,742	43,716	43,697	43,875	43,742	43,716
Belgium	40,100	41,140	42,055	41,970	41,499	41,298	42,055	41,970	41,499	41,298	42,055	41,970	41,499	41,298	42,055	41,970	41,499	41,298
Bulgaria	24,653	25,527	26,526	26,907	27,053	27,169	26,526	26,907	27,053	27,169	26,526	26,907	27,053	27,169	26,526	26,907	27,053	27,169
Cyprus	2,283	2,383	2,497	2,560	2,587	2,607	2,497	2,560	2,587	2,607	2,497	2,560	2,587	2,607	2,497	2,560	2,587	2,607
Czech Republic	67,692	69,395	71,135	71,055	70,642	70,465	71,135	71,055	70,642	70,465	71,135	71,055	70,642	70,465	71,135	71,055	70,642	70,465
Denmark	25,825	26,656	27,541	27,780	27,768	27,800	27,541	27,780	27,768	27,800	27,541	27,780	27,768	27,800	27,541	27,780	27,768	27,800
Estonia	5,201	5,326	5,432	5,406	5,335	5,303	5,432	5,406	5,335	5,303	5,432	5,406	5,335	5,303	5,432	5,406	5,335	5,303
Finland	17,844	18,492	19,271	19,589	19,766	19,885	19,271	19,589	19,766	19,885	19,271	19,589	19,766	19,885	19,271	19,589	19,766	19,885
France	272,943	264,463	254,603	246,259	234,985	230,458	254,603	246,259	234,985	230,458	254,603	246,259	234,985	230,458	254,603	246,259	234,985	230,458
Germany	443,139	455,505	468,333	469,593	467,753	467,212	468,333	469,593	467,753	467,212	468,333	469,593	467,753	467,212	468,333	469,593	467,753	467,212
Greece	25,662	26,796	28,156	28,914	29,324	29,604	28,156	28,914	29,324	29,604	28,156	28,914	29,324	29,604	28,156	28,914	29,324	29,604
Hungary	35,154	36,193	37,310	37,515	37,465	37,477	37,310	37,515	37,465	37,477	37,310	37,515	37,465	37,477	37,310	37,515	37,465	37,477
Ireland	9,729	10,008	10,234	10,239	10,101	10,047	10,234	10,239	10,101	10,047	10,234	10,239	10,101	10,047	10,234	10,239	10,101	10,047
Italy	361,433	372,803	385,419	388,681	389,171	389,868	385,419	388,681	389,171	389,868	385,419	388,681	389,171	389,868	385,419	388,681	389,171	389,868
Latvia	6,734	6,900	7,026	6,989	6,876	6,825	7,026	6,989	6,876	6,825	7,026	6,989	6,876	6,825	7,026	6,989	6,876	6,825
Lithuania	9,631	9,917	10,196	10,239	10,183	10,167	10,196	10,239	10,183	10,167	10,196	10,239	10,183	10,167	10,196	10,239	10,183	10,167
Luxembourg	2,994	3,126	3,291	3,382	3,440	3,477	3,291	3,382	3,440	3,477	3,291	3,382	3,440	3,477	3,291	3,382	3,440	3,477
Malta	66	79	98	117	131	139	98	117	131	139	98	117	131	139	98	117	131	139
Netherlands	60,591	62,643	64,884	65,623	65,744	65,906	64,884	65,623	65,744	65,906	64,884	65,623	65,744	65,906	64,884	65,623	65,744	65,906
Poland	132,356	135,979	139,704	139,978	139,351	139,140	139,704	139,978	139,351	139,140	139,704	139,978	139,351	139,140	139,704	139,978	139,351	139,140
Portugal	36,031	37,252	38,625	39,090	39,235	39,364	38,625	39,090	39,235	39,364	38,625	39,090	39,235	39,364	38,625	39,090	39,235	39,364
Romania	59,202	60,984	62,907	63,312	63,262	63,302	62,907	63,312	63,262	63,302	62,907	63,312	63,262	63,302	62,907	63,312	63,262	63,302

Scenario[1]	All Scenarios		Baseline scenario (2)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Slovakia	17,766	18,270	18,813	18,886	18,849	18,845	18,813	18,886	18,849	18,845	18,813	18,886	18,849	18,845	18,813	18,886	18,849	18,845
Slovenia	13,367	13,674	13,960	13,889	13,748	13,681	13,960	13,889	13,748	13,681	13,960	13,889	13,748	13,681	13,960	13,889	13,748	13,681
Spain	212,863	261,596	327,140	392,239	438,533	468,506	327,140	392,239	438,533	468,506	327,140	392,239	438,533	468,506	327,140	392,239	438,533	468,506
Sweden	51,433	52,811	54,192	54,232	53,915	53,794	54,192	54,232	53,915	53,794	54,192	54,232	53,915	53,794	54,192	54,232	53,915	53,794
United Kingdom	311,845	290,472	259,833	229,289	206,252	192,805	259,833	229,289	206,252	192,805	259,833	229,289	206,252	192,805	259,833	229,289	206,252	192,805
TOTAL	2,287,798	2,350,844	2,422,877	2,457,607	2,466,708	2,478,859	2,422,877	2,457,607	2,466,708	2,478,859	2,422,877	2,457,607	2,466,708	2,478,859	2,422,877	2,457,607	2,466,708	2,478,859

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Proportion of the population exposed																	
Austria	1.408	1.345	1.327	1.304	1.293	1.304	1.327	1.304	1.293	1.304	1.327	1.304	1.293	1.304	1.327	1.304	1.293	1.304
Belgium	1.085	1.040	1.017	0.982	0.951	0.934	1.017	0.982	0.951	0.934	1.017	0.982	0.951	0.934	1.017	0.982	0.951	0.934
Bulgaria	0.929	0.982	1.082	1.140	1.212	1.312	1.082	1.140	1.212	1.312	1.082	1.140	1.212	1.312	1.082	1.140	1.212	1.312
Cyprus	0.841	0.718	0.662	0.610	0.564	0.536	0.662	0.610	0.564	0.536	0.662	0.610	0.564	0.536	0.662	0.610	0.564	0.536
Czech Republic	1.845	1.788	1.843	1.842	1.868	1.948	1.843	1.842	1.868	1.948	1.843	1.842	1.868	1.948	1.843	1.842	1.868	1.948
Denmark	1.375	1.354	1.352	1.350	1.339	1.319	1.352	1.350	1.339	1.319	1.352	1.350	1.339	1.319	1.352	1.350	1.339	1.319
Estonia	1.255	1.244	1.306	1.291	1.285	1.321	1.306	1.291	1.285	1.321	1.306	1.291	1.285	1.321	1.306	1.291	1.285	1.321
Finland	0.976	0.960	0.988	1.007	1.018	1.025	0.988	1.007	1.018	1.025	0.988	1.007	1.018	1.025	0.988	1.007	1.018	1.025
France	1.325	1.206	1.107	1.028	0.956	0.918	1.107	1.028	0.956	0.918	1.107	1.028	0.956	0.918	1.107	1.028	0.956	0.918
Germany	1.483	1.481	1.532	1.579	1.640	1.728	1.532	1.579	1.640	1.728	1.532	1.579	1.640	1.728	1.532	1.579	1.640	1.728
Greece	0.621	0.625	0.648	0.654	0.669	0.698	0.648	0.654	0.669	0.698	0.648	0.654	0.669	0.698	0.648	0.654	0.669	0.698
Hungary	1.046	1.053	1.093	1.103	1.118	1.156	1.093	1.103	1.118	1.156	1.093	1.103	1.118	1.156	1.093	1.103	1.118	1.156
Ireland	0.647	0.562	0.519	0.476	0.440	0.422	0.519	0.476	0.440	0.422	0.519	0.476	0.440	0.422	0.519	0.476	0.440	0.422
Italy	1.661	1.643	1.657	1.641	1.661	1.713	1.657	1.641	1.661	1.713	1.657	1.641	1.661	1.713	1.657	1.641	1.661	1.713
Latvia	0.947	0.950	1.021	1.037	1.054	1.112	1.021	1.037	1.054	1.112	1.021	1.037	1.054	1.112	1.021	1.037	1.054	1.112
Lithuania	0.927	0.914	0.966	1.000	1.028	1.093	0.966	1.000	1.028	1.093	0.966	1.000	1.028	1.093	0.966	1.000	1.028	1.093
Luxembourg	1.769	1.634	1.546	1.466	1.399	1.338	1.546	1.466	1.399	1.338	1.546	1.466	1.399	1.338	1.546	1.466	1.399	1.338
Malta	0.046	0.050	0.061	0.073	0.082	0.089	0.061	0.073	0.082	0.089	0.061	0.073	0.082	0.089	0.061	0.073	0.082	0.089
Netherlands	1.070	1.045	1.043	1.055	1.072	1.084	1.043	1.055	1.072	1.084	1.043	1.055	1.072	1.084	1.043	1.055	1.072	1.084
Poland	1.045	1.011	1.047	1.069	1.101	1.169	1.047	1.069	1.101	1.169	1.047	1.069	1.101	1.169	1.047	1.069	1.101	1.169
Portugal	0.963	0.941	0.934	0.917	0.915	0.928	0.934	0.917	0.915	0.928	0.934	0.917	0.915	0.928	0.934	0.917	0.915	0.928
Romania	0.821	0.818	0.858	0.878	0.911	0.974	0.858	0.878	0.911	0.974	0.858	0.878	0.911	0.974	0.858	0.878	0.911	0.974
Slovakia	0.986	0.940	0.964	0.980	1.011	1.078	0.964	0.980	1.011	1.078	0.964	0.980	1.011	1.078	0.964	0.980	1.011	1.078

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Slovenia	1.814	1.771	1.823	1.848	1.911	2.029	1.823	1.848	1.911	2.029	1.823	1.848	1.911	2.029	1.823	1.848	1.911	2.029
Spain	1.259	1.408	1.685	1.946	2.176	2.398	1.685	1.946	2.176	2.398	1.685	1.946	2.176	2.398	1.685	1.946	2.176	2.398
Sweden	1.603	1.508	1.499	1.458	1.405	1.374	1.499	1.458	1.405	1.374	1.499	1.458	1.405	1.374	1.499	1.458	1.405	1.374
United Kingdom	1.506	1.287	1.094	0.919	0.789	0.711	1.094	0.919	0.789	0.711	1.094	0.919	0.789	0.711	1.094	0.919	0.789	0.711
TOTAL	1.320	1.281	1.291	1.291	1.298	1.327	1.291	1.291	1.298	1.327	1.291	1.291	1.298	1.327	1.291	1.291	1.298	1.327

Table 8.4.3 Results for baseline, forecast, and intervention [1] scenarios (2) to (5) for lung cancer, by country, men plus women

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Fraction (%)																	
Austria	0.13	0.11	0.09	0.06	0.04	0.03	0.09	0.06	0.02	0.01	0.09	0.06	0.03	0.01	0.09	0.06	0.03	0.02
Belgium	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bulgaria	0.09	0.08	0.06	0.05	0.03	0.02	0.06	0.04	0.02	0.00	0.06	0.04	0.02	0.01	0.06	0.04	0.03	0.02
Cyprus	0.05	0.04	0.02	0.01	0.01	0.00	0.02	0.01	0.00	0.00	0.02	0.01	0.00	0.00	0.02	0.01	0.01	0.00
Czech Republic	0.21	0.18	0.15	0.11	0.08	0.06	0.15	0.10	0.05	0.02	0.15	0.11	0.06	0.03	0.15	0.11	0.07	0.05
Denmark	0.12	0.11	0.09	0.06	0.04	0.03	0.08	0.05	0.02	0.01	0.08	0.06	0.03	0.01	0.08	0.06	0.03	0.02
Estonia	0.10	0.09	0.07	0.05	0.03	0.02	0.07	0.04	0.02	0.00	0.07	0.04	0.02	0.01	0.07	0.04	0.02	0.01
Finland	0.10	0.09	0.07	0.05	0.04	0.03	0.07	0.05	0.02	0.01	0.07	0.05	0.03	0.01	0.07	0.05	0.03	0.02
France	0.14	0.11	0.08	0.05	0.03	0.02	0.08	0.05	0.02	0.00	0.08	0.05	0.02	0.01	0.08	0.05	0.03	0.01
Germany	0.15	0.13	0.11	0.08	0.06	0.04	0.11	0.08	0.04	0.01	0.11	0.08	0.04	0.02	0.11	0.08	0.05	0.04
Greece	0.05	0.04	0.03	0.02	0.01	0.01	0.03	0.02	0.01	0.00	0.03	0.02	0.01	0.00	0.03	0.02	0.01	0.01
Hungary	0.09	0.08	0.07	0.05	0.03	0.02	0.07	0.04	0.02	0.00	0.07	0.04	0.02	0.01	0.07	0.04	0.02	0.02
Ireland	0.05	0.04	0.02	0.01	0.01	0.00	0.02	0.01	0.00	0.00	0.02	0.01	0.01	0.00	0.02	0.01	0.01	0.00
Italy	0.15	0.13	0.10	0.07	0.05	0.03	0.10	0.06	0.03	0.01	0.10	0.06	0.03	0.01	0.10	0.07	0.04	0.02
Latvia	0.07	0.06	0.04	0.03	0.02	0.01	0.04	0.03	0.01	0.00	0.04	0.03	0.01	0.00	0.04	0.03	0.01	0.01
Lithuania	0.07	0.06	0.04	0.03	0.02	0.01	0.04	0.03	0.01	0.00	0.04	0.03	0.01	0.00	0.04	0.03	0.01	0.01
Luxembourg	0.14	0.11	0.08	0.05	0.03	0.02	0.08	0.04	0.02	0.00	0.08	0.04	0.02	0.01	0.08	0.05	0.02	0.01
Malta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Netherlands	0.09	0.07	0.06	0.04	0.03	0.02	0.06	0.04	0.02	0.00	0.06	0.04	0.02	0.01	0.06	0.04	0.02	0.01
Poland	0.10	0.09	0.07	0.05	0.03	0.02	0.07	0.04	0.02	0.01	0.07	0.05	0.02	0.01	0.07	0.05	0.03	0.02
Portugal	0.08	0.07	0.05	0.03	0.02	0.01	0.05	0.03	0.01	0.00	0.05	0.03	0.02	0.01	0.05	0.03	0.02	0.01
Romania	0.08	0.07	0.05	0.04	0.02	0.02	0.05	0.03	0.01	0.00	0.05	0.03	0.02	0.01	0.05	0.03	0.02	0.01

