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

Rubber Process Fumes and Dust

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SUMMARY

Working in the rubber manufacturing industry has been classified as a group 1 carcinogen (Carcinogenic to humans) by the International Agency for Research on Cancer (IARC). Airborne rubber dust and fume comprise complex mixtures of chemicals and in the absence of a clear understanding of the specific chemicals that may increase the risk of cancer these measures have been used as pragmatic markers of exposure as part of a strategy to control occupational cancer risks in the industry. Rubber dust and fume are not classified under the EU classification and labelling legislation and are therefore not currently within the scope of the EU Carcinogens Directive. There are no occupational exposure limits (OELs) for rubber dust and fume specified in the Directive.

This report considers the likely health, socioeconomic and environmental impacts associated with possible changes to the Carcinogens Directive, in particular the possible introduction of OELs of 6 mg/m^3 for rubber process dust and 0.6 mg/m^3 for rubber fume.

The use of rubber is widespread. Tyres and tubes are the largest consumers of rubber (56%) and the remaining 44% is taken up by the general rubber goods (GRG) sector. There are more about 8,000 companies involved in the European rubber industry, employing approximately 370,000 individuals. The turnover of these companies is more than €49 billion with exports of more than €6 billion. GRG companies are mostly SMEs whilst tyre companies tend to be large in size. There are only eleven companies that produce tyres in the EU and in 2006 around 240 million units of tyres were produced, which represents 22% of world production. Seventy-five percent of the goods produced in the GRG industry are used in the automobile sector.

From data provide by the industry we have assumed that workers in mixing, component preparation and curing may be exposed to rubber fume (23 – 47% of employees). Exposure to rubber process dust occurs during mixing, but not during component preparation or curing, and we have assumed that 9% – 16 % of employees are exposed to rubber dust. However, in calculating the health impact we have selected the upper figures, i.e. 56,800 workers exposed to rubber dust and 172,300 to rubber fume.

We estimate the geometric mean (GM) exposure to rubber process dust across all countries is 1.14 mg/m^3 with a geometric standard deviation (GSD) of 4.7. It is estimated that 14% of exposed workers are currently exposed to dust levels above 6 mg/m^3. The estimated GM exposure to rubber fume is 0.37 mg/m^3 with a GSD of 4.00. Thirty seven percent of exposed workers are estimated to be currently exposed above 0.6 mg/m^3. Exposure levels were estimated to have declined by between 0.7% and 7.4% per annum for process dust, depending on the country where the plants were located. For rubber fume an average decline of 3% per annum was estimated for the GRG sector and 0.9% per annum in tyre production.

Workers in the rubber industry have an increased risk from leukaemia and cancers of the larynx, lung and stomach. The risk from bladder cancer due to aromatic amines identified in workers before the 1950's, has essentially disappeared due to the elimination of the relevant substances from the process. There is a large amount of

epidemiological literature for this industry, and for the health impact we have chosen to use data from a meta-analysis carried out in 2006 involving 36 published studies of 31 different cohort groups. Separate risk estimates have been used for workers producing tyres and for GRG, the latter being the overall cancer site-specific risk estimates. For tyre manufacture the relative risks (RRs) were: leukaemia 1.03; cancer of the larynx 1.01; lung cancer 1; stomach cancer 1. The identified risk estimates for all other rubber workers were: leukaemia 1.70; cancer of the larynx 1.19; lung cancer 1.05; stomach cancer 1. As the risk estimates for stomach cancer were both judged to be 1 this cancer site has been excluded from the assessment.

Health and economic impacts were estimated separately for rubber dust and rubber fume, but these data cannot be added together since the exposures are not independent and to do so may result in an overstatement of any benefits arising from the interventions. Deaths and registrations attributable to rubber process dust slowly decrease for all three types of cancer; for lung from 7 registrations in 2010 to 2 in 2060; from 3 registrations to 1 for larynx and from 7 to 4 registrations for leukaemia. The decrease is a consequence of the assumed decline in exposure up to 2020. The attributable fraction in 2010, i.e. the proportion of all cancers of that type in the exposed workers that has been attributed to the exposure, ranges from 0.0093% for laryngeal cancer to 0.012% for leukaemia; in 2060 the corresponding figures are 0.00244% to 0.005%. In 2010 the estimated DALYs were highest for laryngeal cancer (380 years) and lowest for leukaemia (68 years). By 2060 these estimates range form 131 DALYs for laryngeal cancer to 26 years for lung cancer.

The attributable cancer deaths and registrations for rubber fume are higher than for rubber process dust, although as we noted above it is not possible to add these health impacts since the exposures are not independent. In 2010 the estimated number of registrations and deaths from lung cancer were 20 and 18, for larynx cancer 10 and 2 and for leukaemia 31 and 19. The corresponding data for the decade starting 2060 are 16 registrations and 16 deaths per annum, 8 and 2 per annum and 31 and 25 per annum, for lung, larynx and leukaemia, respectively. Estimated DALYs in 2010 were highest for cancer of the larynx (1,152 years) and lowest for leukaemia (292 years). By the decade starting 2060 the annual DALYs ranged from 866 years for larynx to 211 years for lung cancer.

Total estimated health costs associated with inaction for the period up to 2069 range from €721m to €859m for rubber process dust and from €2,961m to €3,930m for rubber fume. Note these estimates are not additive.

Further reduction in exposure to rubber dust and fume could be achieved by a combination of engineering, technical and operational control measures, coupled with appropriate training and instruction for workers.

Introducing an OEL of 6 mg/m^3 for rubber process dust has a small health impact; by 2060 there is only one cancer that is estimated to be avoided with this measure. The effect of introducing a limit of 0.6 mg/m^3 for rubber fume is larger with 47 cancers being avoided each year (15 lung, 6 larynx and 26 leukaemia). The total number of attributable cancer registrations and deaths estimated to occur in 2060 with an OEL for rubber fume are: one registration and one death from lung cancer, two registrations and no deaths from laryngeal cancer and six registrations and five deaths from

leukaemia. The monetised health benefits from introducing an OEL for rubber process dust is between €24m and €46m and between €579m and 1,207m for an OEL for rubber fume. Note these estimates are not additive.

Total compliance costs for the period from 2010 to 2069 are estimated to range from €55m to €275m for the rubber process dust OEL and from €466m to €3,212m for the rubber fume OEL. There are no significant social or macro-economic costs associated with introducing an OEL for rubber dust given that only 9-16% of the firms are thought to require any further compliance measures. It is estimated that a significant proportion of enterprises (54-100%) would require further action to comply with an EU-wide OEL of 0.6mg/m^3 for rubber fumes. Of the affected firms, 70% are thought to require ventilation systems. Given the upfront costs of ventilation systems, the affordability of ventilation systems may affect the long term viability of some SMEs in the market.

There are no significant environmental impacts foreseen from the introduction of an OEL for either rubber process dust or rubber fume.

The rubber manufacturing industry has an active programme to identify carcinogenic compounds in rubber dust and fume and to reduce or eliminate their presence in the mix. This was an effective approach to eliminate bladder carcinogens and it has continued to be applied. It has been difficult to judge whether introducing an OEL for rubber dust or fume would divert resource away from such activities, although this is a possibility.

1 PROBLEM DEFINITION

1.1 OUTLINE OF THE INVESTIGATION

Airborne rubber dust and fume comprise complex mixtures of chemicals and in the absence of a clear understanding of the specific chemicals that may increase the risk of cancer these measures have been used as pragmatic markers of exposure as part of a strategy to control occupational cancer risks in the industry.

Exposure to airborne contaminants in rubber manufacturing may result in increased risks for leukaemia, lung and laryngeal cancer. Working in the rubber manufacturing industry has been classified as a group 1 carcinogen (Carcinogenic to humans) by the International Agency for Research on Cancer (IARC)[1], based on the available epidemiological and toxicological data. Rubber dust and fume are not classified in the EU under the classification and labelling legislation and are therefore not currently regulated as a carcinogen throughout the EU[2]. In this assessment we consider the impacts of introducing exposure limits for rubber dust and fume within the EU Carcinogens and Mutagens Directive.

The key objectives of the present study are to identify the technical feasibility and the socioeconomic, health and environmental impacts of introducing regulatory exposure limits of 6 mg/m^3 for rubber process dust and 0.6 mg/m^3 for rubber fume.

1.2 OELS/EXPOSURE CONTROL

The Insitut für Arbeitsschutz der Deutschen Gesetzlichen Unfallversicherung has compiled a database consisting of occupational exposure limits (OELS) for various EU member states (including Austria, Belgium, Denmark, France, Germany, Hungary, Italy, Poland, Spain, Sweden, The Netherlands, and the United Kingdom) and selected countries outside the EU (including Canada, Japan, Switzerland, and the United States). Of the countries examined only France and the UK had OELS for rubber fume. Both have eight-hour time weighted average OELs of 0.6 mg/m^3. Only the UK had an OEL for rubber process dust. The UK eight-hour time weighted average OEL for rubber process dust is 6 mg/m^3. For the purposes of this report OELs of 6 mg/m^3 for rubber process dust and 0.6 mg/m^3 for rubber fume will be considered typical for the EU.

1.3 DESCRIPTION OF DIFFERENT USES

1.3.1 Definitions

The International Agency for Research on Cancer (IARC) has classified work in the rubber industry as carcinogenic to humans based on evidence of a causal association between work in the rubber industry and leukaemia and cancers of the bladder, stomach and lungs (IARC, 1982). The IARC monograph on the Rubber Industry concluded that rubber workers are exposed to complex mixtures of substances and that the mixture of substances is likely more relevant to cancer risk than are single compounds (IARC, 1982). Rubber fumes and dusts are produced during rubber

[1] Available at: http://monographs.iarc.fr/ENG/Classification/ClassificationsAlphaOrder.pdf
[2] Available at: http://ecb.jrc.ec.europa.eu/esis/

manufacturing. The composition of these fumes and dusts can vary between facilities and processes.

Rubber fumes and dusts have been defined by the UK Health and Safety Executive (HSE) as follows:

> ***Rubber fume*** *is fume evolved in the mixing and milling of natural rubber or synthetic elastomers or of natural rubber and synthetic polymers combined with chemicals and in the processes which convert the resultant blends into finished products of parts thereof, and include any inspection procedures where fume continues to be evolved*
>
> ***Rubber process dust*** *is defined as the mixed dust arising in the stages of rubber manufacture where ingredients are handled, weighted, added to or mixed with uncured material or synthetic elastomers. It does not include dust arising from the abrasion of cured rubber.*[3]

Rubber process dust consists of the rubber and chemicals used during the processes leading up to and including the mixing of the rubber and chemicals. Rubber fumes also include these substances and additionally include reaction or decomposition products generated during processing of raw materials.[4]

1.3.2 Manufacturing Process

The chemicals involved in rubber processing include the following:

- Mastification agents such as N,N'dithiodi-o-phenylenedibenzamide
- Vulcanisation agents such as N-Cyclohexyl-2-benzothiazole sulfenamide (CBS) and Diphenyl guanidine (DPG)
- Antidegradants such as N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine and wax
- Fillers and pigments such as carbon black, silica, TiO_2
- Plasticisers including low-aromatic oils such as Treated Distillate Aromatic Extract (TDAE) and Mild Extractant Solvate (MES)
- Lubricants and flow improvers such as fatty acids
- Tackifiers such as hydrocarbon resins
- Filler activators such as island coupling agents
- Bonding agents such as cobalt salts
- Emulsifiers such as sulphates
- Solvents such as naptha and hexane
- Reinforcing agents such as Heamethoxy Methyl Melamine (HMMM)
- Release agents such as silicones[5]

In accordance with REACH the European Tyre and Rubber Manufacturer's Association (ETRMA) have produced documents to inform the manufacturers of the chemicals

[3] HSE. MDHS 47/2 (1999) Determination of rubber process dust and rubber fume (measured as cyclohexane-soluble material) in air.
[4] Communication with the European Tyre & Rubber Manufacturer's Association (ETRMA)
[5] ETRMA (2009) Identification of uses for the Rubber Sector – Tyre.

used in the rubber industries of the uses of those chemicals within the industry and potential exposure scenarios. These documents include a useful overview of the rubber and tyre manufacturing process, the substances used, and exposures during the process (Figure 1.1). All procedural steps from storage to final treatment are relevant for both tyre and general rubber goods manufacturing. Casing inspection, buffing/skiving and cementing/filling are relevant only to the manufacture of tyres.[6]

Exposure to rubber process dust occurs in the first five process phases (storage, weighing, mixing, cement preparation, and shaping). The following tasks have been identified by ETRMA as particularly relevant to rubber process dust exposure:

- Bulk unloading of materials;
- Storage of rubbers and compounding ingredients;
- Weighing or ancillary handling of ingredients;
- Milling;
- Mixing;
- Cooling;
- Anti-tack dipping.

Exposure to rubber fume occurs in the third through sixth process phases (mixing, cement preparation, shaping, and curing) and the concentration of fumes released generally increases with the heat of the process. The following tasks have been identified by ETRMA as particularly relevant to rubber fume exposure:

- Milling;
- Mixing;
- Cooling;
- Anti-tack dipping;
- Extruding (including re-heating or warming);
- Calendaring (including re-heating and warming);
- Curing.

[6] ETRMA (2009) Identification of uses for the Rubber Sector – Tyre.

Process Phase	PROC	Description	Substances involved	Brief exposure overview
Storage	8b 9	*Storage of raw materials in original packaging (drums, big bags, pigments bags) or (underground)tanks/silos*	All raw materials	- Potential dust/vapour emission associated to material transfer between packaging and storage place. - Substance has the same physical form and concentration as supplied by the manufacturer.
Weighing	9	*Substances are weighed and transferred into small plastic bags according to compound production needs.*	Mastication agents, Vulcanisation agents, Antidegradants, Fillers, Tackifiers, Filler activators, Bonding agents, Reinforcing agents, Hardeners, lubricants	- Potential dust emission associated to material transfer, manual or automatic, between substance packaging and plastic bag. - Substances have the same physical form and concentration as supplied by the manufacturer.
Mixing	5 8b 9	*Raw materials are transfered into the mixing chamber (liquid raw materials are directly injected into the chamber). Once mixed, the compound batch is extruded into a cooling bath.*	Mastication agents, Vulcanisation agents, Antidegradants, Fillers, Tackifiers, Filler activators, Bonding agents, Reinforcing agents, Lubricants, Plasticizers, Rubber,	**Mixer loading:** dermal contact with raw polymers (pigments are contained in the plastic bags) **Mixing:** Potential environmental exposure due to emission of dust and organic vapours. **Batch release:** emission of hot organic vapours. Substance are now bound in the rubber matrix. Concentration is defined by compound recipe.
Cement preparation	9	*Certain compounds are dissolved into the solvent in order to obtain a liquid mixture called "cement" used as a "glue" between rubber components*	Vulcanisation agents, Antidegradants, Fillers, Plasticizers, Lubricants, Emulsifiers, Reinforcing agents, Solvent	**Compound transfer in the vessel:** dermal contact with compounds **Solvent loading:** air emission **Mixture preparation:** emission to the air of solvents vapours **Cement transfer into small containers:** potential dermal contact and workers exposure to solvents vapours Substances are now bound in a liquid mixture. Concentration is defined by cement recipe.
Shaping = Extrusion + Milling + Building + Precuring + Filling (only retreading)	7 10 14 21	*Compounds are given a specific shape and combined to build up a complex articles (eg "green tyres"), ready to be cured.* *For retreading: see specific production phases*	Vulcanisation agents, Antidegradants, Fillers, Plasticisers, Lubricants, Tackifiers, Emulsifier, Filler activators, Bonding agents, Reinforcing agents, Solvent, Release agents	- Dermal contact with rubber blends and exposure to solvents/vapours Substances are bound in the rubber matrix. Concentration is defined by compound recipe.
Curing	14	*Most of the substances react to give a three-dimensional polymer network (final article). Non-reacting substances remain bound in the matrix with reduced mobility.* *For retreading: see specific production phases*	Remaing substances after curing: antidegradants, Plasticizers	- Generation of fumes (C6-C12 hydrocarbons > 99%) deriving from the curing of the rubber compounds. Substance concentration as per compound recipe.
Final treatment	10	*Articles undergo further treatment for quality control purpose, to enhance their appearance, or for mounting into multi-component articles.* *For retreading: see specific production phases*	Lubricants, solvents	- Dermal contact with final article, lubricant residues and exposure to solvents from cement used for repairing/appearance (when the case). Lubricants are in the physical form and concentration as provided by the manufacturer.
Casing inspection	21	*Carcasses are selected and cleaned*	Lubricants	- Dermal contact with tyre and lubricants. Substance in the tyre are entangled in the matrix. Lubricants are in the form and concentration as supplied by the manufacturer.
Buffing/skiving = Casing buffing + grunding +	21	*Part of rubber and rusted cords are removed from casing; casing cleaning*	Cured rubber compounds and steel cords	- Contact with fugitive buffing rubber swarfs and steel cords.
Cementing /filling = case cementing + filling	14	*Spray application and wiping cement. Skived cavities are filled with extruded rubber (Preparation of cement and extruded rubber follow the above tyre process phases)* *The repaired carcass is coupled with new tread compound and cured to produce final article (refer to the above tyre production scheme).*	Vulcanisation agents, Antidegradants, Fillers, Plasticisers, Lubricants, Tackifiers, Emulsifier, Filler activators, Bonding agents, Reinforcing agents, Solvent, anti-tack agents	Dermal contact with compounds air emission of solvents vapours. Cement transfer into small containers: potential dermal contact and workers exposure to solvents vapours Substances into a liquid mixture,concentration according to mixture recipe. Filling material: potential dermal contact.

Figure 1.1 Schematic of Rubber Good Manufacturing Process. Stages following final treatment are only relevant to the rubber manufacturing industry (source: ETRMA, 2009 – Identification of Uses for the Rubber Sector – Tyre)

1.4 RISKS TO HUMAN HEALTH

1.4.1 Introduction

Leukaemia

There are four main types of leukaemia: acute lymphoblastic leukaemia (ALL), chronic myeloid leukaemia (CML), acute myeloid (AML) and chronic lymphocytic leukaemia (CLL), although the last two account for about two-thirds of all leukaemias diagnosed. Overall it is the 12th commonest occurring cancer accounting for about 2.6% of all cases diagnosed in the EU (Ferlay *et al*, 2007). There are roughly equal numbers of leukaemias diagnosed in men and women (Ferlay *et al*, 2007).

Around 40% of people with leukaemia survive for at least five years after they are diagnosed, although the survival rate differs by leukaemia type. Survival rates for leukaemia have steadily increased over the last thirty years (Verdecchia *et al*, 2007).

Leukaemia may be caused by ionising radiation, although this probably only accounts for a small proportion of cases. Other agents that are accepted risk factors are occupational exposure to ethylene oxide, benzene, work in boot and shoe manufacture and some drugs used in cancer chemotherapy. It also thought that leukaemia may be induced by some viruses, e.g. Epstein-Barr virus and Hepatitis B virus. People who smoke cigarettes are also at increased risk. Siemiatycki *et al* (2004) that there is suggestive evidence that occupational exposure to formaldehyde and nonarsenical insecticides, along with work in petroleum refining may also cause leukaemia.

Cancer of the larynx

Laryngeal cancer is the 17th commonest cancer in the European Union, with about 30,000 cases occurring each year (Ferlay *et al*, 2007). The vast majority of cases of larynx cancer occur in men: 27,000 versus 3,000. Each year there are about 11,000 deaths from laryngeal cancer in the EU, with 5-year survival ranging from 90% for those with and early diagnosis to about 25% for those whose cancer is diagnosed at a late stage of development (Rudolph *et al*, 2011).

Smoking tobacco and drinking alcohol are the main risk factors for cancer of the larynx, although some types of human papilloma virus (HPV) may slightly increase the risk of laryngeal cancer. A poor diet may also increase risk for this type of cancer along with acid reflux.

Some occupational exposures may also increase the risk of cancer of the larynx, in particular working in isopropanol manufacture using the strong acid process (possibly due to exposure to diisopropyl sulphate, isopropyl oils or sulphuric acid), exposure to inorganic acid mists containing sulphuric acid, plus possibly from exposure to asbestos (Siemiatycki *et al*, 2004).

Lung cancer

Lung cancer is the most common malignant neoplasm among men in most countries and incidence has been steadily increasing among women. In the EU the incidence is

about 30 per 100,000 persons, with about 290,000 new cases each year[7]. 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 regularly two to three times higher in lower than higher 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 such cases in females (Ferlay *et al*, 2007).

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.

1.4.2 Summary of the available epidemiological literature on risk

Workers in the rubber industry have an increased risk from leukaemia and cancers of the larynx, lung and stomach. The risk from bladder cancer due to aromatic amines identified in workers before the 1950's has largely disappeared due to the removal of the relevant substances. There have been numerous studies in many countries of workers in the rubber industry.

Leukaemia

A study of 15,649 US synthetic rubber workers, employed for at least one year between 1943 and 1991, observed 48 deaths from leukaemia, whereas 36.6 were expected (SMR=1.31, 95%CI=1.74) (Sathiakumar *et al*, 1998). In an extended follow-up to 1998 there were 71 leukaemia deaths giving a SMR of 1.16 (95%CI=0.91-1.47) (Sathiakumar *et al*, 2005). Those employed in polymerisation (SMR=2.04, 95%CI=1.21-3.22), coagulation (SMR=2.31, 95%CI=1.11-4.25), maintenance labour (SMR=3.26, 95%CI=1.78-4.56) and laboratory operations (SMR=3.26, 95%CI=1.78-5.46) had the greatest risk.

A review of studies published after 1982, including 7 cohort studies in 6 countries and 2 case-control studies, found moderate increases in leukaemia risk in a number of studies and no excesses in others (Kogevinas *et al*, 1998). Of those studies reviewed that could examine exposure to specific agents benzene was most associated with the increased risk. A recent meta-analysis among workers in the synthetic rubber-producing industry examined cancer mortality/incidence from 36 published studies of 31 different cohort groups (Alder *et al*, 2006). The pooled SMR for leukaemia (based on 16 studies) was 1.21 (95%CI=1.03-1.43), whereas for incidence (four studies) the pooled SIR was 1.16 (95%CI=0.67-2.03). In cohorts of tyre workers the mortality risk was 1.03 (95%CI=0.76-1.41), compared to 1.12 (95%CI=0.93-1.34) among those

[7] http://globocan.iarc.fr/factsheets/populations/factsheet.asp?uno=990

manufacturing tyres and other goods, and 1.70 (95%CI=1.14-2.54) for those exclusively manufacturing other goods.

Cancer of the larynx

The review by Kogevinas *et al* (1998) found low or moderate excess risks in all seven studies reporting results on laryngeal cancer, although 95% CIs were wide. The highest risks were found for workers in Russia (Solionova & Smulevich (1993) and Poland (Szeszenia-Dabrowska *et al,* 1991) based on few numbers of cases.

The meta-analysis of the synthetic rubber-producing industry by Alder *et al* (2006) calculated a pooled estimate of 1.19 (95% CI=0.88-1.60) for mortality, with a high level of heterogeneity (p-value=0.01), and 1.39 (95% CI=0.75-2.59) for incidence (Alder *et al,* 2006). Four papers gave separate estimates for mortality for tyre manufacture giving a pooled estimate for mortality of 1.01 (95%CI=0.70-1.48).

Cancer of the lung

The review by Kogevinas *et al* (1998) found excess risks for lung cancer (ranging from 1.7 to 3.3) in four of the seven cohort studies; in contrast consistently high risks ranging from 1.5 to 4.6 were seen in five case-control studies reviewed.

The meta-analysis by Alder *et al* (2006) identified 24 studies reporting results for lung cancer mortality giving a pooled risk estimate of 1.05 (95%CI=0.94-1.18), although there was significant heterogeneity between studies. For incidence, five studies were combined to give a pooled estimate of 1.12 (95%CI=0.92-1.36) but this time there was no heterogeneity. In cohorts of workers exclusively producing tyres the pooled estimate for lung cancer mortality was 0.95 (95%CI=0.78-1.15).

Cancer of the stomach

The meta-analysis by Alder *et al* (2006) estimated a pooled risk estimate of 1.00 (95%CI=0.90-1.10) for stomach cancer mortality overall and 0.94(95%CI=0.75-1.19) for incidence overall. In cohorts of workers exclusively producing tyres the pooled estimate for stomach cancer mortality was 1.00 (95%CI=0.75-1.34).

1.4.3 Choice of risk estimates to assess health impact

The meta-analysis by Alder *et al* (2006) has been used for the risk estimates. Separate risk estimates have been used for workers producing tyres and for other rubber workers, the latter being the overall cancer site specific risk estimates. For tyre manufacture the RRs are: leukaemia 1.03 (95%CI 0.76, 1.41); cancer of the larynx 1.01 (0.70, 1.48); lung cancer 0.95 (0.78, 1.15) (risk estimate taken as 1); stomach cancer 1.00 (0.75, 1.34). The risk estimates for all other rubber workers are: leukaemia 1.70 (95%CI 1.14, 2.54); cancer of the larynx 1.19 (0.88, 1.60); lung cancer 1.05 (0.94, 1.18); stomach cancer 1.00 (0.90, 1.10). As the risk estimates for stomach cancer are both 1.00 this cancer site has been excluded.

2 BASELINE SCENARIOS

2.1 STRUCTURE OF THE SECTOR

The rubber industry in Europe began in the early years of the nineteenth century. The synthetic rubber industry developed during the early part of the twentieth century largely due to the two World Wars that occurred.

The use of rubber is widespread. Tyres and tubes are the largest consumers of rubber (56%) and the remaining 44% is taken up by the general rubber goods (GRG) sector. GRG can be divided into three categories: industrial products; consumer products and latex products. The relative importance of these products varies from country to country and varies over time.

ETRMA represents 4,200 companies in the EU25, employing approximately 360,000 individuals. The turnover of these companies is estimated to exceed € 49 billion, whilst exports represent more than € 6.3 billion.[8] According to consultation with industry, GRG companies are mostly SMEs whilst tyre companies tend to be large in size. The product range of its members is extensive from tyres to pharmaceutical, baby care, construction and automotive rubber goods. Section 1.3 provides information of volumes of rubber produced in the EU.

Table 2.1 shows the total number of people employed, number of enterprises and turnover in the sector based on information from Eurostat.

Table 2.1 Statistics of the sectors used in this study

Sector	NACE code	Total number of employees in sector[1]	Number of enterprises	Turnover (or gross premiums written)
Manufacture of rubber products	25.1	366,501	7,893	68,031

Notes:
1) This gives the total number of employees employed in the sector and does not represent the number of personnel exposed to rubber fume and dust (as shown in Table 2.2 and Table 2.3)

Source: Eurostat data

Production Volume

There are eleven tyre companies that produce tyres in the EU and in 2006 around 240 million units of tyres were produced in the EU. This represents 22% of worldwide production. Approximately 27% of tyres produced in the EU are exported outside the EU. Tyre production plants are present in most EU member states. Ten per cent of production takes place in new member states such as Poland, Slovakia, Romania and Slovenia and growth in demand is greater in these member states than in Western

[8] Consultation with ETRMA in December 2009 and the ETRMA website, available online here: http://www.etrma.org

Europe. It is estimated that 200,000 workers in the EU are employed in the tyre manufacturing industry.[9]

Total EU production volume is not available for the general rubber goods industry however the ETRMA has reported that 2005 production volume for the four countries that produce the largest quantity of general rubber goods (Germany, France, Italy and Spain) was 1.76 million tonnes. The UK and Poland also have significant general rubber goods production industries however production volume figures were not available for these countries. The ETRMA has estimated that the industry's 2007 turnover was €23 billion. There are over 4,100 companies (mostly SMES) in the industry in the EU that employ an estimated 160,000 workers. Seventy-five percent of the goods produced in the general rubber goods industry are used in the automobile sector.[10]

Industries

Exposure to rubber process fume and dust occurs in NACE 251 (Manufacture of rubber products). Within NACE 251 are three subgroups: 25.11 (Manufacture of rubber tyres and tubes), 25.12 (Retreading and rebuilding of rubber tyres) and 25.13 (Manufacture of other rubber products). Exposure to rubber fume occurs in all three subgroups and exposure to rubber process dust occurs in groups 25.11 and 25.13. There are no processes that generate rubber process dust in the retreading and rebuilding of rubber tyres (Dost *et al*, 2000).

2.2 PREVALENCE OF RUBBER PROCESS FUME AND DUST EXPOSURE IN EU

The prevalence of exposure to rubber process fume and dust has been estimated from 2006 employment data from the structural business statistics on the Eurostat database.[11] The structural business statistics database includes estimates of the number of workers in each EU member state employed in NACE 251 and all three subgroups.

The number of employees in some industry subgroups and countries were not available on the Eurostat database. Where possible, missing data have been substituted with 2005 or 2004 data for the applicable industry and country. In cases where 2005 or 2007 data were also unavailable 2003 or 2004 have been substituted (estimates made for Slovenia) or the number of employees was estimated based on available data on employees in other subgroups within the same country or in the same subgroup in neighbouring countries (estimates made for Belgium, Luxembourg and the Netherlands).

The ETRMA has estimated the typical percentage of employees in the rubber industry who are in the departments in which exposure is most likely to occur:

[9] European Tyre Industry. Available at: http://www.etrma.org/public/keyfigurestyreind.asp
[10] European General Rubber Goods Industry. Available at: http://www.etrma.org/public/keyfiguresgrgind.asp
[11] Eurostat Structural Business Statistics. Available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/

- Mixing: 9 – 16% of employees
- Component Preparation (i.e. extruding, calendaring etc..): 8 – 20%
- Curing: 3 – 11%

Exposure to rubber fume occurs in all three of the above departments and we have assumed that all exposed employees (23 – 47%) are exposed to rubber fume. Exposure to rubber process dust occurs during mixing but not during component preparation or curing and we have assumed that 9 – 16 % of employees are exposed to rubber dust. Furthermore, exposure to rubber fume occurs in all three industry subgroups (NACE 25.11m 25.12 and 25.13) whereas exposure to rubber process dust does not occur in the retreading industry (NACE 25.12).

An estimated 366,500 people are employed in the rubber manufacturing industry in the EU. Based on the above assumptions, 842,300 – 172,300 of these workers are exposed to rubber fume, and 32,000 – 56,800 are exposed to rubber dust. Estimated numbers of exposed workers in each industry group and EU member state are presented in Table 2.2 and Table 2.3.

All of our calculations within this study will be based on the upper estimate of prevalence. The remaining workers within the rubber industry are likely to be exposed to background levels of rubber process fume and dust.

The estimated number of male and female employees exposed to rubber fume (Table 8.1.1) and rubber dust (Table 8.1.1) in each industry subgroup 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 manufacturing industry for each country to the upper estimate of the number of exposed employees. Male to female employee ratios were calculated with data from the Labour Force Survey, available on the Eurostat database.

Table 2.2 Estimated number of total workers and workers exposed to Rubber Fume in the Rubber Industry by EU Member State

	All Rubber Industry			Industry Subgroups								
	NACE 25.1 (All Rubber) Manufacture of rubber products			NACE 25.11 Manufacture of rubber tyres and tubes			NACE 25.12 Retreading and rebuilding of rubber tyres			NACE 25.13 Manufacture of other rubber products		
Member State[1]	Total	"low" [2]	"high"	Total	"low"	"high"	Total	"low"	"high"	Total	"low"	"high"
Austria	3369	674	1583	437	87	205	138	28	65	2854	571	1341
Belgium	3473	695	1632	1050	5	494	117	23	55	2306	461	1084
Bulgaria	3700	740	1739	802	160	377	157	31	74	2741	548	1288
Cyprus	24	5	11	0	0	0	14	3	7	10	2	5
Czech Republic	21560	4312	10133	8868	1774	4168	1112	222	523	12885	2577	6056
Denmark	1477	295	694	80	16	38	81	16	38	1316	263	619
Estonia	473	95	222	0	0	0	125	25	59	354	71	166
Finland	2977	595	1399	1564	313	735	45	9	21	1368	274	643
France	66884	13377	31435	35209	7042	16548	1127	225	530	30548	6110	14358
Germany	73470	14694	34531	22729	4546	10683	1347	269	633	49395	9879	23216
Greece	910	182	428	16	3	8	56	11	26	838	168	394
Hungary	10028	2006	4713	3549	710	1668	141	28	66	6338	1268	2979
Ireland	701	140	329	0	0	0	0	0	0	701	140	329
Italy	45654	9131	21457	11614	2323	5459	2412	482	1134	31628	6326	14865
Latvia	293	59	138	1	0	0	57	11	27	235	47	110
Lithuania	337	67	158	23	5	11	86	17	40	234	47	110
Luxembourg	3817	763	1794	1154	231	542	128	26	60	2534	507	1191
Netherlands	3259	652	1532	1108	222	521	136	27	64	2151	430	1011
Poland	32240	6448	15153	9447	1889	4440	768	154	361	22025	4405	10352
Portugal	5311	1062	2496	1999	400	940	1005	201	472	2180	436	1025
Romania	12719	2544	5978	5367	1073	2522	355	71	167	6997	1399	3289
Slovakia	6415	1283	3015	3254	651	1529	237	47	111	2924	585	1374
Slovenia	3548	710	1668	2432	486	1143	159	32	75	1015	203	477
Spain	29593	5919	13909	14747	2949	6931	1256	251	590	13590	2718	6387
Sweden	6266	1253	2945	47	9	22	458	92	215	5761	1152	2708
United Kingdom	28003	5601	13161	7060	1412	3318	1129	226	531	19814	3963	9313
TOTAL	366501	73300	172255	132557	26511	62302	12646	2529	5944	222742	44548	104689

[1] No exposure is expected in Malta

[2] "low" and "high" estimates for the number of people exposed (range 23% – 47% of the total population)

Table 2.3 Estimated number of total workers and workers exposed to Rubber Dust in the Rubber Industry by EU Member State

	All Industry Rubber Industry			Industry Subgroups					
	NACE 25.1 (All Rubber) Manufacture of rubber products			NACE 25.11 Manufacture of rubber tyres and tubes			NACE 25.13 Manufacture of other rubber products		
Member State	Total	"low" [1]	"high"	Total	"low"	"high"	Total	"low"	"high"
Austria	3369	296	527	437	39	70	2854	257	457
Belgium	3473	302	537	1050	95	168	2306	208	369
Bulgaria	3700	319	567	802	72	128	2741	247	439
Cyprus	24	1	2	0	0	0	10	1	2
Czech Republic	21560	1958	3480	8868	798	1419	12885	1160	2062
Denmark	1477	126	223	80	7	13	1316	118	211
Estonia	473	32	57	0	0	0	354	32	57
Finland	2977	264	469	1564	141	250	1368	123	219
France	66884	5918	10521	35209	3169	5633	30548	2749	4888
Germany	73470	6491	11540	22729	2046	3637	49395	4446	7903
Greece	910	77	137	16	1	3	838	75	134
Hungary	10028	890	1582	3549	319	568	6338	570	1014
Ireland	701	63	112	0	0	0	701	63	112
Italy	45654	3892	6919	11614	1045	1858	31628	2847	5060
Latvia	293	21	38	1	0	0	235	21	38
Lithuania	337	23	41	23	2	4	234	21	37
Luxembourg	3817	332	590	1154	104	185	2534	228	406
Netherlands	3259	293	521	1108	100	177	2151	194	344
Poland	32240	2832	5036	9447	850	1512	22025	1982	3524
Portugal	5311	376	669	1999	180	320	2180	196	349
Romania	12719	1113	1978	5367	483	859	6997	630	1120
Slovakia	6415	556	988	3254	293	521	2924	263	468
Slovenia	3548	310	552	2432	219	389	1015	91	162
Spain	29593	2550	4534	14747	1327	2360	13590	1223	2174
Sweden	6266	523	929	47	4	8	5761	518	922
United Kingdom	28003	2419	4300	7060	635	1130	19814	1783	3170
TOTAL	366501	31977	56848	132557	11930	21209	222742	20047	35639

[1] "low" and "high" estimates for the number of people exposed (range 9% – 47% of the total population)

2.3 LEVEL OF EXPOSURE TO RUBBER PROCESS FUME AND DUST

2.3.1 Estimation of exposure levels

The European Union Concerted Action 'Improved Exposure Assessment for Prospective cohort Studies and Exposure Control in the Rubber Manufacturing Industry' EXASRUB has facilitated the collection of European exposure measurements from the rubber industry into a single database. The EXASRUB database includes exposure measurements from the rubber industry taken between the 1970s and 2003 in five participating member states: Sweden, Poland, the United Kingdom, Germany and the Netherlands. The database includes 13,380 inhalable and 816 respirable rubber dust measurements and 5,657 rubber fume measurements (measured as cyclohexane soluble fraction). The measurements within the database were carried out by a number of organisations including research centres, industry associations, regulators, and rubber manufacturing companies. The purposes of sampling varied widely, and included research, control evaluation, compliance testing, and complaint follow up. The database has been described in greater detail by de Vocht *et al* (2005). Hierarchical mixed effects models have been developed with the data to assess exposure trends over time (de Vocht *et al*, 2008). An adjustment factor was used to estimate inhalable dust concentrations from respirable dust measurements.

Rubber Process Dust

Estimated geometric mean exposure levels for inhalable rubber process dust have been generated using the EXASRUB model. Exposure estimates have been generated at five-year intervals starting with 1975 and ending with 2000 and the annual change in exposure (time trend) has been estimated for each country (Table 2.4).