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Slovakia	0.11	0.09	0.07	0.06	0.04	0.03	0.07	0.05	0.02	0.01	0.07	0.05	0.03	0.01	0.07	0.05	0.03	0.02
Slovenia	0.20	0.18	0.15	0.11	0.08	0.06	0.15	0.10	0.05	0.02	0.15	0.10	0.06	0.03	0.15	0.11	0.07	0.05
Spain	0.06	0.06	0.05	0.04	0.03	0.02	0.05	0.04	0.02	0.00	0.05	0.04	0.02	0.01	0.05	0.04	0.02	0.02
Sweden	0.14	0.12	0.10	0.07	0.05	0.03	0.10	0.06	0.03	0.01	0.10	0.07	0.03	0.02	0.10	0.07	0.04	0.03
United Kingdom	0.12	0.09	0.06	0.03	0.02	0.01	0.06	0.03	0.01	0.00	0.06	0.03	0.01	0.00	0.06	0.03	0.01	0.01
TOTAL	0.12	0.10	0.08	0.05	0.03	0.02	0.08	0.05	0.02	0.01	0.08	0.05	0.02	0.01	0.08	0.05	0.03	0.02

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Deaths																	
Austria	5	5	5	4	3	2	5	3	2	0	5	3	2	1	5	4	2	1
Belgium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	3	3	3	2	1	1	3	2	1	0	3	2	1	0	3	2	1	1
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	13	14	13	11	8	6	13	10	5	2	13	10	6	3	13	11	7	5
Denmark	5	5	5	4	2	2	5	3	2	0	5	3	2	1	5	4	2	1
Estonia	1	1	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
Finland	2	3	2	2	1	1	2	2	1	0	2	2	1	0	2	2	1	1
France	43	40	32	23	14	9	32	21	9	2	32	21	10	4	32	22	12	7
Germany	67	71	66	54	37	26	66	48	23	7	66	49	27	13	66	51	32	21
Greece	3	3	3	2	1	1	3	2	1	0	3	2	1	0	3	2	1	1
Hungary	8	8	7	5	3	2	7	4	2	1	7	5	2	1	7	5	3	2
Ireland	1	1	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0
Italy	55	56	50	39	28	19	50	35	17	4	50	36	19	8	50	37	24	15
Latvia	1	1	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
Lithuania	1	1	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	9	10	9	7	5	3	9	6	3	1	9	6	3	1	9	7	4	2
Poland	26	26	25	19	14	10	24	18	9	2	24	18	10	5	24	19	12	8
Portugal	3	3	3	2	1	1	3	2	1	0	3	2	1	0	3	2	1	1
Romania	8	7	7	5	3	2	6	5	2	0	7	5	2	1	7	5	3	2
Slovakia	3	3	3	2	2	1	3	2	1	0	3	2	1	1	3	2	2	1

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Slovenia	2	3	3	2	2	1	3	2	1	0	3	2	1	1	3	2	1	1
Spain	14	16	18	16	13	9	18	15	7	2	18	15	8	4	18	15	10	7
Sweden	5	5	5	4	3	2	5	3	2	1	5	3	2	1	5	4	2	2
United Kingdom	46	41	30	19	10	6	30	17	7	1	30	18	7	2	30	18	9	4
TOTAL	336	334	296	227	155	105	295	206	95	26	295	210	109	49	295	217	132	85

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Registrations																	
Austria	6	6	5	4	3	2	5	4	2	0	5	4	2	1	5	4	2	2
Belgium	9	9	8	6	4	2	8	5	2	1	8	5	3	1	8	5	3	2
Bulgaria	3	3	2	2	1	1	2	1	1	0	2	1	1	0	2	2	1	1
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	15	15	15	12	9	6	15	11	5	2	15	11	6	3	15	11	8	5
Denmark	5	5	4	3	2	1	4	3	1	0	4	3	2	1	4	3	2	1
Estonia	1	1	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
Finland	2	3	2	2	1	1	2	2	1	0	2	2	1	0	2	2	1	1
France	45	41	32	22	14	9	32	20	8	2	32	21	10	4	32	21	12	7
Germany	76	77	71	56	38	26	71	50	24	7	71	51	27	13	71	53	33	22
Greece	3	3	3	2	1	1	3	2	1	0	3	2	1	0	3	2	1	1
Hungary	9	8	7	5	4	2	7	5	2	1	7	5	2	1	7	5	3	2
Ireland	1	1	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0
Italy	64	64	56	43	29	19	56	39	18	5	56	40	20	9	56	41	24	15
Latvia	1	1	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
Lithuania	1	1	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	11	11	10	7	5	3	10	7	3	1	10	7	3	1	10	7	4	2
Poland	28	29	26	21	15	10	26	19	9	3	26	19	10	5	26	20	13	8
Portugal	3	3	2	2	1	1	2	2	1	0	2	2	1	0	2	2	1	1
Romania	7	7	6	5	3	2	6	4	2	0	6	4	2	1	6	4	3	2
Slovakia	3	3	3	3	2	2	3	2	1	0	3	3	1	1	3	3	2	1
Slovenia	3	3	3	2	2	1	3	2	1	0	3	2	1	1	3	2	1	1

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Spain	15	17	18	16	12	9	18	15	7	2	18	15	8	3	18	15	10	7
Sweden	5	5	4	3	2	2	4	3	1	0	4	3	2	1	4	3	2	1
United Kingdom	56	49	36	22	11	6	36	20	7	1	36	20	8	3	36	21	10	5
TOTAL	368	362	315	237	158	106	314	214	97	26	314	219	112	50	314	226	135	86

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Years of Life Lost (YLLs)																	
Austria	78	79	68	50	34	23	68	45	20	6	68	46	24	11	68	48	29	19
Belgium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	48	44	37	26	16	10	36	24	10	2	36	24	11	4	36	25	14	8
Cyprus	1	1	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0
Czech Republic	189	189	174	142	101	69	173	127	62	20	173	130	72	35	173	135	87	58
Denmark	74	74	62	45	29	20	62	40	18	5	62	41	21	9	62	43	25	16
Estonia	10	9	8	6	4	2	8	5	2	0	8	5	2	1	8	5	3	2
Finland	32	33	29	22	15	11	29	20	9	3	29	20	11	5	29	21	13	9
France	758	679	508	345	209	134	507	313	129	33	507	320	148	62	507	330	178	108
Germany	1,037	1,050	925	700	470	324	923	631	290	89	923	646	335	161	924	668	404	269
Greece	48	46	38	26	16	10	38	24	10	2	38	24	11	4	38	25	13	8
Hungary	124	113	96	69	44	28	96	63	27	6	96	64	31	12	96	66	37	22
Ireland	13	13	11	8	5	3	11	7	3	1	11	7	3	1	11	8	4	2
Italy	779	769	671	499	330	218	669	450	201	52	669	459	231	99	670	475	280	176
Latvia	10	9	7	5	3	2	7	5	2	0	7	5	2	1	7	5	3	2
Lithuania	15	13	11	8	5	3	11	7	3	1	11	7	3	1	11	8	4	2
Luxembourg	5	5	4	3	2	1	4	3	1	0	4	3	1	0	4	3	1	1
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	133	136	115	82	51	33	114	74	31	8	114	76	36	15	114	78	44	27
Poland	385	379	331	257	178	117	330	232	109	29	330	237	125	54	330	245	151	95

Scenario[1]	All Scenarios		Baseline scenario (2)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Portugal	52	50	41	29	18	12	41	26	11	3	41	27	13	5	41	28	16	9
Romania	120	112	97	71	44	27	97	64	27	6	97	65	31	12	97	68	37	22
Slovakia	36	37	35	28	20	14	35	25	12	4	35	26	14	7	35	27	17	11
Slovenia	39	40	37	28	19	13	37	26	12	4	37	26	14	7	37	27	17	11
Spain	229	263	284	242	172	118	283	214	98	22	283	219	113	47	283	228	141	93
Sweden	78	76	65	49	34	24	65	44	21	7	65	45	24	12	65	47	29	20
United Kingdom	642	552	391	233	123	67	390	217	81	15	390	220	90	29	390	225	106	53
TOTAL	5,164	4,981	4,217	3,075	2,004	1,325	4,206	2,780	1,229	328	4,208	2,840	1,413	617	4,212	2,936	1,706	1,077

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Years of Life Lived with Disability (DALYs)																	
Austria	81	83	71	53	35	24	71	47	21	6	71	49	25	11	71	50	30	19
Belgium	5	5	5	3	2	1	5	3	1	0	5	3	1	1	5	3	2	1
Bulgaria	49	45	38	27	17	10	38	24	10	2	38	25	12	4	38	26	14	8
Cyprus	1	1	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0
Czech Republic	199	198	182	149	106	73	182	134	65	21	182	137	75	37	182	142	91	61
Denmark	77	77	65	47	30	20	64	42	19	5	65	43	21	10	65	45	26	17
Estonia	11	10	8	6	4	2	8	5	2	0	8	5	3	1	8	6	3	2
Finland	33	35	30	23	16	11	30	21	10	3	30	21	11	5	30	22	13	9
France	787	705	527	358	218	139	526	325	135	34	526	332	154	64	527	343	185	112
Germany	1,082	1,096	967	732	492	339	964	659	303	93	965	675	351	168	966	699	423	281
Greece	50	48	39	27	17	10	39	25	10	2	39	25	11	4	39	26	14	8
Hungary	129	119	101	73	46	29	101	66	28	7	101	67	32	13	101	69	39	24
Ireland	14	13	12	8	5	3	12	8	3	1	12	8	4	1	12	8	4	2
Italy	817	806	703	523	347	228	701	472	210	54	702	482	242	104	702	498	294	184
Latvia	11	9	8	5	3	2	8	5	2	0	8	5	2	1	8	5	3	2
Lithuania	15	14	12	8	5	3	12	8	3	1	12	8	4	1	12	8	4	2
Luxembourg	5	5	4	3	2	1	4	3	1	0	4	3	1	1	4	3	2	1
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	139	143	120	86	54	35	120	78	33	8	120	79	38	16	120	82	46	28
Poland	403	396	347	269	187	123	346	243	114	30	346	248	131	57	346	257	159	100

Scenario[1]	All Scenarios		Baseline scenario (2)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Portugal	54	51	43	30	19	12	42	27	12	3	42	28	13	5	42	29	16	10
Romania	125	117	101	74	46	28	101	67	28	6	101	68	32	12	101	70	39	23
Slovakia	39	39	37	30	22	15	37	27	13	4	37	28	15	7	37	29	18	12
Slovenia	41	42	39	30	20	14	39	27	13	4	39	27	15	7	39	28	17	12
Spain	238	273	295	252	179	123	294	223	102	23	294	228	118	49	294	237	147	97
Sweden	81	78	68	51	35	24	68	46	21	7	68	47	25	12	68	49	30	20
United Kingdom	675	581	411	245	129	71	410	229	86	15	410	232	95	30	411	237	111	55
TOTAL	5,390	5,200	4,405	3,214	2,096	1,387	4,393	2,906	1,285	343	4,395	2,969	1,478	645	4,399	3,068	1,784	1,127

[1] Intervention scenarios have been estimated assuming baseline exposure and employment levels
[2] Change from 2010 in baseline scenario is due to trends in 'historic' (pre 2005) part of REP

Note: Numbers and proportions ever exposed remain constant across the baseline and intervention scenarios

Table 8.4.3 Results for baseline, forecast and intervention[1] scenarios (2) to (5) for sinonasal cancer, by country, men plus women

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Fraction (%)																	
Austria	3.27	3.14	2.98	2.75	2.56	2.49	2.98	2.70	2.43	2.33	2.98	2.71	2.46	2.38	2.98	2.73	2.51	2.45
Belgium	0.84	0.81	0.78	0.71	0.65	0.62	0.78	0.70	0.63	0.59	0.78	0.70	0.63	0.60	0.78	0.70	0.64	0.62
Bulgaria	3.07	3.16	3.27	3.20	3.20	3.34	3.27	3.16	3.08	3.17	3.27	3.17	3.11	3.22	3.27	3.18	3.15	3.30
Cyprus	1.89	1.59	1.41	1.23	1.11	1.04	1.41	1.22	1.08	1.02	1.41	1.22	1.09	1.02	1.41	1.23	1.10	1.04
Czech Republic	5.43	5.24	5.16	4.83	4.61	4.57	5.16	4.74	4.34	4.20	5.16	4.76	4.41	4.32	5.16	4.79	4.51	4.49
Denmark	3.62	3.52	3.34	3.11	2.89	2.75	3.34	3.06	2.76	2.58	3.34	3.07	2.79	2.63	3.34	3.09	2.84	2.71
Estonia	3.68	3.63	3.69	3.47	3.31	3.33	3.69	3.43	3.20	3.19	3.69	3.44	3.22	3.22	3.69	3.45	3.26	3.29
Finland	2.59	2.53	2.48	2.36	2.27	2.23	2.48	2.32	2.16	2.08	2.48	2.32	2.18	2.12	2.48	2.34	2.23	2.20
France	3.38	3.01	2.63	2.29	2.02	1.86	2.63	2.26	1.93	1.75	2.63	2.26	1.95	1.78	2.63	2.27	1.98	1.83
Germany	3.67	3.65	3.64	3.51	3.38	3.43	3.64	3.44	3.20	3.19	3.64	3.46	3.25	3.26	3.64	3.48	3.32	3.38
Greece	1.46	1.42	1.40	1.34	1.32	1.35	1.40	1.33	1.29	1.30	1.40	1.33	1.29	1.31	1.40	1.34	1.31	1.34
Hungary	2.94	2.92	2.90	2.77	2.68	2.69	2.90	2.73	2.58	2.55	2.90	2.73	2.60	2.59	2.90	2.75	2.64	2.66
Ireland	1.62	1.39	1.24	1.06	0.92	0.86	1.24	1.05	0.90	0.83	1.24	1.05	0.90	0.84	1.24	1.05	0.91	0.85
Italy	3.96	3.85	3.71	3.46	3.30	3.27	3.71	3.41	3.16	3.09	3.71	3.42	3.19	3.14	3.71	3.44	3.24	3.22
Latvia	2.54	2.54	2.65	2.57	2.51	2.60	2.65	2.54	2.44	2.52	2.65	2.55	2.46	2.54	2.65	2.56	2.48	2.58
Lithuania	2.76	2.69	2.73	2.66	2.61	2.72	2.73	2.63	2.54	2.63	2.73	2.64	2.56	2.66	2.73	2.65	2.58	2.70
Luxembourg	3.58	3.28	2.98	2.66	2.42	2.26	2.98	2.63	2.33	2.16	2.98	2.63	2.35	2.19	2.98	2.65	2.38	2.23
Malta	0.10	0.11	0.13	0.16	0.20	0.22	0.13	0.16	0.20	0.22	0.13	0.16	0.20	0.22	0.13	0.16	0.20	0.22
Netherlands	2.44	2.37	2.26	2.14	2.05	2.02	2.26	2.11	1.97	1.92	2.26	2.12	1.99	1.95	2.26	2.13	2.02	2.00
Poland	2.85	2.73	2.70	2.56	2.51	2.58	2.70	2.52	2.40	2.42	2.70	2.53	2.42	2.47	2.70	2.55	2.47	2.54
Portugal	2.82	2.70	2.56	2.36	2.24	2.21	2.55	2.33	2.16	2.10	2.56	2.34	2.18	2.13	2.56	2.35	2.21	2.18

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Romania	2.67	2.61	2.59	2.48	2.42	2.49	2.59	2.44	2.33	2.37	2.59	2.45	2.35	2.40	2.59	2.46	2.38	2.46
Slovakia	2.96	2.79	2.73	2.59	2.52	2.58	2.73	2.54	2.39	2.40	2.73	2.56	2.42	2.45	2.73	2.57	2.47	2.54
Slovenia	5.28	5.16	5.11	4.82	4.64	4.69	5.10	4.72	4.38	4.33	5.10	4.74	4.44	4.44	5.10	4.77	4.54	4.61
Spain	2.34	2.52	2.99	3.41	3.84	4.25	2.99	3.37	3.75	4.14	2.99	3.38	3.77	4.17	2.99	3.39	3.80	4.22
Sweden	4.04	3.81	3.62	3.30	3.00	2.82	3.62	3.24	2.83	2.62	3.62	3.25	2.87	2.68	3.62	3.27	2.94	2.78
United Kingdom	3.72	3.19	2.60	2.04	1.61	1.39	2.60	2.02	1.56	1.33	2.60	2.03	1.57	1.35	2.60	2.03	1.59	1.37
TOTAL	3.28	3.13	3.01	2.82	2.68	2.66	3.01	2.78	2.57	2.52	3.01	2.78	2.60	2.56	3.01	2.80	2.64	2.63

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Deaths																	
Austria	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Belgium	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Bulgaria	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Denmark	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
France	5	5	5	5	5	5	5	5	5	4	5	5	5	4	5	5	5	4
Germany	8	9	10	10	11	10	10	10	10	9	10	10	10	10	10	10	10	10
Greece	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Hungary	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ireland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Italy	6	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Latvia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Poland	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Portugal	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Romania	1	1	1	2	2	2	1	2	2	2	1	2	2	2	1	2	2	2
Slovakia	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Slovenia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spain	3	3	5	6	8	9	5	6	8	9	5	6	8	9	5	6	8	9

Scenario[1]	All Scenarios		Baseline scenario (2)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Sweden	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
United Kingdom	5	5	5	4	4	3	5	4	4	3	5	4	4	3	5	4	4	3
TOTAL	39	44	48	50	51	52	48	49	49	49	48	49	50	50	48	50	50	51

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Registrations																	
Austria	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Belgium	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Bulgaria	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Denmark	1	2	2	2	2	2	2	2	2	1	2	2	2	1	2	2	2	2
Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Finland	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
France	15	16	15	15	14	13	15	14	13	12	15	15	13	12	15	15	13	13
Germany	24	27	29	30	29	28	29	29	28	26	29	29	28	27	29	29	29	27
Greece	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Hungary	2	2	2	2	3	3	2	2	2	3	2	2	2	3	2	2	2	3
Ireland	0	0	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1
Italy	19	21	23	23	23	23	23	23	22	22	23	23	23	22	23	23	23	23
Latvia	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Lithuania	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Poland	7	8	9	9	9	10	9	9	9	9	9	9	9	9	9	9	9	10
Portugal	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Romania	4	4	4	5	5	5	4	5	5	5	4	5	5	5	4	5	5	5
Slovakia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Slovenia	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Spain	8	10	14	18	22	26	14	18	22	25	14	18	22	25	14	18	22	25
Sweden	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
United Kingdom	16	15	14	12	11	10	14	12	10	9	14	12	10	9	14	12	10	10
TOTAL	118	129	139	143	144	145	139	141	138	137	139	142	140	139	139	142	142	143

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Years of Life Lost (YLLs)																	
Austria	11	12	13	12	12	11	13	12	11	10	13	12	11	11	13	12	11	11
Belgium	11	12	12	11	10	10	12	11	10	10	12	11	10	10	12	11	10	10
Bulgaria	8	8	8	8	8	8	8	8	8	7	8	8	8	7	8	8	8	8
Cyprus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Czech Republic	20	21	23	22	21	20	23	22	20	19	23	22	20	19	23	22	21	20
Denmark	8	8	8	8	7	7	8	7	7	7	8	8	7	7	8	8	7	7
Estonia	2	2	2	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2
Finland	6	6	6	6	6	6	6	6	6	5	6	6	6	5	6	6	6	6
France	89	89	84	77	70	66	84	76	67	62	84	77	68	64	84	77	69	65
Germany	133	145	150	143	137	131	150	140	130	122	150	140	132	124	150	141	135	129
Greece	7	7	8	8	8	8	8	8	7	7	8	8	7	7	8	8	8	8
Hungary	10	10	11	11	11	10	11	11	10	10	11	11	10	10	11	11	10	10
Ireland	2	3	3	3	3	3	3	3	3	2	3	3	3	2	3	3	3	3
Italy	109	118	123	118	113	111	123	116	108	104	123	117	109	106	123	117	111	109
Latvia	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Lithuania	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Luxembourg	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	16	17	17	17	16	16	17	16	16	15	17	17	16	15	17	17	16	16
Poland	36	39	40	42	41	40	40	41	39	37	40	41	39	38	40	41	40	39
Portugal	12	13	13	13	13	13	13	13	12	12	13	13	12	12	13	13	13	12
Romania	17	18	19	20	19	19	19	19	18	18	19	19	19	18	19	20	19	18

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Slovakia	5	5	5	6	6	5	5	6	5	5	5	6	5	5	5	6	5	5
Slovenia	4	5	5	5	4	4	5	5	4	4	5	5	4	4	5	5	4	4
Spain	45	58	78	97	112	122	78	96	109	119	78	97	110	120	78	97	111	122
Sweden	16	16	17	16	15	15	17	16	14	13	17	16	14	14	17	16	15	14
United Kingdom	89	85	76	63	54	48	76	62	52	46	76	63	53	47	76	63	53	48
TOTAL	654	697	721	707	687	673	721	696	659	637	721	698	666	647	721	702	676	664

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Years of Life Lived with Disability (DALYs)																	
Austria	14	15	16	15	15	14	16	15	14	13	16	15	14	14	16	15	15	14
Belgium	14	15	15	14	13	13	15	14	13	12	15	14	13	12	15	14	13	13
Bulgaria	10	11	11	11	11	11	11	11	10	10	11	11	10	10	11	11	11	10
Cyprus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Czech Republic	26	27	29	29	28	27	29	28	26	25	29	29	27	25	29	29	27	26
Denmark	10	10	10	10	9	9	10	10	9	9	10	10	9	9	10	10	9	9
Estonia	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Finland	7	8	8	8	8	7	8	8	7	7	8	8	7	7	8	8	7	7
France	111	111	105	97	89	84	105	96	85	79	105	96	86	80	105	97	87	82
Germany	167	183	190	183	176	168	190	179	167	156	190	180	169	160	190	181	173	165
Greece	8	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Hungary	13	13	14	14	14	14	14	14	13	13	14	14	14	13	14	14	14	14
Ireland	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Italy	136	147	155	149	144	141	154	147	138	133	154	148	139	135	155	148	142	139
Latvia	2	2	3	3	3	3	3	3	3	2	3	3	3	2	3	3	3	3
Lithuania	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Luxembourg	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	20	22	22	22	21	20	22	21	20	19	22	21	20	20	22	21	21	20
Poland	46	50	52	54	53	53	52	53	51	49	52	54	51	50	52	54	52	52
Portugal	15	16	17	17	16	16	17	17	16	16	17	17	16	16	17	17	16	16
Romania	23	24	25	26	26	25	25	26	25	24	25	26	25	24	25	26	25	25
Slovakia	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Slovenia	5	6	6	6	6	6	6	6	5	5	6	6	6	5	6	6	6	5
Spain	55	72	98	123	142	156	98	121	139	152	98	122	140	153	98	122	141	155
Sweden	20	20	21	20	19	18	21	20	18	17	21	20	18	18	21	20	19	18
United Kingdom	112	107	96	80	68	61	95	79	66	59	95	79	67	60	95	80	68	61
TOTAL	822	879	915	903	881	866	914	889	845	819	915	892	853	833	915	896	867	854

Table 8.4.4 Numbers and proportions of the EU population ever exposed, by industry, men plus women

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Numbers ever exposed																	
Agriculture, hunting and related service activities	2,540	2,163	1,632	1,100	697	421	1,632	1,100	697	421	1,632	1,100	697	421	1,632	1,100	697	421
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	4,136	4,109	4,056	3,915	3,812	3,749	4,056	3,915	3,812	3,749	4,056	3,915	3,812	3,749	4,056	3,915	3,812	3,749
Mining of metal ores	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of food products and beverages	79,780	81,025	82,408	82,031	81,814	81,745	82,408	82,031	81,814	81,745	82,408	82,031	81,814	81,745	82,408	82,031	81,814	81,745
Manufacture of textiles	28,240	28,594	28,980	28,656	28,397	28,249	28,980	28,656	28,397	28,249	28,980	28,656	28,397	28,249	28,980	28,656	28,397	28,249
Manufacture of wearing apparel; dressing and dyeing of fur	35,098	35,757	36,525	36,348	36,198	36,117	36,525	36,348	36,198	36,117	36,525	36,348	36,198	36,117	36,525	36,348	36,198	36,117
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	34,065	35,028	36,235	36,577	36,811	36,994	36,235	36,577	36,811	36,994	36,235	36,577	36,811	36,994	36,235	36,577	36,811	36,994
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	72,025	64,190	47,499	29,601	10,384	0	47,499	29,601	10,384	0	47,499	29,601	10,384	0	47,499	29,601	10,384	0
Manufacture of pulp, paper and paper products	48,970	49,573	50,299	50,049	49,806	49,737	50,299	50,049	49,806	49,737	50,299	50,049	49,806	49,737	50,299	50,049	49,806	49,737
Publishing, printing and reproduction of recorded media	58,287	57,951	57,335	55,576	54,220	53,429	57,335	55,576	54,220	53,429	57,335	55,576	54,220	53,429	57,335	55,576	54,220	53,429
Manufacture of coke, refined petroleum products and nuclear fuel	21,953	21,871	21,733	21,225	20,803	20,581	21,733	21,225	20,803	20,581	21,733	21,225	20,803	20,581	21,733	21,225	20,803	20,581

Scenario[1]	All Scenarios		Baseline scenario (2)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Manufacture of chemicals and chemical products	170,348	150,802	110,643	68,797	23,962	0	110,643	68,797	23,962	0	110,643	68,797	23,962	0	110,643	68,797	23,962	0
Manufacture of Rubber and Plastic Products	143,127	143,487	143,674	140,942	138,705	137,493	143,674	140,942	138,705	137,493	143,674	140,942	138,705	137,493	143,674	140,942	138,705	137,493
Manufacture of other non-metallic mineral products	37,732	38,357	39,116	39,033	38,935	38,924	39,116	39,033	38,935	38,924	39,116	39,033	38,935	38,924	39,116	39,033	38,935	38,924
Manufacture of basic metals	117,830	119,954	122,596	122,713	122,667	122,828	122,596	122,713	122,667	122,828	122,596	122,713	122,667	122,828	122,596	122,713	122,667	122,828
Manufacture of fabricated metal products, except machinery and equipment	1,133,057	1,155,906	1,185,035	1,191,501	1,194,971	1,199,398	1,185,035	1,191,501	1,194,971	1,199,398	1,185,035	1,191,501	1,194,971	1,199,398	1,185,035	1,191,501	1,194,971	1,199,398
Manufacture of machinery and equipment	535,492	543,550	553,196	551,044	548,938	548,328	553,196	551,044	548,938	548,328	553,196	551,044	548,938	548,328	553,196	551,044	548,938	548,328
Manufacture of electrical machinery and apparatus	41,102	41,481	41,880	41,313	40,849	40,593	41,880	41,313	40,849	40,593	41,880	41,313	40,849	40,593	41,880	41,313	40,849	40,593
Manufacture of radio, television and communication equipment and apparatus	15,640	15,697	15,743	15,456	15,215	15,084	15,743	15,456	15,215	15,084	15,743	15,456	15,215	15,084	15,743	15,456	15,215	15,084
Manufacture of medical, precision and optical instruments, watches and clocks	42,001	42,148	42,255	41,473	40,830	40,478	42,255	41,473	40,830	40,478	42,255	41,473	40,830	40,478	42,255	41,473	40,830	40,478
Manufacture of other transport equipment	174,205	174,160	173,907	170,859	168,284	167,050	173,907	170,859	168,284	167,050	173,907	170,859	168,284	167,050	173,907	170,859	168,284	167,050
Manufacture of furniture, manufacturing n.e.c	65,833	66,360	66,874	65,838	65,017	64,550	66,874	65,838	65,017	64,550	66,874	65,838	65,017	64,550	66,874	65,838	65,017	64,550
Electricity, gas, steam and hot water supply	35,471	35,587	35,685	35,077	34,561	34,292	35,685	35,077	34,561	34,292	35,685	35,077	34,561	34,292	35,685	35,077	34,561	34,292
Collection, purification and distribution of water	1,660	1,724	1,809	1,863	1,902	1,932	1,809	1,863	1,902	1,932	1,809	1,863	1,902	1,932	1,809	1,863	1,902	1,932
Construction	166,953	173,136	181,187	186,685	190,596	193,546	181,187	186,685	190,596	193,546	181,187	186,685	190,596	193,546	181,187	186,685	190,596	193,546
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	190,601	229,576	284,600	340,253	380,159	404,775	284,600	340,253	380,159	404,775	284,600	340,253	380,159	404,775	284,600	340,253	380,159	404,775

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Wholesale trade and commission trade, except of motor vehicles and motorcycles	3,844	4,630	5,739	6,862	7,668	8,165	5,739	6,862	7,668	8,165	5,739	6,862	7,668	8,165	5,739	6,862	7,668	8,165
Land transport; transport via pipelines	20,533	24,740	30,669	36,657	40,944	43,583	30,669	36,657	40,944	43,583	30,669	36,657	40,944	43,583	30,669	36,657	40,944	43,583
Water Transport	2,660	3,205	3,973	4,749	5,304	5,646	3,973	4,749	5,304	5,646	3,973	4,749	5,304	5,646	3,973	4,749	5,304	5,646
Air Transport	15,234	18,355	22,753	27,196	30,377	32,336	22,753	27,196	30,377	32,336	22,753	27,196	30,377	32,336	22,753	27,196	30,377	32,336
Supporting and auxiliary transport activities; activities of travel agencies	10,607	12,780	15,843	18,936	21,151	22,515	15,843	18,936	21,151	22,515	15,843	18,936	21,151	22,515	15,843	18,936	21,151	22,515
Post and telecommunications	255	307	381	455	508	541	381	455	508	541	381	455	508	541	381	455	508	541
Research and development	8,679	10,451	12,956	15,492	17,312	18,436	12,956	15,492	17,312	18,436	12,956	15,492	17,312	18,436	12,956	15,492	17,312	18,436
Other business activities	24,893	29,978	37,164	44,438	49,659	52,883	37,164	44,438	49,659	52,883	37,164	44,438	49,659	52,883	37,164	44,438	49,659	52,883
Public administration and defence; compulsory social security	72,279	87,024	107,886	129,023	144,209	153,598	107,886	129,023	144,209	153,598	107,886	129,023	144,209	153,598	107,886	129,023	144,209	153,598
Education	25,932	31,205	38,687	46,287	51,763	55,159	38,687	46,287	51,763	55,159	38,687	46,287	51,763	55,159	38,687	46,287	51,763	55,159
Health and Social Work	8,355	10,052	12,463	14,913	16,680	17,776	12,463	14,913	16,680	17,776	12,463	14,913	16,680	17,776	12,463	14,913	16,680	17,776
Sewage and refuse disposal, sanitatio nand similar activities	66,804	80,424	99,704	119,249	133,298	141,989	99,704	119,249	133,298	141,989	99,704	119,249	133,298	141,989	99,704	119,249	133,298	141,989