Table 2.4 Geometric mean rubber process dust exposure estimates (mg/m^3) for five member states at five year intervals between 1975 and 2000 and time trends in exposure levels

	Sweden	Poland	UK	Germany	Netherlands
1975	4.96	41.10	1.85	17.66	0.75
1980	3.51	28.65	1.56	12.20	0.72
1985	2.48	19.96	1.32	8.43	0.70
1990	1.75	13.91	1.11	5.82	0.67
1995	1.24	9.70	0.94	4.02	0.65
2000	0.88	6.76	0.79	2.78	0.63
Time Trend*	-6.9%	-7.2%	-3.4%	-7.4%	- 0.7%

* Annual change in exposure

Assuming that the time trends calculated for 1975 – 2000 remained constant between 2000 and 2010 the exposure estimates have been projected to 2010 (Table 2.5). Geometric standard deviations (GSD) are assumed to be equivalent to the GSD estimated for all personal inhalable dust measurements within the EXASRUB database (de Vocht *et al*, 2008).

Table 2.5 Projected 2010 geometric mean rubber process dust exposure estimates (mg/m^3) for five member states

	GM	GSD
Sweden	0.43	3.87
Poland	3.2	3.49
UK	0.56	3.7
Germany	1.29	4.8
Netherlands	0.59	2.94

Dost *et al* (2000) found no significant difference in personal exposure to rubber fume in general rubber goods, and new and retread tires and also saw no significant difference in exposures to rubber dust. The results presented are pooled from all three sub-industries.

As exposure estimates are only available for five member states – all other member states have been placed in regional groups and assigned the GM and GSD of one of these five member states. The assignments have been based on geographic proximity and industrial activity patterns (Table 2.6).

Table 2.6 Assigned exposure estimates for 26 EU Member States

Countries in Regional Group	Country for which data is available	Assigned GM (GSD) Rubber Process Dust
Finland, Denmark	Sweden	0.43 mg/m^3 (3.87)
Belgium, Luxembourg	Netherlands	0.59 mg/m^3 (2.94)
Austria	Germany	1.29 mg/m^3 (4.8)
Ireland, France, Spain, Portugal, Italy	UK	0.56 mg/m^3 (3.7)
Czech Republic, Slovenia, Hungary, Slovakia, Romania, Bulgaria, Greece, Cyprus, Lithuania, Latvia, Estonia	Poland	3.2 mg/m^3 (3.49)

The overall weighted GM and GSD across the EU was estimated 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 countries and sub-industries is 1.14 mg/m^3 with a GSD of 4.7.

The percentage of exposed workers currently exposed above the typical OEL of 6 mg/m^3 was estimated based a distribution simulated in @Risk with a GM of 1.14 mg/m^3 and a GSD of 4.7. From these data about 14% of exposed workers are currently exposed above 6 mg/m^3.

Rubber Process Fume

Estimated geometric mean exposure levels for rubber process fume have been generated using the EXASRUB model. Only UK data was available for use in this

report. Exposure estimates are available for the general rubber goods industry and the rubber tyre industry.

GM exposure estimates have been generated at five-year intervals starting with 1985 and ending with 2005 and the annual change in exposure (time trend) has been estimated for each industry (Table 2.7). GSDs for each year and industry were not available, but de Vocht *et al* (2008) reported a GSD of 3.6 for rubber fume exposure in the UK industry and an equivalent GSD will be assumed.

Table 2.7 Geometric mean rubber process fume exposure estimates (mg/m^3) for the UK general rubber goods and rubber tyre industries at five year intervals between 1985 and 2005 and time trends in exposure levels

	General Rubber Goods	Tyres
1985	0.418	0.354
1990	0.341	0.333
19953	0.279	0.314
2005	0.228	0.295
Time Trend*	-3.0%	-0.9%

* Annual change in exposure

The available exposure data for rubber process dust indicate that exposures in central and Eastern Europe are higher than exposures in Western Europe. No rubber fume exposure measurements are available from Germany, and measurements from Poland are only available from 1987 – 1988 so insufficient data exists to test whether exposures are highest in central and eastern Europe. The available Polish measurements suggest that Polish exposure levels in the late 1980s (1,130 mg/m^3) was about three times higher than UK exposures from the same time period. We therefore propose to estimate that exposures in Western Europe are equivalent to the measured UK exposures, and exposures in Central and Eastern Europe are three times higher. Estimates of current rubber fume exposure levels are presented in Table 2.8. The UK 2005 exposure estimates have been projected to 2010 levels using the time trends shown in Table 2.7. The projected 2010 exposure estimates were multiplied by three to estimate exposure in Central and Eastern Europe. We have assumed that rubber tyre industry exposure estimates are representative of exposures in the rubber tyre retread and rebuilding industry.

Table 2.8 Projected 2010 geometric mean rubber process fume exposure estimates (mg/m^3)

Region	Industry NACE 25.13 Manufacture of General Rubber Goods (GSD)	NACE 25.11 Manufacture of Rubber Tyres (GSD)	NACE 25.12 Retreading and Rebuilding of Tyres (GSD)
Northern and Western Europe (UK, Finland, Denmark, Sweden, Belgium, Luxembourg, Netherlands, Ireland, France, Spain, Portugal, Italy)	0.196 (3.6)	0.282 (3.6)	0.282 (3.6)
Central and Eastern Europe (Germany, Austria, Poland, Czech Republic, Slovenia, Hungary, Slovakia, Romania, Bulgaria, Greece, Cyprus, Lithuania, Latvia, Estonia)	0.588 (3.6)	0.846 (3.6)	0.846 (3.6)

It is important to note that the UK exposure measurements used in the above estimates were taken during industry based surveys performed by the British Rubber Manufacturers' Association (BRMA). A comparison of these data with measurements taken by the UK regulatory agency, the Health and Safety Executive (HSE) found that exposure estimates based on the HSE data were about four times higher than those made using the BRMA data (Agostini *et al*, 2010). A number of explanations for the differences between the two data sources have been proposed:

- BRMA data may have been predominately from large, well controlled plants whereas the majority of HSE measurements may have been taken at SMEs (this was reported anecdotally and could not be confirmed);
- HSE measurements were taken by regulatory inspectors who took fewer measurements and more likely to do worst-case sampling;
- Companies where exposure levels are low may have been more likely to share their measurement data with the BRMA.

The BRMA data was selected for use in this assessment because it contained more measurements than the HSE dataset (BRMA: N= 2464; HSE: N=1310) and to maintain consistency with the EXASRUB exposure models in which HSE measurements were standardized to levels typical of the BRMA dataset. The estimates used in this assessment may therefore be underestimates, and higher exposures could be possible in SMEs.

The overall weighted GM and GSD across the EU was estimated 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 countries and sub-industries is 0.372 mg/m^3 with a GSD of 4.00.

The percentage of exposed workers currently exposed above the typical OEL of 0.6 mg/m^3 was estimated based a distribution simulated in @Risk with a GM of 0.372 mg/m^3 with a GSD of 4.00 from these data about 37% of exposed workers are currently exposed above 0.6 mg/m^3.

2.4 HEALTH IMPACT FROM CURRENT EXPOSURES

2.4.1 Background data

The occupational cancers associated with exposure to rubber fumes and dust are shown in Table 2.9 along with a summary of the information used in the health impact assessment.

Table 2.9 Occuaptional cancers associated with exposure to rubber fumes and dust

Cancer site	**Lung**		**Larynx**		**Leukaemia**	
ICD-10 code	C33-C34		C32		C91-C95	
IARC group for carcinogen	1		1		1	
Strength of evidence for cancer site [(1)]	-		-			
Latency assumption	10-50 yrs		10-50 yrs		0-20 yrs	
Source of forecast numbers - deaths	Eurostat, 2006 (for C32-C34), divided between C32 and C33-C34 using GB proportions		Eurostat, 2006 (for C32-C34), divided between C32 and C33-C34 using GB proportions		Eurostat, 2006 (for C81-C96), adjusted to C91-C95 using E&W proportions	
Source of forecast numbers - registrations	GLOBOCAN, 2002[12]		GLOBOCAN, 2002		GLOBOCAN, 2002	
Exposure levels	***Relative Risk (RR)***	***Source of RR***	***Relative Risk (RR)***	***Source of RR***	***Relative Risk (RR)***	***Source of RR***
Tyre manufacture (L)	0.95 (0.78, 1.15) (risk estimate taken as 1))	Alder *et al* (2006)	1.01 (0.70, 1.48)	Alder *et al* (2006)	1.03 (95%CI 0.76, 1.41)	Alder *et al* (2006)
Other rubber workers (H)	1 .05 (0.94, 1.18)		1.19 (0.88, 1.60)		1.70 (95%CI 1.14, 2.54)	
Workers in the affected industries not exposed (B)	1	Default	1	Default	1	Default

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

[12] IARC, GLOBOCAN database, available at: http://www-dep.iarc.fr/globocan/database.htm

2.4.2 Exposed numbers and exposure levels

Rubber process dust

Industry sectors, their NACE codes, classifications to High/Medium/Low/Background exposure as applicable for the mid 1970's and numbers exposed in 2006 are given in Table 2.3 in the previous section on exposure. The estimated average exposure level (GM) and measure of variability (GSD) for NACE industries exposed to rubber process dust are as given in Table 2.6 by country for 2010 and percentage declines over the past 20 to 30 years (c1981-2005) are assumed as given in Table 2.4 by country.

For rubber process dust, as the GMs and GSDs from the EXASRUB database are assumed to be for exposed workers only in the affected industries, no estimate of background exposed workers is included in the analysis. This estimate would be taken as the total number of workers in the industries affected minus the exposed workers and for whom RR is assumed to be 1.

Rubber process fume

Industry sectors, their NACE codes, classifications to High/Medium/Low/Background exposure as applicable for the mid 1970's and numbers exposed in 2006 are given in Table 2.2 1 in the previous section on the exposure. The estimated average exposure level (GM) and measure of variability (GSD) for NACE industries exposed to rubber process fume are 0.372 and 4 mg/m^3 respectively, and a percentage annual decline of 2.17% over the past 20 to 30 years (c1981-2005) is assumed, estimated as a weighted average of 3% in general rubber goods and 0.9% in tyre manufacture and retreading and rebuilding, weighted on the EU totals exposed in these industries in 2006.

We present data for a "baseline" scenario, which for all industries assumes the annual declines as above in exposure levels and standard change in employed numbers up to the 2021-30 estimation interval and constant levels thereafter.

2.4.3 Forecast cancer numbers

Estimates for total numbers of deaths for lung plus laryngeal cancers (ICD-10 C32-C34) and for leukaemia (C91-C95) by age band are available from EUROSTAT for the 27 countries of the EU, for 2006, and for registrations for lung (C33-C34) and larynx (C32) separately and for leukaemia from GLOBOCAN for 2002. The estimates for deaths from lung plus laryngeal cancers have been separated between these two sites according to their relative proportions in men and women age 25+ based on GB deaths in 2005 (96.9% and 98.8% respectively are lung cancers). 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 rubber process fumes and dust for the baseline scenario are presented per year for the target years given and are based on the all working age cohort of currently (2006) exposed workers. Attributable fractions and numbers of deaths and registrations, and Years of

Life Lost (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, laryngeal and leukaemia cancers for the total EU is in **Table 2.10** for rubber process dust and **Table 2.11** below.

The relative risks used are for exposure to both fume and dust in the rubber industry. As most of the workers counted as exposed to one exposure will also be exposed to the other (except tyre retreading and rebuilding which is fume only), it is not correct to 'sum' or combine these two sets of attributable numbers. Therefore for the baseline scenario, although both sets of results are presented as both will be needed for the intervention scenario 'avoided cancers' results to test the trial OELs, only one set of results should be used, e.g. for rubber process fume, to avoid double counting. Attributable cancers estimated for fume are greater than for dust as exposed numbers are higher.

Table 2.10 Results for the baseline forecast scenario for rubber process dust, total EU (27 countries), men plus women[13]

Scenario	**All scenarios**		**Baseline (trend) scenario (1) - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.**			
EU Total	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Long latency cancers						
Numbers ever exposed	231,336	233,510	236,336	234,955	233,340	232,869
Proportion of the population exposed	0.06%	0.06%	0.06%	0.06%	0.06%	0.06%
Lung cancer						
Attributable Fraction	0.00219%	0.00181%	0.00133%	0.00091%	0.00060%	0.00043%
Attributable deaths	6	6	5	4	3	2
Attributable registrations 'Avoided' cancers	7	6	5	4	3	2
YLLs	95	89	72	52	35	24
DALYs	99	93	75	54	36	26
Larynx cancer						
Attributable Fraction	0.00930%	0.00777%	0.00593%	0.00426%	0.00309%	0.00244%
Attributable deaths	1	1	1	0	0	0
Attributable registrations 'Avoided' cancers	3	3	3	2	2	1
YLLs	372	355	298	225	165	128
DALYs	380	362	304	230	168	131

[13] Deaths and registrations are rounded to the nearest whole number. Where YLLs/YLDs/DALYs appear in association with zero deaths/registrations, this is due to rounding the deaths/registrations down to zero.

Scenario	All scenarios		Baseline (trend) scenario (1) - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.			
EU Total	2010	2020	2030	2040	2050	2060
Short latency cancer						
Numbers ever exposed	163,887	162,144	161,665	160,630	160,630	160,630
Proportion of the population exposed	0.041%	0.040%	0.040%	0.040%	0.042%	0.043%
Leukaemia						
Attributable Fraction	0.012%	0.008%	0.006%	0.005%	0.005%	0.005%
Attributable deaths	4	4	3	3	3	3
Attributable registrations	7	6	5	4	4	4
'Avoided' cancers						
YLLs	62	49	39	33	36	37
DALYs	68	53	43	36	39	41

Deaths and registrations attributable to rubber process dust slowly decrease for all three types of cancer considered; for lung from 7 registrations in 2010 to 2 registration in 2060; for larynx from 3 registrations to 1 and for leukaemia from 7 to 4 registrations. The decrease is a consequence of the assumed decline in exposure up to 2020. Attributable fraction in 2010 ranges from 0.0093% for laryngeal cancer to 0.012% for leukaemia, and in 2060 the corresponding figures are 0.00244% to 0.005%. In 2010 the estimated DALYs are highest for laryngeal cancer (380 years) and lowest for leukaemia (68 years). By 2060 these estimates range form 131 DALYs for laryngeal cancer to 26 for lung cancer.

Table 2.11 Results for the baseline forecast scenario for rubber process fumes, total EU (27 countries), men plus women

Scenario	All scenarios		Baseline (trend) scenario (1) - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.			
EU Total	2010	2020	2030	2040	2050	2060
Long latency cancers						
Numbers ever exposed	703,401	710,195	718,995	714,943	710,179	708,823
Proportion of the population exposed	0.19%	0.19%	0.18%	0.18%	0.18%	0.18%
Lung cancer						
Attributable Fraction	0.00664%	0.00605%	0.00540%	0.00464%	0.00399%	0.00356%
Attributable deaths	18	19	20	19	17	16
Attributable registrations	20	22	22	20	18	16
'Avoided' cancers						
YLLs	287	297	292	265	229	202
DALYs	299	311	305	276	240	211
Larynx cancer						

Scenario	All scenarios		Baseline (trend) scenario (1) - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.			
EU Total	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Attributable Fraction	0.02817%	0.02572%	0.02313%	0.02012%	0.01759%	0.01595%
Attributable deaths	2	2	2	2	2	2
Attributable registrations	10	11	11	10	9	8
'Avoided' cancers						
YLLs	1,128	1,177	1,168	1,073	948	849
DALYs	1,152	1,202	1,192	1,095	967	866
Short latency cancer						
Numbers ever exposed	498,524	493,346	491,975	488,956	488,956	488,956
Proportion of the population exposed	0.125%	0.122%	0.120%	0.122%	0.127%	0.131%
Leukaemia						
Attributable Fraction	0.052%	0.045%	0.039%	0.035%	0.036%	0.037%
Attributable deaths	19	20	20	21	24	25
Attributable registrations	31	30	29	28	30	31
'Avoided' cancers						
YLLs	265	259	251	245	267	278
DALYs	292	285	276	269	293	305

The attributable cancer deaths and registrations for rubber fume are higher than for rubber process dust, although as we noted earlier it is not possible to add these health impacts since the exposures are not independent. In 2010 the estimated number of registrations and deaths from lung cancer were 20 and 18, for larynx cancer 10 and 2 and for leukaemia 31 and 19. The corresponding data for the decade starting 2060 are 16 and 16 per annum, 8 and 2 per annum and 31 and 25 per annum, for lung, larynx and leukaemia, respectively. Estimated DALYs in 2010 were highest for cancer of the larynx (1,152 years) and lowest for leukaemia (292 years). By the 2060 the annual DALYs ranged from 866 years for larynx to 211 years for lung cancer.

2.5 POSSIBLE COSTS ASSOCIATED WITH NOT MODIFYING THE DIRECTIVE

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 leukaemia and cancers of the larynx and lung resulting from predicted future exposure to rubber process fumes and dust. There is predicted to be a decline in registrations and YLLs over time of all three cancers as a result of predicted exposure reduction owing to implementation of existing and ongoing risk management measures across the EU.

Method in brief

Using the health data (cancer registrations and YLLs), 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, give a total value for COI. (COI is often the main market-based approach in relation to health impact[14]). COI includes the direct and indirect costs of cancer but not the intangible costs (see below).
- Willingness to Pay (WTP) to avoid cancer – WTP in this study is used as an alternative method (high cost scenario) based on publicly available, peer reviewed studies on what people would be willing to pay to avoid having cancer. This includes various intangible costs (such as disfigurement, functional limitations, pain and fear) and includes the costs associated with life years lost.

The cost variables used in this study are presented in Table 2.12 in 2010 prices. For the purposes of this study, valuations are increased by 2% each year in the future in part to present costs in real terms (i.e. adjusting for inflation in prices) and to reflect the increasing value society attaches to its health (as economic growth typically increases over a long period of time).[15]

Table 2.12 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.[16] 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.

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

[15] This is consistent with some other European Commission studies and is standard practice for air quality under the Clean Air for Europe (CAFE) programme.

[16] European Commission impact Assessment Guidelines (Jan 2009) - http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf

The health data shown in section 2.4 are 'snap-shots' (i.e. an 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 – Rubber Process Dust

The health costs under the baseline scenario are presented in Table 2.13. Health-related costs of rubber process dust 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.

Table 2.13 sets out the ranges of health costs for each representative decade. The ranges are based on the high and low cost scenarios (see Table 2.12). The results are also illustrated in Figure 2.1.

Table 2.13 Rubber process dust 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	47 to 47	34 to 31	22 to 20	13 to 13	8 to 10	6 to 8	129 to 129
Male	200 to 247	154 to 183	105 to 125	65 to 80	41 to 55	27 to 40	592 to 729
Total	247 to 293	188 to 214	127 to 145	78 to 93	49 to 65	33 to 48	721 to 857

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

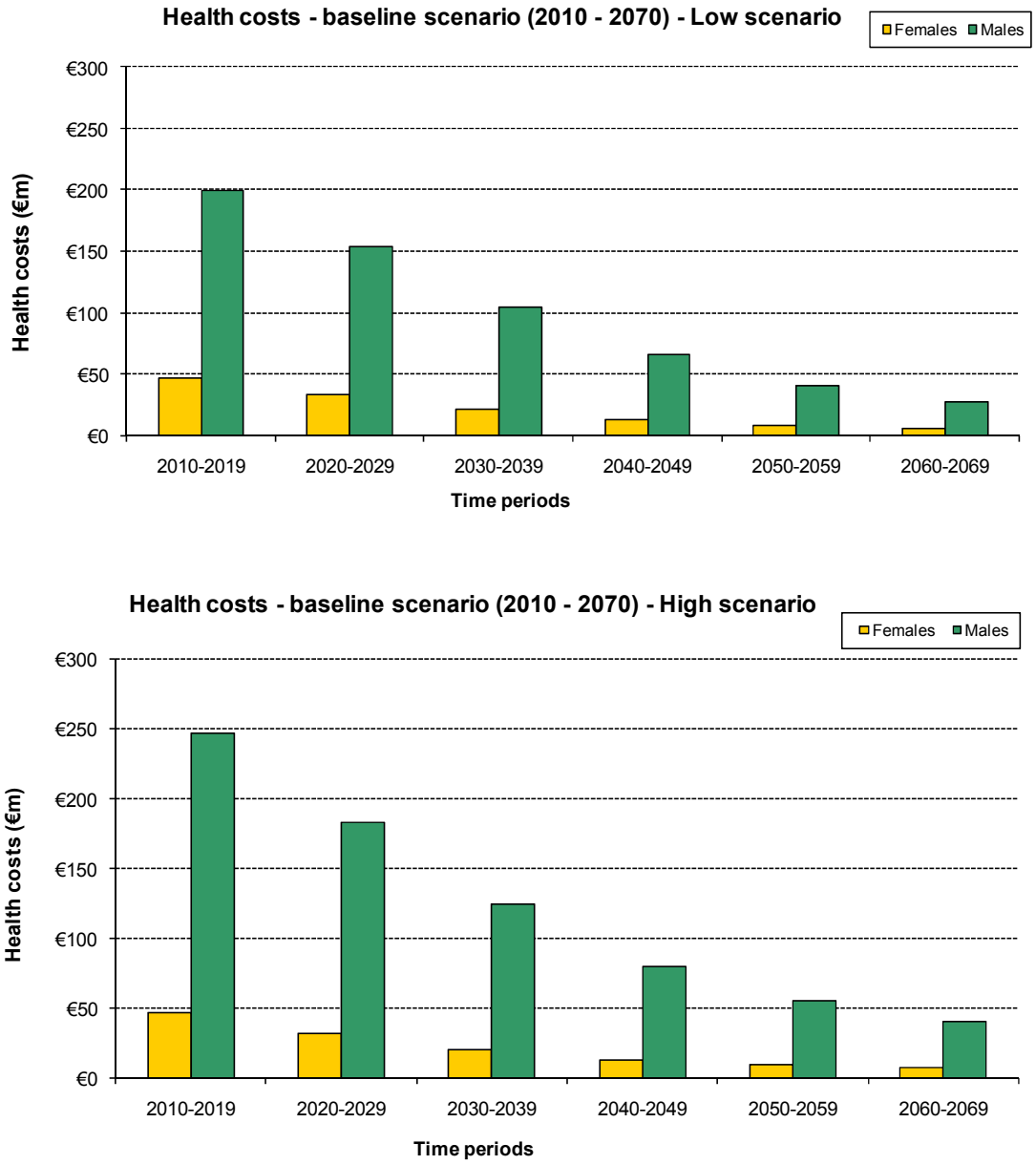

Figure 2.1 Health costs of rubber process dust - baseline scenario – 2010 to 2070 (Present Value – 2010 €m prices)

These costs will affect Member States differently depending upon the overall number of workers within affected industry groups, existing RMMs and the proportion of males and females within these groups.
Figure **2.3** shows that France, Germany and Italy predicted to have relatively high health costs – note these differences are probably not due to differences in estimated exposure levels but reflect differences in the population exposed (see Table 2.3). The industrial sector estimated to be most affected under the baseline is the manufacture of other rubber products. This is shown in Figure 2.5.

Detailed tables are included in the Appendix 8.3.

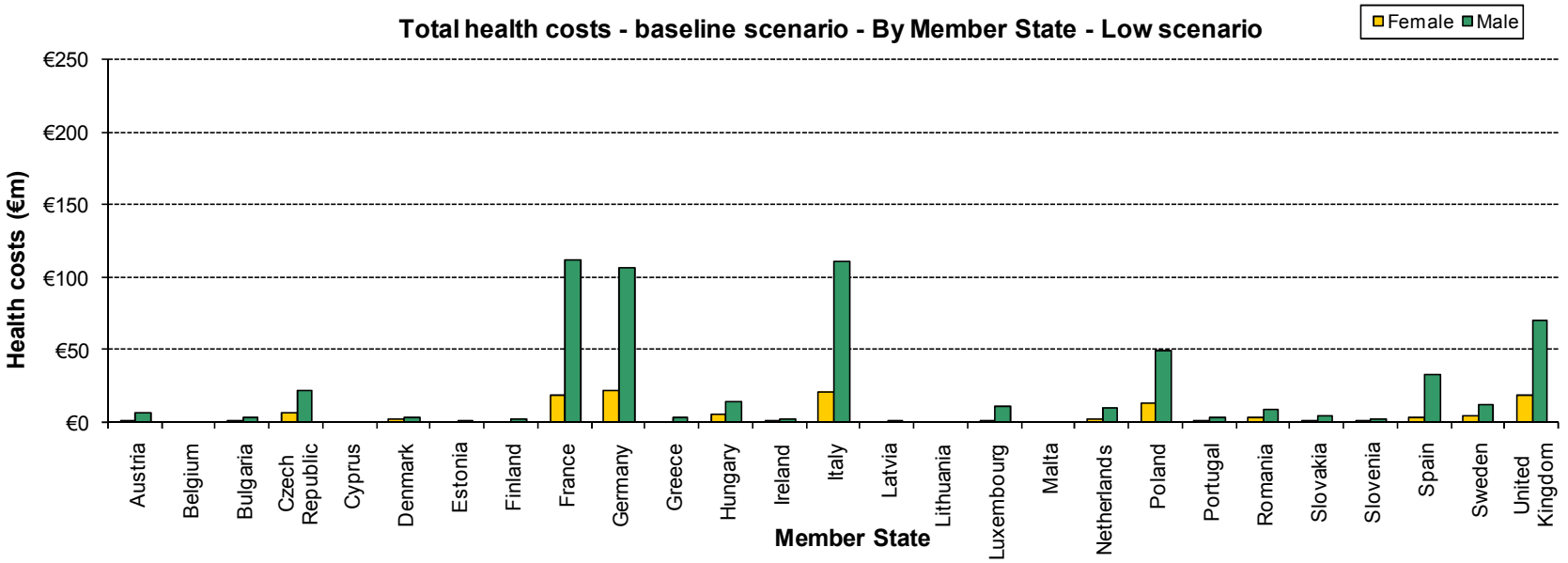

Figure 2.2 Total health costs of rubber process dust - baseline scenario – By Member State (Present Value – 2010 €m prices)

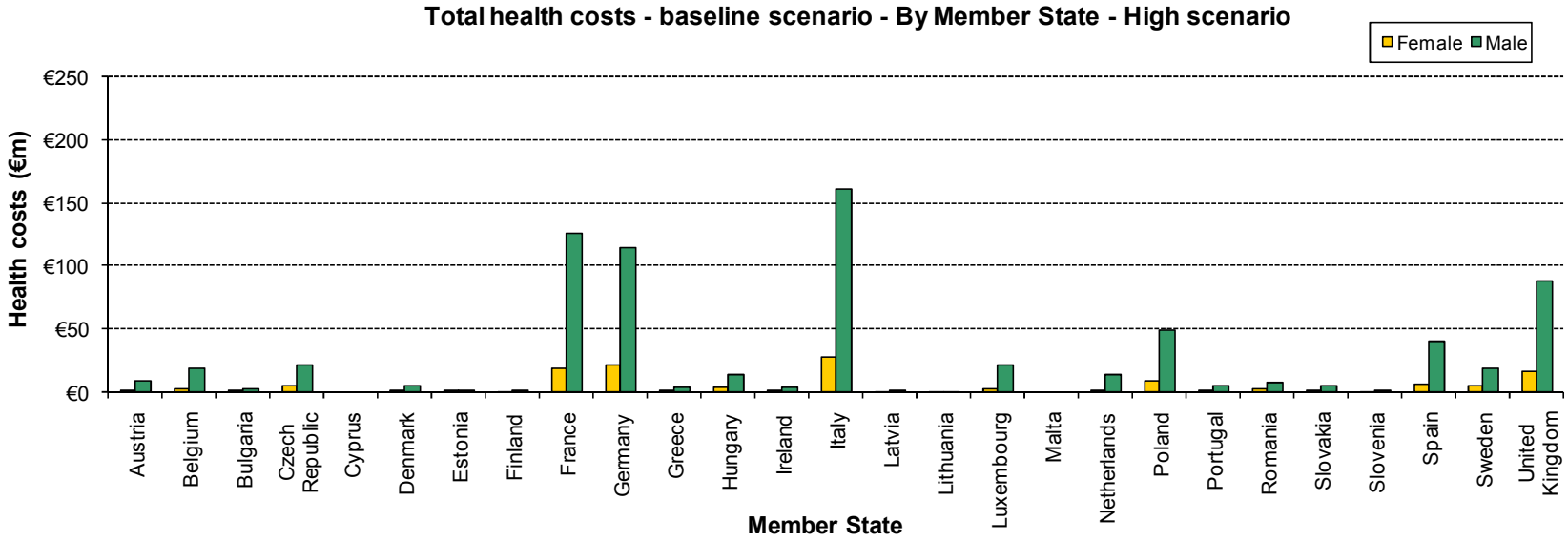

Figure 2.3 Total health costs of rubber process dust - baseline scenario – By Member State (Present Value – 2010 €m prices)

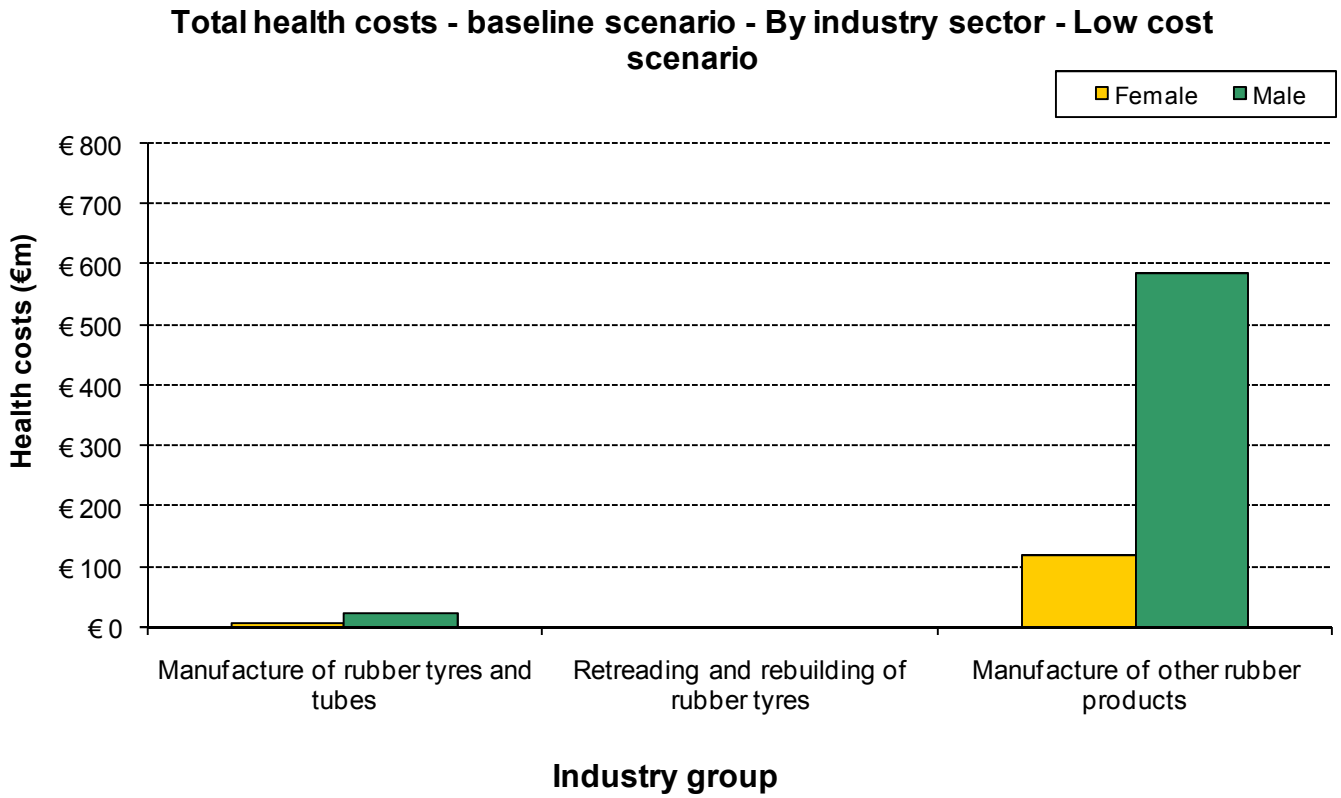

Figure 2.4 Total health costs of rubber process dust - baseline scenario - by industry group (Present Value – 2010 €m prices) [17]

[17] Charts exclude industries for which zero costs are estimated.

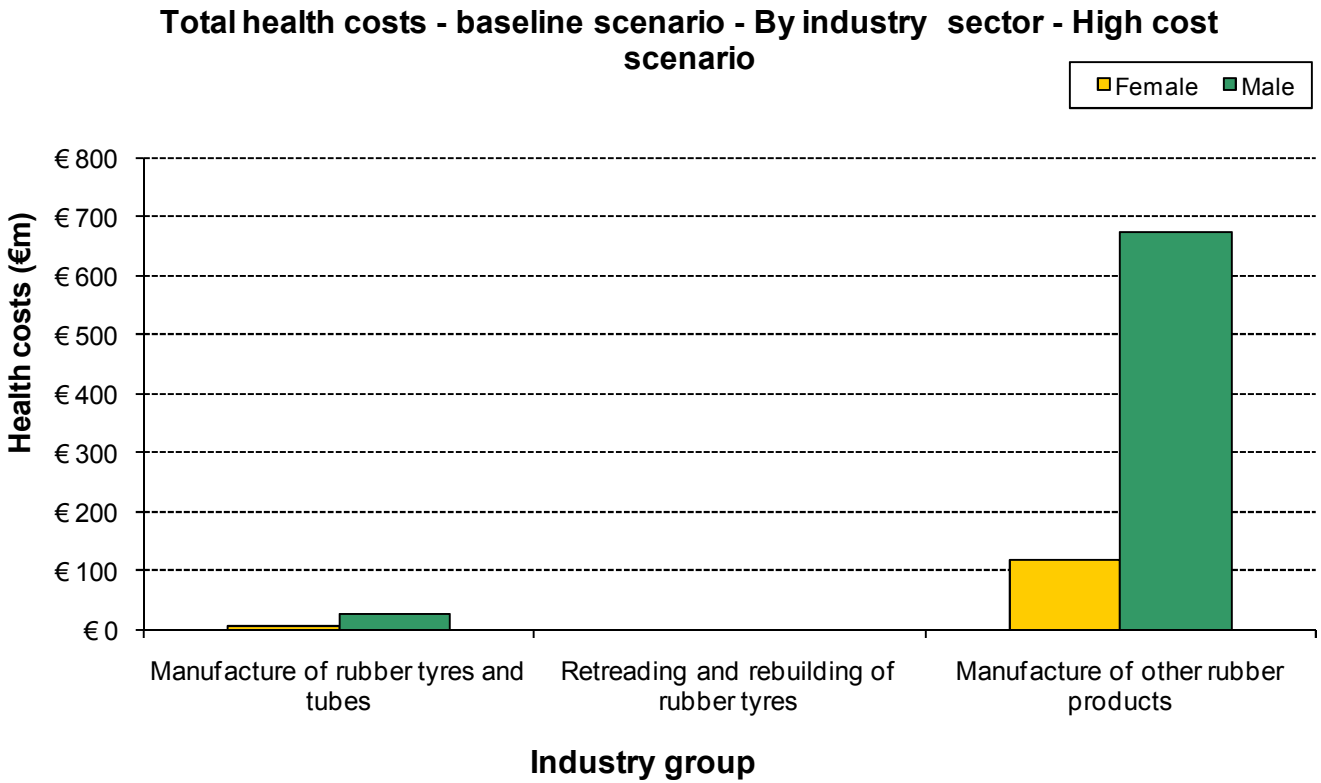

Figure 2.5 Total health costs of rubber process dust - baseline scenario - by industry group (Present Value – 2010 €m prices) [18]

[18] Charts exclude industries for which zero costs are estimated.

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.