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Proportion of the population exposed																	
Agriculture, hunting and related service activities	0.0007	0.0006	0.0004	0.0003	0.0002	0.0001	0.0004	0.0003	0.0002	0.0001	0.0004	0.0003	0.0002	0.0001	0.0000	0.0000	0.0000	0.0000
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Mining of metal ores	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Manufacture of food products and beverages	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Manufacture of textiles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Manufacture of wearing apparel; dressing and dyeing of fur	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Manufacture of wood and of products of wood and cork, except furniture; manufacture of	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Scenario[1]	All Scenarios		Baseline scenario (2)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
articles of straw and plaiting materials																		
Manufacture of pulp, paper and paper products	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Publishing, printing and reproduction of recorded media	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Manufacture of coke, refined petroleum products and nuclear fuel	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Manufacture of chemicals and chemical products	0.0095	0.0080	0.0057	0.0029	0.0007	0.0000	0.0057	0.0029	0.0007	0.0000	0.0057	0.0029	0.0007	0.0000	0.0057	0.0029	0.0007	0.0000
Manufacture of Rubber and Plastic Products	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Manufacture of other non-metallic mineral products	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Manufacture of basic metals	0.0064	0.0054	0.0042	0.0030	0.0020	0.0014	0.0042	0.0027	0.0012	0.0004	0.0042	0.0028	0.0014	0.0007	0.0042	0.0029	0.0017	0.0011
Manufacture of fabricated metal products, except machinery and equipment	0.0616	0.0523	0.0405	0.0287	0.0192	0.0131	0.0404	0.0258	0.0116	0.0032	0.0405	0.0263	0.0134	0.0061	0.0405	0.0273	0.0163	0.0106
Manufacture of machinery and equipment	0.0293	0.0249	0.0194	0.0137	0.0092	0.0064	0.0193	0.0123	0.0056	0.0016	0.0193	0.0126	0.0065	0.0030	0.0194	0.0131	0.0079	0.0052
Manufacture of electrical machinery and apparatus	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Manufacture of	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Scenario[1]	All Scenarios		Baseline scenario (2)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
radio, television and communication equipment and apparatus																		
Manufacture of medical, precision and optical instruments, watches and clocks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Manufacture of other transport equipment	0.0096	0.0080	0.0060	0.0042	0.0027	0.0018	0.0060	0.0037	0.0016	0.0004	0.0060	0.0038	0.0019	0.0008	0.0060	0.0040	0.0023	0.0015
Manufacture of furniture, manufacturing n.e.c	0.0035	0.0030	0.0023	0.0016	0.0010	0.0007	0.0023	0.0014	0.0006	0.0002	0.0023	0.0015	0.0007	0.0003	0.0023	0.0015	0.0009	0.0006
Electricity, gas, steam and hot water supply	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Collection, purification and distribution of water	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Construction	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Land transport; transport via pipelines	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Scenario[1]	All Scenarios		Baseline scenario (2)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Water Transport	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Air Transport	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Supporting and auxiliary transport activities; activities of travel agencies	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Post and telecommunications	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Research and development	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Other business activities	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Public administration and defence; compulsory social security	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Education	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Health and Social Work	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sewage and refuse disposal, sanitatio nand similar activities	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Table 8.4.5 Occupation attributable fractions, deaths, registrations, YLLs and DALYs for lung cancer by industry, men plus women

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Fraction																	
Agriculture, hunting and related service activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mining of metal ores	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of food products and beverages	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of textiles	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of wearing apparel; dressing and dyeing of fur	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of pulp, paper and paper products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Publishing, printing and reproduction of recorded media	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of coke, refined petroleum products and nuclear fuel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of chemicals and chemical products	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Manufacture of Rubber and Plastic Products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Manufacture of other non-metallic mineral products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of basic metals	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of fabricated metal products, except machinery and equipment	0.06	0.05	0.04	0.03	0.02	0.01	0.04	0.03	0.01	0.00	0.04	0.03	0.01	0.01	0.04	0.03	0.02	0.01
Manufacture of machinery and equipment	0.03	0.02	0.02	0.01	0.01	0.01	0.02	0.01	0.01	0.00	0.02	0.01	0.01	0.00	0.02	0.01	0.01	0.01
Manufacture of electrical machinery and apparatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of radio, television and communication equipment and apparatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of medical, precision and optical instruments, watches and clocks	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of other transport equipment	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Manufacture of furniture, manufacturing n.e.c	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity, gas, steam and hot water supply	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Collection, purification and distribution of water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Land transport; transport via pipelines	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Supporting and auxiliary transport activities; activities of travel agencies	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Post and telecommunications	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Research and development	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other business activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Public administration and defence; compulsory social security	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Education	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Health and Social Work	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sewage and refuse disposal, sanitatio nand similar activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Deaths																	
Agriculture, hunting and related service activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining of metal ores	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of food products and beverages	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of textiles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of wearing apparel; dressing and dyeing of fur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of pulp, paper and paper products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Publishing, printing and reproduction of recorded media	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of coke, refined petroleum products and nuclear fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Manufacture of chemicals and chemical products	26	26	22	12	3	0	22	12	3	0	22	12	3	0	22	12	3	0
Manufacture of Rubber and Plastic Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of other non-metallic mineral products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of basic metals	18	18	16	13	9	6	16	11	5	2	16	12	6	3	16	12	8	5
Manufacture of fabricated metal products, except machinery and equipment	173	172	153	121	85	59	153	108	51	14	153	111	59	27	153	115	72	48
Manufacture of machinery and equipment	82	82	73	58	41	29	73	52	25	7	73	53	29	13	73	55	35	23
Manufacture of electrical machinery and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of radio, television and communication equipment and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of medical, precision and optical instruments, watches and clocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of other transport equipment	27	26	23	17	12	8	23	16	7	2	23	16	8	4	23	17	10	7
Manufacture of furniture, manufacturing n.e.c	10	10	9	7	5	3	9	6	3	1	9	6	3	1	9	6	4	3
Electricity, gas, steam and hot water supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Land transport; transport via pipelines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Supporting and auxiliary transport activities; activities of travel agencies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Post and telecommunications	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other business activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public administration and defence; compulsory social security	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Health and Social Work	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sewage and refuse disposal, sanitatio nand similar activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Registrations																	
Agriculture, hunting and related service activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining of metal ores	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of food products and beverages	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of textiles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of wearing apparel; dressing and dyeing of fur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of pulp, paper and paper products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Publishing, printing and reproduction of recorded media	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of coke, refined petroleum products and nuclear fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Manufacture of chemicals and chemical products	29	28	23	13	3	0	23	13	3	0	23	13	3	0	23	13	3	0
Manufacture of Rubber and Plastic Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of other non-metallic mineral products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of basic metals	20	19	17	13	9	6	17	12	6	2	17	12	6	3	17	13	8	5
Manufacture of fabricated metal products, except machinery and equipment	189	186	163	126	87	60	163	113	53	15	163	115	61	28	163	120	74	48
Manufacture of machinery and equipment	90	89	78	60	42	29	78	54	25	7	78	55	29	14	78	57	36	24
Manufacture of electrical machinery and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of radio, television and communication equipment and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of medical, precision and optical instruments, watches and clocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of other transport equipment	30	29	24	18	12	8	24	16	7	2	24	17	9	4	24	17	10	7
Manufacture of furniture, manufacturing n.e.c	11	11	9	7	5	3	9	6	3	1	9	6	3	1	9	7	4	3
Electricity, gas, steam and hot water supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Land transport; transport via pipelines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Supporting and auxiliary transport activities; activities of travel agencies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Post and telecommunications	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other business activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public administration and defence; compulsory social security	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Health and Social Work	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sewage and refuse disposal, sanitatio nand similar activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lost (YLLs)																	
Agriculture, hunting and related service activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining of metal ores	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of food products and beverages	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of textiles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of wearing apparel; dressing and dyeing of fur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of pulp, paper and paper products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Publishing, printing and reproduction of recorded media	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of coke, refined petroleum products and nuclear fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of chemicals and chemical products	406	389	306	165	41	0	306	165	41	0	306	165	41	0	306	165	41	0

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Manufacture of Rubber and Plastic Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of other non-metallic mineral products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of basic metals	275	266	229	171	116	79	228	154	70	20	228	157	81	37	228	163	99	65
Manufacture of fabricated metal products, except machinery and equipment	2,654	2,564	2,188	1,630	1,101	743	2,181	1,465	665	182	2,183	1,498	768	344	2,185	1,552	933	603
Manufacture of machinery and equipment	1,261	1,222	1,046	781	530	360	1,043	702	321	91	1,043	718	372	170	1,044	744	451	294
Manufacture of electrical machinery and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of radio, television and communication equipment and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of medical, precision and optical instruments, watches and clocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of other transport equipment	415	393	325	236	155	103	324	213	95	25	325	218	109	47	325	225	132	83
Manufacture of furniture, manufacturing n.e.c	153	147	123	90	60	40	123	81	37	10	123	83	42	19	123	86	51	33
Electricity, gas, steam and hot water supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Land transport; transport via pipelines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Supporting and auxiliary transport activities; activities of travel agencies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Post and telecommunications	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other business activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Public administration and defence; compulsory social security	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Health and Social Work	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sewage and refuse disposal, sanitatio nand similar activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lived with Disability (DALYs)																	
Agriculture, hunting and related service activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining of metal ores	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of food products and beverages	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of textiles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of wearing apparel; dressing and dyeing of fur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of pulp, paper and paper products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Publishing, printing and reproduction of recorded media	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of coke, refined petroleum products and nuclear fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of chemicals and chemical products	424	406	320	173	43	0	320	173	43	0	320	173	43	0	320	173	43	0
Manufacture of Rubber and Plastic Products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of other non-metallic mineral products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of basic metals	287	278	239	179	122	83	238	161	74	21	238	164	85	39	238	170	103	68

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Manufacture of fabricated metal products, except machinery and equipment	2,770	2,677	2,285	1,704	1,151	777	2,278	1,531	695	191	2,280	1,566	803	360	2,282	1,622	975	631
Manufacture of machinery and equipment	1,316	1,275	1,092	817	555	377	1,089	734	336	95	1,090	751	389	178	1,091	778	471	307
Manufacture of electrical machinery and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of radio, television and communication equipment and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of medical, precision and optical instruments, watches and clocks	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of other transport equipment	433	411	340	247	163	108	339	223	99	26	339	228	114	49	339	235	138	87
Manufacture of furniture, manufacturing n.e.c	160	153	129	95	63	42	129	85	38	10	129	87	44	19	129	90	53	34
Electricity, gas, steam and hot water supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Land transport; transport via pipelines	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Supporting and auxiliary transport activities; activities of travel agencies	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Post and telecommunications	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other business activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Public administration and defence; compulsory social security	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Education	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Health and Social Work	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sewage and refuse disposal, sanitatio nand similar activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table .4.6 Occupation attributable fractions, deaths, registrations, YLLs and DALYs for sinonasal cancer by industry, men plus women

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Fraction																	
Agriculture, hunting and related service activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mining of metal ores	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of food products and beverages	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Manufacture of textiles	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Manufacture of wearing apparel; dressing and dyeing of fur	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.05	0.05	0.04	0.03	0.01	0.00	0.04	0.03	0.01	0.00	0.04	0.03	0.01	0.00	0.04	0.03	0.01	0.00
Manufacture of pulp, paper and paper products	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Publishing, printing and reproduction of recorded media	0.04	0.04	0.04	0.04	0.03	0.03	0.04	0.04	0.03	0.03	0.04	0.04	0.03	0.03	0.04	0.04	0.03	0.03
Manufacture of coke, refined petroleum products and nuclear fuel	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Manufacture of chemicals and chemical products	0.19	0.18	0.15	0.09	0.03	0.00	0.15	0.09	0.03	0.00	0.15	0.09	0.03	0.00	0.15	0.09	0.03	0.00
Manufacture of Rubber and Plastic Products	0.10	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Manufacture of other non-metallic mineral products	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Manufacture of basic metals	0.13	0.12	0.11	0.10	0.09	0.09	0.11	0.10	0.09	0.08	0.11	0.10	0.09	0.08	0.11	0.10	0.09	0.09
Manufacture of fabricated metal products, except machinery and equipment	1.26	1.17	1.09	0.98	0.91	0.88	1.09	0.96	0.85	0.79	1.09	0.96	0.86	0.82	1.09	0.97	0.88	0.86
Manufacture of machinery and equipment	0.60	0.56	0.51	0.46	0.42	0.40	0.51	0.45	0.39	0.36	0.51	0.45	0.40	0.38	0.51	0.45	0.41	0.39
Manufacture of electrical machinery and apparatus	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Manufacture of radio, television and communication equipment and apparatus	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Manufacture of medical, precision and optical instruments, watches and clocks	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Manufacture of other transport equipment	0.20	0.18	0.16	0.14	0.13	0.12	0.16	0.14	0.12	0.11	0.16	0.14	0.12	0.11	0.16	0.14	0.13	0.12
Manufacture of furniture, manufacturing n.e.c	0.07	0.07	0.06	0.05	0.05	0.05	0.06	0.05	0.05	0.04	0.06	0.05	0.05	0.04	0.06	0.05	0.05	0.05
Electricity, gas, steam and hot water supply	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Collection, purification and distribution of water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Construction	0.12	0.12	0.12	0.12	0.13	0.13	0.12	0.12	0.13	0.13	0.12	0.12	0.13	0.13	0.12	0.12	0.13	0.13

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	0.11	0.12	0.16	0.19	0.23	0.26	0.16	0.19	0.23	0.26	0.16	0.19	0.23	0.26	0.16	0.19	0.23	0.26
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
Land transport; transport via pipelines	0.01	0.01	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03
Water Transport	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air Transport	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.01	0.02	0.02	0.02	0.01	0.02	0.02	0.02
Supporting and auxiliary transport activities; activities of travel agencies	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Post and telecommunications	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Research and development	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Other business activities	0.01	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03
Public administration and defence; compulsory social security	0.04	0.05	0.06	0.07	0.08	0.09	0.06	0.07	0.08	0.09	0.06	0.07	0.08	0.09	0.06	0.07	0.08	0.09
Education	0.01	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03	0.02	0.02	0.03	0.03
Health and Social Work	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sewage and refuse disposal, sanitatio nand similar activities	0.04	0.04	0.05	0.06	0.08	0.08	0.05	0.06	0.08	0.09	0.05	0.06	0.08	0.08	0.05	0.06	0.08	0.08