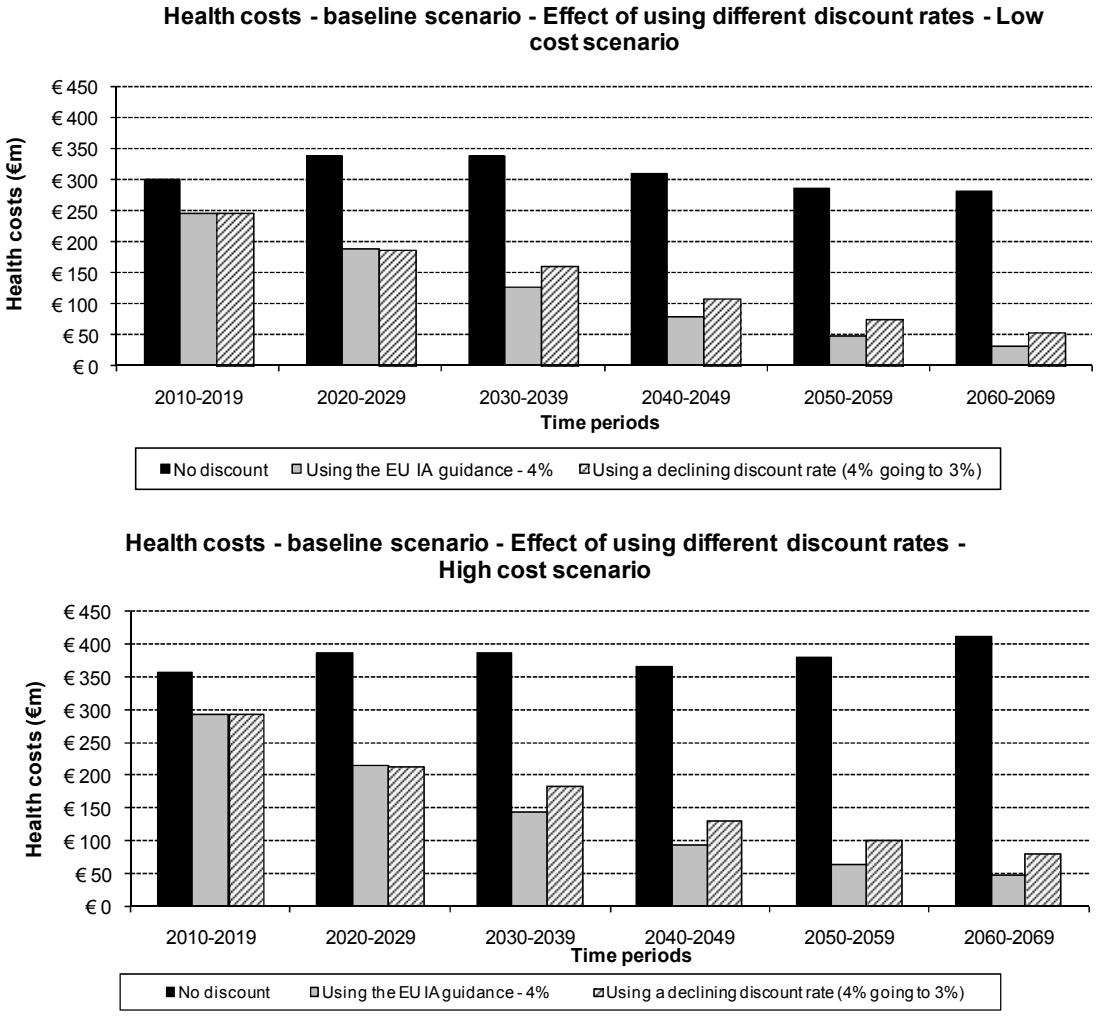

Figure 2.6 Impacts of discounting - rubber process dust

Results – Rubber Fumes

The health costs under the baseline scenario are presented in Table 2.14. Total health-related costs (over the whole period 2010-2069) are estimated at between €2.96-3.93 billion, the upper bound of which is four times higher than predicted for rubber dust. The costs of rubber fumes 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 results are also illustrated in Figure 2.7 below.

Table 2.14 Rubber fumes 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	153 to 181	126 to 146	99 to 116	75 to 91	57 to 77	44 to 63	553 to 675
Male	632 to 846	541 to 713	442 to 583	341 to 456	258 to 366	195 to 291	2,408 to 3,255
Total	785 to 1,027	666 to 859	541 to 699	416 to 547	315 to 442	238 to 355	2,961 to 3,930

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

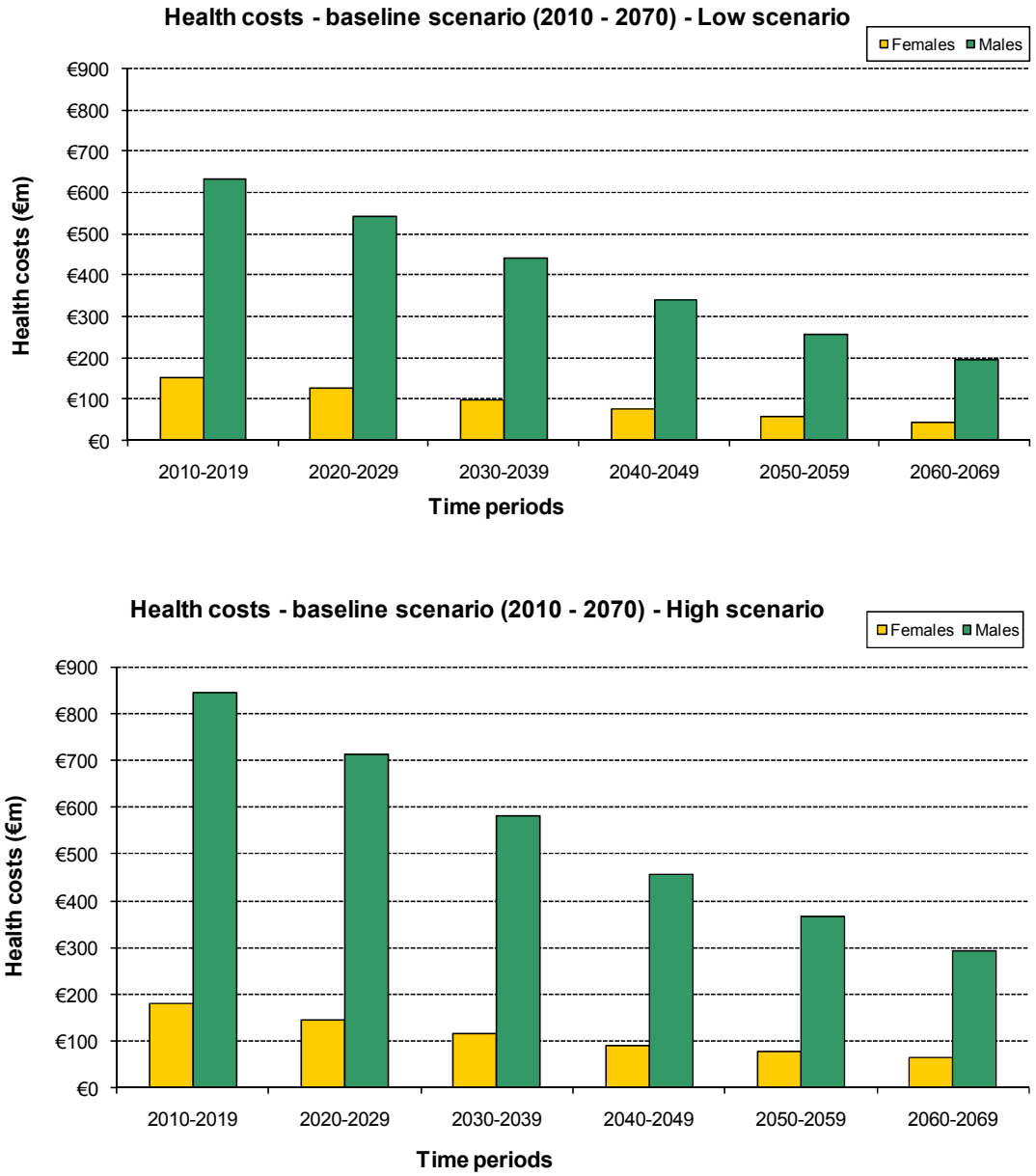

Figure 2.7 Health costs of rubber fumes - baseline scenario – 2010 to 2070 (Present Value – 2010 €m prices)

These costs will affect Member States differently depending upon the overall number of workers within affected industry groups, existing RMMs and the proportion of males and females within these groups. Figure 2.9 shows that France, Germany and Italy are predicted to have relatively high health costs. The industrial sector estimated to be most affected under the baseline is the manufacture of other rubber products. This is shown in Figure 2.11.

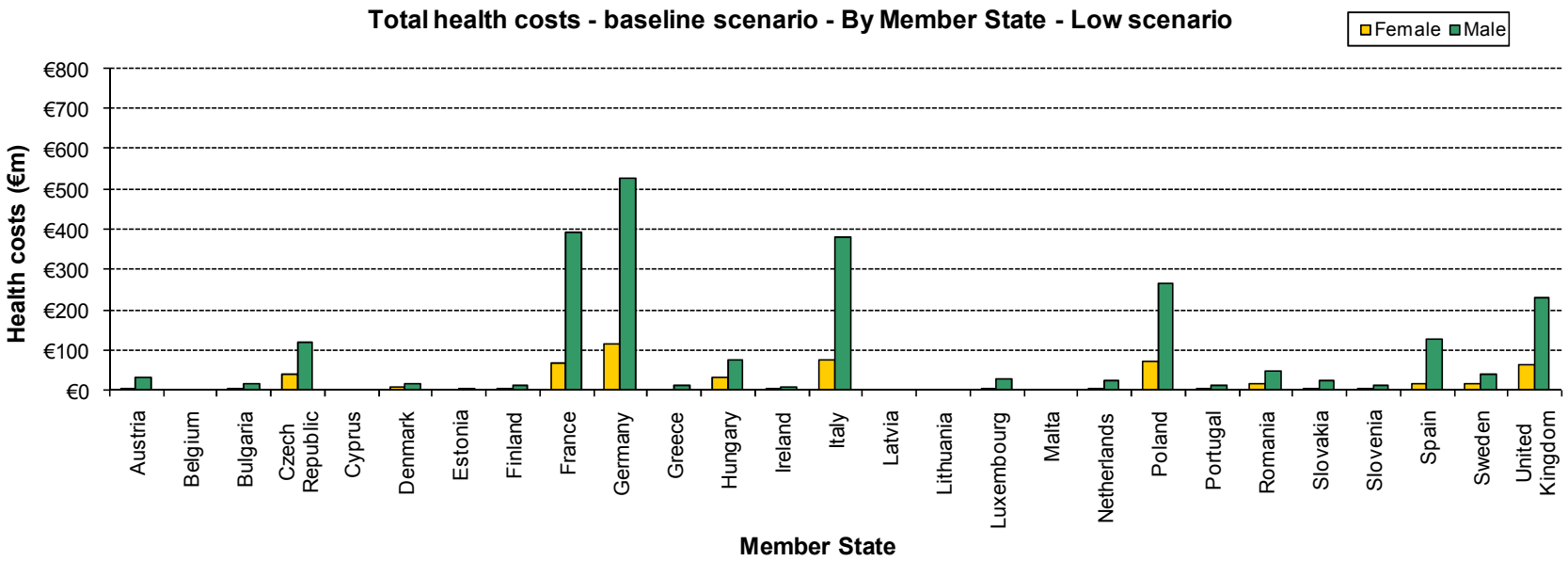

Figure 2.8 Total health costs of rubber fumes - baseline scenario – By Member State (Present Value – 2010 €m prices)

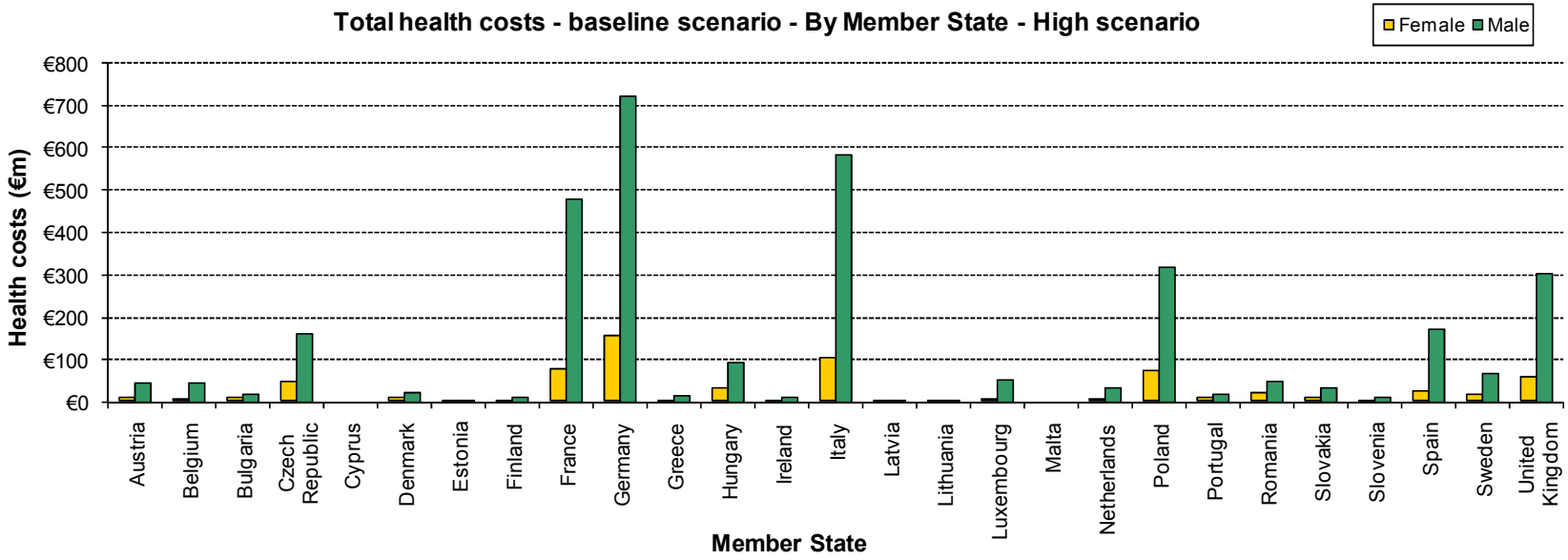

Figure 2.9 Total health costs of rubber fumes - baseline scenario – By Member State (Present Value – 2010 €m prices)

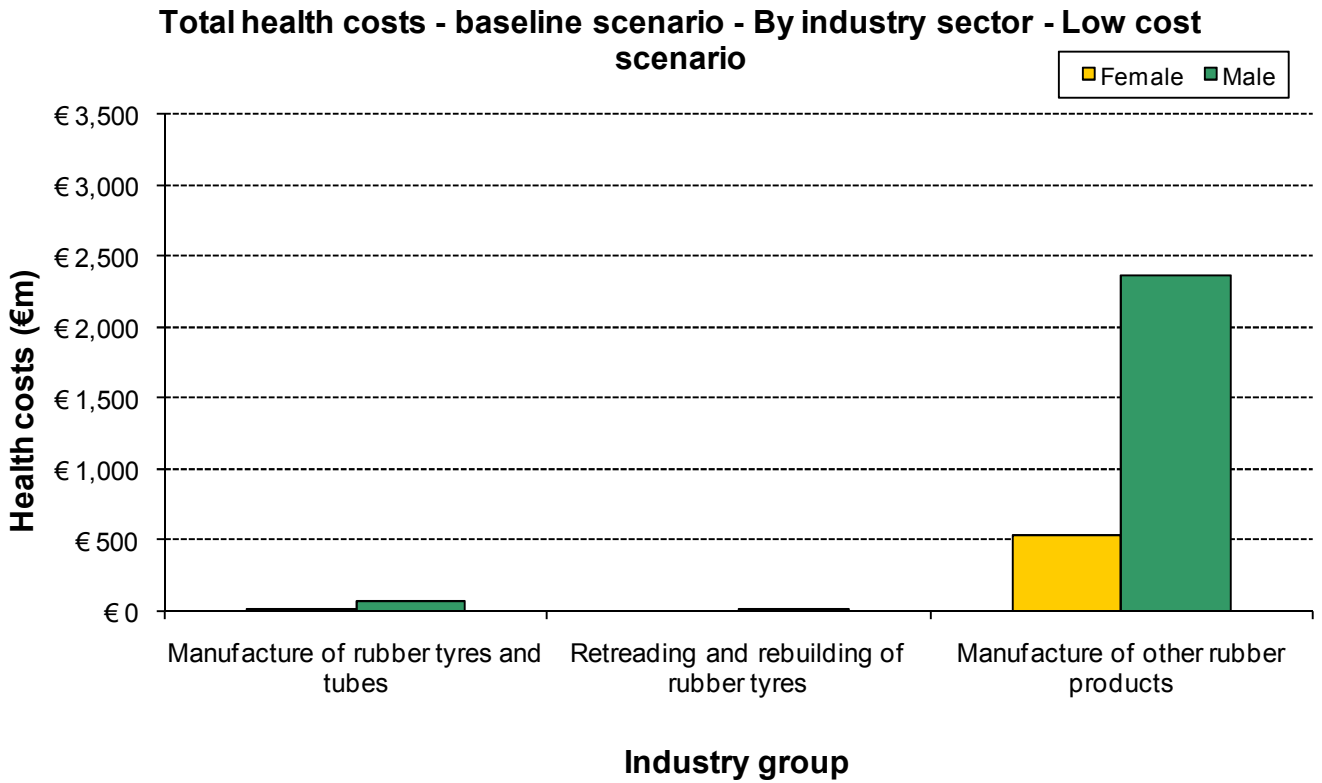

Figure 2.10 Total health costs of rubber fumes - baseline scenario - by industry group (Present Value – 2010 €m prices) [19]

[19] Charts exclude industries for which zero costs are estimated.

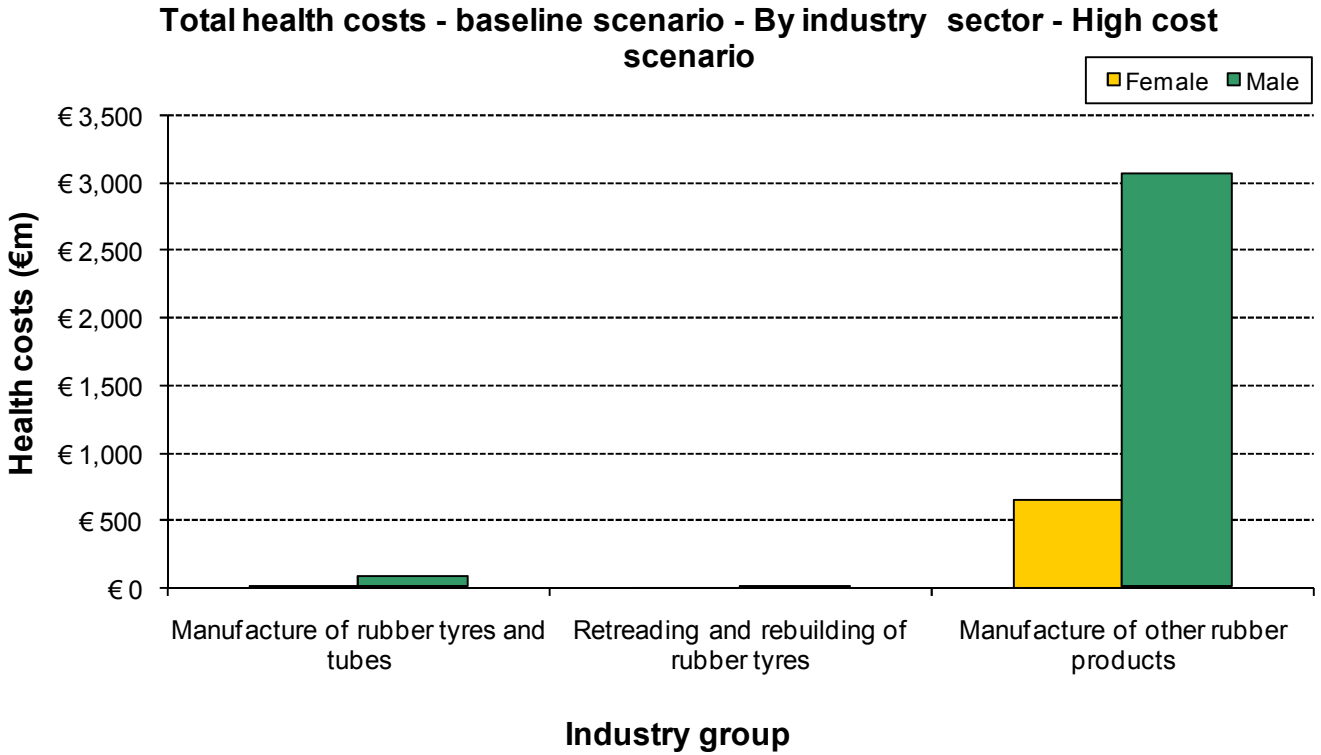

Figure 2.11 Total health costs of rubber fumes - baseline scenario - by industry group (Present Value – 2010 €m prices) [20]

[20] Charts exclude industries for which zero costs are estimated.

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 2.12, 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.

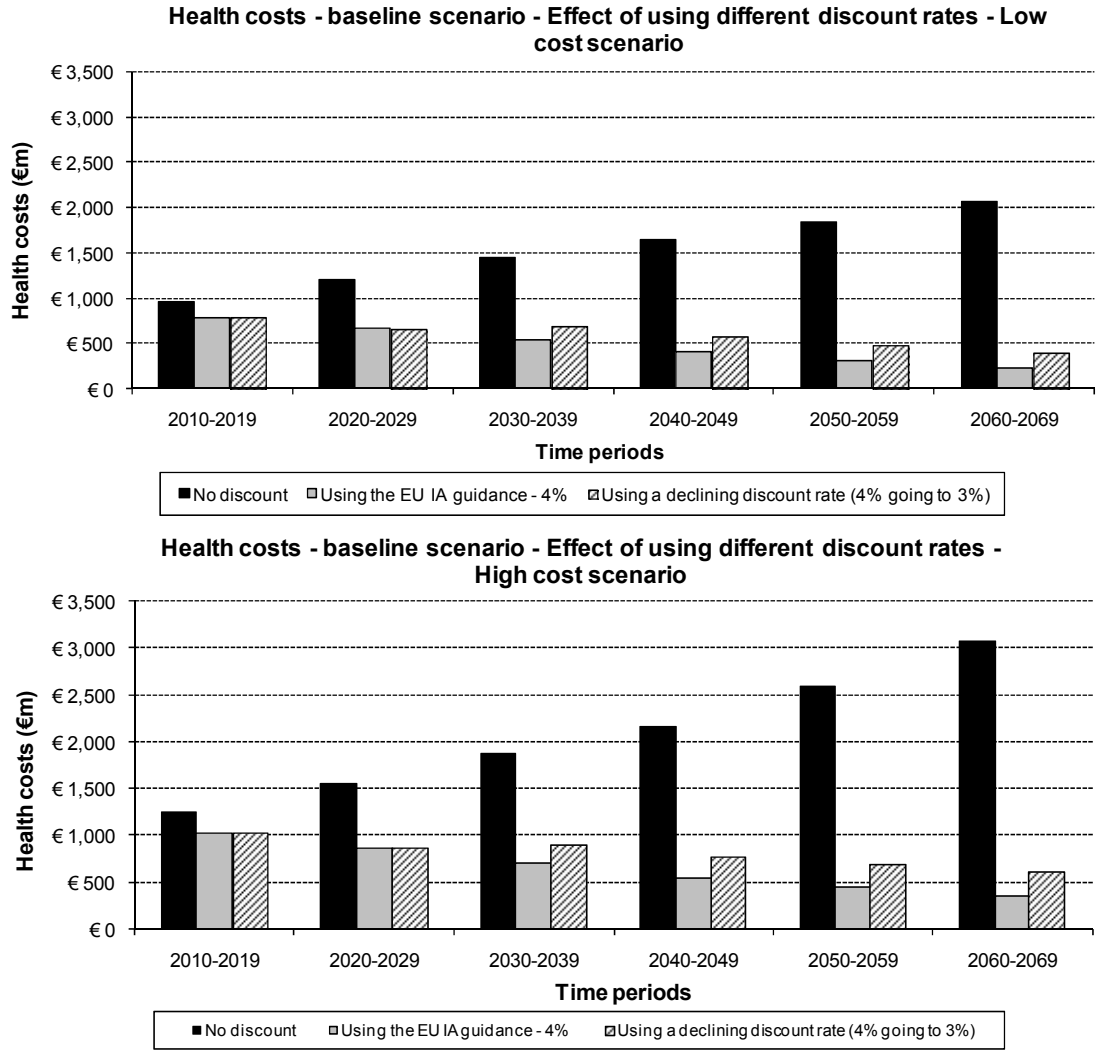

Figure 2.12 Impacts of discounting - rubber fumes

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 0.6mg/m^3 for rubber fume and 6mg/m^3 for rubber dust.

The specific control measures required to reduce exposure to rubber fumes and dust are summarised in Table 3.1 below.

3.2 LEVEL OF PROTECTION ACHIEVED (OELS)

Vermeulen *et al*, (2000) studied the effectiveness of control measures used to reduce exposure to rubber dust in the Dutch rubber manufacturing industry. They identified control measures that had been implemented and found that most were at the compounding and mixing, moulding, and curing production stages. Most of the control measures focussed on reducing exposure to generated dusts rather than on reducing emission at the source. The exposure control measures identified by Vermuelen *et al* are summarised in Table 3.1.

Table 3.1 Rubber process dust exposure control methods and relevant production stages

	Type of Control Measure		
Production Stage	**Elimination of source**	**Reduction of emission at source**	**Control of exposure**
Compounding / Mixing	Closure of the department where exposure occurs	Master batches	Local Exhaust Ventilation
	Use of liquid anti-tacking	Empty bag compactor	Respiratory Protective Equipment
		Dust free chemicals	
Pre-treating	Use of anti-tacking foil	Eliminating anti-tacking	Local Exhaust Ventilation
			Respiratory Protective Equipment
Moulding	Use of liquid anti-tacking	Automation	Local Exhaust Ventilation
			General ventilation
			Enclosed talc drum
			Respiratory Protective Equipment
Curing			Local Exhaust Ventilation
			General Ventilation
			Respiratory Protective Equipment
Finishing		Eliminating anti-tacking	Vacuum cleaning
			Local Exhaust Ventilation

Production Stage	Elimination of source	Type of Control Measure: Reduction of emission at source	Control of exposure
			General ventilation Respiratory Protective Equipment

Source: Vermeulen *et al* (2000)

Vermeulen *et al* (2000) also took exposure measurements at Dutch rubber manufacturing facilities in 1988 and again in 1997. They modelled the relationship between use of control measures and changes in exposure levels. They found that automation of the production process; closing a department, installing empty bag compactors, and reduced use of powdered anti-tacking agents (including replacement with liquids or foils) were all associated with a statistically significant reduction in inhalation exposures. Closure of a department where exposure occurs is not a realistic method of exposure control; however the other methods are all feasible control methods.

Communication with the ETRMA has indicated that other dust reduction control measures include the use of chemicals in pellet and pastille forms, treating chemicals with oil, and the use of closed pre-weighed chemical bags placed directly in mixers (eliminating the need to weigh chemicals). Exposure to rubber fume is generally controlled by local exhaust ventilation; respiratory protective equipment; and, where possible, containment.

In addition to reducing levels of exposure to rubber process fume and dust the rubber industry has aimed to reduce the carcinogenicity of rubber process fume and dust by altering their chemical nature. Rubber process dust consists of a mixture of rubber chemicals and rubber fumes are composed of rubber chemicals and reaction products generated during the processing of the chemicals. The use of known carcinogens including benzene and aromatic amines has been eliminated in the rubber industry.[21] The elimination of these materials may have resulted in a reduction in the carcinogenic potential of rubber process fume and dust since the classification of rubber process fume and dust as a category 1 carcinogen by IARC in 1982.

4 ANALYSIS OF IMPACTS

4.1 HEALTH IMPACTS FROM CHANGES TO THE EU DIRECTIVE

4.1.1 Health information

For rubber process dust, an OEL of 6 mg/m^3 and for fume an OEL of 0.6 mg/m^3 are to be tested. Lung and larynx cancer and leukaemia numbers will therefore be estimated given full compliance[22] to these OELs. Baseline for all industries assumes an annual decline in exposure levels as described in section 2.4 and standard change in employed numbers up to the 2021-30 estimation interval and constant levels thereafter.

[21] ETRMA (2009) ETRMA Comments on the ongoing assessment of introducing Rubber Fume and Dust in Annex 1. 2004/37/EC.

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

We present data for two "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 for rubber process fumes and dust

Intervention scenarios[1]	
Baseline (trend) scenario (1)	Linear employment and exposure level trends assumed to 2021-30, constant thereafter.
Rubber process dust	
Intervention scenario (2)	Full compliance for OEL = 6 mg/m^3
Rubber process fume	
Intervention scenario (2)	Full compliance for OEL = 0.06 mg/m^3

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

Examples of results for the baseline scenario (1) and intervention scenarios compared to the baseline scenario are in Figure 4.1 (lung cancer and rubber dust) and Figure 4.2 (leukaemia and rubber fumes) for attributable registrations, Figure 4.3 (lung cancer and dust) and Figure 4.4 (leukaemia and fumes) for attributable fractions and Figure 4.5 (lung cancer and dust) and Figure 4.6 (leukaemia and fumes) for DALYs for men plus women for the total EU (27 countries) for the example of lung cancer and leukaemia. A summary of the results for each cancer for the total EU is in **Table 4.2** below. Due to cancer latency, no effect is seen from interventions in 2010 until 2030 for lung and laryngeal cancers.

The faster historic and predicted annual decline in process dust exposure levels compared to process fume results in falling numbers of cancers due to dust (illustrated for lung cancer in Figure 4.1) whereas if due to fume, cancer numbers will remain high without intervention (illustrated for leukaemia in Figure 4.2). Introducing a 0.6 mg/m^3 OEL in 2010 for fume exposure will also substantially reduce cancer numbers (Table 4.2) whereas the OEL of 6 mg/m^3 has less impact compared to the predicted baseline fall in exposure levels for dust.

Figure 4.1 shows that the number of registrations for lung cancer and rubber dust decreases in both the baseline and the intervention scenarios over the next 50 years. Conversely, Figure 4.2 shows a greater reduction in the number of leukaemia registrations attributable to rubber fumes in the intervention scenario compared to the baseline scenario over the next 50 years.

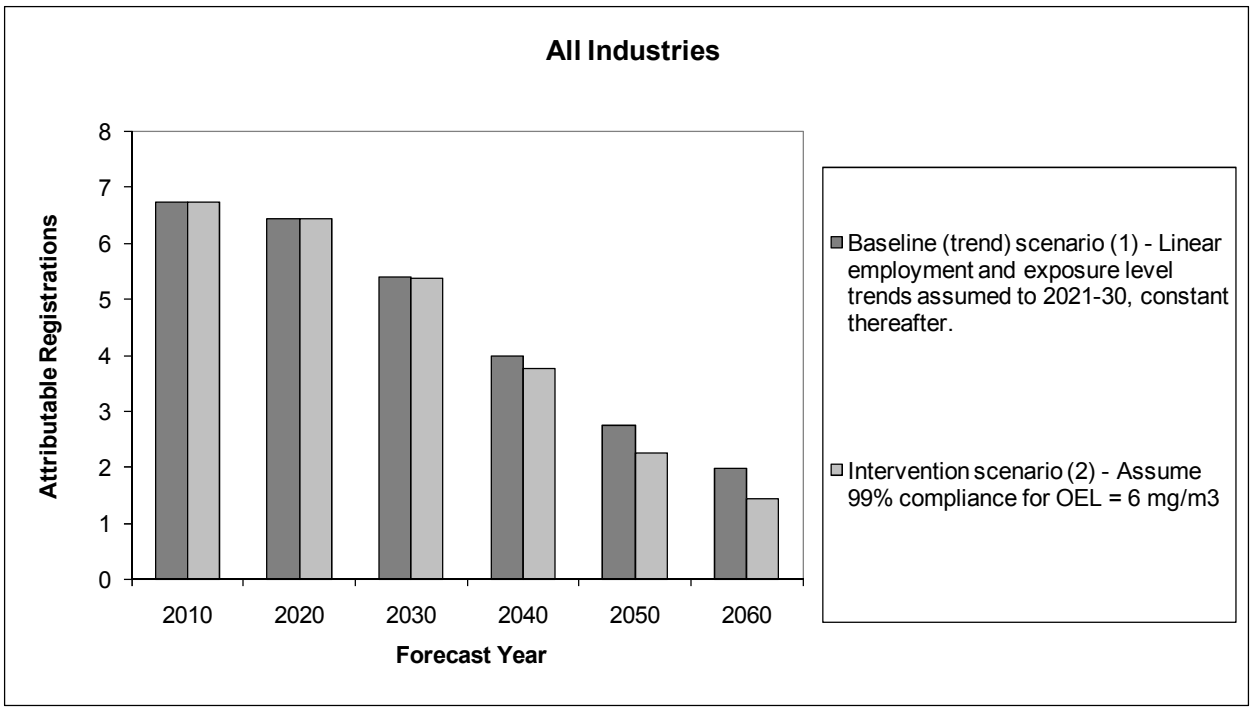

Figure 4.1 Results for intervention scenarios compared to the baseline scenario (1) – Occupation Attributable cancer registrations, Lung cancer from exposure to rubber process dust

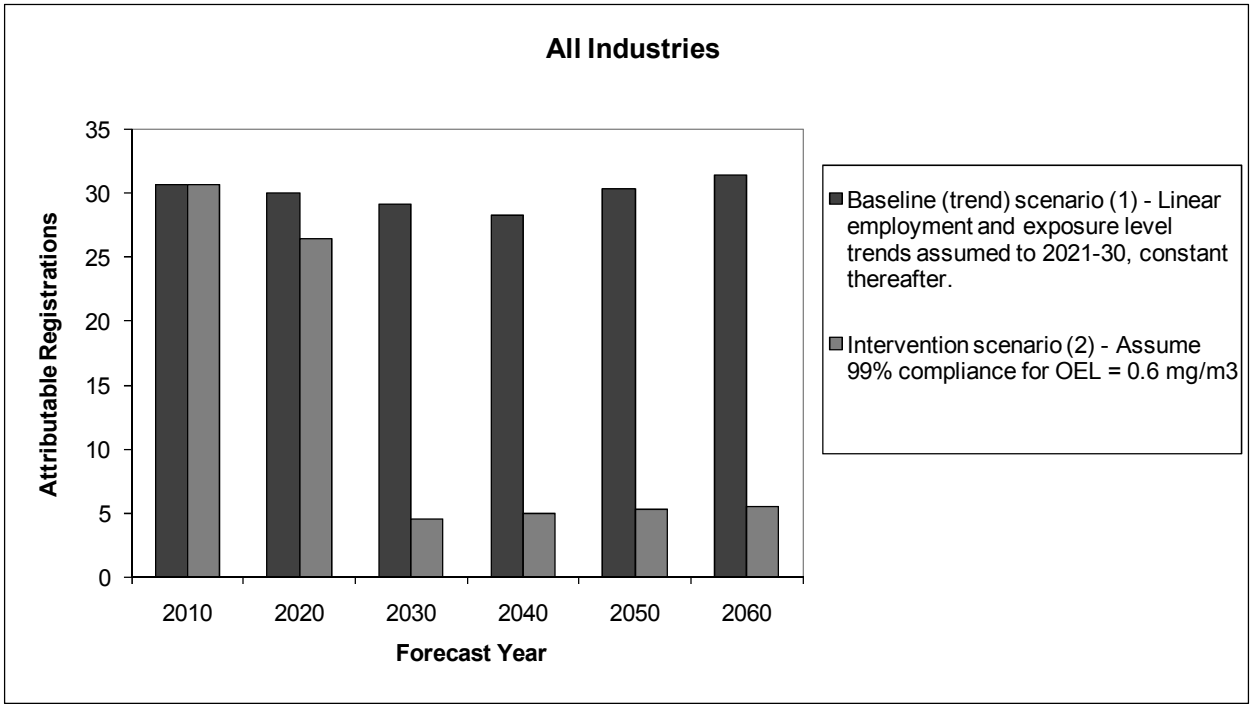

Figure 4.2 Results for intervention scenarios compared to the baseline scenario (1) – Occupation Attributable cancer registrations, Leukaemia from exposure to rubber process fume, men plus women

Figure 4.3 shows that the attributable fraction for lung cancer due to exposure to rubber process dust decreases over the period up to 2060 for both the baseline and intervention scenarios. For both scenarios the attributable fraction decreases for just under 0.0025% in 2010 to around 0.0005% in 2060.

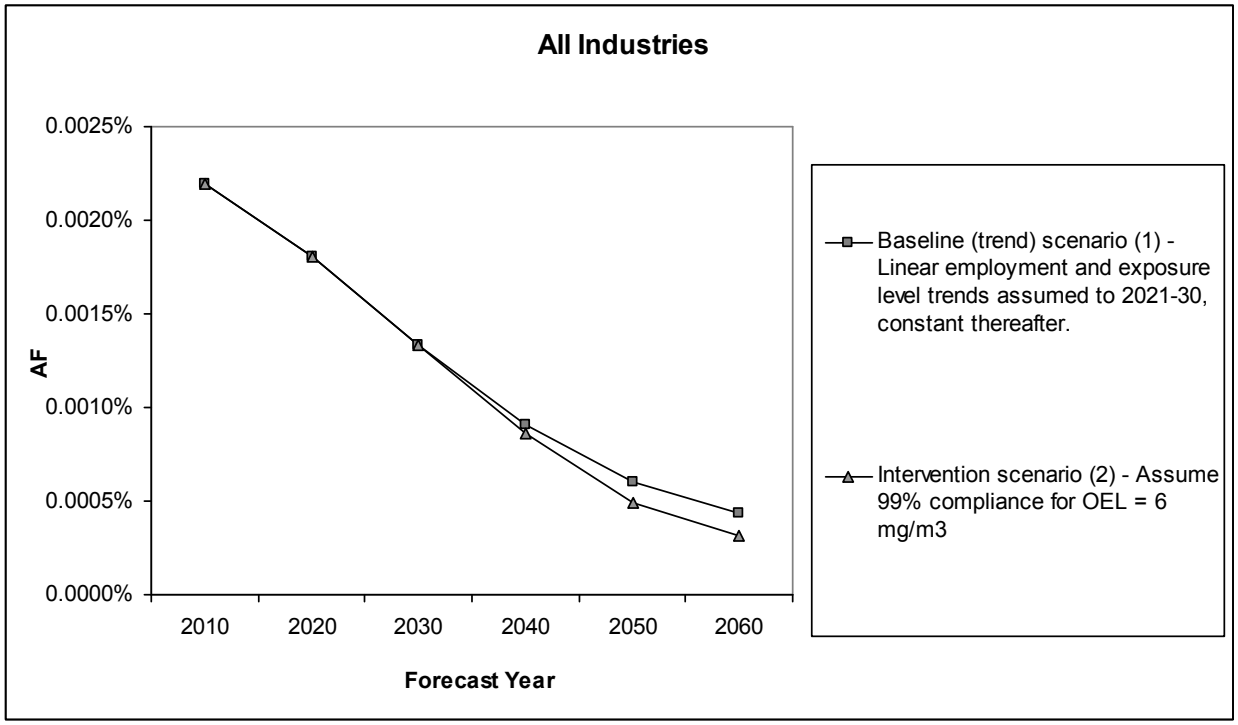

Figure 4.3 Occupation Attributable Fractions, Lung cancer from exposure to rubber process dust

Figure 4.4 shows that the attributable fraction decreases over the period up to 2060. The decrease is more substantial for the intervention scenario resulting in less than 0.01% of all leukaemia cases attributed to rubber process fumes exposure by 2060, while the baseline scenario decreases to just under 0.04% by 2060.