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Deaths																	
Agriculture, hunting and related service activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining of metal ores	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of food products and beverages	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Manufacture of textiles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of wearing apparel; dressing and dyeing of fur	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	1	1	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
Manufacture of pulp, paper and paper products	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Publishing, printing and reproduction of recorded media	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Manufacture of coke, refined petroleum products and nuclear fuel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of chemicals and chemical products	2	2	2	2	0	0	2	2	0	0	2	2	0	0	2	2	0	0
Manufacture of Rubber and Plastic Products	1	1	1	2	2	2	1	2	2	2	1	2	2	2	1	2	2	2
Manufacture of other non-metallic mineral products	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Manufacture of basic metals	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Manufacture of fabricated metal products, except machinery and equipment	15	16	17	17	17	17	17	17	16	15	17	17	16	16	17	17	17	17
Manufacture of machinery and equipment	7	8	8	8	8	8	8	8	7	7	8	8	8	7	8	8	8	8
Manufacture of electrical machinery and apparatus	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
Manufacture of radio, television and communication equipment and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of medical, precision and optical instruments, watches and clocks	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
Manufacture of other transport equipment	2	3	3	3	2	2	3	2	2	2	3	2	2	2	3	2	2	2
Manufacture of furniture, manufacturing n.e.c	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Electricity, gas, steam and hot water supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	1	2	2	2	2	3	2	2	2	3	2	2	2	3	2	2	2	3
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	1	2	2	3	4	5	2	3	4	5	2	3	4	5	2	3	4	5
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Land transport; transport via pipelines	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
Water Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Air Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Supporting and auxiliary transport activities; activities of	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios	Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005						Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
travel agencies																		
Post and telecommunications	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other business activities	0	0	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
Public administration and defence; compulsory social security	0	1	1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2
Education	0	0	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
Health and Social Work	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sewage and refuse disposal, sanitatio nand similar activities	0	1	1	1	1	2	1	1	1	2	1	1	1	2	1	1	1	2

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Registrations																	
Agriculture, hunting and related service activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mining of metal ores	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of food products and beverages	2	2	2	3	3	3	2	3	3	3	2	3	3	3	2	3	3	3
Manufacture of textiles	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Manufacture of wearing apparel; dressing and dyeing of fur	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	2	2	2	1	0	0	2	1	0	0	2	1	0	0	2	1	0	0
Manufacture of pulp, paper and paper products	1	1	1	2	2	2	1	2	2	2	1	2	2	2	1	2	2	2
Publishing, printing and reproduction of recorded media	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Manufacture of coke, refined petroleum products and nuclear fuel	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Manufacture of chemicals and chemical products	7	7	7	4	1	0	7	4	1	0	7	4	1	0	7	4	1	0
Manufacture of Rubber and Plastic Products	3	4	4	5	5	5	4	5	5	5	4	5	5	5	4	5	5	5
Manufacture of other non-metallic mineral products	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Manufacture of basic metals	5	5	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5
Manufacture of fabricated metal products, except machinery and equipment	45	48	50	50	49	48	50	49	45	43	50	49	46	44	50	49	47	47

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Manufacture of machinery and equipment	21	23	24	23	23	22	24	23	21	20	24	23	21	20	24	23	22	21
Manufacture of electrical machinery and apparatus	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Manufacture of radio, television and communication equipment and apparatus	0	0	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
Manufacture of medical, precision and optical instruments, watches and clocks	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Manufacture of other transport equipment	7	7	7	7	7	7	7	7	6	6	7	7	7	6	7	7	7	6
Manufacture of furniture, manufacturing n.e.c	3	3	3	3	3	3	3	3	2	2	3	3	3	2	3	3	3	2
Electricity, gas, steam and hot water supply	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	4	5	6	6	7	7	6	6	7	7	6	6	7	7	6	6	7	7
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	4	5	7	10	12	14	7	10	12	14	7	10	12	14	7	10	12	14
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Land transport; transport via pipelines	0	1	1	1	1	2	1	1	1	2	1	1	1	2	1	1	1	2
Water Transport	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Air Transport	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Supporting and auxiliary transport activities; activities of travel agencies	0	0	0	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1
Post and telecommunications	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	0	0	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
Other business activities	1	1	1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Public administration and defence; compulsory social security	1	2	3	4	4	5	3	4	4	5	3	4	4	5	3	4	4	5
Education	0	1	1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2
Health and Social Work	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1
Sewage and refuse disposal, sanitatio nand similar activities	1	2	2	3	4	5	2	3	4	5	2	3	4	5	2	3	4	5

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Years of Life Lost (YLLs)																	
Agriculture, hunting and related service activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mining of metal ores	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of food products and beverages	10	11	12	13	13	13	12	13	13	13	12	13	13	13	12	13	13	13
Manufacture of textiles	4	4	4	4	5	5	4	4	5	5	4	4	5	5	4	4	5	5
Manufacture of wearing apparel; dressing and dyeing of fur	5	5	5	6	6	6	5	6	6	6	5	6	6	6	5	6	6	6
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	4	5	5	6	6	6	5	6	6	6	5	6	6	6	5	6	6	6
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	9	10	10	7	2	0	10	7	2	0	10	7	2	0	10	7	2	0
Manufacture of pulp, paper and paper products	6	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Publishing, printing and reproduction of recorded media	8	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
Manufacture of coke, refined petroleum products and nuclear fuel	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Manufacture of chemicals and chemical products	38	39	35	22	7	0	35	22	7	0	35	22	7	0	35	22	7	0
Manufacture of Rubber and Plastic Products	19	21	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
Manufacture of other non-metallic mineral products	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Manufacture of basic metals	26	27	27	26	24	23	27	25	22	21	27	25	23	21	27	25	23	22
Manufacture of fabricated metal products, except machinery and equipment	251	261	260	246	232	222	260	240	216	201	260	241	220	207	260	243	226	216

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Manufacture of machinery and equipment	119	124	123	115	108	102	123	112	100	92	123	113	102	95	123	114	105	100
Manufacture of electrical machinery and apparatus	5	6	6	6	7	7	6	6	7	7	6	6	7	7	6	6	7	7
Manufacture of radio, television and communication equipment and apparatus	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Manufacture of medical, precision and optical instruments, watches and clocks	6	6	6	7	7	7	6	7	7	7	6	7	7	7	6	7	7	7
Manufacture of other transport equipment	39	40	39	36	33	31	39	35	31	28	39	35	31	29	39	35	32	30
Manufacture of furniture, manufacturing n.e.c	15	15	15	14	13	12	15	13	12	11	15	13	12	11	15	14	12	12
Electricity, gas, steam and hot water supply	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	23	25	28	30	32	33	28	30	32	33	28	30	32	33	28	30	32	33
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	22	28	37	48	59	65	37	48	59	65	37	48	59	65	37	48	59	65
Wholesale trade and commission trade, except of motor vehicles and motorcycles	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Land transport; transport via pipelines	2	3	4	5	6	7	4	5	7	7	4	5	7	7	4	5	6	7
Water Transport	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Air Transport	2	2	3	4	5	5	3	4	5	5	3	4	5	5	3	4	5	5
Supporting and auxiliary transport activities; activities of travel agencies	1	2	2	3	3	4	2	3	3	4	2	3	3	4	2	3	3	4
Post and telecommunications	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	1	1	2	2	3	3	2	2	3	3	2	2	3	3	2	2	3	3
Other business activities	3	4	5	6	8	8	5	6	8	8	5	6	8	8	5	6	8	8
Public administration and defence; compulsory social security	8	10	14	18	21	24	14	18	21	24	14	18	21	24	14	18	21	24

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Education	3	3	5	6	7	8	5	6	7	8	5	6	7	8	5	6	7	8
Health and Social Work	1	1	1	2	2	3	1	2	2	3	1	2	2	3	1	2	2	3
Sewage and refuse disposal, sanitatio nand similar activities	7	9	12	16	20	22	12	16	20	22	12	16	20	22	12	16	20	22

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Years of Life Lived with Disability (DALYs)																	
Agriculture, hunting and related service activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mining of metal ores	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of food products and beverages	13	14	16	16	17	17	16	16	17	17	16	16	17	17	16	16	17	17
Manufacture of textiles	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Manufacture of wearing apparel; dressing and dyeing of fur	6	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	6	6	7	7	7	8	7	7	7	8	7	7	7	8	7	7	7	8
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	12	13	13	9	3	0	13	9	3	0	13	9	3	0	13	9	3	0
Manufacture of pulp, paper and paper products	8	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Publishing, printing and reproduction of recorded media	10	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Manufacture of coke, refined petroleum products and nuclear fuel	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Manufacture of chemicals and chemical products	48	49	44	28	8	0	44	28	8	0	44	28	8	0	44	28	8	0
Manufacture of Rubber and Plastic Products	24	26	28	28	29	29	28	28	29	29	28	28	29	29	28	28	29	29
Manufacture of other non-metallic mineral products	6	7	7	8	8	8	7	8	8	8	7	8	8	8	7	8	8	8
Manufacture of basic metals	33	34	34	33	31	29	34	32	29	26	34	32	29	27	34	32	30	29
Manufacture of fabricated metal products, except machinery and equipment	315	329	330	314	298	285	330	307	277	258	330	308	282	266	330	311	290	278

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Manufacture of machinery and equipment	149	156	156	147	138	131	156	144	129	119	156	144	131	122	156	145	135	128
Manufacture of electrical machinery and apparatus	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Manufacture of radio, television and communication equipment and apparatus	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Manufacture of medical, precision and optical instruments, watches and clocks	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Manufacture of other transport equipment	49	50	49	46	42	40	49	45	39	36	49	45	40	37	49	45	41	39
Manufacture of furniture, manufacturing n.e.c	18	19	19	18	16	15	19	17	15	14	19	17	15	14	19	17	16	15
Electricity, gas, steam and hot water supply	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Construction	29	32	36	39	41	43	36	39	41	43	36	39	41	43	36	39	41	43
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	28	35	47	62	75	84	47	62	75	84	47	62	75	84	47	62	75	84
Wholesale trade and commission trade, except of motor vehicles and motorcycles	1	1	1	1	2	2	1	1	2	2	1	1	2	2	1	1	2	2
Land transport; transport via pipelines	3	4	5	7	8	9	5	7	8	9	5	7	8	9	5	7	8	9
Water Transport	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Air Transport	2	3	4	5	6	7	4	5	6	7	4	5	6	7	4	5	6	7
Supporting and auxiliary transport activities; activities of travel agencies	2	2	3	4	4	5	3	4	4	5	3	4	4	5	3	4	4	5
Post and telecommunications	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	1	2	2	3	3	4	2	3	3	4	2	3	3	4	2	3	3	4
Other business activities	4	4	6	8	10	11	6	8	10	11	6	8	10	11	6	8	10	11
Public administration and defence; compulsory social security	10	13	17	23	27	31	17	23	27	31	17	23	27	31	17	23	27	31

Scenario[1]	All Scenarios		Baseline scenario (2) [2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter. NACE industries 20 and 24 closed from 2005				Intervention scenario (3) - Full compliance for OEL = 0.025 mg/m3				Intervention scenario (4) - Full compliance for OEL = 0.05 mg/m3				Intervention scenario (5) - Full compliance for OEL = 0.1 mg/m3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Education	3	4	6	8	9	10	6	8	9	10	6	8	9	10	6	8	9	10
Health and Social Work	1	1	2	2	3	3	2	2	3	3	2	2	3	3	2	2	3	3
Sewage and refuse disposal, sanitatio nand similar activities	9	12	16	21	25	28	16	21	25	28	16	21	25	28	16	21	25	28

8.5 VALUING HEALTH BENEFITS – INTERVENTION SCENARIOS

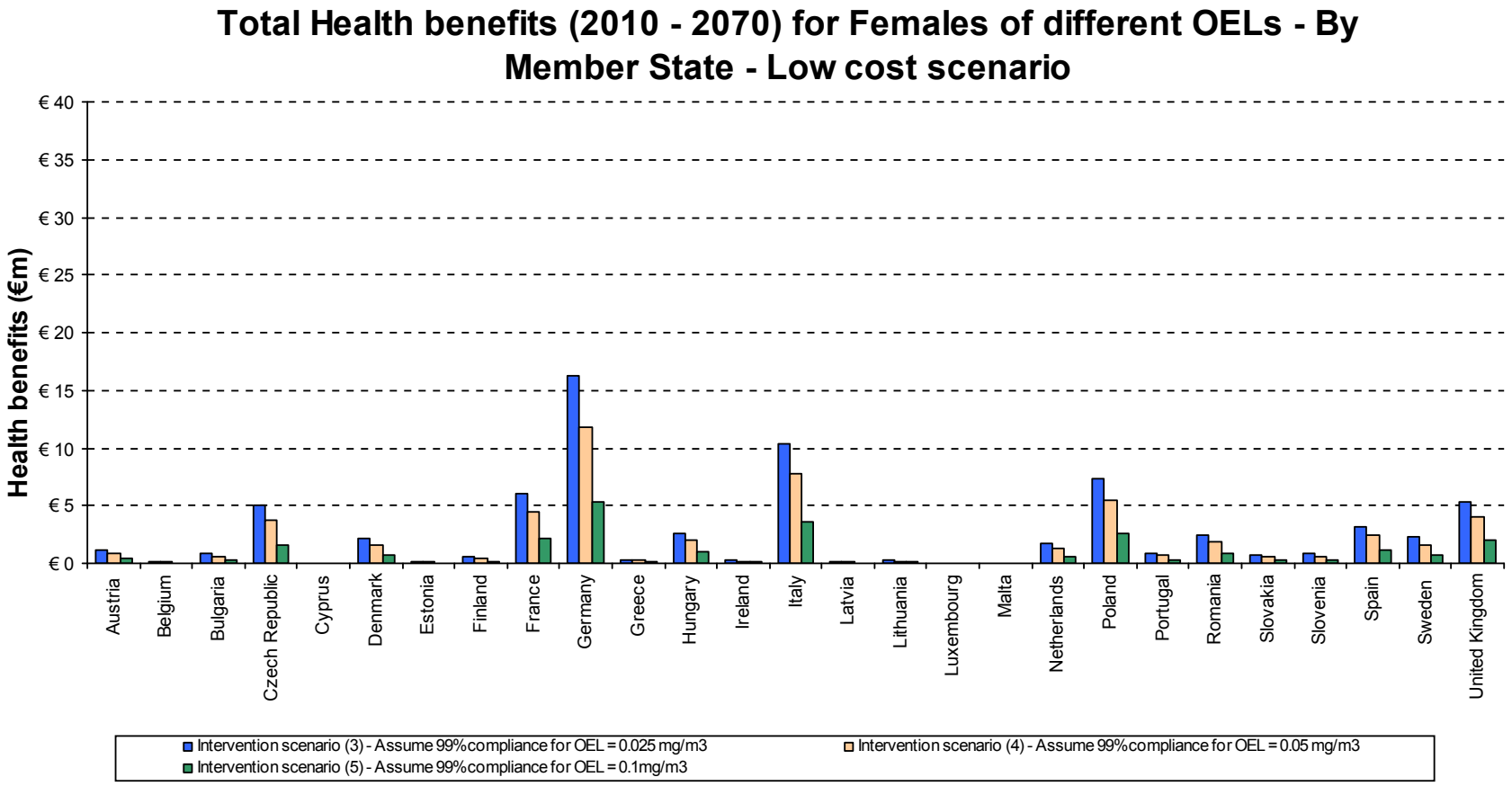

Figure 8.5.1 Total health benefits to females of introducing an EU-wide OEL – By Member State – Low Scenario (Present Value – 2010 €m prices)