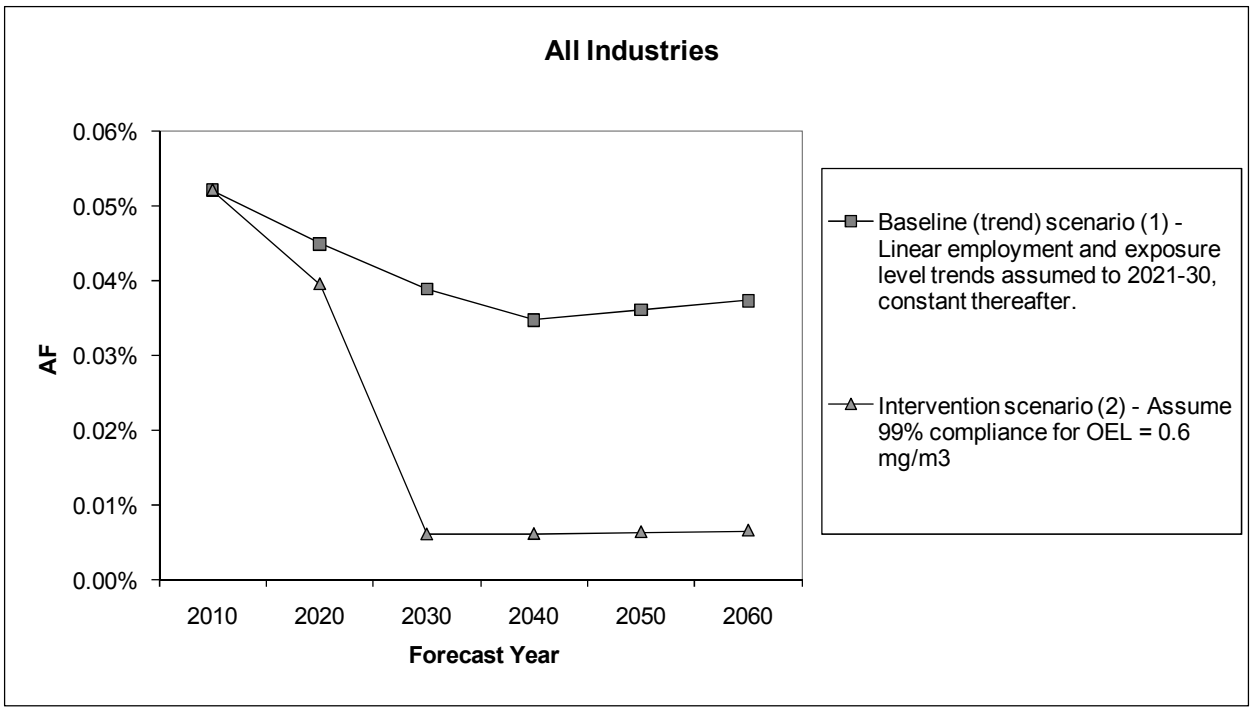

Figure 4.4 Occupation Attributable Fractions, Leukaemia from exposure to rubber process fume

The estimated DALYs decrease for both the baseline and intervention scenarios over the next 50 years for lung cancer and rubber process dust. For both scenarios the estimated DALYs decrease from just under 100 years in 2010 to around 20 years in 2060 (Figure 4.5).

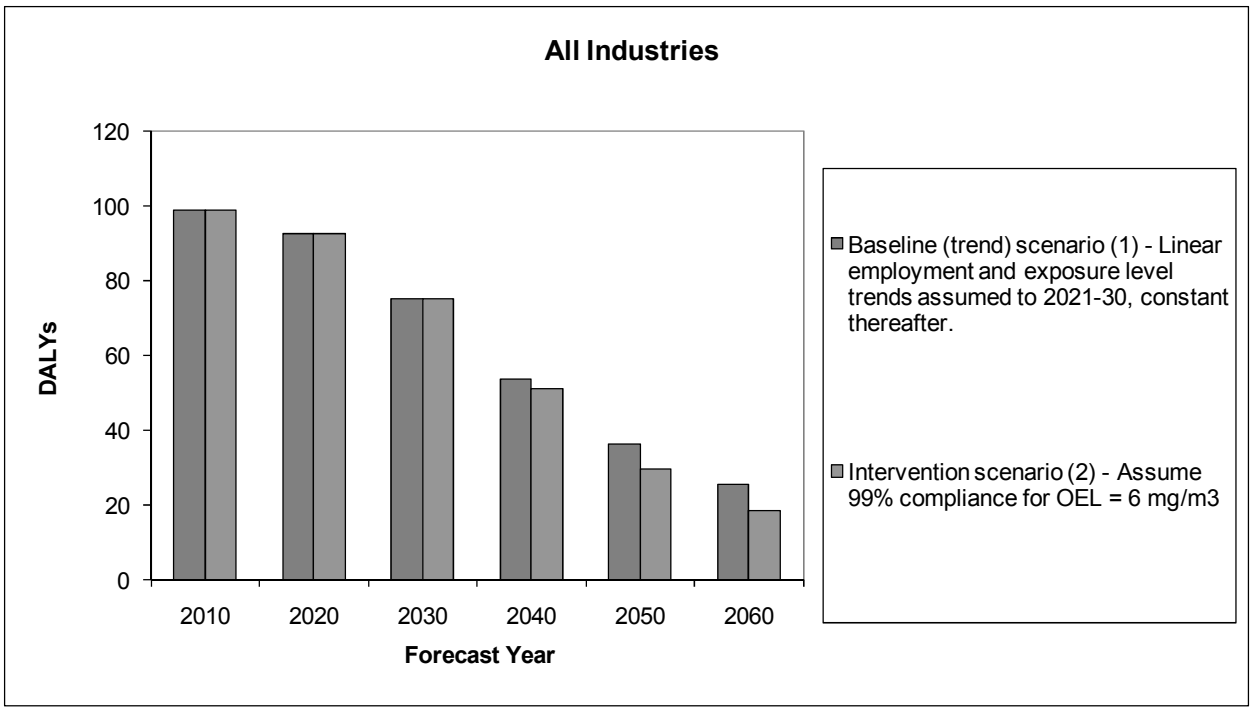

Figure 4.5 Occupation Attributable DALYs, Lung cancer from exposure to rubber process dust

For the baseline scenario for leukaemia and rubber process fumes, the estimated DALYs increase until 2040 and then begin to increase again back to the 2010 level. Conversely, for the intervention scenario, the DALYs decrease greatly over the next 50 years from just under 300 years in 2010 to just under 50 years in 2060 (Figure 4.6).

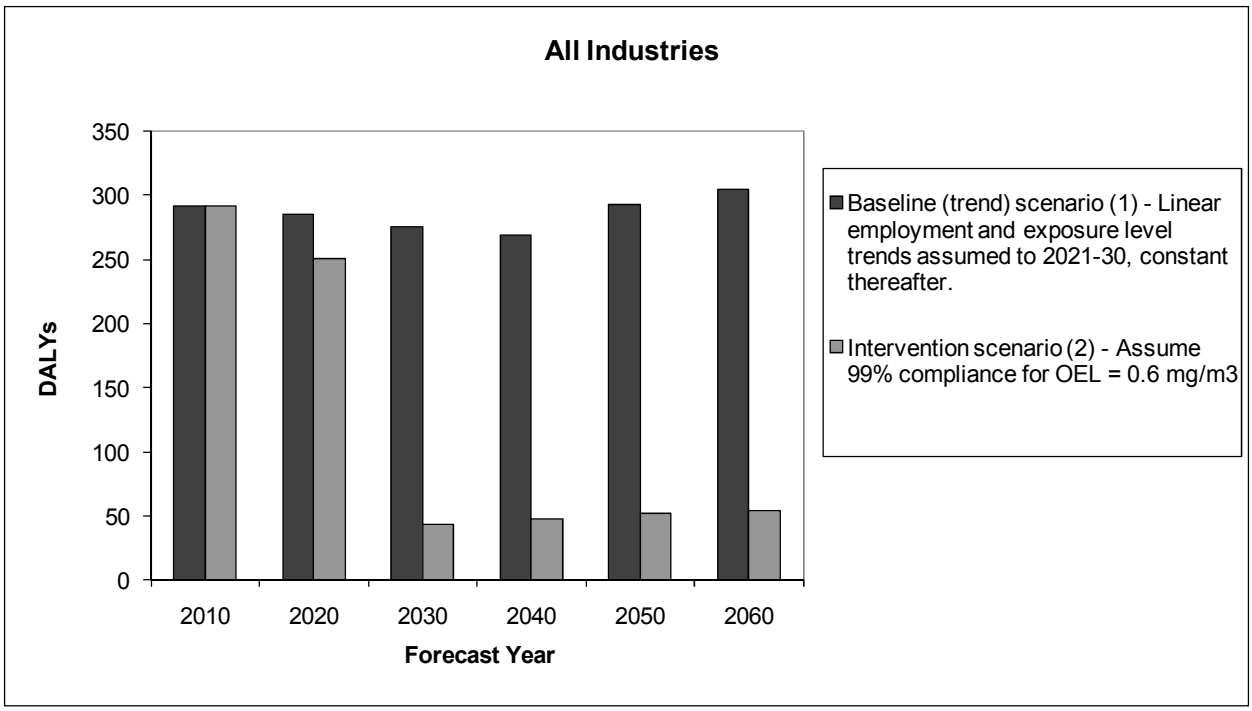

Figure 4.6 Occupation Attributable DALYs, Leukaemia from exposure to rubber process fume

Table 4.2 shows the results for all three cancers. The data for rubber process dust and fume are shown separately. For the two exposures, the data for the first two time periods (2010, 2020) are identical for all scenarios, and then the data for the intervention scenario are shown in the group of four columns (2030-2060). For rubber process dust, attributable deaths for all three cancers decrease from 11 deaths in 2010 to 4 deaths in 2060 for the interventions scenario (OEL of 6 mg/m^3). For rubber process fumes, attributable deaths for all three cancers decrease from 40 deaths in 2010 to 6 deaths in 2060 for the intervention scenario (OEL of 0.6 mg/m^3).

In Tables 8.4.1 (rubber dust) and 8.4.2 (rubber fumes) in Appendix 8.4 are the estimated proportions exposed above the OELs to be tested, currently and as estimated under the baseline trend scenario (1). Under the alternative change scenarios they behave as determined by the scenarios. In this report we have adjusted the results to take into account the fact that the estimates of GM and GSD were specifically for 2010 (for other reports the estimated H/L boundaries and therefore proportions exposed above the OELs have been based on GMs and GSDs that have been assumed to apply in 2005, to represent the 2001-10 estimation interval).

Full results are given in Appendix 8.4 for men plus women by country and by industry. Data for men and women separately, and by industry within country, are available in supplementary spreadsheets ('*Rubber Report data dust.xls*' and '*Rubber Report data fume.xls*'). 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. Numbers and proportions exposed in these tables include workers in the rubber process exposed industries who were not considered to be exposed to dust or fume respectively; these are 'baseline' exposed for which no excess risk of cancer is assumed (RR=1). They do not therefore have a raised risk for cancer and are excluded from the ever exposed estimates in Table 4.2, and from the analysis (as the estimates of GM and GSD from EXASRUB data are assumed to exclude exposure samples for these unexposed workers).

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

	Rubber process dust						Rubber process fume					
Scenario	All scenarios		Intervention scenario (2) - Full compliance for OEL = 6 mg/m3				All scenarios		Intervention scenario (2) - Full compliance for OEL = 0.6 mg/m3			
EU Total	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060
Long latency cancers												
Numbers ever exposed	231,336	233,510	236,336	234,955	233,340	232,869	703,401	710,195	718,995	714,943	710,179	708,823
Proportion of the population exposed	0.06%	0.06%	0.06%	0.06%	0.06%	0.06%	0.19%	0.19%	0.18%	0.18%	0.18%	0.18%
Lung cancer												
Attributable Fraction	0.00219%	0.00181%	0.00133%	0.00086%	0.00049%	0.00031%	0.00664%	0.00605%	0.00537%	0.00387%	0.00175%	0.00020%
Attributable deaths	6	6	5	4	2	1	18	19	20	16	8	1
Attributable registrations	7	6	5	4	2	1	20	22	22	17	8	1
'Avoided' cancers			0	0	1	1			0	3	10	15
YLLs	95	89	72	49	28	18	287	297	290	221	101	11
DALYs	99	93	75	51	30	19	299	311	303	231	105	12
Larynx cancer												
Attributable Fraction	0.00930%	0.00777%	0.00593%	0.00408%	0.00266%	0.00197%	0.02817%	0.02572%	0.02301%	0.01715%	0.00900%	0.00304%
Attributable deaths	1	1	1	0	0	0	2	2	2	2	1	0
Attributable registrations	3	3	3	2	1	1	10	11	11	8	5	2
'Avoided' cancers			0	0	0	0			0	1	4	6
YLLs	372	355	298	216	142	103	1,128	1,177	1,162	915	485	162
DALYs	380	362	304	220	144	106	1,152	1,202	1,186	934	495	165
Short latency cancer												
Numbers ever exposed	163,887	162,144	161,665	160,630	160,630	160,630	498,524	493,346	491,975	488,956	488,956	488,956
Proportion of the population	0.041%	0.040%	0.040%	0.040%	0.042%	0.043%	0.125%	0.122%	0.120%	0.122%	0.127%	0.131%

	Rubber process dust						Rubber process fume					
Scenario	**All scenarios**		**Intervention scenario (2) - Full compliance for OEL = 6 mg/m3**				**All scenarios**		**Intervention scenario (2) - Full compliance for OEL = 0.6 mg/m3**			
EU Total	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
exposed												
Leukaemia												
Attributable Fraction	0.012%	0.008%	0.004%	0.004%	0.004%	0.004%	0.052%	0.040%	0.006%	0.006%	0.006%	0.007%
Attributable deaths	4	4	2	3	3	3	19	17	3	4	4	5
Attributable registrations	7	5	3	3	4	4	31	26	5	5	5	6
'Avoided' cancers			1	0	0	0			25	23	25	26
YLLs	62	47	27	29	32	33	265	228	39	43	47	49
DALYs	68	51	30	32	35	37	292	251	43	48	52	54

4.1.2 Monetised health benefits – Rubber process dust

The possible health benefits (i.e. avoided healthcare costs and effects of having cancer) for the introduction of an EU-wide OEL at 6 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 chronic impacts from past exposure as well as short term acute impacts 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 2030 onwards. The impacts of introducing an OEL at 6 mg/m^3 are estimated to have limited benefits as there is already estimated to be a reduction towards 6 mg/m^3 and below under the baseline scenario. The results are also illustrated in Figure 4.8.

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

Costs by Gender (€m)	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069	Totals
Intervention scenario (2) - Assume 99% compliance for OEL = 6 mg/m^3							
Female	0 to 0	0 to 1	1 to 4	1 to 1	1 to 1	1 to 1	4 to 9
Male	0 to 0	1 to 2	3 to 13	4 to 6	6 to 8	6 to 8	20 to 38
Total	0 to 0	1 to 3	5 to 17	4 to 8	7 to 10	7 to 9	24 to 46

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

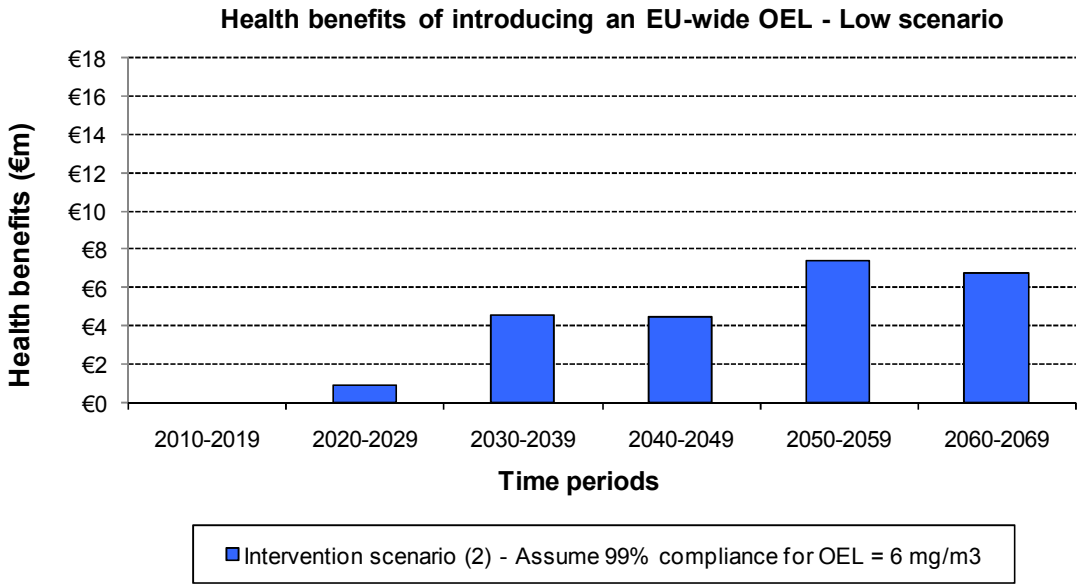

Figure 4.7 Health benefits over time of introducing an EU wide OEL (Present Value – 2010 €m prices) - rubber process dust

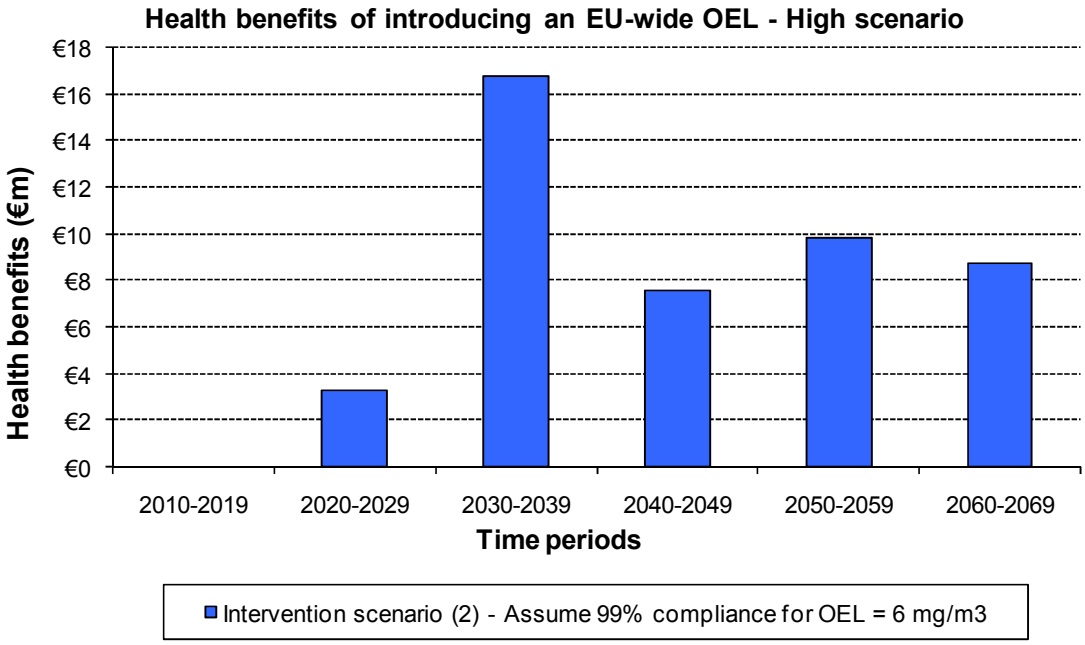

Figure 4.8 Health benefits over time of introducing an EU wide OEL (Present Value – 2010 €m prices) - rubber process dust

These benefits will affect Member States differently depending upon the overall number of workers within affected industry groups, existing risk management measures (RMMs) and the proportion of males and females within these groups. The total benefits by Member State are shown in Figure 4.9 (low scenario) and Figure 4.10 (high scenario), where France, Germany and Italy are predicted to particularly benefit from the OEL assuming full compliance[23].

The monetised benefits of a revised OEL for rubber process fumes and dust are likely to affect men more than women given the industrial sectors most exposed to rubber process fumes and dust. The industrial sector estimated to benefit most from a revised OEL (and full compliance) is the manufacture of other rubber products. This is shown in Figure 4.11 (low scenario) and Figure 4.12 (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 the Appendix 8.5.

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

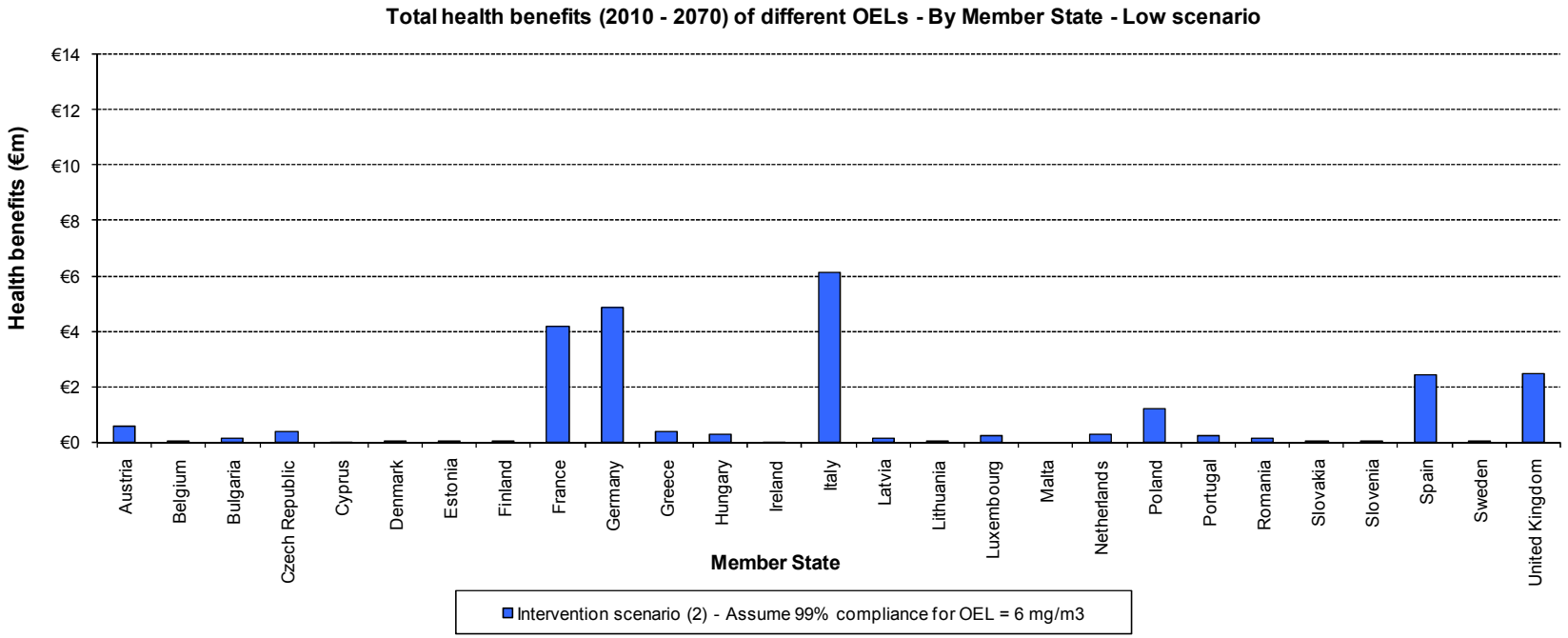

Figure 4.9 Total health benefits of introducing an EU wide OEL for rubber process dust – By Member State – Low Scenario (Present Value – 2010 €m prices)

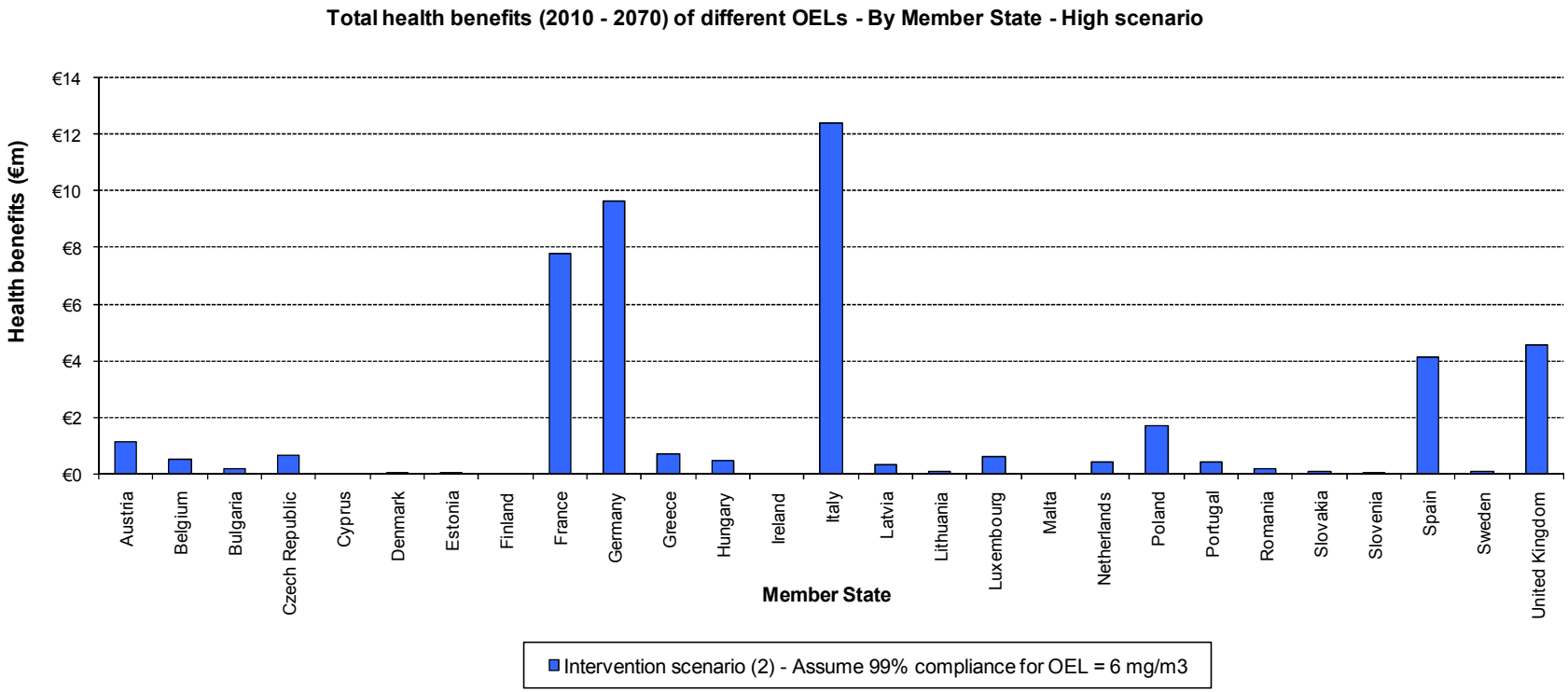

Figure 4.10 Total health benefits of introducing an EU wide OEL for rubber process dust – By Member State – High Scenario (Present Value – 2010 €m prices)

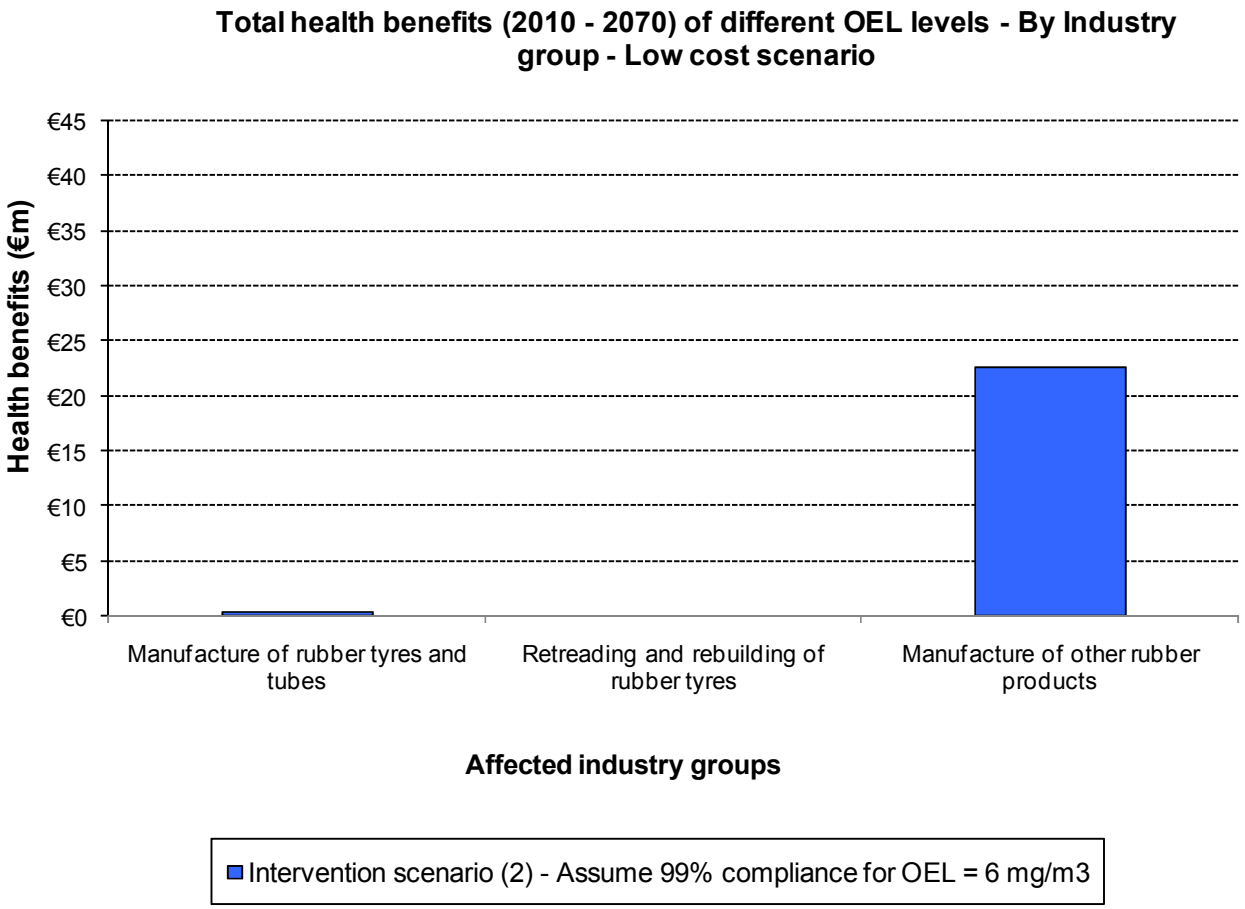

Figure 4.11 Total health benefits of introducing an EU wide OEL for rubber process dust – By Industry Group – Low Scenario (Present Value – 2010 €m prices)

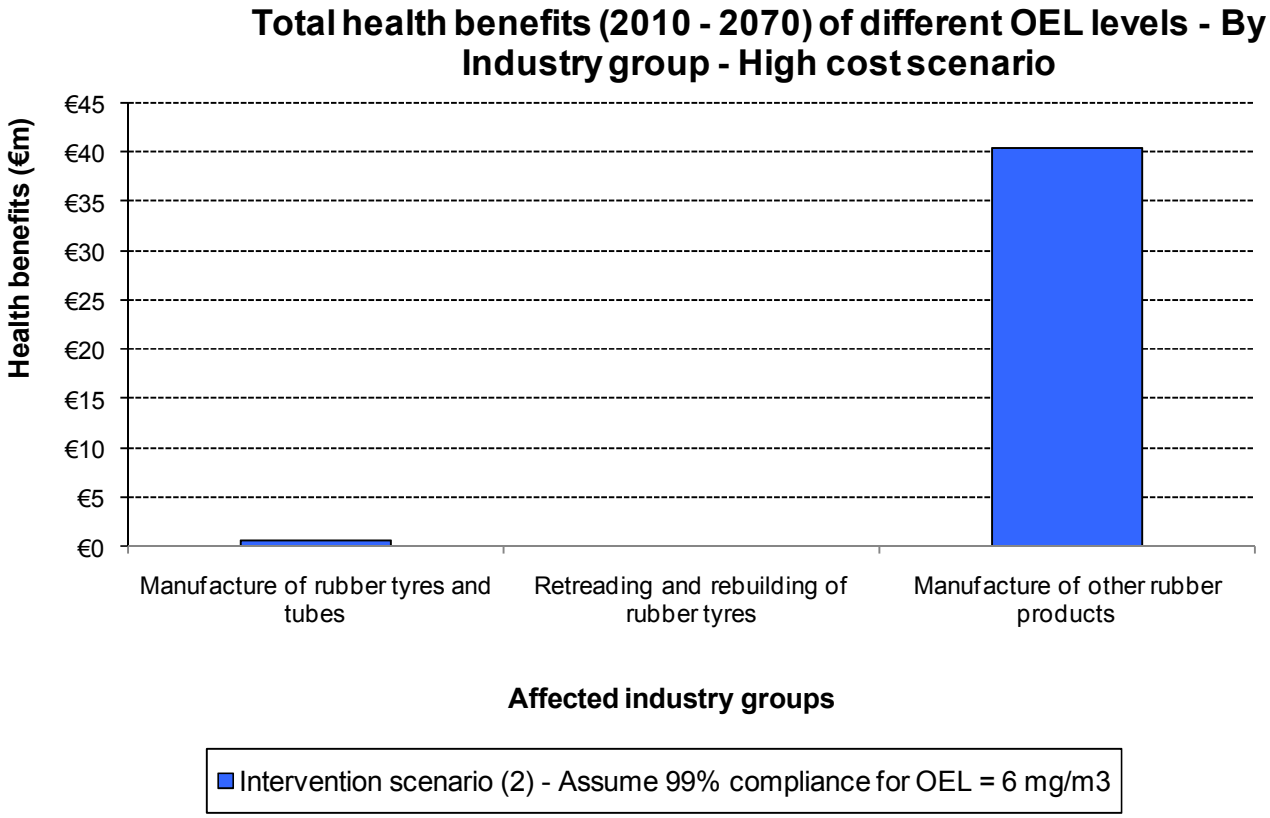

Figure 4.12 Total health benefits of introducing an EU wide OEL for rubber process dust – By Industry Group – High Scenario (Present Value – 2010 €m prices)

As with the baseline scenario, in order to present all costs and benefits consistently in present value, it is necessary to discount all future costs and benefits. This was done using the 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 4.13.

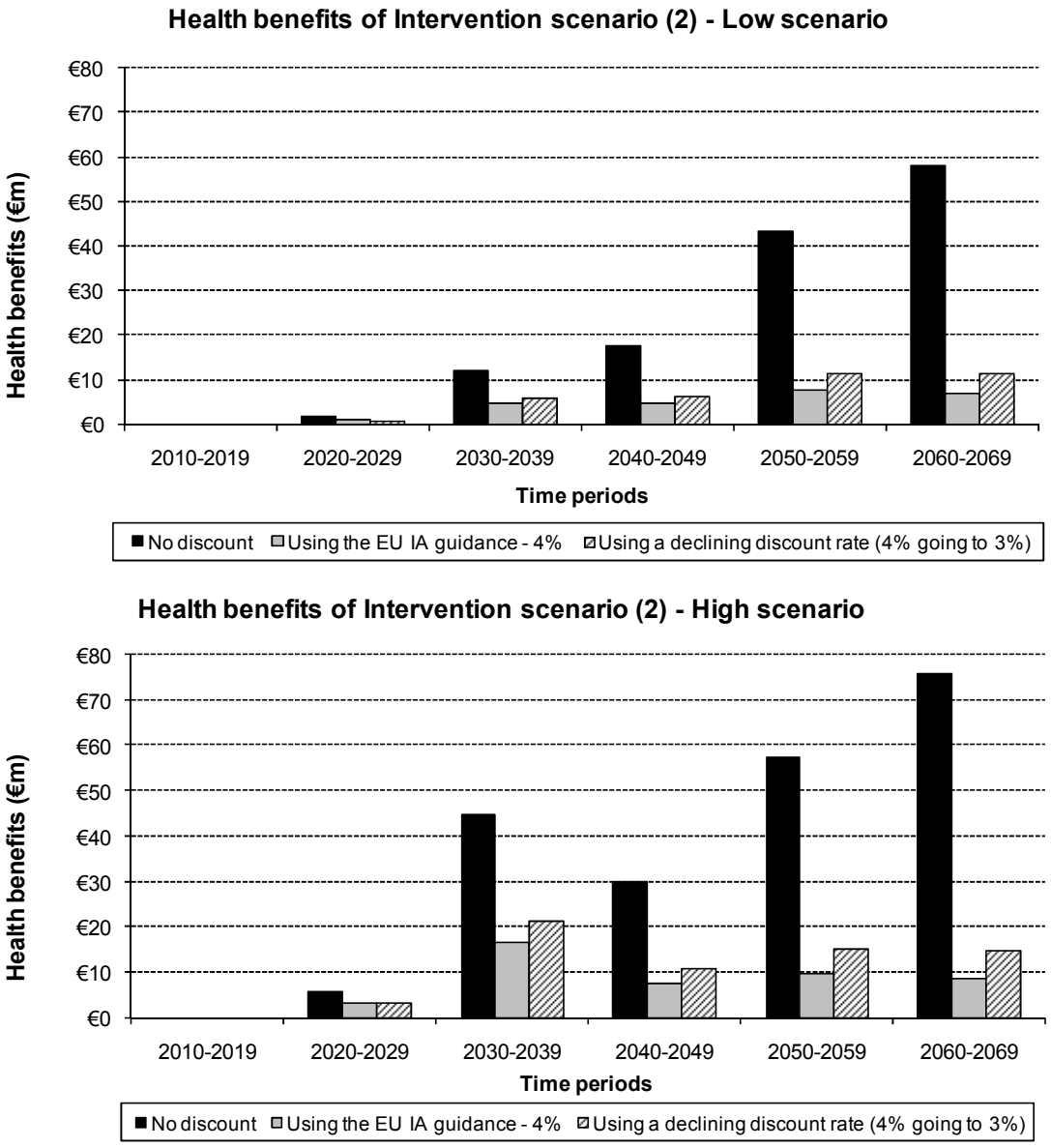

Figure 4.13 Impacts of discounting – Introducing an OEL of 0.6mg/m^3 for rubber process dust

Since the benefits of introducing an EU-wide OEL are mostly realised from 2030, the level of discounting has a significant impact on the overall size of health benefits. A limitation is that the benefits of any RMMs 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) which is not estimated in this study.