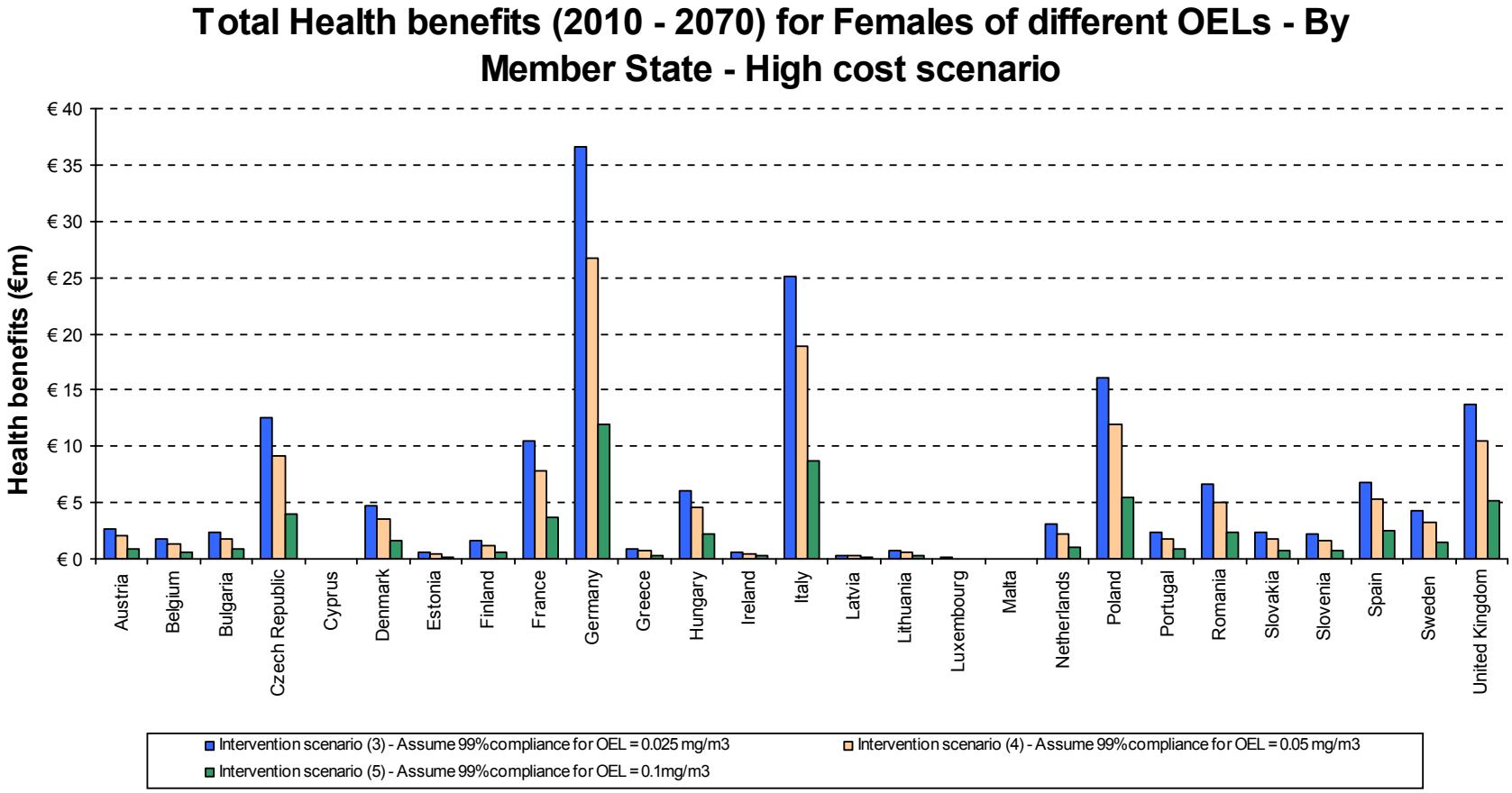

Figure 8.5.2 Total health benefits for females of introducing an EU-wide OEL – By Member State – High Scenario (Present Value – 2010 €m prices).

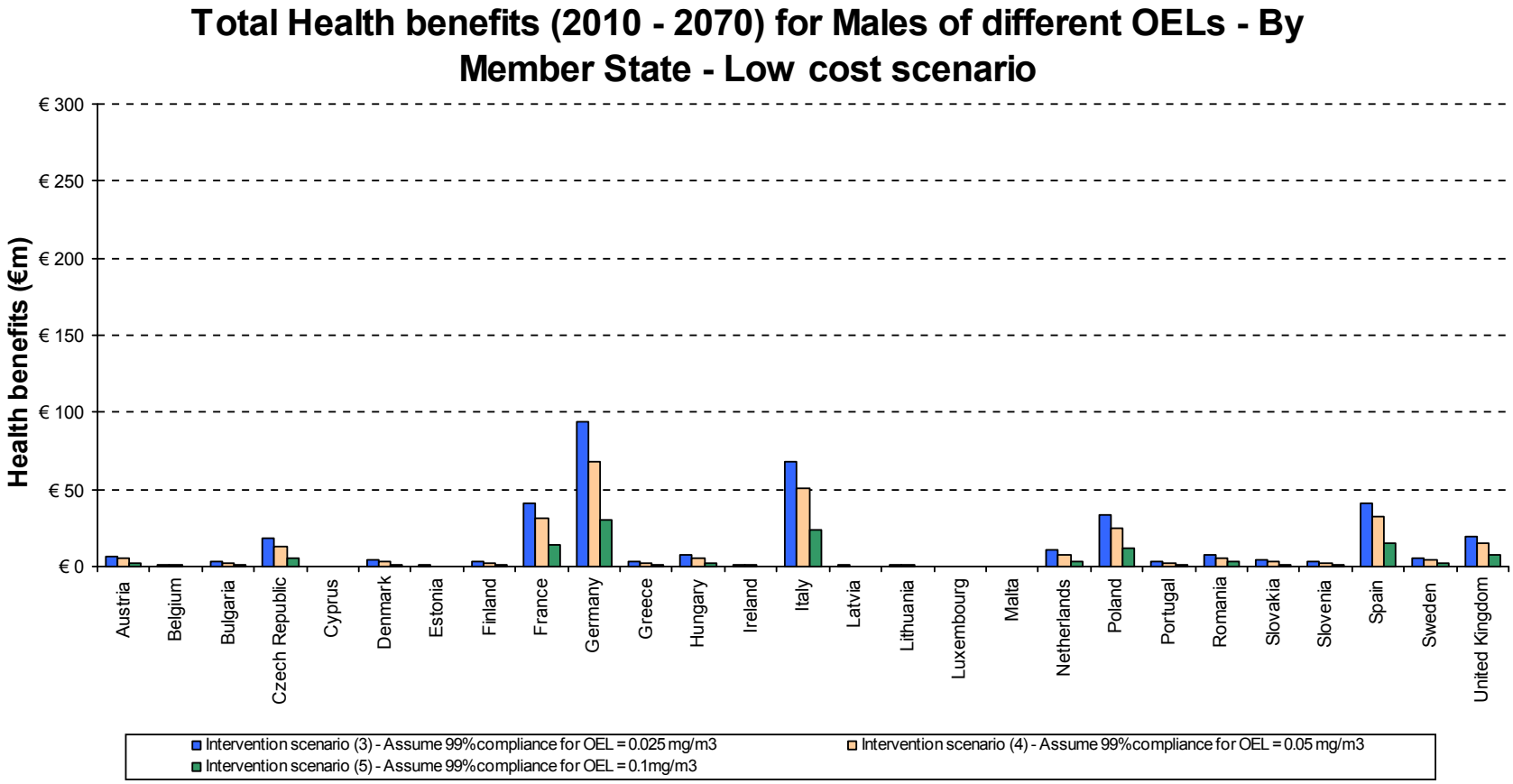

Figure 8.5.3 Total health benefits to males of introducing an EU-wide OEL – By Member State – Low Scenario (Present Value – 2010 €m prices)

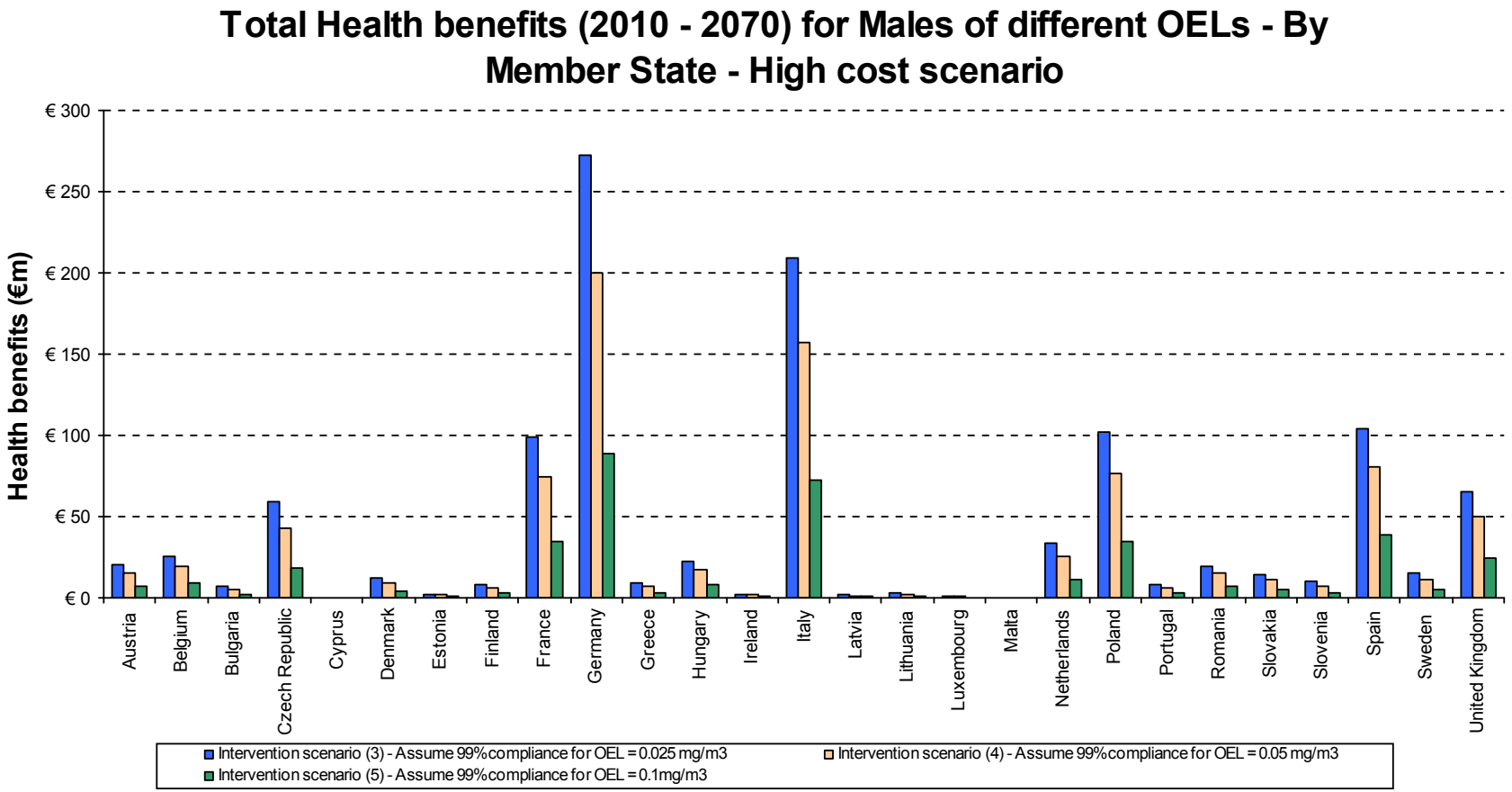

Figure 8.5.4 Total health benefits for males of introducing an EU-wide OEL – By Member State – High Scenario (Present Value – 2010 €m prices)

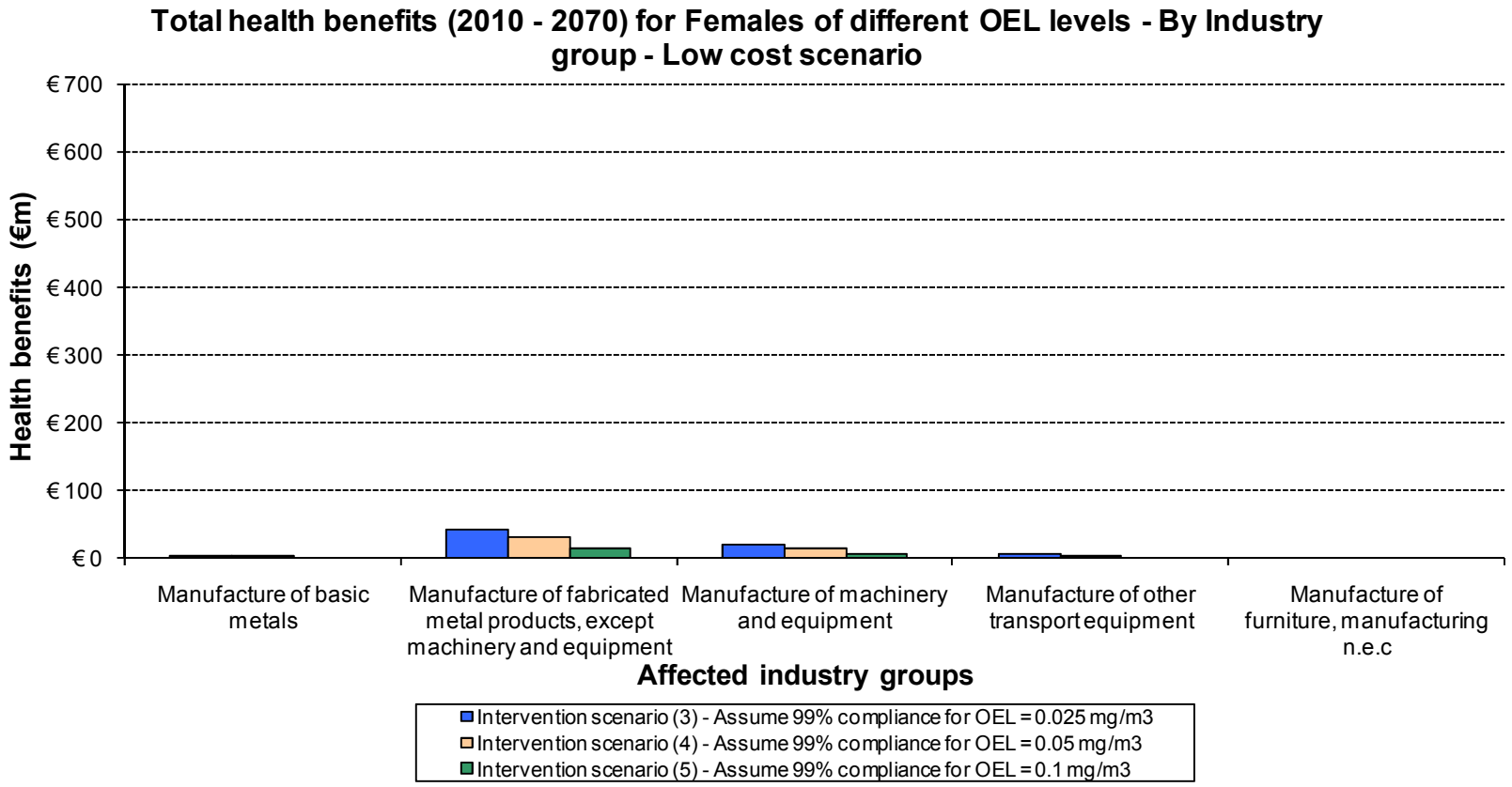

Figure 8.5.5 Total health benefits to females of introducing an EU-wide OEL – By Industry Group – Low Scenario (Present Value – 2010 €m prices)

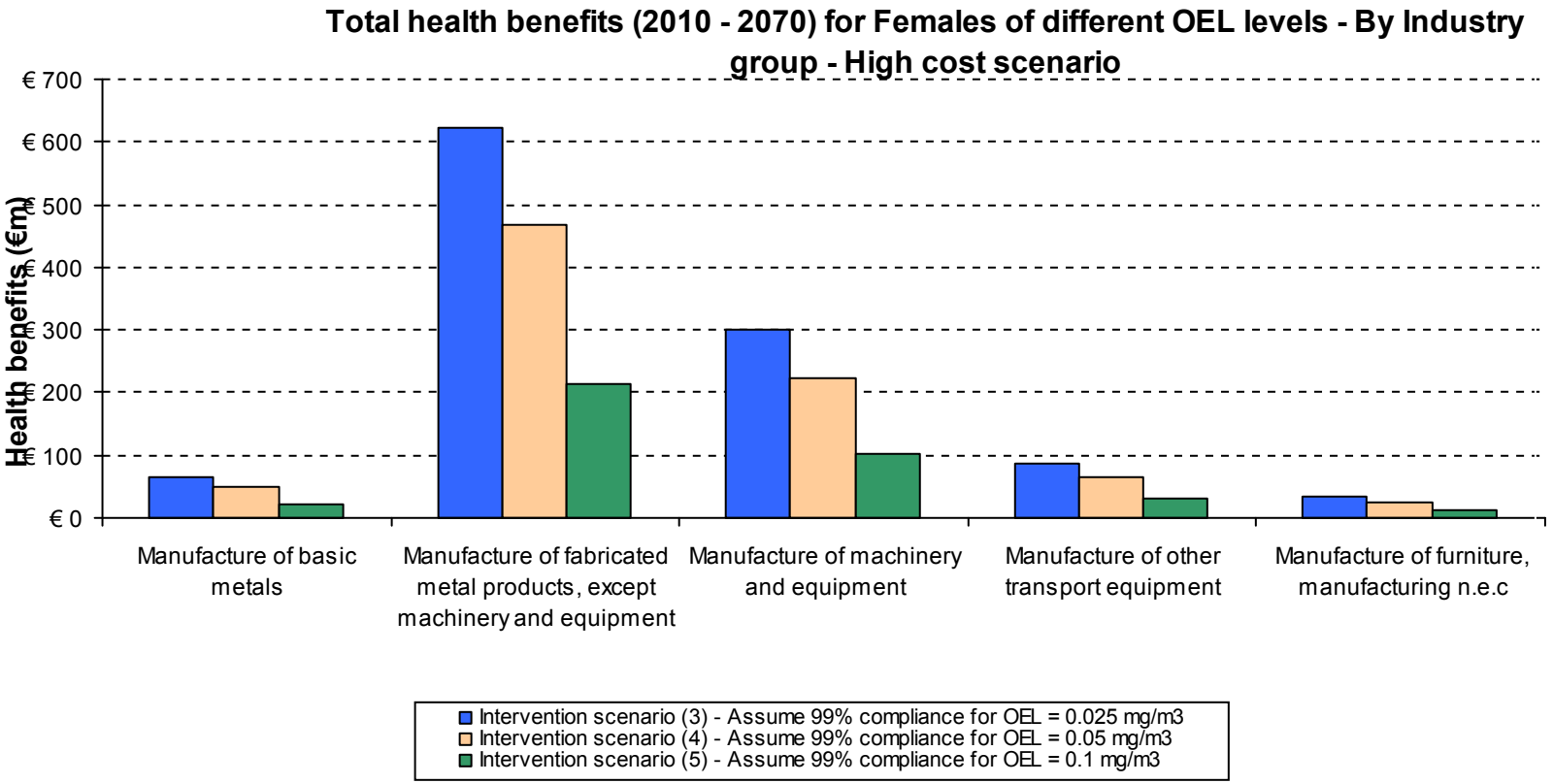

Figure 8.5.6 Total health benefits for females of introducing an EU-wide OEL – By Industry Group – High Scenario (Present Value – 2010 €m prices)

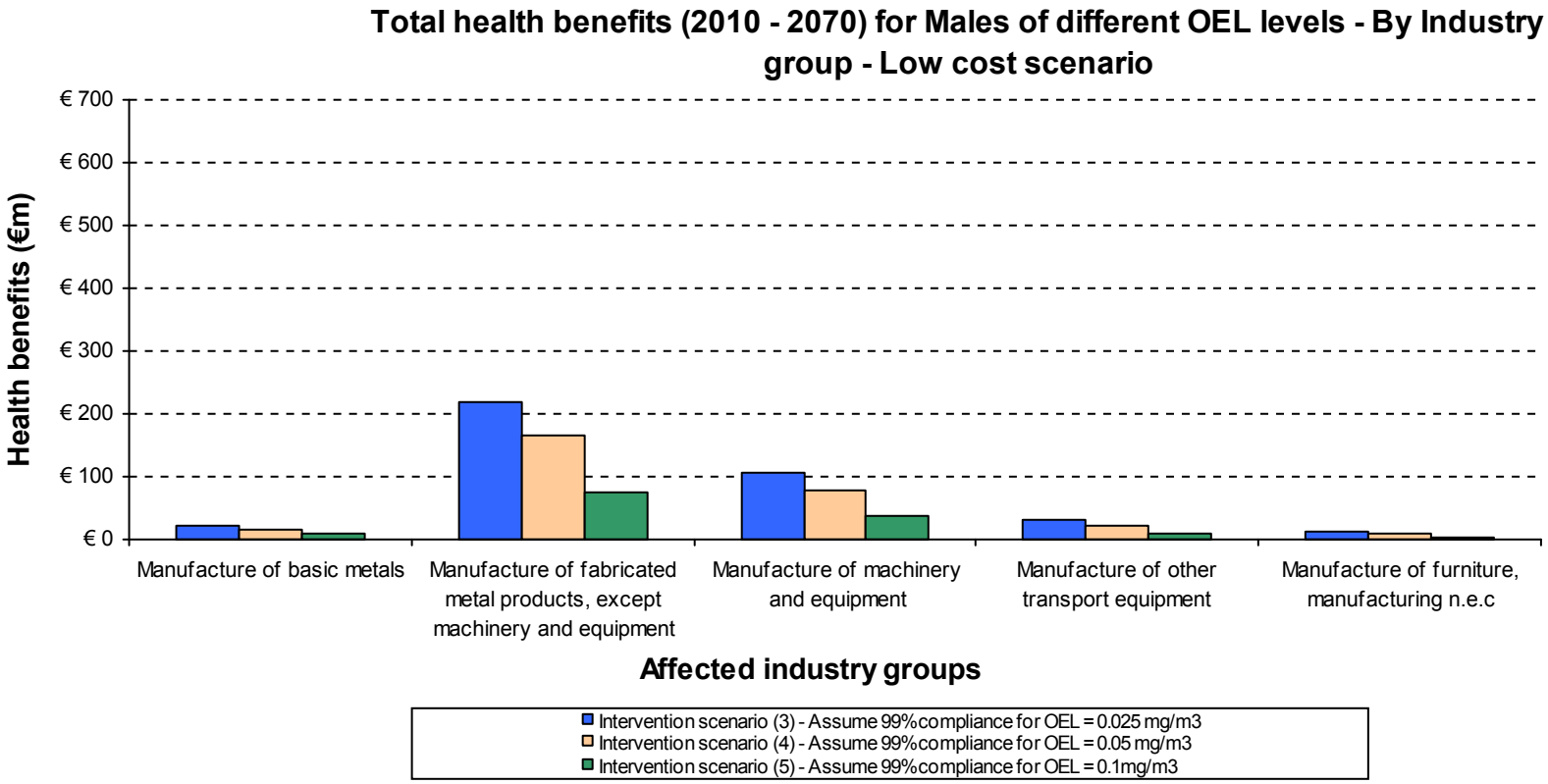

Figure 8.5.7 Total health benefits to males of introducing an EU-wide OEL – By Industry Group – Low Scenario (Present Value – 2010 €m prices)

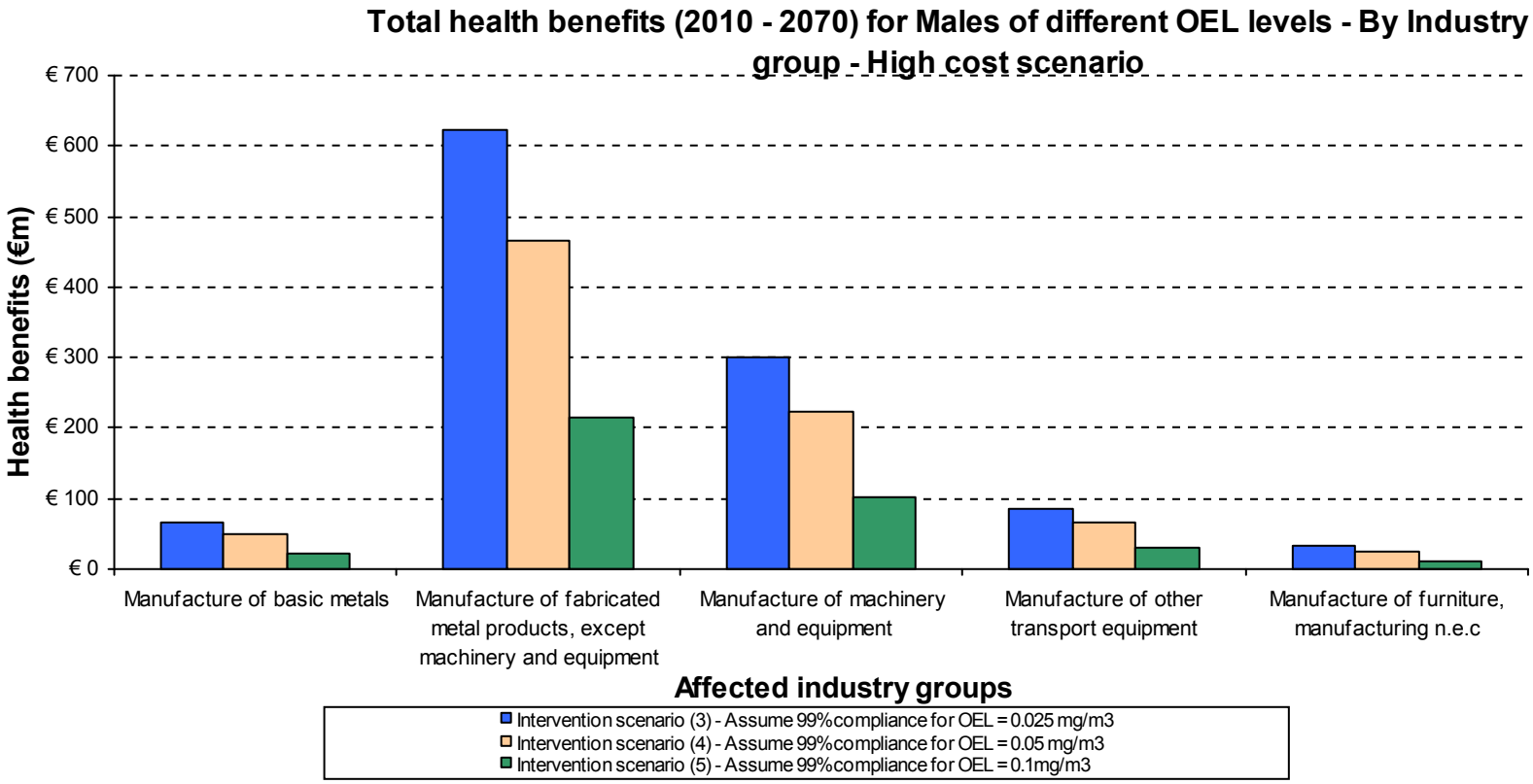

Figure 8.5.8 Total health benefits for males of introducing an EU-wide OEL – By Member State – High Scenario (Present Value – 2010 €m prices)

8.6 HEALTH BENEFITS USING DIFFERENT DISCOUNT RATES

COLOUR KEY
No discount
Using the EU IA guidance - 4%
Using a declining discount rate (4% going to 3%)

Table 8.6.1: Introducing an OEL of 0.025 mg/m^3

Hardwood dust		Intervention scenario (3) - Assume 99% compliance for OEL = 0.025 mg/m3					
Range of costs (€m)	Gender	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
	Females	0 to 0	0 to 0	2 to 3	51 to 113	164 to 380	255 to 605
	Males	0 to 0	0 to 0	9 to 24	274 to 788	879 to 2589	1376 to 4125
	Totals	0 to 0	0 to 0	10 to 28	324 to 901	1044 to 2969	1631 to 4730
	Gender	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
	Females	0 to 0	0 to 0	1 to 1	13 to 29	28 to 65	29 to 70
	Males	0 to 0	0 to 0	3 to 9	69 to 200	151 to 443	159 to 477
	Totals	0 to 0	0 to 0	4 to 10	82 to 228	179 to 508	189 to 547
	Gender	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
	Females	0 to 0	0 to 0	1 to 2	18 to 40	43 to 100	50 to 119
	Males	0 to 0	0 to 0	4 to 12	97 to 280	232 to 685	271 to 812
	Totals	0 to 0	0 to 0	5 to 13	115 to 320	276 to 785	321 to 931