4.1.3 Monetised health benefits – Rubber process fumes

The possible health benefits (i.e. avoided healthcare costs and effects of having cancer) for the introduction of an EU wide OEL 0.6 mg/m^3 are shown in Table 4.4.

The change in cancer impacts over the first 30 years (2010-2040) are predominately the result of chronic impacts from past exposure as well as short term acute impacts 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 2030 onwards. The results are also illustrated in Figure 4.14.

Table 4.4 Health benefits of the intervention over time (Present Value – 2010 €m prices) - rubber fumes

Costs by Gender (€m)	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069	Totals
Intervention scenario (2) - Assume 99% compliance for OEL = 0.6 mg/m^3							
Female	0 to 0	4 to 14	20 to 69	24 to 57	34 to 58	36 to 54	119 to 251
Male	0 to 0	9 to 36	56 to 215	87 to 206	145 to 248	163 to 251	460 to 956
Total	0 to 0	13 to 50	77 to 284	111 to 264	179 to 306	199 to 304	579 to 1,207

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

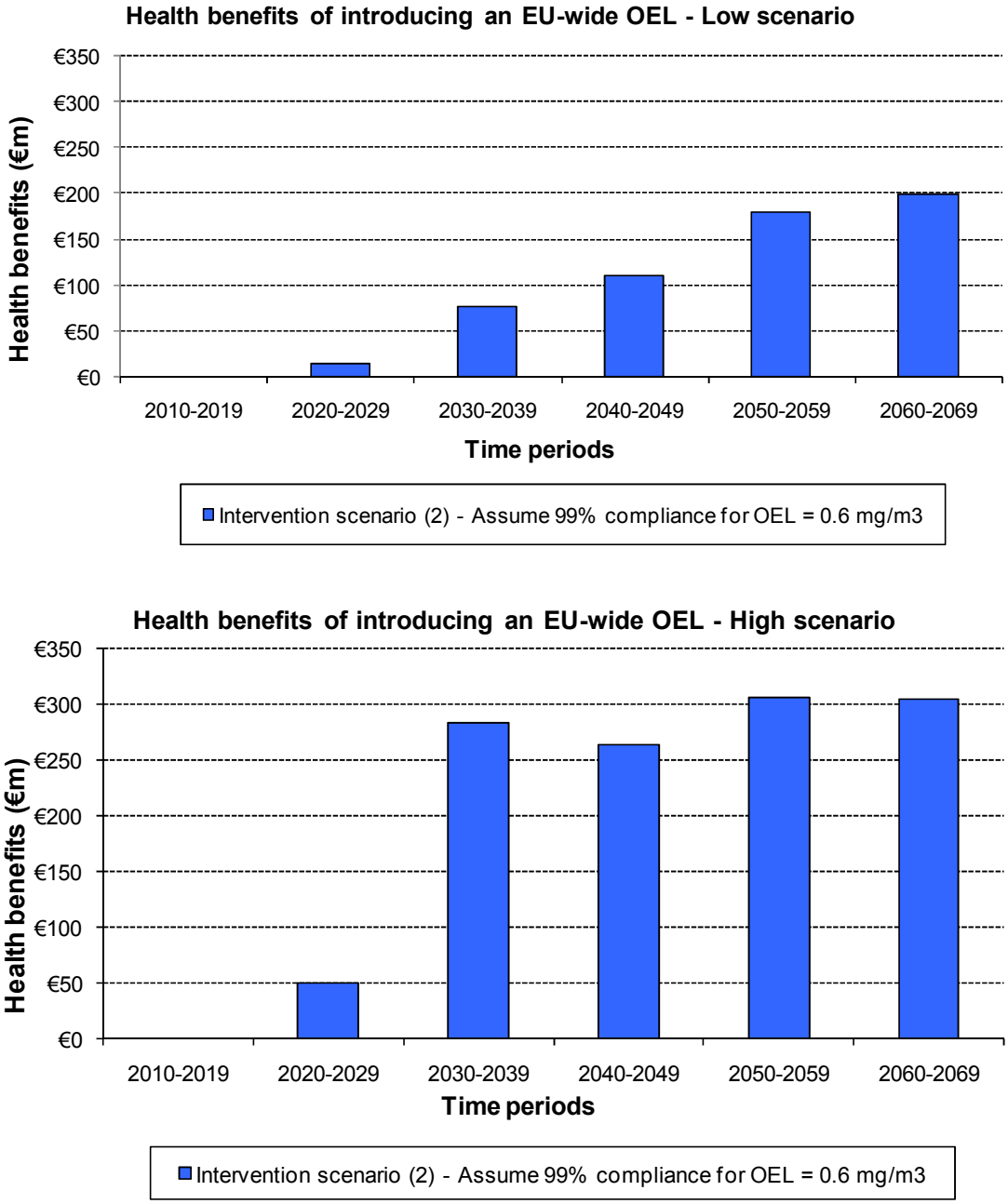

Figure 4.14 Health benefits over time of introducing an EU wide OEL (Present Value – 2010 €m prices)

These benefits will affect Member States differently depending upon the overall number of workers within affected industry groups, existing risk management measures (RMMs) and the proportion of males and females within these groups. The total benefits by Member State are shown in Figure 4.15 (low scenario) and Figure 4.16 (high scenario), where France, Germany and Italy are predicted to particularly benefit from the OEL assuming full compliance[24].

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

The monetised benefits of a revised OEL for rubber process fumes and dust are likely to affect men more than women given the industrial sectors most exposed to rubber process fumes and dust. The industrial sector estimated to benefit most from a revised OEL (and full compliance) is the manufacture of other products. This is shown in Figure 4.17 (low scenario) and Figure 4.18 (high scenario).

The Member State and industry groups that are predicted to benefit most from a revised OEL also vary at a gender level.

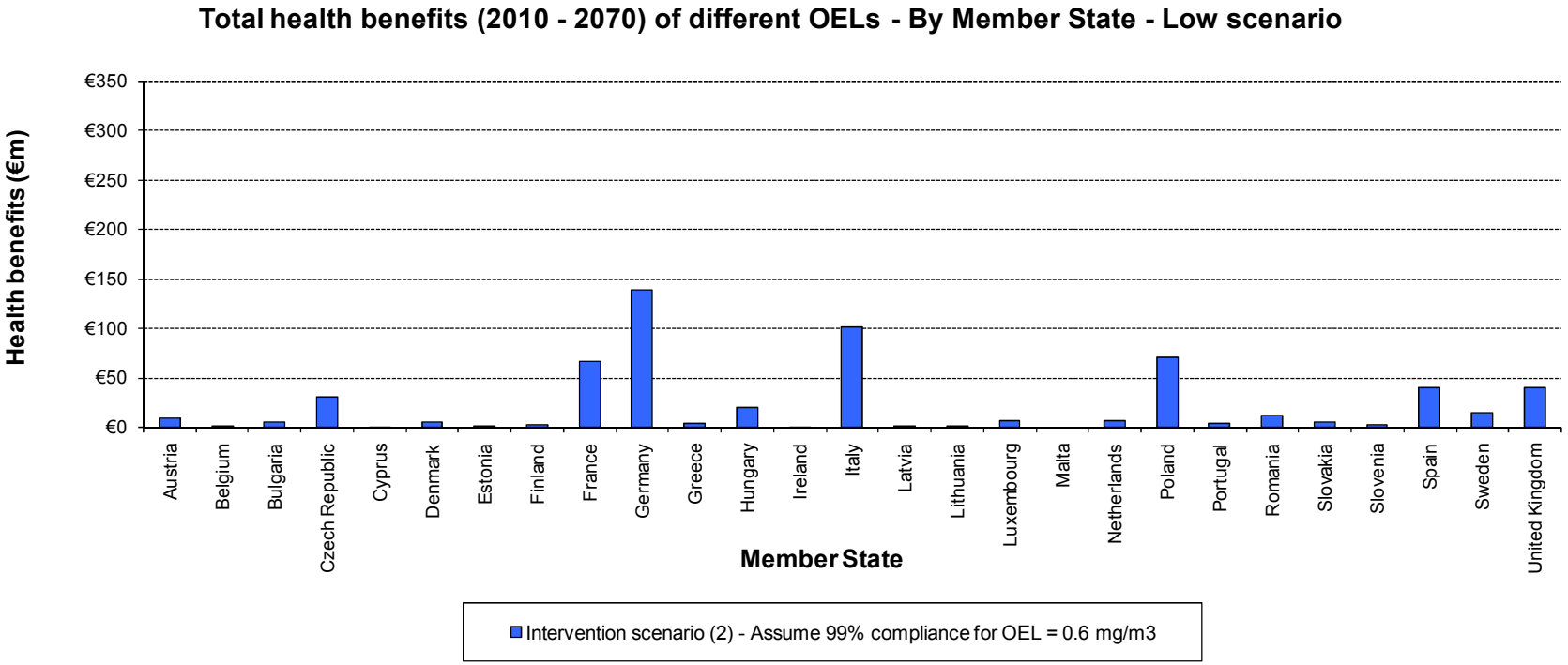

Figure 4.15 Total health benefits of introducing an EU wide OEL for rubber fumes – By Member State – Low Scenario (Present Value – 2010 €m prices)

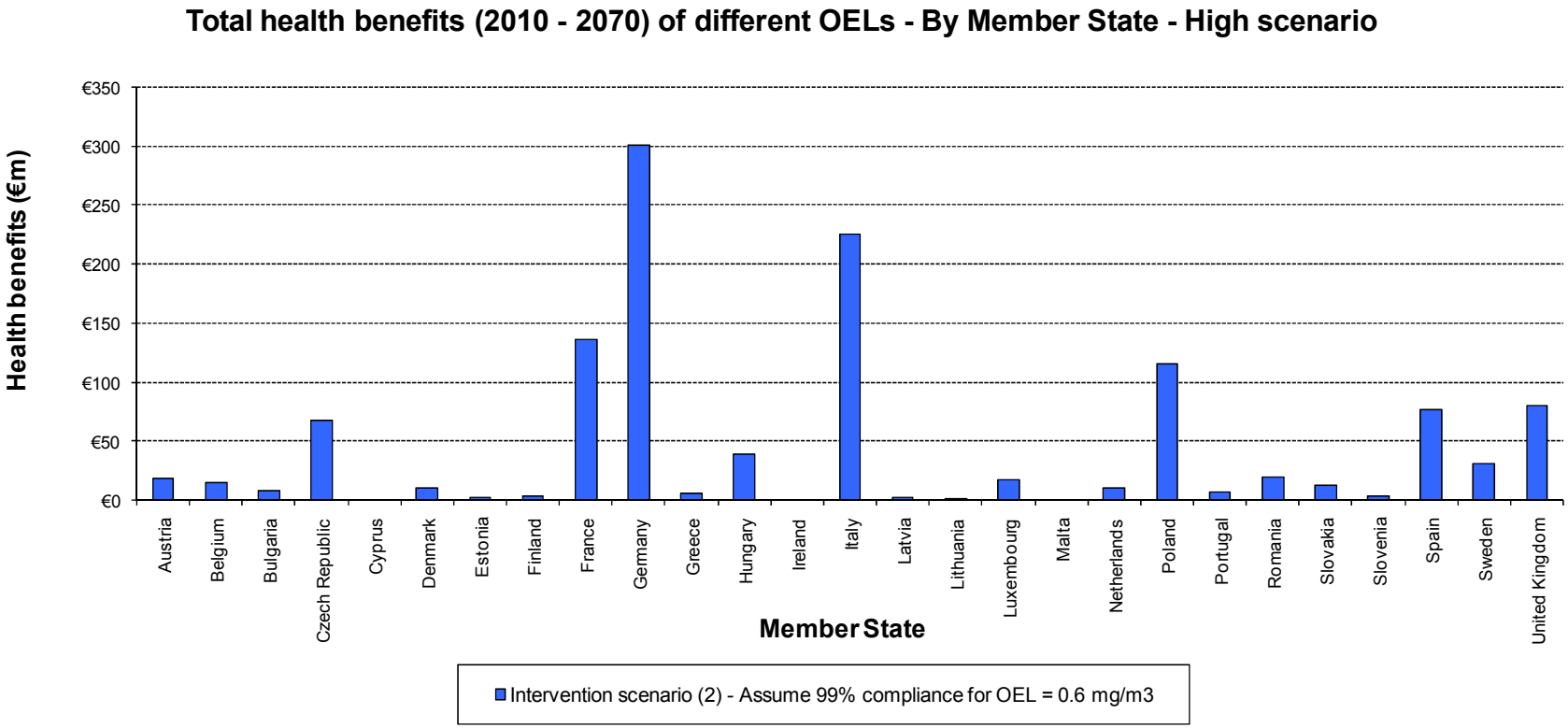

Figure 4.16 Total health benefits of introducing an EU wide OEL for rubber fumes – By Member State – High Scenario (Present Value – 2010 €m prices)

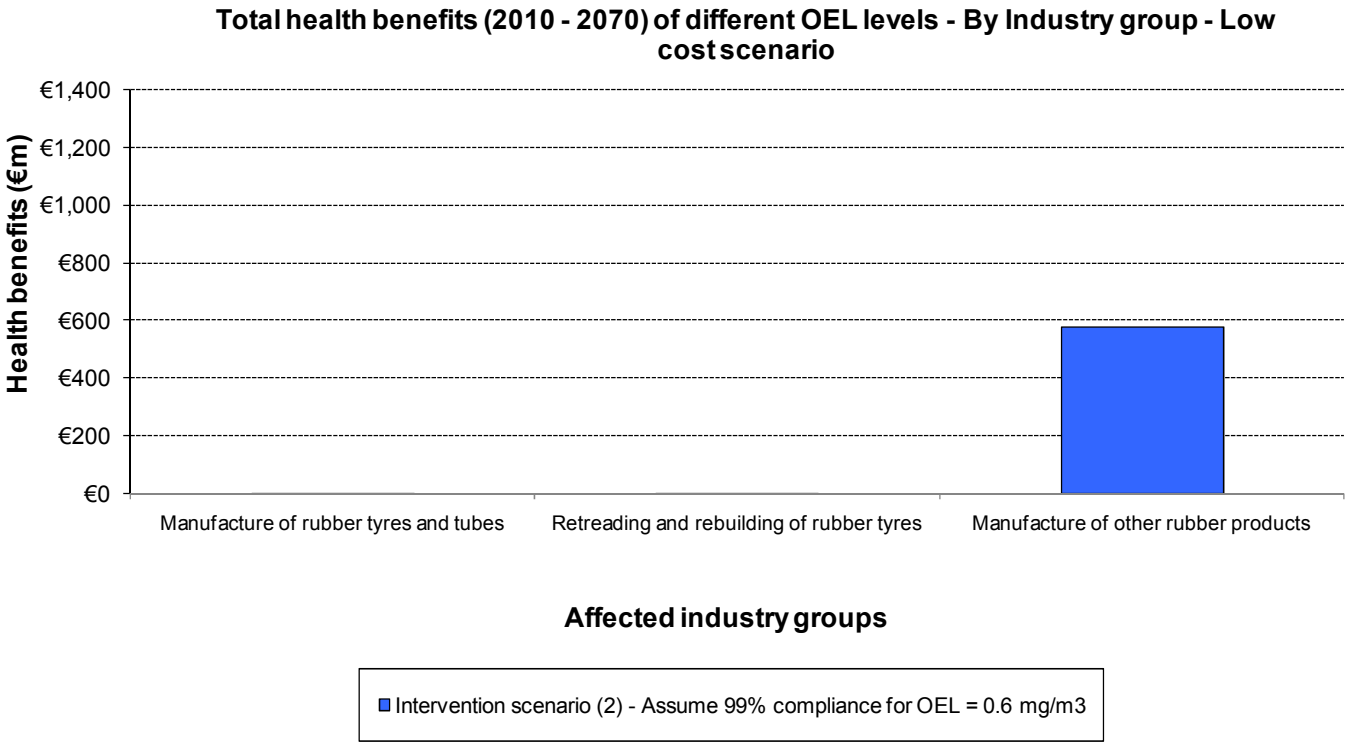

Figure 4.17 Total health benefits of introducing an EU wide OEL for rubber fumes – By Industry Group – Low Scenario (Present Value – 2010 €m prices)

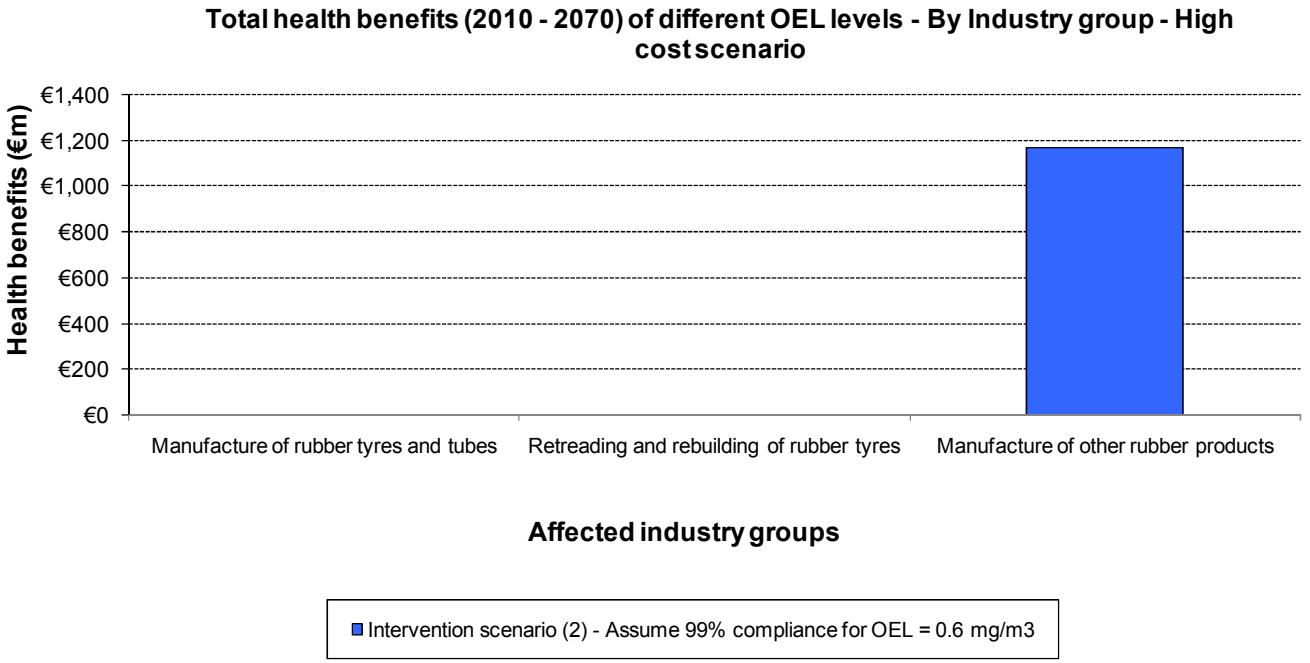

Figure 4.18 Total health benefits of introducing an EU wide OEL for rubber fumes – By Industry Group – High Scenario (Present Value – 2010 €m prices)

As with the baseline scenario, in order to present all costs and benefits consistently in present value, it is necessary to discount all future costs and benefits. This was done using the 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 4.19.

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

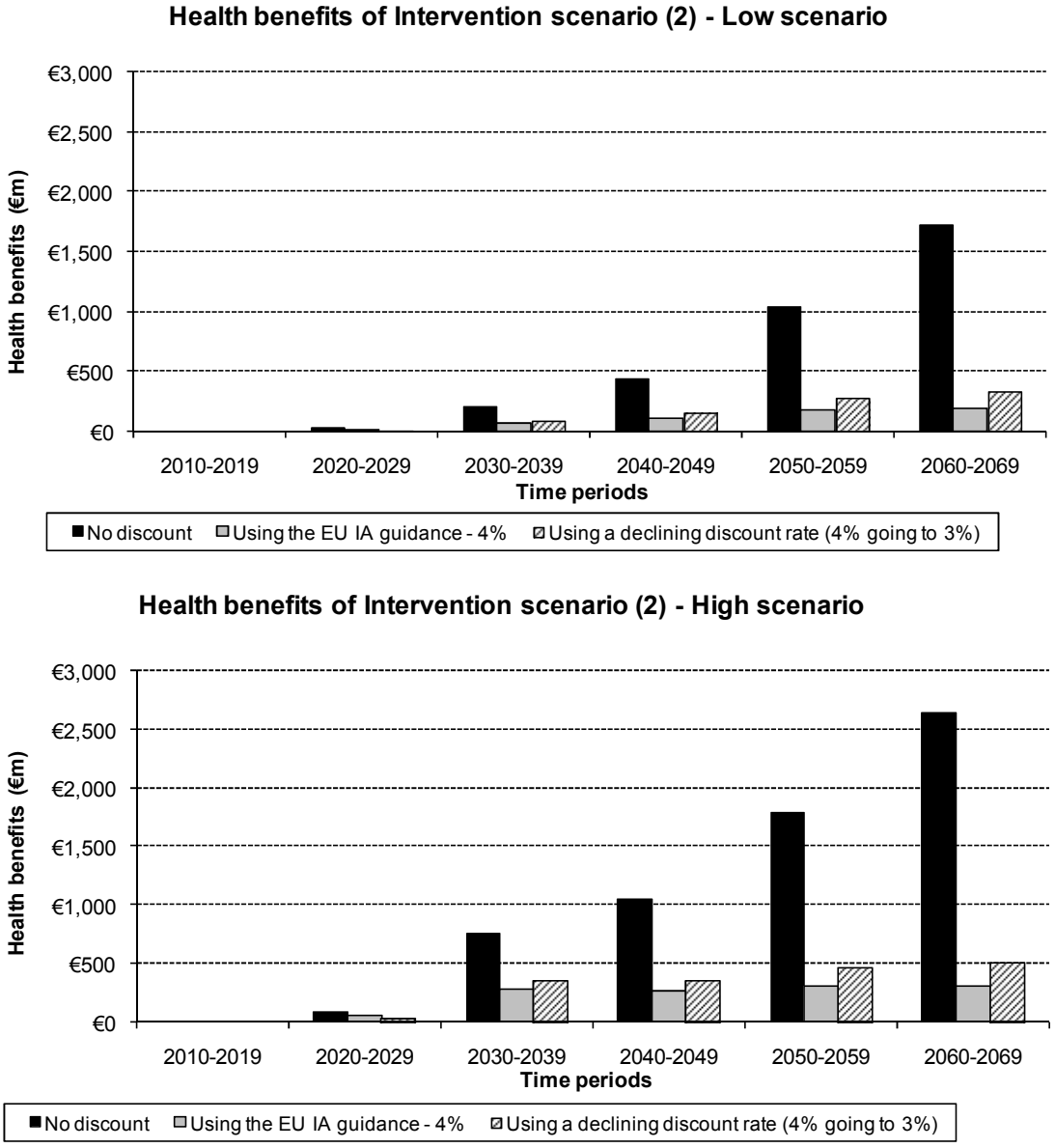

Figure 4.19 Impacts of discounting – Introducing an OEL of 0.6mg/m^3 for rubber fumes

Since the benefits of introducing a more stringent OEL are mostly realised from 2030, the level of discounting has a significant impact on the overall size of health benefits. A

limitation is that the benefits of any RMMs 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) which is not estimated in this study.

4.2 ECONOMIC IMPACTS

4.2.1 Operating costs and conduct of business

Number of firms affected

Rubber Dust

In Section 2.2 it was estimated that there are between 32,000 and 56,800 people typically exposed to rubber dust in the EU in total (including NACE 25.11 and NACE 25.13). It is estimated that approximately 14 per cent of these workers are exposed above the proposed EU-wide OEL of 6 mg/m^3. This percentage alongside the available Eurostat data on the number of enterprises has been used to estimate the number of enterprises that may be affected by the proposed OEL. This is set out in Table 4.5 below.

Table 4.5 Estimates of the number of enterprises affected

Number of employees	Average composition of enterprises for affected NACE sectors with exposure to rubber dust *	Number of workers potentially exposed		Estimated number of enterprises affected by band size	
		Low	High	Low	High
Between 1 and 9	64%	2,867	5,096	573	1,019
Between 10 and 19	14%	634	1,128	42	75
Between 20 and 49	10%	461	820	13	23
Between 50 and 250	9%	382	679	3	5
Greater than 250	3%	133	236	0	0
Total	**100%**	**4,477**	**7,959**	**632**	**1,123**
Percentage of affected firms relative to total number of firms in the sector	-	-	-	9%	16%

As shown above it is estimated that between 600–1,100 enterprises could be affected by the introduction of an EU-wide OEL of 6 mg/m^3.

Rubber Fumes

In Section 2.2 it was estimated that there are between 84,000 and 172,000 people typically exposed to rubber fumes in the EU in total (including NACE 25.11, NACE 25.12 and NACE 25.13). It is estimated that 37 per cent of workers are exposed above the proposed EU-wide OEL of 0.6 mg/m^3. This percentage alongside the available Eurostat data on the number of enterprises has been used to estimate the number of

enterprises that may be affected by the proposed OEL. This is set out in Table 4.6 below.

Table 4.6 Estimates of the number of enterprises affected

Number of employees	Average composition of enterprises for affected NACE codes *	Number of workers potentially exposed		Estimated number of enterprises affected	
		Low	High	Low	High
Between 1 and 9	64%	20,049	40,971	4,010	4,527
Between 10 and 19	14%	4,438	9,068	296	1,002
Between 20 and 49	10%	3,224	6,589	92	728
Between 50 and 250	9%	2,671	5,457	18	603
Greater than 250	3%	930	1,901	2	210
Total	**100%**	**27,228**	**63,986**	**3,840**	**7,070**
Percentage of affected firms relative to total number of firms in the sector	-	-	-	**54%**	**100%**

As shown above it is estimated that between 3,800–7,070 enterprises could be affected by the introduction of an EU-wide OEL of 0.6 mg/m^3.

It is recognised that there are limitations to this approach, as it assumes affected workers are distributed across the NACE code sector in the same way as the average distribution for the NACE code. For example, if the sector is predominately made up of SMEs, then most workers affected will be employed in SMEs and the number of enterprises affected will be higher than if the sector is made up of enterprise employing over 250 workers; (whereby the number of enterprises affected will be smaller). In the absence of better data, this is seen as a reasonable approach to broadly estimating the number of enterprises affected.

Compliance costs

As discussed in section 3.2 there are a number of control measures that can be implemented to limit exposure to rubber dust and fumes. The HSE (1998) study states that a combination of engineering, technical and operational control measures, coupled with appropriate training and instruction of employees involved, should form the basis of an effective strategy for dust and fume control. The specific control measures required by individual enterprises depend on existing measures in place and the nature of operations conducted. The HSE study, however, notes that, as a general measure, local exhaust ventilation (LEV) is widely applicable for controlling both dust and fume. Local exhaust ventilation systems capture and remove process emissions at or close to their source of generation and prior to their escape into the workplace environment.

A recent HSE study (2010) visited 12 GRG sites in the UK to assess the status of exposure control strategies. It was found that almost all sites where rubber fumes are encountered had significant deficiencies in their exposure control strategy. Moulding presses without LEV fitted were frequently encountered and where LEV was installed, deficiencies linked to design, use and maintenance were observed. Use of RPE was

found to be uncommon and where it was encountered there was found to be inadequacies (such as workers with beards wearing equipment which relies upon a seal for effective protection).

The study found that at sites where rubber process dust is encountered, LEV was typically present for operations with potential exposure. However deficiencies in design, use and maintenance mean that they are not adequately controlling exposure. RPE was available at some of the sites but was not worn consistently for all tasks with exposure potential. In the absence of additional information, these findings are assumed to represent the typical situation across all EU member states.

According to the HSE (1998) faulty and indifferent maintenance is a major cause of failure of ventilation systems and relatively small expenditure on cleaning, adjustment, repair and general maintenance can improve the performance of a ventilation system. Cost data for ventilation units are based on estimates from ventilation suppliers. Costs per unit for rubber fumes and dust industries are increased as exhaust equipment requires a high efficiency particulate air (HEPA) filter, which is more costly than a standard filter. The range of costs is shown in Table 4.7.

Table 4.7 Capital costs per enterprise for ventilation units for stationary LEV

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

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

Appropriate respiratory equipment (RPE) and 'good housekeeping' (HSE, 1998) also has an impact on the magnitude of workplace exposure to rubber process dust and fumes. There are not expected to be any significant costs associated with enclosure, housekeeping and RPE, which in any case would be considered to be good practice. It is assumed that costs range between €500-€2,000/year per enterprises (including costs of equipment and the cost of time spent on labour e.g. cleaning)

This cost data has been used alongside the estimates of number of enterprises affected by the proposed OELs to estimate total compliance costs. Insufficient information was available to determine more accurately which measures might be required to meet each OEL for each firm size or sector. Therefore the following assumptions have been used based on available information (e.g. HSE, 2010) in the absence of better data:

Enterprises where rubber process dust are encountered:

- 10% of affected firms only incur costs of RPE to comply with the proposed OEL.

- 70% of affected firms have LEV but do not necessary use and/ or maintain their system properly. Therefore costs to properly maintain and use of their LEVs and use of RPE will be sufficient to comply with the OEL.
- 20% of affected firms will incur costs associated with purchase, maintenance and use of LEV and use of RPE

Enterprises where rubber fumes are encountered:

- 10% of affected firms only incur costs of RPE to comply with the proposed OEL.
- 20% of affected firms have LEV but do not necessary use and/ or maintain their system properly. Therefore costs to properly maintain and use of their LEVs and use of RPE will be sufficient to comply with the OEL.
- 70% of affected firms will incur costs associated with purchase, maintenance and use of LEV and use of RPE

These estimates are subject to high uncertainty. Using this breakdown in approaches to compliance the costs of each OEL scenario is summarised below in Table 4.8 and Table 4.9.

Table 4.8 Total costs of compliance for control of rubber process dust with proposed EU-wide OEL of 6mg/m^3

Number of enterprises affected		Action required	Average annualised cost per enterprise (2010)		Total annual cost in millions (2010)		Total cost 2010-2070 in millions	
			Low	High	Low	High	Low	High
Low	High							
63	112	RPE	€ 500	€ 2,000	€ 0.03	€ 0.22	€ 1	€ 5
442	786	RPE + proper use of existing LEV	£3,123	£7,123	€ 1.38	€ 5.60	€ 35	€ 136
126	225	RPE + install and use LEV	€ 6,214	€ 25,666	€ 0.78	€ 5.76	€ 19	€ 133
632	**1,123**	-	-	-	**€ 2**	**€ 12**	**€ 55**	**€ 275**

Note: Total costs are round to nearest euro.

Table 4.9 Total costs of compliance for control of rubber fumes with proposed EU-wide OEL of 0.6 mg/m^3

Number of enterprises affected		Action required	Average annualised cost per enterprise (2010)		Total annual cost in millions (2010)		Total cost 2010-2070 in millions	
Low	High		Low	High	Low	High	Low	High
384	707	RPE	€ 500	€ 2,000	€ 0.19	€ 1.41	€ 5	€ 33
768	1414	RPE + proper use of existing LEV	£3,123	£7,123	€ 2.40	€ 10.07	€ 61	€ 245
2,688	4949	RPE + install and use LEV	€ 6,214	€ 25,666	€ 16.70	€ 127.02	€ 401	€ 2,934
3,840	**7,070**	-	-	-	**€ 19**	**€ 139**	**€ 466**	**€ 3,212**

Note: Total costs are round to nearest euro.

Conduct of employers

The introduction of an EU-wide OEL may require those companies not already complying to reorganise their workplace to ensure that exposure is minimised. There may also be additional training required to ensure that employees minimise their exposure by adhering to good practice in order to reducing exposure (e.g. using RPE properly).

Potential for closure of companies

Rubber Dust

As indicated in Table 4.5, it is estimated that between 630 and 1,120 enterprises (9-16% of all firms in the sector) are likely to be affected by the introduction of an EU-wide OEL (6mg/m^3). If compliance with the OEL can be achieved just by improving existing work practices and RPE (~33% of affected enterprises), then the cost of compliance per enterprise (€500-2000) is not thought to be prohibitive. Based on the HSE (2010) report it is thought some companies already have LEV systems in place but that they may not be properly maintained or used. Therefore compliance can be achieved without significantly posing a risk to closure. However, where LEVs are not in place, the upfront capital cost of LEVs may be difficult to finance, which may trigger a decision to close production.

Rubber Fumes

As indicated in Table 4.6, it is estimated that a significant proportion of enterprises (54-100%) would require further action to comply with an EU-wide OEL of 0.6mg/m^3. It is assumed that many of these enterprises would require some form of ventilation system to comply (~70%). For those enterprises, there is a significant cost to consider (Table 4.7). The estimated annualised cost varies from about €4k - 25k, but this added cost 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[25]. This is likely to be a significant cost for this sector, which may potentially result in the closure of some companies or to companies altering production to prevent production of rubber fumes where this is feasible.

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 available from Eurostat, it is possible to compare the initial capital cost 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 whether they might opt to close the business or at least their EDB market.

Table 4.10 shows the average operating surplus for firms with different employee numbers. Operating surplus is a measure of profitability of the enterprise prior to

[25] Based on discussion with LEV suppliers

payment of interest and tax (i.e. pre-tax profit income). The average surplus varies considerably according to the number of employees. These data also show the capital cost of ventilation systems (from Table 4.7) as a percentage of average operating surplus for the manufacture of rubber products.

Table 4.10 NACE code 251 – Manufacture of rubber products

Number of employees	Proportion of enterprises (%)	Gross operating surplus (€m)	Average operating surplus (€m)	Capital cost / operating surplus (%)	
				Low	High
Between 1 and 9	64%	230.9	€ 51,005	82%	494%
Between 10 and 19	14%	144.4	€ 144,112	29%	175%
Between 20 and 49	10%	236.9	€ 325,412	13%	77%
Between 50 and 250	9%	236.9	€ 392,869	11%	64%
Greater than 250	3%	3991.2	€ 19,005,714	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 4.5.

The results indicate that for larger firms the costs of LEVs could likely be financed internally and therefore is less likely to trigger decisions to close plants. However for SMEs the costs of LEVs (for larger more expense LEVs) represents a significant cost that may need to be financed externally and therefore may trigger decisions to close plants if they are unable to get access to this finance.

Potential impacts for specific types of companies

The costs of compliance are likely to initially fall on those enterprises that cure or compound rubber items. It is possible, however, that any additional costs may be passed on to downstream users using rubber products.

The main advantage of an EU-wide OEL would be to create consistency in regulation across the EU and remove any competitive disadvantage to those Member States who previously had more stringent national OELs in place.

Companies that require ventilation systems and do not already have one, will incur a larger proportion of the estimated costs of compliance.

Administrative costs to employers and public authorities

The following table (Table 4.1) describes the administrative burden to employers by the substance being included on the Carcinogens Directive.

Table 4.11 Administrative burdens to employers

Type of administrative cost	Relevant article(s)	Type of cost	Significance
1. Familiarisation costs with the Directive and requirements for full compliance	-	Individual(s) responsible for health and safety and training will need to familiarise themselves with the requirements of the Directive. This is largely a one-off cost with some periodic costs for training of new trainers.	Low
2. Time for R&D and exploration of suitable alternatives to reduce and replace use of the substance so far as technically feasible 3. Document findings	4 – Reduction and replacement	Largely one-off cost but findings may need to be updated annually. Many large size firms are likely to already be investing in R&D and alternatives. As part of the CLP Regulation (EC) No 1272/2008 and Chemicals Agents Directive (CAD) risks must be eliminated or reduced to a minimum. Substitution is preferred and, if that isn't possible, there is a hierarchy of controls (e.g. workplace changes, general protective equipment, PPE, etc).	Low
4. Change in practice to use of 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
5. Upon request, employers will need make information available to competent authorities on activities/processes carried out and why the substance is used, quantities used, number of workers exposed and protective measures and equipment used to reduce exposure	6 – Information for the competent authority	As this information is only required upon request (with the frequency of requests unknown), the administrative costs are likely to be low given much of this information should be readily available to the firms concerned.	Low

Type of administrative cost	Relevant article(s)	Type of cost	Significance
6. 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	Some firms may only incur a one-off cost from updating existing guidance and training material. 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. Firms should already be doing many of these good practices as part of the CLP Regulation and the CAD.	Low-Medium
7. Additional costs of training new and existing staff in line with requirements of the Directive 8. Additional costs of making information available to employees 9. Consultation with employees on compliance with the Directive	11 – Information and training of workers 12 – Information for workers 13 – Consultation and participation with workers	Largely one-off cost but training may need to be repeated periodically if necessary. Periodic training should typically be carried out as best practice so largely one-off cost of updating training material.	Low/medium
9. Record keeping for 40 years of list of workers engaged in activities where they are exposed to the substance and individual medical records when health surveillance is carried out.	15 – Record keeping Reference to 12(c) and 14(4)	Likely to be a small annual cost to ensure personnel files are kept up to date and information is correctly stored.	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 4.11) describes the administrative burden to competent authorities by the substance being included on the Carcinogens Directive.

Table 4.11 Administrative burdens to Competent Authorities

Type of administrative cost	Relevant article(s)	Type of cost	Significance
1. Familiarisation costs with the Directive and requirements for full compliance	-	Individual(s) responsible will need to familiarise themselves with the requirements of the directive. This is largely a one-off cost with some periodic costs for new/replacement staff.	Low
2. Establishing, in accordance with national laws and/or practice, arrangements for carrying out relevant health surveillance of workers for whom the results of the assessment referred to in Article 3(2) reveal a risk to health or safety.	14 – Health Surveillance	The annual costs will depend on the number visits undertaken.	Low – High
3. Communication with the Commission on provisions in national law to enforce the Directive. 4. Time and costs of implementing Directive into national law (consultation process)	19 – Notifying the commission 20 – Repeal	Largely one-off cost of transposing the Directive into national law	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.

Third countries

As noted in section 2.1, there is a global market for rubber, in particular with, tyres and rubber tubes. Therefore the introduction of an OEL could affect the competitiveness of EU manufacturers and distributors, in particular, if the costs of compliance for affected firms are passed through to consumers with higher product prices. However, this depends on the risk of import penetration (from outside the EU) and other factors such as product branding. However, it is also possible that sales may be distributed to other EU firms who are already in compliance with the possible OEL who then don't need to change product prices. The overall impact on third countries is therefore thought to be minimal.

4.2.2 Impact on innovation and research

It is thought that SMEs would be tend to adopt approaches and techniques that are already being applied within other parts of the industry in order to comply with an EU-wide OEL.

However, the potential volume of ventilation systems being required across the EU may stimulate investment in R&D to alter the chemical nature of rubber process fumes and dust to reduce their carcinogenity. According to the UK HSE (1998) *"this is a complex, dynamic and competitive industry; formulations and process conditions are always changing. New formulations and higher temperatures may introduce new risks and improved research techniques may reveal the dangers present in old established processes".*

4.2.3 Macroeconomic impact

With fewer life years lost and cancer registrations, there might be an economic benefit 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. However, at a macroeconomic level any benefit would be negligible.

Short term spending on risk management measures may also be good for the economy as equipment manufacturers (ventilation systems), 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). However again, the overall macroeconomic impact is unlikely to be significant given for example the total value of goods and services in the manufacturing sector of €5trillion in 2006 alone (i.e. a single year rather than a 60 year period).

4.3 SOCIAL IMPACTS

4.3.1 Employment and labour markets

Rubber Dust

It is estimated that only 9-16% of the firms might be affected by the introduction of an OEL at 6mg/m^3 and therefore the majority of the sector will not require further exposure control measures to meet the OEL. Therefore there is not expected to be any significant social and labour market impacts.

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.

Overall, there are not expected to be any significant changes to jobs skills, patterns or the total numbers of workers required as a result of using of ventilation systems. However for some SMEs the affordability of ventilation systems may affect their long term viability in the market.

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 typically reduce the ventilation heat loss by 80-90% and the total heat loss by 30-60%, depending on the insulation level[26].

Rubber Fumes

It is estimated that a significant proportion of enterprises (54-100%) would require further action to comply with an EU-wide OEL of 0.6mg/m^3. Of the affected firms, 70% are thought to require ventilation systems. Given the upfront costs of ventilation systems, the affordability of ventilation systems may affect the long term viability of some SMEs in the market.

Similarly to rubber dust, 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.

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

4.3.2 Changes in end products

There are not expected to be any significant changes to the end products since control measures are not expected to change the characteristics of the products that rubber fumes and dust are used to manufacture.

4.4 ENVIRONMENTAL IMPACTS

The achievement of the OEL via the measures described in this report may lead to more direct emissions of rubber fumes and dust to the environment (through ventilation), but probably not to an increased overall environmental burden. Therefore it is assumed that an OEL would not increase the level of environmental harm. Having said this, a quantitative assessment of the amounts of rubber fumes and dust released into the environment as a result of the measures that would be put in place to achieve the OEL has not been done for the purposes of this study.

[26] "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.)

5 COMPARISON OF OPTIONS

The main impacts discussed in more detail in section 4 are summarised in the tables below, which are broken down by the main types of impacts (health, economic, social, macroeconomic and environmental).

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

Baseline Scenario		Intervention scenario	
Health Costs	**Health Benefits**	**Health Costs**	**Health Benefits**
Rubber Dust		Assumes full compliance for OEL = 6 mg/mg^3	
As set out in section 2.5, the health costs of cancer (leukaemia and cancers of the larynx and lung in relation to rubber dust) over the period 2010-70 are estimated to be: - Females: €129m to €129m - Males: €592m to €729m - Total: €721m to €857m 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).	It is estimated that exposures to rubber dust decline by between 0.7% and 7.4% per annum. Therefore there is expected to be some reduction in health costs going forward in the absence of further regulatory intervention.	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.	Health benefits of the possible OEL have been analysed at the Member State and industrial sector level. The results showed that the benefits of introducing an OEL in 2010 are most apparent to the manufacture of other rubber products sector. It was also found that the monetised benefits are likely to affect men more than women. The monetised benefits over 2010-2070 were estimated as: - Females: €4m to €9m - Males: €20m to €38m - Totals: €24m to €46m
Rubber Fumes		Assumes full compliance for OEL = 0.6 mg/mg^3	
As set out in section 2.5, the health costs of cancer (leukaemia and cancers of the larynx and lung in relation to rubber fumes) over the period 2010-70 are estimated to be: - Females: €553m to €675m - Males: €2.4bn to €3.3bn - Total: €3bn to €3.9bn	It is assumed that exposures to rubber fumes will fall by 3% per year in the future in the GRG sector and 0.9% per annum in tyre production. Therefore there is expected to be some	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.	Health benefits of the possible OEL have been analysed at the Member State and industrial sector level. The results showed that the benefits of introducing an OEL in 2010 are most apparent to the manufacture of other products sector. It was also found that the monetised benefits are likely to affect men more than women.

Baseline Scenario		Intervention scenario	
Health Costs	**Health Benefits**	**Health Costs**	**Health Benefits**
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).	reduction in health costs going forward in the absence of further regulatory intervention.		The monetised benefits over 2010-2070 were estimated as: - Females: €119m to 251m - Males: €460m to 956m - Totals: €579m to 1.2bn

Note: Costs and benefits under the intervention options are relative to the baseline scenario (i.e. are not absolute impacts but differences)

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

Baseline Scenario		Intervention scenario	
Economic Costs	**Economic Benefits**	**Economic Costs**	**Economic Benefits**
Rubber Dust		Assumes full compliance for OEL = 6 mg/mg^3	
There are expected to be costs to firms exposed to rubber dust to put into place improved training and cleaning measures to reduce inhalation exposure that would occur regardless of further intervention over the period 2010-2070.	-	There are expected to be economic costs related to changes to workplace practices in order to meet the possible OEL for the manufacture of rubber products industry. It is estimated that between 600 and 1,100 enterprises could require some form of additional control measure to meet the possible OEL. The remainder of enterprise are assumed to already be meeting the possible OEL under the baseline scenario and therefore would require no further action. It is assumed that the majority of those enterprises that do not currently comply would need to implement	Having an EU-wide OEL should remove any EU competitive distortions between EU Member States with different OEL limits.

Baseline Scenario		Intervention scenario	
Economic Costs	**Economic Benefits**	**Economic Costs**	**Economic Benefits**
		relatively low-cost measures to reduce exposure levels to meet this OEL. These costs (€0.5-2k per enterprise) are not considered to be significant. The remainder (20% of affected firms) may need to invest in new ventilation systems. The up-front capital cost of a ventilation system is estimated to be in the region of €42k - 252k per enterprise. The total costs of compliance over the period 2010-2069 (NPV) are estimated at between €55m to €275 m. There would also be administrative costs of implementing the OEL in national legislation and of demonstrating and verifying compliance.	
Rubber Fumes		Assumes full compliance for OEL = 0.6 mg/mg^3	
There are expected to be costs to firms exposed to rubber fumes to put into place improved training and cleaning measures to reduce inhalation exposure that would occur regardless of further intervention over the period 2010-2070.	-	There are expected to be economic costs related to changes to workplace practices in order to meet the possible OEL for the manufacture of rubber products industry. It is estimated that between 3,800 and 7,000 enterprises would require some form of additional control measure to meet the possible OEL. The remainder of enterprises are assumed to already be meeting the possible OEL under the baseline scenario and therefore would require no further action.	Having an EU-wide OEL should remove any EU competitive distortions between EU Member States with different OEL limits.

Baseline Scenario		Intervention scenario	
Economic Costs	**Economic Benefits**	**Economic Costs**	**Economic Benefits**
		It is assumed that the majority of those enterprises that do not currently (~70%) comply would need to invest in new ventilation systems. The up-front capital cost of a ventilation system is estimated to be in the region of €42k - 252k per enterprise. The total costs of compliance over the period 2010-2069 (NPV) are estimated at between €470m to €3.2bn. There would also be administrative costs of implementing the OEL in national legislation and of demonstrating and verifying compliance.	

Note: Costs and benefits under the intervention options are relative to the baseline scenario (i.e. are not absolute impacts but differences)

Table 5.3 Comparison of social impacts by scenario

Baseline Scenario		Intervention scenario	
Social Costs	**Social Benefits**	**Social Costs**	**Social Benefits**
Rubber Dust		Assumes full compliance for OEL = 6 mg/mg^3	
There are not expected to be any significant social impacts under the baseline scenario at an EU level.		It is estimated that only 9-16% of the firms might be affected by the introduction of an OEL at 6mg/m^3 and therefore the majority of the sector will not require further exposure control measures to meet the OEL. Therefore there is not expected to be any significant social and labour market impacts.	
Rubber Fumes		Assumes full compliance for OEL = 0.6 mg/mg^3	
There are not expected to be any significant social impacts under the baseline scenario at an EU level.		It is estimated that a significant proportion of enterprises (54-100%) would require further action to comply with an EU-wide OEL of 0.6mg/m^3. Of the affected firms, 70% are thought to require ventilation systems. Given the	

Baseline Scenario		Intervention scenario	
Social Costs	**Social Benefits**	**Social Costs**	**Social Benefits**
		upfront costs of ventilation systems, the affordability of ventilation systems may affect the long term viability of some SMEs in the market.	

Note: Costs and benefits under the intervention options are relative to the baseline scenario (i.e. are not absolute impacts but differences)

Table 5.4 Comparison of macro-economic impacts by scenario

Baseline Scenario		Intervention scenario	
Macro-economic Costs	**Macro-economic Benefits**	**Macro-economic Costs**	**Macro-economic Benefits**
Rubber Dust		Assumes full compliance for OEL = 6 mg/mg^3	
There are not expected to be any significant macroeconomic impacts under the baseline scenario.		There are not expected to be any significant macroeconomic impacts relative to the baseline scenario from introducing an EU-wide OEL.	
Rubber Fumes		Assumes full compliance for OEL = 0.6 mg/mg^3	
There are not expected to be any significant macroeconomic impacts under the baseline scenario.		There are not expected to be any significant macroeconomic impacts relative to the baseline scenario from introducing an EU-wide OEL.	

Note: Costs and benefits under the intervention options are relative to the baseline scenario (i.e. are not absolute impacts but differences)

Table 5.5 Comparison of environmental impacts by scenario

Baseline Scenario		Intervention scenario	
Environmental Costs	**Environmental Benefits**	**Environmental Costs**	**Environmental Benefits**
Rubber Dust		Assumes full compliance for OEL = 6 mg/mg^3	
There are not expected to be any significant changes in environmental impacts.		Minimal – it is expected that the imposition of measures would not cause additional environmental impacts.	It is not expected that the measures for human health would lead to any additional environmental benefit.
Rubber Fumes		Assumes full compliance for OEL = 0.6 mg/mg^3	
There are not expected to be any significant macroeconomic impacts under the baseline scenario.		Minimal – it is expected that the imposition of measures would not cause additional environmental impacts.	It is not expected that the measures for human health would lead to any additional environmental benefit.

Note: Costs and benefits under the intervention options are relative to the baseline scenario (i.e. are not absolute impacts but differences)

6 CONCLUSIONS

Airborne rubber dust and fume comprise complex mixtures of chemicals and in the absence of a clear understanding of the specific chemicals that may increase the risk of cancer these measures have been used as pragmatic markers of exposure as part of a strategy to control occupational cancer risks in the industry.

This report has considered the likely health, socioeconomic and environmental impacts associated with possible changes to the Carcinogens Directive, in particular the possible introduction of OELs of 6 mg/m^3 for rubber process dust and 0.6 mg/m^3 for rubber fume.

The use of rubber is widespread. Tyres and tubes are the largest consumers of rubber (56%) and the remaining 44% is taken up by the general rubber goods (GRG) sector. There are more about 8,000 companies involved in the European rubber industry, employing approximately 370,000 individuals. From data provide by the industry we have assumed that workers in mixing, component preparation and curing may be exposed to rubber fume. Exposure to rubber process dust occurs during mixing, but not during component preparation or curing. We have assumed that there may be up to 56,800 workers exposed to rubber dust and 172,300 to rubber fume – both figures represent the upper estimate of the likely range.

The GM exposure to rubber process dust across all countries was estimated to be 1.14 mg/m^3 with a GSD of 4.7 (14% exposed above 6 mg/m^3). The estimated GM exposure to rubber fume was 0.372 mg/m^3 with a GSD of 4.00 (37% above 0.6 mg/m^3). Exposure levels were estimated to have declined by between 0.7% and 7.4% per annum for process dust, depending on the country where the plants were located. For rubber fume an average decline of 3% per annum was estimated for the GRG sector and 0.9% per annum in tyre production.

Workers in the rubber industry may have increased risks from leukaemia and cancers of the larynx, lung and stomach (although we found no evidence for increased risks for stomach cancer in the data we have used). The identified risk estimates differed by cancer and sector within the industry. For tyre manufacture the RRs were: leukaemia 1.03; cancer of the larynx 1.01; lung cancer 1. The identified RRs for the GRG sector were: leukaemia 1.70; cancer of the larynx 1.19; lung cancer 1.05.

Health and economic impacts were estimated separately for rubber dust and rubber fume, but these data cannot be added together since the exposures are not independent and to do so may result in an overstatement of any benefits arising from the interventions. Deaths and registrations attributable to rubber process dust slowly decrease for all three types of cancer; for lung from 7 registrations in 2010 to 2 in 2060; from 3 registrations to 1 for larynx and from 7 to 4 registrations for leukaemia. The decrease is a consequence of the assumed decline in exposure up to 2020. The attributable fraction in 2010, i.e. the proportion of all cancers of that type in the exposed workers that has been attributed to the exposure, ranges from 0.0093% for laryngeal cancer to 0.012% for leukaemia; in 2060 the corresponding figures are 0.00244% to 0.005%. In 2010 the estimated DALYs were highest for laryngeal cancer (380 years) and lowest for leukaemia (68 years). By 2060 these estimates range form 131 DALYs for laryngeal cancer to 26 for lung cancer.

The attributable cancer deaths and registrations for rubber fume are higher than for rubber process dust, although as we noted above it is not possible to add these health impacts since the exposures are not independent. In 2010 the estimated number of registrations and deaths from lung cancer were 20 and 18, for larynx cancer 10 and 2 and for leukaemia 31 and 19. The corresponding data for the decade starting 2060 are 16 registrations and 16 deaths per annum, 8 and 2 per annum and 31 and 25 per annum, for lung, larynx and leukaemia, respectively. Estimated DALYs in 2010 were highest for cancer of the larynx (1,152 years) and lowest for leukaemia (292 years). By the decade starting 2060 the annual DALYs ranged from 866 years for larynx to 211 years for lung cancer.

Total estimated health costs associated with inaction for the period up to 2069 range from €721m to €859m for rubber process dust and from €2,961m to €3,930m for rubber fume. Note these estimates are not additive.

Further reduction in exposure to rubber dust and fume could be achieved by a combination of engineering, technical and operational control measures, coupled with appropriate training and instruction for workers.

Introducing an OEL of 6 mg/m^3 for rubber process dust has a small health impact; by 2060 there is only one cancer that is estimated to be avoided with this measure. The effect of introducing a limit of 0.6 mg/m^3 for rubber fume is larger with 47 cancers being avoided each year (15 lung, 6 larynx and 26 leukaemia). The total number of attributable cancer registrations and deaths estimated to arise with an OEL for rubber fume are: one registration and one death from lung cancer, two registrations and no deaths from laryngeal cancer and six registrations and five deaths from leukaemia. The monetised health benefits from introducing an OEL for rubber process dust is between €24m and €46m and between €579m and 1,207m for an OEL for rubber fume. Note these estimates are not additive.

Total compliance costs for the period from 2010 to 2069 are estimated to range from €55m to €275m for the rubber process dust OEL and from €466m to €3,212m for the rubber fume OEL. There are no significant social or macro-economic costs associated with introducing an OEL for rubber dust given that only 9-16% of the firms are thought to require any further compliance measures. It is estimated that a significant proportion of enterprises (54-100%) would require further action to comply with an EU-wide OEL of 0.6mg/m^3 for rubber fumes. Of the affected firms, 70% are thought to require ventilation systems. Given the upfront costs of ventilation systems, the affordability of ventilation systems may affect the long term viability of some SMEs in the market.

There are no significant environmental impacts foreseen from the introduction of an OEL for either rubber process dust or rubber fume.

The rubber manufacturing industry has an active programme to identify carcinogenic compounds in rubber dust and fume and to reduce or eliminate their presence in the mix. This was an effective approach to eliminate bladder carcinogens and it has continued to be applied. It has been difficult to judge whether introducing an OEL for rubber dust or fume would divert resource away from such activities, although this is a possibility.

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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 Rubber Fumes by Member State and NACE code – males and females

	ALL RUBBER INDUSTRY			INDUSTRY SUBGROUPS								
	NACE 25.1 Manufacture of rubber products			NACE 25.11 Manufacture of rubber tyres and tubes			NACE 25.12 Retreading and rebuilding of rubber tyres			NACE 25.13 Manufacture of other rubber products		
	Workers Exposed	Males Exposed	Females Exposed	Workers Exposed	Males Exposed	Females Exposed	Workers Exposed	Males Exposed	Females Exposed	Workers Exposed	Males Exposed	Females Exposed
Austria	1583	1283	301	205	166	39	65	53	12	1341	1087	255
Belgium	1632	1322	310	494	400	94	55	45	10	1084	878	206
Bulgaria	1739	904	835	377	196	181	74	38	35	1288	670	618
Cyprus	11	8	3	0	0	0	7	5	2	5	4	1
Czech Republic	10133	6587	3547	4168	2709	1459	523	340	183	6056	3936	2120
Denmark	694	507	187	38	27	10	38	28	10	619	452	167
Estonia	222	122	100	0	0	0	59	32	26	166	92	75
Finland	1399	1035	364	735	544	191	21	16	5	643	476	167
France	31435	24205	7230	16548	12742	3806	530	408	122	14358	11055	3302
Germany	34531	26589	7942	10683	8226	2457	633	487	146	23216	17876	5340
Greece	428	325	103	8	6	2	26	20	6	394	299	95
Hungary	4713	2969	1744	1668	1051	617	66	42	25	2979	1877	1102
Ireland	329	247	82	0	0	0	0	0	0	329	247	82
Italy	21457	16093	5364	5459	4094	1365	1134	850	283	14865	11149	3716
Latvia	138	80	58	0	0	0	27	16	11	110	64	46
Lithuania	158	82	76	11	6	5	40	21	19	110	57	53
Luxembourg	1794	1561	233	542	472	71	60	52	8	1191	1036	155
Netherlands	1532	1271	260	521	432	89	64	53	11	1011	839	172
Poland	15153	10152	5000	4440	2975	1465	361	242	119	10352	6936	3416
Portugal	2496	1473	1023	940	554	385	472	279	194	1025	605	420

	ALL RUBBER INDUSTRY			INDUSTRY SUBGROUPS								
	NACE 25.1			NACE 25.11			NACE 25.12			NACE 25.13		
	Manufacture of rubber products			Manufacture of rubber tyres and tubes			Retreading and rebuilding of rubber tyres			Manufacture of other rubber products		
	Workers Exposed	Males Exposed	Females Exposed	Workers Exposed	Males Exposed	Females Exposed	Workers Exposed	Males Exposed	Females Exposed	Workers Exposed	Males Exposed	Females Exposed
Romania	5978	3228	2750	2522	1362	1160	167	90	77	3289	1776	1513
Slovakia	3015	1930	1085	1529	979	551	111	71	40	1374	880	495
Slovenia	1668	1101	567	1143	754	389	75	49	25	477	315	162
Spain	13909	10849	3060	6931	5406	1525	590	460	130	6387	4982	1405
Sweden	2945	2297	648	22	17	5	215	168	47	2708	2112	596
United Kingdom	13161	10661	2501	3318	2688	630	531	430	101	9313	7543	1769
TOTAL	172255	119975	52280	62302	43670	18632	5944	4168	1776	104689	72598	32091

Table 8.1.2 Number of workers exposed to Rubber Dust by Member State and NACE code – males and females

	ALL RUBBER INDUSTRY			INDUSTRY SUBGROUPS					
	NACE 25.1 (All Rubber)			NACE 25.11			NACE 25.13		
	Manufacture of rubber products			Manufacture of rubber tyres and tubes			Manufacture of other rubber products		
	Workers Exposed	Males Exposed	Females Exposed	Workers Exposed	Males Exposed	Females Exposed	Workers Exposed	Males Exposed	Females Exposed
Austria	527	427	100	70	57	13	457	370	87
Belgium	537	435	102	168	136	32	369	299	70
Bulgaria	567	295	272	128	67	62	439	228	211
Cyprus	2	1	0	0	0	0	2	1	0
Czech Republic	3480	2262	1218	1419	922	497	2062	1340	722
Denmark	223	163	60	13	9	3	211	154	57
Estonia	57	31	25	0	0	0	57	31	25
Finland	469	347	122	250	185	65	219	162	57
France	10521	8101	2420	5633	4338	1296	4888	3764	1124
Germany	11540	8886	2654	3637	2800	836	7903	6085	1818
Greece	137	104	33	3	2	1	134	102	32

	ALL RUBBER INDUSTRY			INDUSTRY SUBGROUPS					
	NACE 25.1 (All Rubber)			NACE 25.11			NACE 25.13		
	Manufacture of rubber products			Manufacture of rubber tyres and tubes			Manufacture of other rubber products		
	Workers Exposed	Males Exposed	Females Exposed	Workers Exposed	Males Exposed	Females Exposed	Workers Exposed	Males Exposed	Females Exposed
Hungary	1582	997	585	568	358	210	1014	639	375
Ireland	112	84	28	0	0	0	112	84	28
Italy	6919	5189	1730	1858	1394	465	5060	3795	1265
Latvia	38	22	16	0	0	0	38	22	16
Lithuania	41	21	20	4	2	2	37	19	18
Luxembourg	590	513	77	185	161	24	406	353	53
Netherlands	521	433	89	177	147	30	344	286	59
Poland	5036	3374	1662	1512	1013	499	3524	2361	1163
Portugal	669	394	274	320	189	131	349	206	143
Romania	1978	1068	910	859	464	395	1120	605	515
Slovakia	988	633	356	521	333	187	468	299	168
Slovenia	552	364	188	389	257	132	162	107	55
Spain	4534	3536	997	2360	1840	519	2174	1696	478
Sweden	929	725	204	8	6	2	922	719	203
United Kingdom	4300	3483	817	1130	915	215	3170	2568	602
TOTAL	56848	41889	14959	21209	15594	5615	35639	26295	9344

8.2 ESTIMATED DEATHS AND REGISTRATIONS IN THE EU FROM RUBBER PROCESS FUMES AND DUST

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

Lung cancer deaths	*MEN*						*WOMEN*					
FTY	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Austria	2,615	3,243	3,834	4,345	4,566	4,599	1,116	1,275	1,443	1,592	1,685	1,667
Belgium	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	3,030	3,104	3,241	3,392	3,349	3,052	584	597	619	627	617	581
Cyprus	142	193	249	311	377	442	37	50	65	81	95	112
Czech Republic	4,595	5,593	6,455	7,261	7,837	7,829	1,563	1,770	2,000	2,179	2,252	2,297
Denmark	2,270	2,825	3,260	3,495	3,581	3,630	1,798	2,112	2,352	2,500	2,522	2,533
Estonia	592	646	728	821	908	951	152	164	170	180	187	181
Finland	1,634	2,100	2,536	2,698	2,735	2,833	585	685	777	814	809	807
France	24,088	28,386	32,593	35,424	37,040	38,467	6,620	7,415	8,256	8,937	9,185	9,281
Germany (including ex-GDR from 1991)	32,083	38,243	42,953	46,852	46,647	44,632	12,483	13,856	14,696	15,401	15,279	14,416
Greece	5,601	6,390	7,345	8,363	8,990	9,046	1,058	1,251	1,372	1,524	1,646	1,685
Hungary	5,881	6,430	7,170	7,875	8,334	8,359	2,408	2,527	2,714	2,770	2,782	2,753
Ireland	1,138	1,546	2,047	2,608	3,197	3,643	712	921	1,195	1,495	1,794	2,027
Italy	28,492	33,452	38,968	44,672	48,200	47,742	7,766	8,814	9,796	10,803	11,547	11,414
Latvia	993	1,058	1,183	1,313	1,438	1,456	218	228	236	253	262	260
Lithuania	1,341	1,491	1,709	1,921	2,072	2,097	264	283	309	340	348	346
Luxembourg	171	220	282	339	374	401	51	60	74	88	95	101
Malta	141	186	228	247	267	290	19	21	21	23	23	23
Netherlands	6,956	9,038	11,071	12,289	12,481	12,361	3,404	4,032	4,529	4,779	4,727	4,665
Poland	19,203	23,459	27,456	30,446	33,211	33,853	5,651	6,476	7,190	7,909	8,030	7,860

Lung cancer deaths	*MEN*						*WOMEN*					
FTY	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Portugal	3,015	3,489	4,044	4,563	4,913	5,029	669	769	868	966	1,034	1,060
Romania	8,085	8,897	10,049	11,126	11,365	10,717	1,913	2,076	2,308	2,492	2,596	2,559
Slovakia	1,903	2,412	2,963	3,400	3,764	3,811	432	502	601	701	733	764
Slovenia	915	1,132	1,362	1,497	1,532	1,505	278	313	349	375	375	366
Spain	19,434	23,870	29,553	35,388	39,157	39,480	2,908	3,463	4,005	4,483	4,847	4,963
Sweden	2,014	2,426	2,797	3,026	3,237	3,433	1,640	1,841	2,040	2,173	2,275	2,363
United Kingdom	21,240	25,303	29,857	33,713	37,057	39,950	15,114	16,982	19,549	22,039	23,820	25,266
European Union (27 countries)	203,597	241,403	280,580	313,714	332,361	338,025	69,242	78,269	87,743	95,724	99,434	99,401

Lung cancer registrations	*MEN*						*WOMEN*					
FTY	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
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

Lung cancer registrations FTY	*MEN* 2010	2020	2030	2040	2050	2060	*WOMEN* 2010	2020	2030	2040	2050	2060
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
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

Laryngeal cancer deaths FTY	*MEN* 2010	2020	2030	2040	2050	2060	*WOMEN* 2010	2020	2030	2040	2050	2060
Austria	83	103	122	138	145	146	13	15	17	19	20	20
Belgium	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	96	99	103	108	106	97	7	7	7	7	7	7
Cyprus	5	6	8	10	12	14	0	1	1	1	1	1
Czech	146	178	205	231	249	249	18	21	23	26	26	27

Laryngeal cancer deaths FTY	*MEN* 2010	2020	2030	2040	2050	2060	*WOMEN* 2010	2020	2030	2040	2050	2060
Republic												
Denmark	72	90	104	111	114	115	21	25	28	29	30	30
Estonia	19	21	23	26	29	30	2	2	2	2	2	2
Finland	52	67	81	86	87	90	7	8	9	10	9	9
France	765	902	1,035	1,125	1,177	1,222	77	87	97	105	108	109
Germany (including ex-GDR from 1991)	1,019	1,215	1,364	1,488	1,482	1,418	146	162	172	180	179	169
Greece	178	203	233	266	286	287	12	15	16	18	19	20
Hungary	187	204	228	250	265	266	28	30	32	32	33	32
Ireland	36	49	65	83	102	116	8	11	14	17	21	24
Italy	905	1,063	1,238	1,419	1,531	1,517	91	103	115	126	135	134
Latvia	32	34	38	42	46	46	3	3	3	3	3	3
Lithuania	43	47	54	61	66	67	3	3	4	4	4	4
Luxembourg	5	7	9	11	12	13	1	1	1	1	1	1
Malta	4	6	7	8	8	9	0	0	0	0	0	0
Netherlands	221	287	352	390	396	393	40	47	53	56	55	55
Poland	610	745	872	967	1,055	1,075	66	76	84	93	94	92
Portugal	96	111	128	145	156	160	8	9	10	11	12	12
Romania	257	283	319	353	361	340	22	24	27	29	30	30
Slovakia	60	77	94	108	120	121	5	6	7	8	9	9
Slovenia	29	36	43	48	49	48	3	4	4	4	4	4
Spain	617	758	939	1,124	1,244	1,254	34	41	47	52	57	58
Sweden	64	77	89	96	103	109	19	22	24	25	27	28
United Kingdom	675	804	948	1,071	1,177	1,269	177	199	229	258	279	296
European Union (27 countries)	6,468	7,669	8,913	9,966	10,558	10,738	811	916	1,027	1,121	1,164	1,164

Laryngeal cancer registrations FTY	*MEN* 2010	2020	2030	2040	2050	2060	*WOMEN* 2010	2020	2030	2040	2050	2060
Austria	482	576	648	690	710	708	65	75	81	82	84	82
Belgium	904	1,034	1,132	1,198	1,234	1,262	135	149	159	167	171	172
Bulgaria	411	410	427	433	406	381	14	14	14	14	13	13
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	563	626	706	753	740	713	46	53	58	60	60	61
Denmark	256	299	328	337	341	351	57	62	66	67	68	69
Estonia	77	82	88	96	97	96	6	6	6	6	6	6
Finland	117	140	151	154	156	158	14	17	19	19	19	19
France	5,389	6,098	6,656	6,917	7,151	7,381	370	411	441	455	462	466
Germany (including ex-GDR from 1991)	4,016	4,602	4,909	4,973	4,869	4,613	665	723	742	741	725	681
Greece	610	692	784	860	885	865	98	110	120	130	135	132
Hungary	910	951	1,043	1,104	1,094	1,073	84	86	90	90	86	84
Ireland	115	150	190	231	259	276	27	35	43	52	55	58
Italy	5,586	6,438	7,216	7,664	7,747	7,615	360	399	432	453	455	441
Latvia	99	107	116	127	134	128	7	7	8	8	8	8
Lithuania	236	261	284	313	322	309	12	13	13	14	14	13
Luxembourg	34	43	50	56	61	65	5	6	6	7	8	9
Malta	21	25	27	29	31	31	4	4	4	4	4	4
Netherlands	753	920	1,031	1,064	1,062	1,066	122	137	143	145	146	143
Poland	3,656	4,092	4,481	5,005	4,999	4,727	424	458	494	530	513	481
Portugal	854	974	1,102	1,186	1,224	1,234	61	69	78	85	90	90
Romania	1,243	1,344	1,511	1,611	1,585	1,492	97	104	113	121	123	117
Slovakia	332	382	438	482	480	457	21	24	25	28	28	25
Slovenia	136	161	181	191	187	177	16	17	18	18	17	16
Spain	4,482	5,551	6,646	7,286	7,390	7,266	174	209	240	253	255	254
Sweden	174	201	222	236	249	259	38	41	45	48	50	51

Laryngeal cancer registrations FTY	*MEN*						*WOMEN*					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
United Kingdom	2,289	2,635	2,931	3,185	3,412	3,633	464	519	576	622	665	693
European Union (27 countries)	33,279	38,197	42,289	44,918	45,799	45,501	3,368	3,742	4,046	4,238	4,269	4,196

Leukaemia deaths FTY	*MEN*						*WOMEN*					
	2010	**2020**	**2030**	**2040**	**2050**	**2060**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Austria	349	439	540	651	728	730	298	334	398	475	535	532
Belgium	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	162	164	175	186	193	191	108	112	116	117	119	114
Cyprus	24	33	44	55	68	81	16	22	29	36	44	51
Czech Republic	382	481	602	684	777	854	318	378	451	495	537	588
Denmark	249	317	389	428	457	459	176	207	257	287	310	314
Estonia	44	50	57	68	77	87	50	52	56	60	62	64
Finland	231	302	382	412	418	436	200	239	294	325	325	324
France	2,886	3,486	4,329	5,037	5,455	5,711	2,313	2,651	3,148	3,724	3,987	4,035
Germany (including ex-GDR from 1991)	3,692	4,615	5,278	6,106	6,377	6,060	3,103	3,541	3,894	4,403	4,673	4,375
Greece	473	551	631	753	868	923	366	456	503	586	667	708
Hungary	345	391	447	507	569	619	307	339	371	397	418	441
Ireland	177	242	328	424	534	645	114	146	194	249	309	374
Italy	3,069	3,670	4,288	5,003	5,662	5,747	2,558	2,930	3,294	3,757	4,214	4,258
Latvia	69	72	79	87	94	99	64	65	67	72	72	75
Lithuania	94	104	119	139	155	163	105	114	123	141	148	149
Luxembourg	19	24	32	39	45	48	18	21	27	34	40	43
Malta	16	22	28	32	34	38	7	9	11	12	13	13
Netherlands	682	887	1,128	1,281	1,338	1,315	525	626	787	916	981	955
Poland	1,187	1,456	1,788	2,070	2,264	2,484	993	1,167	1,383	1,566	1,628	1,727

Leukaemia deaths FTY	MEN						WOMEN					
	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060
Portugal	372	434	511	601	680	727	304	357	408	468	521	547
Romania	483	531	600	678	741	754	355	381	420	456	483	486
Slovakia	158	199	251	298	338	365	129	153	189	217	237	254
Slovenia	85	116	148	186	204	216	80	94	109	129	138	139
Spain	1,665	2,011	2,487	3,125	3,736	4,003	1,336	1,568	1,868	2,294	2,710	2,904
Sweden	431	525	637	697	760	812	344	390	464	509	547	580
United Kingdom	2,733	3,269	3,913	4,453	4,974	5,327	2,062	2,294	2,718	3,147	3,543	3,757
European Union (27 countries)	20,327	24,615	29,433	34,330	38,022	39,604	16,633	19,103	22,109	25,529	27,949	28,707

Leukaemia registrations FTY	MEN						WOMEN					
	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060
Austria	560	660	762	829	853	858	425	471	530	576	589	585
Belgium	847	978	1,111	1,200	1,238	1,279	586	651	722	775	797	810
Bulgaria	265	269	281	292	297	289	205	207	210	210	204	192
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	698	837	942	1,038	1,109	1,105	481	557	608	647	677	681
Denmark	492	582	639	670	672	690	327	373	411	430	434	440
Estonia	63	67	74	81	88	93	70	73	76	78	78	78
Finland	222	270	295	299	303	310	187	221	241	245	243	244
France	4,818	5,662	6,346	6,793	7,020	7,272	3,739	4,264	4,707	5,009	5,092	5,134
Germany (including ex-GDR from 1991)	6,296	7,107	7,865	8,166	7,982	7,653	5,054	5,424	5,835	6,006	5,869	5,586
Greece	829	934	1,060	1,193	1,263	1,236	584	652	714	775	804	782
Hungary	656	733	802	894	989	1,017	562	607	636	665	692	693
Ireland	240	316	400	491	585	629	142	181	228	274	324	351

Leukaemia registrations	*MEN*						*WOMEN*					
FTY	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Italy	5,132	5,826	6,598	7,324	7,498	7,348	3,549	3,927	4,334	4,733	4,825	4,673
Latvia	149	158	180	202	221	235	165	167	178	185	192	195
Lithuania	206	226	258	287	309	316	209	220	243	258	260	261
Luxembourg	43	54	66	75	81	87	28	35	42	48	53	57
Malta	23	28	30	32	34	34	22	26	29	31	32	33
Netherlands	884	1,083	1,229	1,292	1,275	1,280	626	724	806	844	838	828
Poland	1,582	1,890	2,181	2,345	2,547	2,616	1,289	1,500	1,709	1,790	1,874	1,891
Portugal	611	693	789	878	938	948	489	548	606	654	677	673
Romania	698	745	817	902	949	938	545	578	620	664	677	658
Slovakia	276	346	416	474	530	542	204	236	267	292	305	299
Slovenia	110	134	154	166	169	161	86	96	107	113	114	110
Spain	2,679	3,209	3,874	4,520	4,853	4,745	2,067	2,425	2,834	3,202	3,394	3,340
Sweden	626	729	802	860	896	950	429	477	522	555	577	600
United Kingdom	4,231	4,910	5,550	6,082	6,467	7,000	2,939	3,289	3,718	4,105	4,342	4,624
European Union (27 countries)	33,068	38,259	43,388	47,343	49,194	49,568	24,892	27,858	30,891	33,221	34,075	33,880