Member State	Low cost	High cost	Low cost	High cost	Low cost	High cost
Austria	€ 53	€ 153	€ 8	€ 23	€ 13	€ 36
Belgium	€ 7	€ 6	€ 1	€ 28	€ 2	€ 44
Bulgaria	€ 24	€ 22	€ 4	€ 9	€ 6	€ 15
Czech Republic	€ 154	€ 137	€ 23	€ 72	€ 37	€ 114
Cyprus	€ 1	€ 1	€ 0	€ 0	€ 0	€ 0
Denmark	€ 44	€ 40	€ 7	€ 17	€ 11	€ 27
Estonia	€ 6	€ 5	€ 1	€ 3	€ 1	€ 4
Finland	€ 24	€ 21	€ 4	€ 10	€ 6	€ 16
France	€ 312	€ 279	€ 47	€ 109	€ 75	€ 173
Germany	€ 728	€ 647	€ 110	€ 309	€ 173	€ 490
Greece	€ 24	€ 22	€ 4	€ 10	€ 6	€ 16
Hungary	€ 67	€ 60	€ 10	€ 29	€ 16	€ 45
Ireland	€ 7	€ 6	€ 1	€ 3	€ 2	€ 5

Member State	Low cost	High cost	Low cost	High cost	Low cost	High cost
Italy	€ 519	€ 465	€ 78	€ 234	€ 124	€ 370
Latvia	€ 5	€ 5	€ 1	€ 2	€ 1	€ 3
Lithuania	€ 8	€ 7	€ 1	€ 4	€ 2	€ 6
Luxembourg	€ 3	€ 3	€ 0	€ 1	€ 1	€ 2
Malta	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Netherlands	€ 80	€ 71	€ 12	€ 36	€ 19	€ 58
Poland	€ 272	€ 244	€ 41	€ 118	€ 65	€ 188
Portugal	€ 29	€ 26	€ 4	€ 11	€ 7	€ 17
Romania	€ 67	€ 60	€ 10	€ 26	€ 16	€ 42
Slovakia	€ 32	€ 29	€ 5	€ 17	€ 8	€ 27
Slovenia	€ 30	€ 26	€ 4	€ 12	€ 7	€ 19
Spain	€ 294	€ 267	€ 44	€ 111	€ 70	€ 176
Sweden	€ 53	€ 47	€ 8	€ 20	€ 13	€ 31
United Kingdom	€ 167	€ 150	€ 25	€ 79	€ 40	€ 125

Industry Group	Low cost	High cost	Low cost	High cost	Low cost	High cost
Agriculture, hunting and related service activities	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Mining of metal ores	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of food products and beverages	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of textiles	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of wearing apparel; dressing and dyeing of fur	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of pulp, paper and paper products	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Publishing, printing and reproduction of recorded media	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of coke, refined petroleum products and nuclear fuel	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of chemicals and chemical products	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of Rubber and Plastic Products	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of other non-metallic mineral products	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of basic metals	€ 183	€ 507	€ 28	€ 76	€ 44	€ 120
Manufacture of fabricated metal products, except machinery and equipment	€ 1,738	€ 4,811	€ 262	€ 722	€ 414	€ 1,143
Manufacture of machinery and equipment	€ 833	€ 2,307	€ 125	€ 346	€ 198	€ 548

Industry Group	Low cost	High cost	Low cost	High cost	Low cost	High cost
Manufacture of electrical machinery and apparatus	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of radio, television and communication equipment and apparatus	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of medical, precision and optical instruments, watches and clocks	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of other transport equipment	€ 242	€ 669	€ 36	€ 101	€ 58	€ 159
Manufacture of furniture, manufacturing n.e.c	€ 94	€ 260	€ 14	€ 39	€ 22	€ 62
Electricity, gas, steam and hot water supply	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Collection, purification and distribution of water	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Construction	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Wholesale trade and commission trade, except of motor vehicles and motorcycles	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Land transport; transport via pipelines	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Water Transport	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Air Transport	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Supporting and auxiliary transport activities; activities of travel agencies	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Post and telecommunications	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Research and development	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Other business activities	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Public administration and defence; compulsory social security	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Education	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Health and Social Work	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Sewage and refuse disposal, sanitation and similar activities	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
TOTAL	€ 3,090	€ 8,555	€ 465	€ 1,283	€ 736	€ 2,032

Table 8.6.2 Introducing an OEL of 0.05 mg/m^3

Hardwood dust		Intervention scenario (3) - Assume 99% compliance for OEL = 0.025 mg/m3					
Range of costs (€m)	Gender	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
	Females	0 to 0	0 to 0	1 to 3	40 to 90	125 to 290	181 to 429
	Males	0 to 0	0 to 0	7 to 19	218 to 628	671 to 1975	978 to 2931
	Totals	0 to 0	0 to 0	8 to 22	258 to 718	796 to 2264	1159 to 3360
	Gender	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
	Females	0 to 0	0 to 0	0 to 1	10 to 23	21 to 50	21 to 50
	Males	0 to 0	0 to 0	3 to 7	55 to 159	115 to 338	113 to 339
	Totals	0 to 0	0 to 0	3 to 8	65 to 182	136 to 388	134 to 389
	Gender	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
	Females	0 to 0	0 to 0	1 to 1	14 to 32	33 to 77	36 to 84
	Males	0 to 0	0 to 0	3 to 9	78 to 223	177 to 522	193 to 577
	Totals	0 to 0	0 to 0	4 to 11	92 to 255	211 to 599	228 to 661

Member State	Low cost	High cost	Low cost	High cost	Low cost	High cost
Austria	€ 39	€ 30	€ 6	€ 17	€ 9	€ 27
Belgium	€ 5	€ 4	€ 1	€ 21	€ 1	€ 32
Bulgaria	€ 18	€ 14	€ 3	€ 7	€ 4	€ 11
Czech Republic	€ 111	€ 84	€ 17	€ 52	€ 27	€ 82
Cyprus	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Denmark	€ 32	€ 25	€ 5	€ 13	€ 8	€ 20
Estonia	€ 4	€ 3	€ 1	€ 2	€ 1	€ 3
Finland	€ 17	€ 13	€ 3	€ 7	€ 4	€ 12
France	€ 231	€ 178	€ 35	€ 82	€ 56	€ 129
Germany	€ 526	€ 404	€ 80	€ 226	€ 126	€ 357
Greece	€ 19	€ 14	€ 3	€ 8	€ 4	€ 12
Hungary	€ 50	€ 39	€ 8	€ 22	€ 12	€ 34
Ireland	€ 5	€ 4	€ 1	€ 2	€ 1	€ 4
Italy	€ 385	€ 299	€ 59	€ 176	€ 93	€ 277
Latvia	€ 4	€ 3	€ 1	€ 2	€ 1	€ 3
Lithuania	€ 6	€ 5	€ 1	€ 3	€ 1	€ 4
Luxembourg	€ 2	€ 2	€ 0	€ 1	€ 1	€ 2
Malta	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Netherlands	€ 59	€ 46	€ 9	€ 27	€ 14	€ 43
Poland	€ 201	€ 156	€ 31	€ 88	€ 48	€ 140
Portugal	€ 22	€ 17	€ 3	€ 8	€ 5	€ 13
Romania	€ 51	€ 39	€ 8	€ 20	€ 12	€ 31
Slovakia	€ 23	€ 18	€ 4	€ 12	€ 6	€ 20
Slovenia	€ 21	€ 16	€ 3	€ 9	€ 5	€ 14
Spain	€ 226	€ 177	€ 34	€ 86	€ 54	€ 136
Sweden	€ 38	€ 30	€ 6	€ 14	€ 9	€ 23
United Kingdom	€ 126	€ 98	€ 19	€ 61	€ 30	€ 96

Industry Group	Low cost	High cost	Low cost	High cost	Low cost	High cost
Agriculture, hunting and related service activities	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Mining of metal ores	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of food products and beverages	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of textiles	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of wearing apparel; dressing and dyeing of fur	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of pulp, paper and paper products	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Publishing, printing and reproduction of recorded media	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of coke, refined petroleum products and nuclear fuel	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of chemicals and chemical products	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of Rubber and Plastic Products	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of other non-metallic mineral products	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of basic metals	€ 135	€ 373	€ 21	€ 57	€ 32	€ 89
Manufacture of fabricated metal products, except machinery and equipment	€ 1,284	€ 3,554	€ 196	€ 540	€ 309	€ 852
Manufacture of machinery and equipment	€ 612	€ 1,694	€ 93	€ 257	€ 147	€ 406
Manufacture of electrical machinery and apparatus	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of radio, television and communication equipment and apparatus	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of medical, precision and optical instruments, watches and clocks	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of other transport equipment	€ 179	€ 496	€ 27	€ 75	€ 43	€ 119
Manufacture of furniture, manufacturing n.e.c	€ 70	€ 192	€ 11	€ 29	€ 17	€ 46
Electricity, gas, steam and hot water supply	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Collection, purification and distribution of water	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Construction	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Wholesale trade and commission trade, except of motor vehicles and motorcycles	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Land transport; transport via pipelines	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Water Transport	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Air Transport	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Supporting and auxiliary transport activities; activities of travel agencies	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Post and telecommunications	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Research and development	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0

Industry Group	Low cost	High cost	Low cost	High cost	Low cost	High cost
Other business activities	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Public administration and defence; compulsory social security	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Education	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Health and Social Work	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Sewage and refuse disposal, sanitation and similar activities	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
TOTAL	€ 2,280	€ 6,309	€ 348	€ 958	€ 548	€ 1,512

Table 8.6.3 Introducing an OEL of 0.1 mg/m^3

Hardwood dust		Intervention scenario (5) - Assume 99% compliance for OEL = 0.1 mg/m3					
Range of costs (€m)	Gender	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
	Females	0 to 0	0 to 0	1 to 2	24 to 53	63 to 146	63 to 151
	Males	0 to 0	0 to 0	4 to 12	130 to 373	339 to 996	343 to 1028
	Totals	0 to 0	0 to 0	5 to 13	153 to 426	402 to 1142	407 to 1178
	Gender	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
	Females	0 to 0	0 to 0	0 to 1	6 to 13	11 to 25	7 to 17
	Males	0 to 0	0 to 0	2 to 4	33 to 94	58 to 170	40 to 119
	Totals	0 to 0	0 to 0	2 to 5	39 to 108	69 to 196	47 to 136
	Gender	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
	Females	0 to 0	0 to 0	0 to 1	8 to 19	17 to 39	12 to 30
	Males	0 to 0	0 to 0	2 to 6	46 to 132	90 to 263	68 to 202
	Totals	0 to 0	0 to 0	2 to 6	55 to 151	106 to 302	80 to 232

Member State	Low cost	High cost	Low cost	High cost	Low cost	High cost
Austria	€ 17	€ 7	€ 3	€ 8	€ 4	€ 12
Belgium	€ 2	€ 1	€ 0	€ 9	€ 1	€ 15
Bulgaria	€ 8	€ 3	€ 1	€ 3	€ 2	€ 5
Czech Republic	€ 46	€ 19	€ 7	€ 23	€ 12	€ 36
Cyprus	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Denmark	€ 14	€ 6	€ 2	€ 6	€ 3	€ 9

Member State	Low cost	High cost	Low cost	High cost	Low cost	High cost
Estonia	€ 2	€ 1	€ 0	€ 1	€ 0	€ 1
Finland	€ 7	€ 3	€ 1	€ 3	€ 2	€ 5
France	€ 103	€ 43	€ 17	€ 38	€ 26	€ 60
Germany	€ 221	€ 93	€ 36	€ 101	€ 56	€ 157
Greece	€ 8	€ 4	€ 1	€ 4	€ 2	€ 6
Hungary	€ 22	€ 9	€ 4	€ 10	€ 6	€ 16
Ireland	€ 2	€ 1	€ 0	€ 1	€ 1	€ 2
Italy	€ 169	€ 71	€ 27	€ 82	€ 42	€ 127
Latvia	€ 2	€ 1	€ 0	€ 1	€ 0	€ 1
Lithuania	€ 3	€ 1	€ 0	€ 1	€ 1	€ 2
Luxembourg	€ 1	€ 0	€ 0	€ 1	€ 0	€ 1
Malta	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Netherlands	€ 26	€ 11	€ 4	€ 13	€ 7	€ 20
Poland	€ 87	€ 37	€ 14	€ 40	€ 22	€ 63
Portugal	€ 10	€ 4	€ 2	€ 4	€ 2	€ 6
Romania	€ 23	€ 9	€ 4	€ 9	€ 6	€ 15
Slovakia	€ 10	€ 4	€ 2	€ 6	€ 2	€ 9
Slovenia	€ 9	€ 4	€ 1	€ 4	€ 2	€ 6
Spain	€ 101	€ 42	€ 16	€ 41	€ 25	€ 64
Sweden	€ 16	€ 7	€ 3	€ 6	€ 4	€ 10
United Kingdom	€ 58	€ 25	€ 9	€ 29	€ 14	€ 46

Industry Group	Low cost	High cost	Low cost	High cost	Low cost	High cost
Agriculture, hunting and related service activities	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Mining of metal ores	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of food products and beverages	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of textiles	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of wearing apparel; dressing and dyeing of fur	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Tanning and dressing of leather; manufacture	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0

Industry Group	Low cost	High cost	Low cost	High cost	Low cost	High cost
of luggage, handbags, saddlery, harness and footwear						
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of pulp, paper and paper products	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Publishing, printing and reproduction of recorded media	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of coke, refined petroleum products and nuclear fuel	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of chemicals and chemical products	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of Rubber and Plastic Products	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of other non-metallic mineral products	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of basic metals	€ 58	€ 161	€ 9	€ 26	€ 15	€ 40
Manufacture of fabricated metal products, except machinery and equipment	€ 559	€ 1,544	€ 91	€ 249	€ 141	€ 387
Manufacture of machinery and equipment	€ 265	€ 731	€ 43	€ 118	€ 67	€ 183
Manufacture of electrical machinery and apparatus	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of radio, television and communication equipment and apparatus	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of medical, precision and optical instruments, watches and clocks	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Manufacture of other transport equipment	€ 79	€ 217	€ 13	€ 35	€ 20	€ 54
Manufacture of furniture, manufacturing n.e.c	€ 30	€ 84	€ 5	€ 13	€ 8	€ 21
Electricity, gas, steam and hot water supply	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Collection, purification and distribution of water	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Construction	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Wholesale trade and commission trade, except of motor vehicles and motorcycles	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Land transport; transport via pipelines	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Water Transport	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Air Transport	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Supporting and auxiliary transport activities; activities of travel agencies	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Post and telecommunications	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Research and development	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Other business activities	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Public administration and defence; compulsory social security	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Education	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Health and Social Work	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
Sewage and refuse disposal, sanitation and similar activities	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
TOTAL	€ 991	€ 2,736	€ 160	€ 441	€ 249	€ 686

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