8.3 SUPPLEMENTARY TABLES - COSTS UNDER THE BASELINE SCENARIO

8.3.1 Rubber dust

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	€ 1.2	€ 6.7	€ 7.9	Austria	€ 1.2	€ 8.4	€ 9.6
Belgium	€ 0.1	€ 0.5	€ 0.6	Belgium	€ 2.3	€ 18.6	€ 20.9
Bulgaria	€ 1.1	€ 3.5	€ 4.6	Bulgaria	€ 0.9	€ 2.8	€ 3.8
Czech Republic	€ 6.7	€ 21.4	€ 28.0	Czech Republic	€ 5.2	€ 21.7	€ 26.9
Cyprus	€ 0.0	€ 0.0	€ 0.0	Cyprus	€ 0.0	€ 0.0	€ 0.0
Denmark	€ 1.8	€ 3.5	€ 5.3	Denmark	€ 1.4	€ 4.6	€ 6.0
Estonia	€ 0.5	€ 1.1	€ 1.6	Estonia	€ 0.8	€ 1.5	€ 2.4
Finland	€ 0.5	€ 1.9	€ 2.3	Finland	€ 0.3	€ 1.5	€ 1.9
France	€ 18.1	€ 111.4	€ 129.5	France	€ 18.4	€ 125.4	€ 143.9
Germany	€ 22.2	€ 106.5	€ 128.6	Germany	€ 20.9	€ 114.2	€ 135.1
Greece	€ 0.3	€ 3.0	€ 3.4	Greece	€ 0.6	€ 3.4	€ 3.9
Hungary	€ 5.7	€ 14.2	€ 19.9	Hungary	€ 3.9	€ 13.7	€ 17.6
Ireland	€ 0.8	€ 2.3	€ 3.2	Ireland	€ 0.8	€ 3.3	€ 4.2
Italy	€ 20.9	€ 110.9	€ 131.8	Italy	€ 27.2	€ 161.2	€ 188.4
Latvia	€ 0.2	€ 0.6	€ 0.8	Latvia	€ 0.4	€ 0.9	€ 1.3
Lithuania	€ 0.1	€ 0.4	€ 0.5	Lithuania	€ 0.2	€ 0.5	€ 0.7
Luxembourg	€ 1.1	€ 11.3	€ 12.4	Luxembourg	€ 1.9	€ 20.7	€ 22.6
Malta	€ 0.0	€ 0.0	€ 0.0	Malta	€ 0.0	€ 0.0	€ 0.0
Netherlands	€ 2.0	€ 10.3	€ 12.3	Netherlands	€ 1.6	€ 13.1	€ 14.7
Poland	€ 12.7	€ 49.2	€ 61.9	Poland	€ 8.7	€ 49.1	€ 57.8
Portugal	€ 1.1	€ 3.7	€ 4.8	Portugal	€ 1.7	€ 4.8	€ 6.5
Romania	€ 2.9	€ 8.9	€ 11.8	Romania	€ 2.1	€ 7.0	€ 9.1
Slovakia	€ 0.9	€ 4.0	€ 4.9	Slovakia	€ 0.9	€ 4.5	€ 5.3
Slovenia	€ 0.6	€ 1.9	€ 2.5	Slovenia	€ 0.4	€ 1.6	€ 2.0
Spain	€ 3.6	€ 32.7	€ 36.3	Spain	€ 5.6	€ 40.7	€ 46.3
Sweden	€ 4.8	€ 12.2	€ 16.9	Sweden	€ 4.5	€ 18.2	€ 22.7
United Kingdom	€ 19.1	€ 69.8	€ 88.8	United Kingdom	€ 16.4	€ 87.2	€ 103.6
TOTAL	€ 128.7	€ 591.9	€ 720.7	**TOTAL**	€ 128.6	€ 728.5	€ 857.1

Table 8.3.2 Health costs – baseline scenario – Member State breakdown - Based on a declining discount rate

Low	Female	Male	Total	High	Female	Male	Total
Austria	€ 1.3	€ 7.8	€ 9.1	Austria	€ 1.4	€ 9.7	€ 11.1
Belgium	€ 0.1	€ 0.6	€ 0.7	Belgium	€ 2.9	€ 23.2	€ 26.1
Bulgaria	€ 1.2	€ 3.9	€ 5.2	Bulgaria	€ 1.0	€ 3.2	€ 4.2
Czech Republic	€ 7.4	€ 23.7	€ 31.1	Czech Republic	€ 5.8	€ 24.0	€ 29.9
Cyprus	€ 0.0	€ 0.0	€ 0.0	Cyprus	€ 0.0	€ 0.0	€ 0.0
Denmark	€ 2.1	€ 4.1	€ 6.1	Denmark	€ 1.7	€ 5.3	€ 7.0
Estonia	€ 0.6	€ 1.4	€ 2.0	Estonia	€ 1.0	€ 2.0	€ 3.0

Low	Female	Male	Total	High	Female	Male	Total
Finland	€ 0.5	€ 2.1	€ 2.6	Finland	€ 0.4	€ 1.7	€ 2.1
France	€ 20.8	€ 127.7	€ 148.5	France	€ 21.4	€ 144.4	€ 165.7
Germany	€ 24.9	€ 120.4	€ 145.3	Germany	€ 23.5	€ 128.9	€ 152.4
Greece	€ 0.4	€ 3.6	€ 4.0	Greece	€ 0.6	€ 3.9	€ 4.6
Hungary	€ 6.3	€ 15.7	€ 22.0	Hungary	€ 4.3	€ 15.2	€ 19.5
Ireland	€ 1.1	€ 3.0	€ 4.1	Ireland	€ 1.1	€ 4.3	€ 5.4
Italy	€ 25.1	€ 133.7	€ 158.7	Italy	€ 32.8	€ 194.5	€ 227.4
Latvia	€ 0.2	€ 0.8	€ 1.0	Latvia	€ 0.5	€ 1.0	€ 1.5
Lithuania	€ 0.1	€ 0.4	€ 0.6	Lithuania	€ 0.2	€ 0.5	€ 0.8
Luxembourg	€ 1.3	€ 14.2	€ 15.5	Luxembourg	€ 2.3	€ 26.1	€ 28.4
Malta	€ 0.0	€ 0.0	€ 0.0	Malta	€ 0.0	€ 0.0	€ 0.0
Netherlands	€ 2.5	€ 12.9	€ 15.4	Netherlands	€ 2.0	€ 16.5	€ 18.6
Poland	€ 14.1	€ 55.0	€ 69.1	Poland	€ 9.7	€ 54.7	€ 64.4
Portugal	€ 1.3	€ 4.4	€ 5.7	Portugal	€ 2.1	€ 5.6	€ 7.7
Romania	€ 3.2	€ 9.8	€ 13.1	Romania	€ 2.4	€ 7.7	€ 10.1
Slovakia	€ 1.0	€ 4.5	€ 5.5	Slovakia	€ 1.0	€ 5.0	€ 6.0
Slovenia	€ 0.6	€ 2.2	€ 2.8	Slovenia	€ 0.5	€ 1.8	€ 2.3
Spain	€ 4.5	€ 41.1	€ 45.6	Spain	€ 7.0	€ 51.1	€ 58.1
Sweden	€ 5.7	€ 14.7	€ 20.5	Sweden	€ 5.4	€ 21.8	€ 27.2
United Kingdom	€ 21.9	€ 80.3	€ 102.1	United Kingdom	€ 18.9	€ 100.4	€ 119.3
TOTAL	€ 148.2	€ 688.1	€ 836.3	**TOTAL**	€ 150.0	€ 852.6	€ 1,002.6

Table 8.3.3 Summary

Costs by Gender (€m)	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
Female	47 to 47	34 to 31	28 to 26	18 to 18	13 to 15	9 to 13
Male	200 to 247	154 to 183	134 to 159	92 to 112	63 to 85	46 to 68
Total	247 to 293	188 to 214	161 to 184	110 to 130	76 to 100	55 to 81

Table 8.3.4 Health costs – baseline scenario – Member State breakdown - Based on a no discounting

Low	Female	Male	Total	High	Female	Male	Total
Austria	€ 2.9	€ 16.9	€ 19.8	Austria	€ 3.0	€ 21.0	€ 24.0
Belgium	€ 0.2	€ 1.7	€ 1.9	Belgium	€ 7.7	€ 62.6	€ 70.3
Bulgaria	€ 2.3	€ 7.7	€ 10.0	Bulgaria	€ 2.0	€ 6.1	€ 8.1
Czech Republic	€ 14.3	€ 46.3	€ 60.6	Czech Republic	€ 11.9	€ 47.1	€ 58.9
Cyprus	€ 0.0	€ 0.1	€ 0.1	Cyprus	€ 0.0	€ 0.0	€ 0.0
Denmark	€ 4.5	€ 9.1	€ 13.6	Denmark	€ 3.7	€ 11.7	€ 15.3
Estonia	€ 1.6	€ 4.1	€ 5.7	Estonia	€ 2.9	€ 5.6	€ 8.5
Finland	€ 1.0	€ 4.2	€ 5.2	Finland	€ 0.8	€ 3.4	€ 4.2
France	€ 44.7	€ 273.8	€ 318.6	France	€ 47.7	€ 314.2	€ 361.9
Germany	€ 50.1	€ 246.0	€ 296.1	Germany	€ 48.2	€ 263.3	€ 311.5
Greece	€ 0.9	€ 8.3	€ 9.2	Greece	€ 1.5	€ 9.1	€ 10.5

Low	Female	Male	Total	High	Female	Male	Total
Hungary	€ 11.9	€ 30.2	€ 42.1	Hungary	€ 8.4	€ 29.2	€ 37.6
Ireland	€ 3.0	€ 8.6	€ 11.6	Ireland	€ 3.1	€ 12.5	€ 15.6
Italy	€ 60.9	€ 326.0	€ 387.0	Italy	€ 81.5	€ 478.7	€ 560.1
Latvia	€ 0.5	€ 2.0	€ 2.5	Latvia	€ 1.2	€ 2.7	€ 3.9
Lithuania	€ 0.3	€ 0.9	€ 1.2	Lithuania	€ 0.5	€ 1.2	€ 1.6
Luxembourg	€ 3.5	€ 38.0	€ 41.6	Luxembourg	€ 6.4	€ 70.7	€ 77.0
Malta	€ 0.0	€ 0.0	€ 0.0	Malta	€ 0.0	€ 0.0	€ 0.0
Netherlands	€ 6.5	€ 34.8	€ 41.3	Netherlands	€ 5.5	€ 44.8	€ 50.3
Poland	€ 27.4	€ 108.8	€ 136.2	Poland	€ 19.4	€ 106.9	€ 126.3
Portugal	€ 3.1	€ 10.0	€ 13.1	Portugal	€ 4.9	€ 13.2	€ 18.2
Romania	€ 6.2	€ 18.9	€ 25.1	Romania	€ 4.9	€ 14.8	€ 19.7
Slovakia	€ 2.0	€ 8.9	€ 11.0	Slovakia	€ 2.2	€ 10.2	€ 12.4
Slovenia	€ 1.3	€ 4.5	€ 5.8	Slovenia	€ 1.1	€ 3.8	€ 4.9
Spain	€ 11.9	€ 110.8	€ 122.6	Spain	€ 18.8	€ 137.5	€ 156.3
Sweden	€ 13.8	€ 36.2	€ 50.0	Sweden	€ 13.1	€ 53.2	€ 66.2
United Kingdom	€ 46.8	€ 173.1	€ 219.9	United Kingdom	€ 41.2	€ 219.1	€ 260.2
TOTAL	€ 322.0	€ 1,529.9	€ 1,851.9	**TOTAL**	€ 341.3	€ 1,942.4	€ 2,283.6

Table 8.3.5 Summary

Costs by Gender (€m)	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
Female	57 to 57	61 to 57	58 to 54	51 to 51	48 to 57	48 to 66
Male	243 to 300	277 to 329	280 to 332	258 to 315	238 to 322	234 to 345
Total	300 to 357	338 to 385	338 to 386	309 to 366	286 to 379	281 to 411

8.3.2 Rubber fumes

Table 8.3.6 Health costs – baseline scenario – Member State breakdown - Based on a 4% discount rate

Low	Female	Male	Total	High	Female	Male	Total
Austria	€ 5.4	€ 30.1	€ 35.5	Austria	€ 7.2	€ 44.6	€ 51.8
Belgium	€ 0.1	€ 1.2	€ 1.4	Belgium	€ 5.4	€ 45.0	€ 50.4
Bulgaria	€ 6.0	€ 17.7	€ 23.7	Bulgaria	€ 7.9	€ 17.9	€ 25.8
Czech Republic	€ 39.0	€ 118.8	€ 157.8	Czech Republic	€ 47.8	€ 160.0	€ 207.8
Cyprus	€ 0.0	€ 0.0	€ 0.1	Cyprus	€ 0.0	€ 0.0	€ 0.0
Denmark	€ 7.1	€ 14.4	€ 21.5	Denmark	€ 7.2	€ 22.8	€ 30.0
Estonia	€ 1.1	€ 2.8	€ 3.9	Estonia	€ 1.8	€ 3.6	€ 5.3
Finland	€ 2.6	€ 10.3	€ 12.8	Finland	€ 2.8	€ 10.5	€ 13.2
France	€ 65.7	€ 391.4	€ 457.1	France	€ 77.2	€ 477.4	€ 554.6
Germany	€ 113.6	€ 527.7	€ 641.3	Germany	€ 154.6	€ 722.2	€ 876.8
Greece	€ 1.4	€ 11.8	€ 13.2	Greece	€ 2.8	€ 15.2	€ 18.0
Hungary	€ 31.1	€ 75.8	€ 106.9	Hungary	€ 32.7	€ 94.0	€ 126.7
Ireland	€ 2.4	€ 6.9	€ 9.3	Ireland	€ 2.5	€ 9.8	€ 12.3

Low	Female	Male	Total	High	Female	Male	Total
Italy	€ 73.5	€ 380.2	€ 453.7	Italy	€ 103.8	€ 582.0	€ 685.8
Latvia	€ 0.6	€ 2.0	€ 2.6	Latvia	€ 1.5	€ 2.9	€ 4.4
Lithuania	€ 0.6	€ 1.7	€ 2.3	Lithuania	€ 1.4	€ 2.5	€ 3.9
Luxembourg	€ 2.6	€ 28.5	€ 31.1	Luxembourg	€ 4.3	€ 49.6	€ 53.9
Malta	€ 0.0	€ 0.0	€ 0.0	Malta	€ 0.0	€ 0.0	€ 0.0
Netherlands	€ 5.0	€ 25.9	€ 30.9	Netherlands	€ 3.8	€ 31.4	€ 35.2
Poland	€ 72.1	€ 267.6	€ 339.7	Poland	€ 72.6	€ 316.0	€ 388.6
Portugal	€ 4.2	€ 13.1	€ 17.2	Portugal	€ 7.1	€ 17.8	€ 24.9
Romania	€ 17.1	€ 48.0	€ 65.1	Romania	€ 19.0	€ 46.4	€ 65.4
Slovakia	€ 5.7	€ 22.8	€ 28.5	Slovakia	€ 8.3	€ 32.7	€ 41.0
Slovenia	€ 3.1	€ 10.1	€ 13.2	Slovenia	€ 3.1	€ 10.6	€ 13.7
Spain	€ 14.7	€ 127.1	€ 141.9	Spain	€ 25.7	€ 170.3	€ 195.9
Sweden	€ 16.0	€ 41.7	€ 57.8	Sweden	€ 16.9	€ 67.5	€ 84.3
United Kingdom	€ 62.6	€ 230.3	€ 292.9	United Kingdom	€ 57.4	€ 302.4	€ 359.8
TOTAL	€ 553.3	€ 2,408.1	€ 2,961.5	**TOTAL**	€ 674.6	€ 3,255.0	€ 3,929.6

Table 8.3.7 Health costs – baseline scenario – Member State breakdown - Based on a declining discount rate

Low	Female	Male	Total	High	Female	Male	Total
Austria	€ 6.6	€ 37.4	€ 44.1	Austria	€ 9.0	€ 55.7	€ 64.6
Belgium	€ 0.2	€ 1.5	€ 1.7	Belgium	€ 6.6	€ 55.2	€ 61.8
Bulgaria	€ 7.3	€ 21.7	€ 29.0	Bulgaria	€ 9.8	€ 22.1	€ 31.9
Czech Republic	€ 47.6	€ 145.8	€ 193.5	Czech Republic	€ 59.1	€ 198.1	€ 257.2
Cyprus	€ 0.0	€ 0.1	€ 0.1	Cyprus	€ 0.0	€ 0.0	€ 0.0
Denmark	€ 8.8	€ 17.9	€ 26.6	Denmark	€ 9.0	€ 28.4	€ 37.4
Estonia	€ 1.4	€ 3.5	€ 4.8	Estonia	€ 2.2	€ 4.5	€ 6.7
Finland	€ 3.1	€ 12.5	€ 15.6	Finland	€ 3.4	€ 12.7	€ 16.1
France	€ 77.6	€ 462.2	€ 539.9	France	€ 92.2	€ 567.2	€ 659.4
Germany	€ 138.6	€ 648.5	€ 787.1	Germany	€ 190.5	€ 892.6	€ 1,083.0
Greece	€ 1.8	€ 14.8	€ 16.6	Greece	€ 3.6	€ 19.2	€ 22.8
Hungary	€ 37.7	€ 92.8	€ 130.5	Hungary	€ 40.2	€ 116.3	€ 156.6
Ireland	€ 3.1	€ 8.8	€ 12.0	Ireland	€ 3.2	€ 12.6	€ 15.9
Italy	€ 90.5	€ 469.4	€ 559.9	Italy	€ 128.5	€ 720.5	€ 849.0
Latvia	€ 0.7	€ 2.5	€ 3.3	Latvia	€ 1.9	€ 3.7	€ 5.6
Lithuania	€ 0.7	€ 2.1	€ 2.8	Lithuania	€ 1.7	€ 3.2	€ 4.9
Luxembourg	€ 3.2	€ 35.0	€ 38.2	Luxembourg	€ 5.3	€ 61.0	€ 66.4
Malta	€ 0.0	€ 0.0	€ 0.0	Malta	€ 0.0	€ 0.0	€ 0.0
Netherlands	€ 6.1	€ 31.7	€ 37.8	Netherlands	€ 4.6	€ 38.7	€ 43.3
Poland	€ 88.6	€ 332.3	€ 420.9	Poland	€ 90.7	€ 395.3	€ 486.0
Portugal	€ 5.1	€ 15.8	€ 20.8	Portugal	€ 8.6	€ 21.7	€ 30.3
Romania	€ 20.8	€ 58.5	€ 79.3	Romania	€ 23.5	€ 57.2	€ 80.7
Slovakia	€ 6.9	€ 28.1	€ 35.0	Slovakia	€ 10.3	€ 40.7	€ 51.1
Slovenia	€ 3.7	€ 12.3	€ 16.0	Slovenia	€ 3.8	€ 13.0	€ 16.8
Spain	€ 18.9	€ 165.5	€ 184.4	Spain	€ 32.9	€ 221.1	€ 254.0
Sweden	€ 19.9	€ 52.0	€ 71.9	Sweden	€ 21.0	€ 84.2	€ 105.2

Low	Female	Male	Total	High	Female	Male	Total
United Kingdom	€ 73.2	€ 270.3	€ 343.5	United Kingdom	€ 67.6	€ 356.3	€ 423.9
TOTAL	€ 672.2	€ 2,942.9	€ 3,615.1	**TOTAL**	€ 829.2	€ 4,001.2	€ 4,830.4

Table 8.3.8 Summary

Costs by Gender (€m)	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
Female	153 to 181	126 to 146	126 to 148	105 to 128	88 to 118	74 to 108
Male	632 to 846	541 to 713	563 to 742	478 to 639	398 to 565	331 to 496
Total	785 to 1027	666 to 859	689 to 890	583 to 767	486 to 683	406 to 603

Table 8.3.9 Health costs – baseline scenario – Member State breakdown - Based on a no discounting

Low	Female	Male	Total	High	Female	Male	Total
Austria	€ 17.3	€ 98.5	€ 115.8	Austria	€ 23.8	€ 148.6	€ 172.3
Belgium	€ 0.5	€ 3.9	€ 4.4	Belgium	€ 16.9	€ 141.5	€ 158.4
Bulgaria	€ 18.4	€ 55.0	€ 73.5	Bulgaria	€ 25.8	€ 58.0	€ 83.8
Czech Republic	€ 120.4	€ 372.6	€ 493.0	Czech Republic	€ 155.4	€ 520.2	€ 675.7
Cyprus	€ 0.0	€ 0.1	€ 0.2	Cyprus	€ 0.0	€ 0.0	€ 0.0
Denmark	€ 22.8	€ 46.9	€ 69.7	Denmark	€ 23.8	€ 75.3	€ 99.1
Estonia	€ 3.6	€ 9.1	€ 12.6	Estonia	€ 5.8	€ 12.0	€ 17.7
Finland	€ 7.7	€ 31.1	€ 38.8	Finland	€ 8.5	€ 32.0	€ 40.4
France	€ 181.4	€ 1,076.3	€ 1,257.7	France	€ 222.9	€ 1,345.8	€ 1,568.8
Germany	€ 350.9	€ 1,662.8	€ 2,013.7	Germany	€ 495.5	€ 2,328.8	€ 2,824.3
Greece	€ 4.8	€ 39.8	€ 44.7	Greece	€ 9.8	€ 52.8	€ 62.6
Hungary	€ 93.6	€ 235.4	€ 329.0	Hungary	€ 104.9	€ 305.3	€ 410.2
Ireland	€ 8.8	€ 25.3	€ 34.1	Ireland	€ 9.2	€ 36.6	€ 45.8
Italy	€ 234.0	€ 1,217.1	€ 1,451.1	Italy	€ 338.8	€ 1,887.5	€ 2,226.2
Latvia	€ 1.9	€ 6.7	€ 8.7	Latvia	€ 5.2	€ 10.2	€ 15.4
Lithuania	€ 1.9	€ 5.5	€ 7.3	Lithuania	€ 4.7	€ 8.7	€ 13.4
Luxembourg	€ 8.2	€ 89.4	€ 97.5	Luxembourg	€ 13.8	€ 157.8	€ 171.6
Malta	€ 0.0	€ 0.0	€ 0.0	Malta	€ 0.0	€ 0.0	€ 0.0
Netherlands	€ 15.2	€ 81.0	€ 96.2	Netherlands	€ 11.9	€ 99.7	€ 111.6
Poland	€ 227.9	€ 874.0	€ 1,101.9	Poland	€ 244.6	€ 1,061.0	€ 1,305.7
Portugal	€ 12.6	€ 38.8	€ 51.4	Portugal	€ 21.9	€ 54.9	€ 76.8
Romania	€ 51.9	€ 146.4	€ 198.2	Romania	€ 61.8	€ 148.3	€ 210.0
Slovakia	€ 17.7	€ 72.2	€ 89.9	Slovakia	€ 27.4	€ 108.8	€ 136.2
Slovenia	€ 9.0	€ 30.5	€ 39.5	Slovenia	€ 9.6	€ 32.8	€ 42.5
Spain	€ 54.1	€ 480.5	€ 534.6	Spain	€ 93.8	€ 641.4	€ 735.2
Sweden	€ 52.1	€ 138.4	€ 190.5	Sweden	€ 55.6	€ 225.5	€ 281.2
United Kingdom	€ 166.0	€ 617.3	€ 783.3	United Kingdom	€ 157.2	€ 827.7	€ 985.0
TOTAL	€ 1,682.8	€ 7,454.6	€ 9,137.4	**TOTAL**	€ 2,148.8	€ 10,321.2	€ 12,470.0

Table 8.3.10 Summary

Costs by Gender (€m)	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
Female	186 to 220	226 to 263	264 to 310	296 to 360	333 to 448	377 to 548
Male	769 to 1030	974 to 1284	1179 to 1554	1344 to 1799	1505 to 2137	1684 to 2518
Total	956 to 1250	1200 to 1547	1443 to 1864	1640 to 2159	1838 to 2584	2061 to 3066

8.4 VALUING HEALTH BENEFITS – INTERVENTION SCENARIOS

8.4.1 Rubber process dust

Table 8.4.1 Proportions exposed to rubber process dust above the exposure limits being tested by country, forecast scenario

Forecast Scenario *OEL*	1971-80 *6 mg/m^3*	1981-90	1991-00	2001-10	2011-20	2021-30
Austria	0.77	0.60	0.40	0.23	0.11	0.04
Belgium	0.03	0.02	0.02	0.02	0.01	0.01
Bulgaria	0.94	0.84	0.65	0.42	0.21	0.08
Cyprus	0.94	0.84	0.65	0.42	0.21	0.08
Czech Republic	0.94	0.84	0.65	0.42	0.21	0.08
Denmark	0.46	0.27	0.12	0.05	0.01	0.00
Estonia	0.94	0.84	0.65	0.42	0.21	0.08
Finland	0.46	0.27	0.12	0.05	0.01	0.00
France	0.19	0.12	0.08	0.05	0.03	0.01
Germany	0.77	0.60	0.40	0.23	0.11	0.04
Greece	0.94	0.84	0.65	0.42	0.21	0.08
Hungary	0.94	0.84	0.65	0.42	0.21	0.08
Ireland	0.19	0.12	0.08	0.05	0.03	0.01
Italy	0.19	0.12	0.08	0.05	0.03	0.01
Latvia	0.94	0.84	0.65	0.42	0.21	0.08
Lithuania	0.94	0.84	0.65	0.42	0.21	0.08
Luxembourg	0.03	0.02	0.02	0.02	0.01	0.01
Malta	0.94	0.84	0.65	0.42	0.21	0.08
Netherlands	0.03	0.02	0.02	0.02	0.01	0.01
Poland	0.94	0.84	0.65	0.42	0.21	0.08
Portugal	0.19	0.12	0.08	0.05	0.03	0.01
Romania	0.94	0.84	0.65	0.42	0.21	0.08
Slovakia	0.94	0.84	0.65	0.42	0.21	0.08
Slovenia	0.94	0.84	0.65	0.42	0.21	0.08
Spain	0.19	0.12	0.08	0.05	0.03	0.01
Sweden	0.46	0.27	0.12	0.05	0.01	0.00

Forecast Scenario *OEL*	1971-80 *6 mg/m^3*	1981-90	1991-00	2001-10	2011-20	2021-30
United Kingdom	0.19	0.12	0.08	0.05	0.03	0.01
TOTAL	0.54	0.41	0.28	0.182	0.11	0.06

Table 8.4.2 Numbers and proportions of the population ever exposed to rubber process dust for baseline and intervention[1] scenario (2) for lung and laryngeal cancers, by country, men plus women

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***	***2030***	***2040***	***2050***	***2060***
	Number ever exposed in the REP									
Austria	12,383	12,687	13,047	13,047	13,047	13,047	13,047	13,047	13,047	13,047
Belgium	12,627	12,937	13,305	13,305	13,305	13,305	13,305	13,305	13,305	13,305
Bulgaria	15,421	15,801	16,252	16,252	16,252	16,252	16,252	16,252	16,252	16,252
Cyprus	39	40	41	41	41	41	41	41	41	41
Czech Republic	88,928	91,117	93,711	93,711	93,711	93,711	93,711	93,711	93,711	93,711
Denmark	5,480	5,614	5,774	5,774	5,774	5,774	5,774	5,774	5,774	5,774
Estonia	1,519	1,557	1,601	1,601	1,601	1,601	1,601	1,601	1,601	1,601
Finland	11,450	11,731	12,064	12,064	12,064	12,064	12,064	12,064	12,064	12,064
France	306,538	293,744	279,904	267,110	253,271	247,064	279,904	267,110	253,271	247,064
Germany	277,245	284,052	292,126	292,126	292,126	292,126	292,126	292,126	292,126	292,126
Greece	3,300	3,381	3,477	3,477	3,477	3,477	3,477	3,477	3,477	3,477
Hungary	40,821	41,826	43,017	43,017	43,017	43,017	43,017	43,017	43,017	43,017
Ireland	2,723	2,790	2,869	2,869	2,869	2,869	2,869	2,869	2,869	2,869
Italy	167,982	172,108	177,001	177,001	177,001	177,001	177,001	177,001	177,001	177,001
Latvia	998	1,023	1,052	1,052	1,052	1,052	1,052	1,052	1,052	1,052
Lithuania	1,119	1,146	1,179	1,179	1,179	1,179	1,179	1,179	1,179	1,179
Luxembourg	13,427	13,755	14,146	14,146	14,146	14,146	14,146	14,146	14,146	14,146
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	12,130	12,427	12,780	12,780	12,780	12,780	12,780	12,780	12,780	12,780

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***	***2030***	***2040***	***2050***	***2060***
Poland	127,380	130,514	134,229	134,229	134,229	134,229	134,229	134,229	134,229	134,229
Portugal	17,594	18,028	18,541	18,541	18,541	18,541	18,541	18,541	18,541	18,541
Romania	53,311	54,627	56,184	56,184	56,184	56,184	56,184	56,184	56,184	56,184
Slovakia	25,382	26,007	26,747	26,747	26,747	26,747	26,747	26,747	26,747	26,747
Slovenia	14,022	14,367	14,776	14,776	14,776	14,776	14,776	14,776	14,776	14,776
Spain	62,520	79,043	101,876	124,710	141,894	153,522	101,876	124,710	141,894	153,522
Sweden	22,208	22,753	23,400	23,400	23,400	23,400	23,400	23,400	23,400	23,400
United Kingdom	149,304	136,362	117,996	99,326	85,887	77,521	117,996	99,326	85,887	77,521
TOTAL	1,445,850	1,459,438	1,477,097	1,468,466	1,458,371	1,455,428	1,477,097	1,468,466	1,458,371	1,455,428

Scenario	*All Scenarios*		*Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.*				*Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3*			
Country	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***	***2030***	***2040***	***2050***	***2060***
	Proportion of the population exposed (%)									
Austria	0.20	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Belgium	0.16	0.16	0.16	0.15	0.15	0.15	0.16	0.15	0.15	0.15
Bulgaria	0.27	0.29	0.31	0.33	0.35	0.38	0.31	0.33	0.35	0.38
Cyprus	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Czech Republic	1.16	1.14	1.17	1.18	1.20	1.26	1.17	1.18	1.20	1.26
Denmark	0.14	0.14	0.14	0.14	0.14	0.13	0.14	0.14	0.14	0.13
Estonia	0.16	0.16	0.17	0.17	0.18	0.19	0.17	0.17	0.18	0.19
Finland	0.30	0.29	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
France	0.71	0.64	0.58	0.54	0.50	0.48	0.58	0.54	0.50	0.48
Germany	0.45	0.45	0.47	0.48	0.50	0.53	0.47	0.48	0.50	0.53
Greece	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Hungary	0.56	0.56	0.59	0.60	0.61	0.63	0.59	0.60	0.61	0.63
Ireland	0.09	0.08	0.07	0.07	0.06	0.06	0.07	0.07	0.06	0.06
Italy	0.37	0.36	0.37	0.36	0.37	0.38	0.37	0.36	0.37	0.38
Latvia	0.06	0.06	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.08
Lithuania	0.05	0.05	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.06
Luxembourg	3.88	3.53	3.26	3.00	2.81	2.66	3.26	3.00	2.81	2.66
Malta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Netherlands	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Poland	0.47	0.46	0.47	0.48	0.50	0.54	0.47	0.48	0.50	0.54
Portugal	0.22	0.22	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
Romania	0.35	0.35	0.37	0.37	0.39	0.42	0.37	0.37	0.39	0.42

Scenario	*All Scenarios*		*Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.*				*Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3*			
Country	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***	***2030***	***2040***	***2050***	***2060***
Slovakia	0.67	0.64	0.65	0.66	0.68	0.73	0.65	0.66	0.68	0.73
Slovenia	0.93	0.91	0.95	0.96	1.00	1.07	0.95	0.96	1.00	1.07
Spain	0.18	0.21	0.26	0.30	0.34	0.38	0.26	0.30	0.34	0.38
Sweden	0.34	0.32	0.32	0.31	0.30	0.30	0.32	0.31	0.30	0.30
United Kingdom	0.35	0.29	0.24	0.19	0.16	0.14	0.24	0.19	0.16	0.14
TOTAL	0.40	0.38	0.38	0.37	0.37	0.38	0.38	0.37	0.37	0.38

Table 8.4.3 Numbers and proportions of the population ever exposed to rubber process dust for baseline and intervention[1] scenario (2) for leukaemia, by country, men plus women

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Number ever exposed in the REP									
Austria	9,134	9,134	9,134	9,134	9,134	9,134	9,134	9,134	9,134	9,134
Belgium	9,314	9,314	9,314	9,314	9,314	9,314	9,314	9,314	9,314	9,314
Bulgaria	10,899	10,899	10,899	10,899	10,899	10,899	10,899	10,899	10,899	10,899
Cyprus	28	28	28	28	28	28	28	28	28	28
Czech Republic	63,981	63,981	63,981	63,981	63,981	63,981	63,981	63,981	63,981	63,981
Denmark	3,990	3,990	3,990	3,990	3,990	3,990	3,990	3,990	3,990	3,990
Estonia	1,078	1,078	1,078	1,078	1,078	1,078	1,078	1,078	1,078	1,078
Finland	8,350	8,350	8,350	8,350	8,350	8,350	8,350	8,350	8,350	8,350
France	197,106	185,225	178,583	166,702	166,702	166,702	178,583	166,702	166,702	166,702

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Germany	203,159	203,159	203,159	203,159	203,159	203,159	203,159	203,159	203,159	203,159
Greece	2,414	2,414	2,414	2,414	2,414	2,414	2,414	2,414	2,414	2,414
Hungary	29,285	29,285	29,285	29,285	29,285	29,285	29,285	29,285	29,285	29,285
Ireland	1,989	1,989	1,989	1,989	1,989	1,989	1,989	1,989	1,989	1,989
Italy	122,701	122,701	122,701	122,701	122,701	122,701	122,701	122,701	122,701	122,701
Latvia	711	711	711	711	711	711	711	711	711	711
Lithuania	791	791	791	791	791	791	791	791	791	791
Luxembourg	10,006	10,006	10,006	10,006	10,006	10,006	10,006	10,006	10,006	10,006
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	8,977	8,977	8,977	8,977	8,977	8,977	8,977	8,977	8,977	8,977
Poland	91,914	91,914	91,914	91,914	91,914	91,914	91,914	91,914	91,914	91,914
Portugal	12,552	12,552	12,552	12,552	12,552	12,552	12,552	12,552	12,552	12,552
Romania	37,776	37,776	37,776	37,776	37,776	37,776	37,776	37,776	37,776	37,776
Slovakia	18,235	18,235	18,235	18,235	18,235	18,235	18,235	18,235	18,235	18,235
Slovenia	10,103	10,103	10,103	10,103	10,103	10,103	10,103	10,103	10,103	10,103
Spain	69,316	85,222	101,127	111,336	111,336	111,336	101,127	111,336	111,336	111,336
Sweden	16,300	16,300	16,300	16,300	16,300	16,300	16,300	16,300	16,300	16,300
United Kingdom	84,180	69,263	57,007	52,209	52,209	52,209	57,007	52,209	52,209	52,209
TOTAL	1,024,290	1,013,398	1,010,405	1,003,935	1,003,935	1,003,935	1,010,405	1,003,935	1,003,935	1,003,935

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Proportion of the population exposed (%)									
Austria	0.14	0.13	0.13	0.13	0.13	0.14	0.13	0.13	0.13	0.14
Belgium	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Bulgaria	0.17	0.19	0.20	0.22	0.24	0.26	0.20	0.22	0.24	0.26
Cyprus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Czech Republic	0.75	0.75	0.76	0.79	0.83	0.90	0.76	0.79	0.83	0.90
Denmark	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Estonia	0.10	0.11	0.11	0.11	0.12	0.13	0.11	0.11	0.12	0.13
Finland	0.20	0.20	0.20	0.20	0.21	0.21	0.20	0.20	0.21	0.21
France	0.41	0.37	0.35	0.32	0.32	0.32	0.35	0.32	0.32	0.32
Germany	0.30	0.31	0.32	0.34	0.37	0.39	0.32	0.34	0.37	0.39
Greece	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Hungary	0.36	0.37	0.38	0.40	0.41	0.45	0.38	0.40	0.41	0.45
Ireland	0.06	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Italy	0.26	0.25	0.25	0.25	0.27	0.28	0.25	0.25	0.27	0.28
Latvia	0.04	0.04	0.04	0.05	0.05	0.06	0.04	0.05	0.05	0.06
Lithuania	0.03	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.04	0.04
Luxembourg	2.59	2.31	2.11	1.99	1.91	1.82	2.11	1.99	1.91	1.82
Malta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Netherlands	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Poland	0.30	0.30	0.31	0.33	0.35	0.39	0.31	0.33	0.35	0.39
Portugal	0.15	0.14	0.14	0.14	0.14	0.15	0.14	0.14	0.14	0.15
Romania	0.22	0.22	0.23	0.24	0.26	0.30	0.23	0.24	0.26	0.30

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060
Slovakia	0.41	0.41	0.42	0.44	0.47	0.53	0.42	0.44	0.47	0.53
Slovenia	0.60	0.61	0.62	0.66	0.71	0.77	0.62	0.66	0.71	0.77
Spain	0.19	0.21	0.24	0.26	0.28	0.30	0.24	0.26	0.28	0.30
Sweden	0.22	0.21	0.21	0.21	0.21	0.20	0.21	0.21	0.21	0.20
United Kingdom	0.17	0.14	0.11	0.10	0.09	0.09	0.11	0.10	0.09	0.09
TOTAL	0.26	0.25	0.25	0.25	0.26	0.27	0.25	0.25	0.26	0.27

Table 8.4.4 Results for baseline, forecast and intervention [(1)] scenario (2) for rubber process dust for lung cancer, by country, men plus women

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Fraction									
Austria	0.002%	0.001%	0.001%	0.001%	0.000%	0.000%	0.001%	0.001%	0.000%	0.000%
Belgium	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%
Bulgaria	0.001%	0.001%	0.001%	0.000%	0.000%	0.000%	0.001%	0.000%	0.000%	0.000%
Cyprus	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Czech Republic	0.005%	0.004%	0.002%	0.001%	0.000%	0.000%	0.002%	0.001%	0.000%	0.000%
Denmark	0.001%	0.001%	0.001%	0.001%	0.000%	0.000%	0.001%	0.001%	0.000%	0.000%
Estonia	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%
Finland	0.001%	0.001%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
France	0.003%	0.002%	0.002%	0.001%	0.001%	0.000%	0.002%	0.001%	0.001%	0.000%

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Germany	0.003%	0.002%	0.002%	0.001%	0.000%	0.000%	0.002%	0.001%	0.000%	0.000%
Greece	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Hungary	0.003%	0.002%	0.001%	0.001%	0.000%	0.000%	0.001%	0.001%	0.000%	0.000%
Ireland	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%
Italy	0.002%	0.002%	0.002%	0.002%	0.001%	0.001%	0.002%	0.001%	0.001%	0.001%
Latvia	0.000%	0.000%	0.001%	0.000%	0.000%	0.000%	0.001%	0.000%	0.000%	0.000%
Lithuania	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Luxembourg	0.028%	0.025%	0.023%	0.020%	0.018%	0.017%	0.023%	0.020%	0.018%	0.016%
Malta	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Netherlands	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%
Poland	0.003%	0.002%	0.001%	0.001%	0.000%	0.000%	0.001%	0.001%	0.000%	0.000%
Portugal	0.001%	0.001%	0.001%	0.000%	0.000%	0.000%	0.001%	0.000%	0.000%	0.000%
Romania	0.001%	0.001%	0.001%	0.000%	0.000%	0.000%	0.001%	0.000%	0.000%	0.000%
Slovakia	0.002%	0.002%	0.001%	0.000%	0.000%	0.000%	0.001%	0.000%	0.000%	0.000%
Slovenia	0.002%	0.001%	0.001%	0.000%	0.000%	0.000%	0.001%	0.000%	0.000%	0.000%
Spain	0.001%	0.001%	0.001%	0.001%	0.000%	0.000%	0.001%	0.001%	0.000%	0.000%
Sweden	0.003%	0.003%	0.002%	0.002%	0.002%	0.001%	0.002%	0.002%	0.002%	0.001%
United Kingdom	0.002%	0.002%	0.001%	0.001%	0.001%	0.000%	0.001%	0.001%	0.000%	0.000%
TOTAL	0.002%	0.002%	0.001%	0.001%	0.001%	0.000%	0.001%	0.001%	0.000%	0.000%

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Deaths									
Austria	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	0	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	1	1	1	1	0	0	1	0	0	0
Germany	1	1	1	1	0	0	1	1	0	0
Greece	0	0	0	0	0	0	0	0	0	0
Hungary	0	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0
Italy	1	1	1	1	1	1	1	1	1	0
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0
Poland	1	1	0	0	0	0	0	0	0	0
Portugal	0	0	0	0	0	0	0	0	0	0
Romania	0	0	0	0	0	0	0	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Slovakia	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	0	0	0	0	0	0	0	0	0	0
Sweden	0	0	0	0	0	0	0	0	0	0
United Kingdom	1	1	1	0	0	0	1	0	0	0
TOTAL	6	6	5	4	3	2	5	4	2	1

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Registrations									
Austria	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	0	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	1	1	1	1	0	0	1	0	0	0
Germany	1	1	1	1	0	0	1	1	0	0
Greece	0	0	0	0	0	0	0	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Hungary	0	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0
Italy	1	1	1	1	1	1	1	1	1	0
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0
Poland	1	1	0	0	0	0	0	0	0	0
Portugal	0	0	0	0	0	0	0	0	0	0
Romania	0	0	0	0	0	0	0	0	0	0
Slovakia	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	0	0	0	0	0	0	0	0	0	0
Sweden	0	0	0	0	0	0	0	0	0	0
United Kingdom	1	1	1	1	0	0	1	1	0	0
TOTAL	7	6	5	4	3	2	5	4	2	1

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lost (YLLs)									
Austria	1	1	1	1	0	0	1	1	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	1	1	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	5	4	2	1	0	0	2	1	0	0
Denmark	1	1	1	0	0	0	1	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	18	16	11	8	5	3	11	7	4	2
Germany	19	17	13	7	4	2	13	7	2	0
Greece	0	0	0	0	0	0	0	0	0	0
Hungary	3	3	2	1	0	0	2	1	0	0
Ireland	0	0	0	0	0	0	0	0	0	0
Italy	13	14	13	11	9	7	13	11	7	5
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	1	1	1	1	1	1	1	1	1	1
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	1	1	1	1	1	1	1	1	1	1
Poland	10	9	6	3	1	0	6	3	1	0
Portugal	1	1	0	0	0	0	0	0	0	0
Romania	2	2	1	0	0	0	1	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Slovakia	1	1	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	3	3	4	4	3	2	4	3	2	2
Sweden	1	2	2	1	1	1	2	1	1	1
United Kingdom	12	11	9	6	4	3	9	6	4	2
TOTAL	95	89	72	52	35	24	72	49	28	18

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lived with Disability (DALYs)									
Austria	1	1	1	1	0	0	1	1	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	1	1	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	5	4	3	1	0	0	3	1	0	0
Denmark	1	1	1	0	0	0	1	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	18	16	12	8	5	4	12	8	4	2
Germany	19	18	13	8	4	2	13	7	2	0
Greece	0	0	0	0	0	0	0	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Hungary	4	3	2	1	0	0	2	1	0	0
Ireland	0	0	0	0	0	0	0	0	0	0
Italy	14	14	14	12	9	7	14	11	8	6
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	1	1	1	1	1	1	1	1	1	1
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	1	1	1	1	1	1	1	1	1	1
Poland	11	9	6	3	1	0	6	3	1	0
Portugal	1	1	0	0	0	0	0	0	0	0
Romania	2	2	1	0	0	0	1	0	0	0
Slovakia	1	1	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	3	3	4	4	3	2	4	3	2	2
Sweden	2	2	2	2	1	1	2	2	1	1
United Kingdom	13	12	9	7	4	3	9	6	4	2
TOTAL	99	93	75	54	36	26	75	51	30	19

Table 8.4.5 Results for baseline, forecast and intervention [1] scenarios (2) for rubber process dust for laryngeal cancer, by country, men plus women

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Fraction									
Austria	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Belgium	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bulgaria	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cyprus	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Czech Republic	0.02%	0.02%	0.01%	0.01%	0.00%	0.00%	0.01%	0.01%	0.00%	0.00%
Denmark	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Estonia	0.00%	0.00%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%
Finland	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
France	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.01%	0.01%	0.00%	0.00%
Germany	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
Greece	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hungary	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
Ireland	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Italy	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.01%	0.01%	0.00%	0.00%
Latvia	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Lithuania	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Luxembourg	0.12%	0.11%	0.10%	0.09%	0.08%	0.07%	0.10%	0.09%	0.08%	0.07%
Malta	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Netherlands	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Poland	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Portugal	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Romania	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slovakia	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slovenia	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Spain	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sweden	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
UNITED KINGDOM	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
TOTAL	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Deaths									
Austria	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	0	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	0	0	0	0	0	0	0	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Germany	0	0	0	0	0	0	0	0	0	0
Greece	0	0	0	0	0	0	0	0	0	0
Hungary	0	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0
Italy	0	0	0	0	0	0	0	0	0	0
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0
Poland	0	0	0	0	0	0	0	0	0	0
Portugal	0	0	0	0	0	0	0	0	0	0
Romania	0	0	0	0	0	0	0	0	0	0
Slovakia	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	0	0	0	0	0	0	0	0	0	0
Sweden	0	0	0	0	0	0	0	0	0	0
United Kingdom	0	0	0	0	0	0	0	0	0	0
TOTAL	1	1	1	0	0	0	1	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Registrations									
Austria	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	0	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	1	1	1	0	0	0	1	0	0	0
Germany	1	1	0	0	0	0	0	0	0	0
Greece	0	0	0	0	0	0	0	0	0	0
Hungary	0	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0
Italy	1	1	1	1	0	0	1	1	0	0
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0
Poland	0	0	0	0	0	0	0	0	0	0
Portugal	0	0	0	0	0	0	0	0	0	0
Romania	0	0	0	0	0	0	0	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Slovakia	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	0	0	0	0	0	0	0	0	0	0
Sweden	0	0	0	0	0	0	0	0	0	0
United Kingdom	0	0	0	0	0	0	0	0	0	0
TOTAL	3	3	3	2	2	1	3	2	1	1

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lost (YLLs)									
Austria	4	4	3	2	2	1	3	2	1	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	3	3	2	1	1	0	2	1	1	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	19	16	11	6	4	3	11	6	3	2
Denmark	2	3	2	2	1	1	2	2	1	1
Estonia	0	0	1	1	1	1	1	1	1	1
Finland	1	1	1	1	0	0	1	1	0	0
France	72	64	49	36	25	19	49	34	21	15
Germany	72	69	53	34	20	13	53	33	16	8
Greece	1	2	2	1	1	1	2	1	1	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Hungary	14	11	8	5	3	2	8	4	2	1
Ireland	1	1	1	1	1	1	1	1	1	1
Italy	50	53	52	46	38	31	52	44	32	24
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	4	4	5	5	4	4	5	5	4	4
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	4	4	5	5	5	4	5	5	4	4
Poland	39	35	26	16	9	6	26	15	8	5
Portugal	2	2	2	1	1	1	2	1	1	1
Romania	8	7	5	3	2	1	5	3	1	1
Slovakia	3	3	2	1	1	1	2	1	1	1
Slovenia	2	1	1	1	0	0	1	1	0	0
Spain	10	13	16	16	15	13	16	15	12	10
Sweden	6	6	6	6	5	4	6	6	5	4
United Kingdom	46	43	35	25	17	12	35	24	15	10
TOTAL	372	355	298	225	165	128	298	216	142	103

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
					Attributable Years of Life Lived with Disability (DALYs)					
Austria	4	4	3	3	2	1	3	2	1	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	3	3	2	1	1	0	2	1	1	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	19	16	11	6	4	3	11	6	3	2
Denmark	2	3	2	2	1	1	2	2	1	1
Estonia	0	0	1	1	1	1	1	1	1	1
Finland	1	1	1	1	0	0	1	1	0	0
France	73	66	50	37	26	20	50	35	22	15
Germany	74	70	54	35	21	14	54	33	16	8
Greece	1	2	2	1	1	1	2	1	1	0
Hungary	14	12	8	5	3	2	8	4	2	1
Ireland	1	1	1	1	1	1	1	1	1	1
Italy	52	54	54	47	39	32	54	45	33	25
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	4	4	5	5	5	4	5	5	4	4
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	4	5	5	5	5	5	5	5	4	4
Poland	40	36	26	16	9	6	26	16	8	5
Portugal	2	2	2	2	1	1	2	1	1	1
Romania	8	7	5	3	2	1	5	3	1	1

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Slovakia	3	3	2	1	1	1	2	1	1	1
Slovenia	2	1	1	1	0	0	1	1	0	0
Spain	11	13	16	17	15	14	16	16	13	11
Sweden	6	6	6	6	5	4	6	6	5	4
United Kingdom	47	43	35	26	17	13	35	25	15	10
TOTAL	380	362	304	230	168	131	304	220	144	106

Table 8.4.6 Results for baseline, forecast and intervention (1) scenarios (2) for rubber process dust for leukaemia, by country, men plus women

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Fraction									
Austria	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Belgium	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Bulgaria	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cyprus	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Czech Republic	0.02%	0.01%	0.01%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%
Denmark	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Estonia	0.01%	0.01%	0.01%	0.01%	0.01%	0.02%	0.01%	0.01%	0.01%	0.01%
Finland	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
France	0.02%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Germany	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Greece	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hungary	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ireland	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Italy	0.02%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Latvia	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Lithuania	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Luxembourg	0.22%	0.19%	0.17%	0.16%	0.15%	0.14%	0.16%	0.15%	0.14%	0.13%
Malta	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Netherlands	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.01%	0.01%	0.01%
Poland	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Portugal	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Romania	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slovakia	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slovenia	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Spain	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sweden	0.03%	0.02%	0.02%	0.01%	0.01%	0.01%	0.02%	0.02%	0.02%	0.02%
United Kingdom	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
TOTAL	0.01%	0.01%	0.01%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Deaths									
Austria	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	0	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	1	1	1	0	0	1	0	0	0	0
Germany	1	1	0	0	0	0	0	0	0	0
Greece	0	0	0	0	0	0	0	0	0	0
Hungary	0	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0
Italy	1	1	1	1	1	1	1	1	1	1
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0
Poland	0	0	0	0	0	0	0	0	0	0
Portugal	0	0	0	0	0	0	0	0	0	0
Romania	0	0	0	0	0	0	0	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Slovakia	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	0	0	0	0	0	0	0	0	0	0
Sweden	0	0	0	0	0	0	0	0	0	0
United Kingdom	1	0	0	0	0	0	0	0	0	0
TOTAL	4	4	3	3	3	3	2	3	3	3

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Registrations									
Austria	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	0	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	1	1	1	1	1	1	1	1	1	1
Germany	1	1	1	0	0	0	0	0	0	0
Greece	0	0	0	0	0	0	0	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Hungary	0	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0
Italy	2	1	1	1	1	1	1	1	1	1
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0
Poland	0	0	0	0	0	0	0	0	0	0
Portugal	0	0	0	0	0	0	0	0	0	0
Romania	0	0	0	0	0	0	0	0	0	0
Slovakia	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	0	0	0	0	0	0	0	0	0	0
Sweden	0	0	0	0	0	0	0	0	0	0
United Kingdom	1	1	1	0	0	0	0	0	0	0
TOTAL	7	6	5	4	4	4	3	3	4	4

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lost (YLLs)									
Austria	1	1	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	2	1	1	1	1	1	0	1	1	1
Denmark	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	12	9	7	5	6	6	5	5	5	5
Germany	12	8	5	4	4	4	2	3	3	3
Greece	0	0	0	0	0	0	0	0	0	0
Hungary	1	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	1	1	0	0	1	1
Italy	14	13	11	10	11	11	8	9	10	10
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	1	1	1	1	1	1	1	1	1	1
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	1	1	1	1	1	1	1	1	1	1
Poland	3	2	1	1	1	1	1	1	1	1
Portugal	1	1	0	0	0	0	0	0	0	0
Romania	1	0	0	0	0	0	0	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Slovakia	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	3	3	3	3	4	4	2	3	3	3
Sweden	3	3	2	2	2	2	2	2	2	2
United Kingdom	9	7	5	3	4	4	3	3	3	3
TOTAL	62	49	39	33	36	37	27	29	32	33

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lived with Disability (DALYs)									
Austria	1	1	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	2	1	1	1	1	1	1	1	1	1
Denmark	1	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	13	10	8	6	6	6	5	5	5	6
Germany	13	9	5	4	4	4	3	3	3	3
Greece	0	0	0	0	0	0	0	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Hungary	1	1	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	1	1	0	0	1	1
Italy	15	14	12	11	12	12	8	9	10	11
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	1	1	1	1	2	2	1	1	1	2
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	1	1	1	1	1	1	1	1	1	1
Poland	3	2	1	1	1	1	1	1	1	1
Portugal	1	1	0	0	0	0	0	0	0	0
Romania	1	0	0	0	0	0	0	0	0	0
Slovakia	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	3	3	3	3	4	4	2	3	3	4
Sweden	3	3	2	2	2	2	2	2	3	3
United Kingdom	10	7	5	4	4	4	3	3	3	4
TOTAL	68	53	43	36	39	41	30	32	35	37

[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 8.4.7 Numbers and proportions of the EU population ever exposed to rubber process dust for lung and laryngeal cancer, by industry, men plus women

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Number ever exposed in the REP									
Manufacture of rubber tyres and tubes	85,843	86,762	88,107	88,128	87,808	87,893	88,107	88,128	87,808	87,893
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	145,493	146,749	148,229	146,827	145,532	144,976	148,229	146,827	145,532	144,976
'Background' exposed = Workers Not Exposed	1,214,514	1,225,928	1,240,762	1,233,512	1,225,032	1,222,559	1,240,762	1,233,512	1,225,032	1,222,559

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Proportion of the population exposed (%)									
Manufacture of rubber tyres and tubes	0.024	0.023	0.023	0.022	0.022	0.023	0.023	0.022	0.022	0.023
Retreading and rebuilding of rubber tyres	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Manufacture of other rubber products	0.040	0.039	0.038	0.037	0.037	0.038	0.038	0.037	0.037	0.038
'Background' exposed = Workers Not Exposed	0.336	0.322	0.319	0.313	0.313	0.318	0.319	0.313	0.313	0.318

Table 8.4.8 Numbers and proportions of the EU population ever exposed to rubber process dust for leukaemia, by industry, men plus women

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Number ever exposed in the REP									
Manufacture of rubber tyres and tubes	61,078	60,757	60,997	60,628	60,628	60,628	60,997	60,628	60,628	60,628
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	102,809	101,387	100,668	100,002	100,002	100,002	100,668	100,002	100,002	100,002
'Background' exposed = Workers Not Exposed	860,403	851,254	848,740	843,305	843,305	843,305	848,740	843,305	843,305	843,305

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Proportion of the population exposed									
Manufacture of rubber tyres and tubes	0.015%	0.015%	0.015%	0.015%	0.016%	0.016%	0.015%	0.015%	0.016%	0.016%
Retreading and rebuilding of rubber tyres	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Manufacture of other rubber products	0.026%	0.025%	0.025%	0.025%	0.026%	0.027%	0.025%	0.025%	0.026%	0.027%
'Background' exposed = Workers Not Exposed	0.216%	0.210%	0.208%	0.210%	0.218%	0.226%	0.208%	0.210%	0.218%	0.226%

Table 8.4.9 Occupation attributable fractions, deaths, registrations, YLLs and DALYs for exposure to rubber process dust for lung cancer by industry, men plus women

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Fraction									
Manufacture of rubber tyres and tubes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Retreading and rebuilding of rubber tyres	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Manufacture of other rubber products	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
'Background' exposed = Workers Not Exposed	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Deaths									
Manufacture of rubber tyres and tubes	0	0	0	0	0	0	0	0	0	0
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	6	6	5	4	3	2	5	4	2	1
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Registrations									
Manufacture of rubber tyres and tubes	0	0	0	0	0	0	0	0	0	0
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	7	6	5	4	3	2	5	4	2	1
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lost (YLLs)									
Manufacture of rubber tyres and tubes	0	0	0	0	0	0	0	0	0	0
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	95	89	72	52	35	24	72	49	28	18
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lived with Disability (DALYs)									
Manufacture of rubber tyres and tubes	0	0	0	0	0	0	0	0	0	0
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	99	93	75	54	36	26	75	51	30	19
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Table 8.4.10 Occupation attributable fractions, deaths, registrations, YLLs and DALYs for exposure to rubber process dust for laryngeal cancer by industry, men plus women

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Fraction									
Manufacture of rubber tyres and tubes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Retreading and rebuilding of rubber tyres	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Manufacture of other rubber products	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
'Background' exposed = Workers Not Exposed	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Deaths									
Manufacture of rubber tyres and tubes	0	0	0	0	0	0	0	0	0	0
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	1	1	1	0	0	0	1	0	0	0
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Registrations									
Manufacture of rubber tyres and tubes	0	0	0	0	0	0	0	0	0	0
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	3	3	3	2	1	1	3	2	1	1
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lost (YLLs)									
Manufacture of rubber tyres and tubes	12	13	14	15	15	15	14	15	15	15
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	360	342	284	210	150	113	283	201	127	89
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lived with Disability (DALYs)									
Manufacture of rubber tyres and tubes	12	13	15	15	15	15	15	15	15	15
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	368	349	290	215	153	115	289	205	129	91
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Table 8.4.11 Occupation attributable fractions, deaths, registrations, YLLs and DALYs for exposure to rubber process dust for leukaemia by industry, men plus women

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Fraction									
Manufacture of rubber tyres and tubes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Retreading and rebuilding of rubber tyres	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Manufacture of other rubber products	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
'Background' exposed = Workers Not Exposed	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Deaths									
Manufacture of rubber tyres and tubes	0	0	0	0	0	0	0	0	0	0
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	4	3	3	2	3	3	2	2	3	3
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Registrations									
Manufacture of rubber tyres and tubes	0	0	0	0	0	0	0	0	0	0
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	7	5	4	3	4	4	3	3	3	3
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lost (YLLs)									
Manufacture of rubber tyres and tubes	3	3	3	4	4	4	3	4	4	4
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	59	45	35	29	32	33	23	26	28	29
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lived with Disability (DALYs)									
Manufacture of rubber tyres and tubes	3	3	4	4	5	5	4	4	4	5
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	65	50	39	32	35	36	26	28	31	32
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

[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

8.4.2 Rubber process fumes

Table 8.4.12 Proportions exposed to rubber process fumes above the exposure limits being tested by country, forecast scenario

Forecast Scenario	1971-80	1981-90	1991-00	2001-10	2011-20	2021-30
OEL	***0.6 mg/m^3***					
Austria	0.58	0.52	0.46	0.40	0.34	0.28
Belgium	0.58	0.52	0.46	0.40	0.34	0.28
Bulgaria	0.58	0.52	0.46	0.40	0.34	0.28
Cyprus	0.58	0.52	0.46	0.40	0.34	0.28
Czech Republic	0.58	0.52	0.46	0.40	0.34	0.28
Denmark	0.58	0.52	0.46	0.40	0.34	0.28
Estonia	0.58	0.52	0.46	0.40	0.34	0.28
Finland	0.58	0.52	0.46	0.40	0.34	0.28

Forecast Scenario	1971-80	1981-90	1991-00	2001-10	2011-20	2021-30
France	0.58	0.52	0.46	0.40	0.34	0.28
Germany	0.58	0.52	0.46	0.40	0.34	0.28
Greece	0.58	0.52	0.46	0.40	0.34	0.28
Hungary	0.58	0.52	0.46	0.40	0.34	0.28
Ireland	0.58	0.52	0.46	0.40	0.34	0.28
Italy	0.58	0.52	0.46	0.40	0.34	0.28
Latvia	0.58	0.52	0.46	0.40	0.34	0.28
Lithuania	0.58	0.52	0.46	0.40	0.34	0.28
Luxembourg	0.58	0.52	0.46	0.40	0.34	0.28
Malta	0.58	0.52	0.46	0.40	0.34	0.28
Netherlands	0.58	0.52	0.46	0.40	0.34	0.28
Poland	0.58	0.52	0.46	0.40	0.34	0.28
Portugal	0.58	0.52	0.46	0.40	0.34	0.28
Romania	0.58	0.52	0.46	0.40	0.34	0.28
Slovakia	0.58	0.52	0.46	0.40	0.34	0.28
Slovenia	0.58	0.52	0.46	0.40	0.34	0.28
Spain	0.58	0.52	0.46	0.40	0.34	0.28
Sweden	0.58	0.52	0.46	0.40	0.34	0.28
United Kingdom	0.58	0.52	0.46	0.40	0.34	0.28
TOTAL	0.58	0.52	0.46	0.395	0.34	0.28

Table 8.4.13 Numbers and proportions of the population ever exposed to rubber process fumes for baseline and intervention[1] scenarios (2) for lung and laryngeal cancers, by country, men plus women

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Number ever exposed in the REP									
Austria	12,902	13,219	13,594	13,594	13,594	13,594	13,594	13,594	13,594	13,594
Belgium	13,068	13,388	13,769	13,769	13,769	13,769	13,769	13,769	13,769	13,769
Bulgaria	16,104	16,502	16,972	16,972	16,972	16,972	16,972	16,972	16,972	16,972
Cyprus	93	96	98	98	98	98	98	98	98	98
Czech Republic	93,474	95,775	98,502	98,502	98,502	98,502	98,502	98,502	98,502	98,502
Denmark	5,798	5,940	6,109	6,109	6,109	6,109	6,109	6,109	6,109	6,109
Estonia	2,056	2,106	2,166	2,166	2,166	2,166	2,166	2,166	2,166	2,166
Finland	11,625	11,911	12,250	12,250	12,250	12,250	12,250	12,250	12,250	12,250
France	311,792	298,779	284,702	271,688	257,611	251,299	284,702	271,688	257,611	251,299
Germany	282,423	289,357	297,582	297,582	297,582	297,582	297,582	297,582	297,582	297,582
Greece	3,517	3,603	3,705	3,705	3,705	3,705	3,705	3,705	3,705	3,705
Hungary	41,403	42,423	43,631	43,631	43,631	43,631	43,631	43,631	43,631	43,631
Ireland	2,723	2,790	2,869	2,869	2,869	2,869	2,869	2,869	2,869	2,869
Italy	177,352	181,708	186,874	186,874	186,874	186,874	186,874	186,874	186,874	186,874
Latvia	1,240	1,270	1,306	1,306	1,306	1,306	1,306	1,306	1,306	1,306
Lithuania	1,493	1,530	1,573	1,573	1,573	1,573	1,573	1,573	1,573	1,573
Luxembourg	13,893	14,233	14,637	14,637	14,637	14,637	14,637	14,637	14,637	14,637
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	12,636	12,946	13,314	13,314	13,314	13,314	13,314	13,314	13,314	13,314

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Poland	130,488	133,699	137,505	137,505	137,505	137,505	137,505	137,505	137,505	137,505
Portugal	21,825	22,363	23,000	23,000	23,000	23,000	23,000	23,000	23,000	23,000
Romania	54,842	56,195	57,797	57,797	57,797	57,797	57,797	57,797	57,797	57,797
Slovakia	26,356	27,004	27,773	27,773	27,773	27,773	27,773	27,773	27,773	27,773
Slovenia	14,668	15,029	15,457	15,457	15,457	15,457	15,457	15,457	15,457	15,457
Spain	65,291	82,547	106,392	130,237	148,183	160,327	106,392	130,237	148,183	160,327
Sweden	23,959	24,547	25,245	25,245	25,245	25,245	25,245	25,245	25,245	25,245
United Kingdom	155,576	142,090	122,954	103,499	89,495	80,778	122,954	103,499	89,495	80,778
TOTAL	1,496,596	1,511,050	1,529,775	1,521,153	1,511,018	1,508,132	1,529,775	1,521,153	1,511,018	1,508,132

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Proportion of the population exposed (%)									
Austria	0.21	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Belgium	0.17	0.16	0.16	0.16	0.15	0.15	0.16	0.16	0.15	0.15
Bulgaria	0.29	0.30	0.33	0.34	0.36	0.39	0.33	0.34	0.36	0.39
Cyprus	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Czech Republic	1.22	1.19	1.23	1.24	1.26	1.32	1.23	1.24	1.26	1.32
Denmark	0.15	0.15	0.15	0.14	0.14	0.14	0.15	0.14	0.14	0.14

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060
Estonia	0.22	0.22	0.23	0.24	0.24	0.25	0.23	0.24	0.24	0.25
Finland	0.31	0.30	0.30	0.30	0.31	0.31	0.30	0.30	0.31	0.31
France	0.72	0.65	0.59	0.54	0.51	0.49	0.59	0.54	0.51	0.49
Germany	0.46	0.46	0.47	0.49	0.51	0.54	0.47	0.49	0.51	0.54
Greece	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Hungary	0.57	0.57	0.60	0.60	0.62	0.64	0.60	0.60	0.62	0.64
Ireland	0.09	0.08	0.07	0.07	0.06	0.06	0.07	0.07	0.06	0.06
Italy	0.39	0.38	0.39	0.38	0.39	0.40	0.39	0.38	0.39	0.40
Latvia	0.08	0.08	0.09	0.09	0.09	0.10	0.09	0.09	0.09	0.10
Lithuania	0.06	0.06	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.08
Luxembourg	4.01	3.65	3.37	3.10	2.91	2.76	3.37	3.10	2.91	2.76
Malta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Netherlands	0.11	0.11	0.10	0.10	0.11	0.11	0.10	0.10	0.11	0.11
Poland	0.49	0.47	0.49	0.50	0.52	0.55	0.49	0.50	0.52	0.55
Portugal	0.28	0.27	0.27	0.26	0.26	0.26	0.27	0.26	0.26	0.26
Romania	0.36	0.36	0.38	0.38	0.40	0.43	0.38	0.38	0.40	0.43
Slovakia	0.69	0.66	0.68	0.69	0.71	0.76	0.68	0.69	0.71	0.76
Slovenia	0.97	0.96	0.99	1.01	1.05	1.12	0.99	1.01	1.05	1.12
Spain	0.19	0.22	0.27	0.32	0.36	0.40	0.27	0.32	0.36	0.40
Sweden	0.37	0.35	0.35	0.34	0.33	0.32	0.35	0.34	0.33	0.32
United Kingdom	0.36	0.31	0.25	0.20	0.17	0.15	0.25	0.20	0.17	0.15
TOTAL	0.41	0.40	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39

Table 8.4.14 Numbers and proportions of the population ever exposed to rubber process fumes for baseline and intervention[1] scenarios (2) for lung and laryngeal cancers, by country, men plus women

Scenario	All Scenarios		Baseline (trend) scenario (1) - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Number ever exposed in the REP									
Austria	9,517	9,517	9,517	9,517	9,517	9,517	9,517	9,517	9,517	9,517
Belgium	9,639	9,639	9,639	9,639	9,639	9,639	9,639	9,639	9,639	9,639
Bulgaria	11,381	11,381	11,381	11,381	11,381	11,381	11,381	11,381	11,381	11,381
Cyprus	68	68	68	68	68	68	68	68	68	68
Czech Republic	67,252	67,252	67,252	67,252	67,252	67,252	67,252	67,252	67,252	67,252
Denmark	4,222	4,222	4,222	4,222	4,222	4,222	4,222	4,222	4,222	4,222
Estonia	1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459	1,459
Finland	8,478	8,478	8,478	8,478	8,478	8,478	8,478	8,478	8,478	8,478
France	200,484	188,399	181,644	169,559	169,559	169,559	181,644	169,559	169,559	169,559
Germany	206,953	206,953	206,953	206,953	206,953	206,953	206,953	206,953	206,953	206,953
Greece	2,573	2,573	2,573	2,573	2,573	2,573	2,573	2,573	2,573	2,573
Hungary	29,703	29,703	29,703	29,703	29,703	29,703	29,703	29,703	29,703	29,703
Ireland	1,989	1,989	1,989	1,989	1,989	1,989	1,989	1,989	1,989	1,989
Italy	129,545	129,545	129,545	129,545	129,545	129,545	129,545	129,545	129,545	129,545
Latvia	883	883	883	883	883	883	883	883	883	883
Lithuania	1,055	1,055	1,055	1,055	1,055	1,055	1,055	1,055	1,055	1,055
Luxembourg	10,353	10,353	10,353	10,353	10,353	10,353	10,353	10,353	10,353	10,353
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	9,352	9,352	9,352	9,352	9,352	9,352	9,352	9,352	9,352	9,352
Poland	94,157	94,157	94,157	94,157	94,157	94,157	94,157	94,157	94,157	94,157

Scenario	All Scenarios		Baseline (trend) scenario (1) - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Portugal	15,570	15,570	15,570	15,570	15,570	15,570	15,570	15,570	15,570	15,570
Romania	38,861	38,861	38,861	38,861	38,861	38,861	38,861	38,861	38,861	38,861
Slovakia	18,935	18,935	18,935	18,935	18,935	18,935	18,935	18,935	18,935	18,935
Slovenia	10,569	10,569	10,569	10,569	10,569	10,569	10,569	10,569	10,569	10,569
Spain	72,389	88,999	105,609	116,271	116,271	116,271	105,609	116,271	116,271	116,271
Sweden	17,585	17,585	17,585	17,585	17,585	17,585	17,585	17,585	17,585	17,585
United Kingdom	87,717	72,173	59,402	54,402	54,402	54,402	59,402	54,402	54,402	54,402
TOTAL	1,060,688	1,049,670	1,046,754	1,040,331	1,040,331	1,040,331	1,046,754	1,040,331	1,040,331	1,040,331

Scenario	All Scenarios		Baseline (trend) scenario (1) - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Proportion of the population exposed (%)									
Austria	0.14	0.14	0.13	0.13	0.14	0.14	0.13	0.13	0.14	0.14
Belgium	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Bulgaria	0.18	0.20	0.21	0.22	0.25	0.28	0.21	0.22	0.25	0.28
Cyprus	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Czech Republic	0.79	0.79	0.80	0.83	0.87	0.95	0.80	0.83	0.87	0.95
Denmark	0.10	0.09	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Estonia	0.14	0.14	0.15	0.15	0.16	0.17	0.15	0.15	0.16	0.17
Finland	0.20	0.20	0.20	0.21	0.21	0.21	0.20	0.21	0.21	0.21
France	0.42	0.38	0.35	0.33	0.33	0.33	0.35	0.33	0.33	0.33

Scenario	All Scenarios		Baseline (trend) scenario (1) - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Germany	0.31	0.32	0.33	0.34	0.38	0.39	0.33	0.34	0.38	0.39
Greece	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Hungary	0.36	0.37	0.38	0.40	0.42	0.46	0.38	0.40	0.42	0.46
Ireland	0.06	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Italy	0.27	0.27	0.26	0.27	0.28	0.30	0.26	0.27	0.28	0.30
Latvia	0.05	0.05	0.05	0.06	0.06	0.07	0.05	0.06	0.06	0.07
Lithuania	0.04	0.04	0.04	0.05	0.05	0.05	0.04	0.05	0.05	0.05
Luxembourg	2.68	2.39	2.18	2.06	1.97	1.89	2.18	2.06	1.97	1.89
Malta	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Netherlands	0.07	0.07	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.08
Poland	0.30	0.31	0.31	0.34	0.36	0.40	0.31	0.34	0.36	0.40
Portugal	0.18	0.18	0.17	0.17	0.18	0.19	0.17	0.17	0.18	0.19
Romania	0.22	0.23	0.24	0.25	0.27	0.30	0.24	0.25	0.27	0.30
Slovakia	0.43	0.42	0.43	0.46	0.49	0.55	0.43	0.46	0.49	0.55
Slovenia	0.63	0.64	0.65	0.69	0.75	0.81	0.65	0.69	0.75	0.81
Spain	0.19	0.22	0.25	0.28	0.29	0.31	0.25	0.28	0.29	0.31
Sweden	0.24	0.23	0.23	0.22	0.22	0.22	0.23	0.22	0.22	0.22
United Kingdom	0.18	0.14	0.11	0.10	0.10	0.10	0.11	0.10	0.10	0.10
TOTAL	0.27	0.26	0.26	0.26	0.27	0.28	0.26	0.26	0.27	0.28

Table 8.4.15 Results for baseline, forecast and intervention [1] scenario (2) for rubber process fumes for lung cancer, by country, men plus women

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Fraction									
Austria	0.005%	0.005%	0.004%	0.004%	0.004%	0.003%	0.004%	0.003%	0.002%	0.000%
Belgium	0.003%	0.003%	0.003%	0.002%	0.002%	0.002%	0.003%	0.002%	0.001%	0.000%
Bulgaria	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.004%	0.003%	0.002%	0.000%
Cyprus	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Czech Republic	0.016%	0.015%	0.014%	0.012%	0.010%	0.009%	0.014%	0.010%	0.004%	0.000%
Denmark	0.003%	0.003%	0.003%	0.003%	0.003%	0.002%	0.003%	0.002%	0.001%	0.000%
Estonia	0.004%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.003%	0.001%	0.000%
Finland	0.004%	0.003%	0.003%	0.002%	0.002%	0.002%	0.003%	0.002%	0.001%	0.000%
France	0.010%	0.008%	0.006%	0.005%	0.004%	0.003%	0.006%	0.004%	0.002%	0.000%
Germany	0.008%	0.008%	0.007%	0.007%	0.006%	0.006%	0.007%	0.006%	0.003%	0.000%
Greece	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.000%	0.000%
Hungary	0.008%	0.008%	0.008%	0.007%	0.006%	0.005%	0.008%	0.006%	0.003%	0.000%
Ireland	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%
Italy	0.007%	0.007%	0.006%	0.006%	0.005%	0.005%	0.006%	0.005%	0.002%	0.000%
Latvia	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.000%
Lithuania	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%	0.000%	0.000%
Luxembourg	0.080%	0.071%	0.060%	0.049%	0.040%	0.034%	0.060%	0.041%	0.017%	0.002%
Malta	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%
Netherlands	0.002%	0.002%	0.002%	0.001%	0.001%	0.001%	0.002%	0.001%	0.001%	0.000%
Poland	0.008%	0.008%	0.007%	0.007%	0.006%	0.006%	0.007%	0.005%	0.003%	0.000%
Portugal	0.003%	0.002%	0.002%	0.002%	0.001%	0.001%	0.002%	0.001%	0.001%	0.000%

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060
Romania	0.004%	0.004%	0.004%	0.003%	0.003%	0.003%	0.004%	0.003%	0.001%	0.000%
Slovakia	0.007%	0.007%	0.006%	0.005%	0.004%	0.004%	0.006%	0.004%	0.002%	0.000%
Slovenia	0.006%	0.006%	0.005%	0.004%	0.003%	0.003%	0.005%	0.003%	0.001%	0.000%
Spain	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.002%	0.001%	0.000%
Sweden	0.008%	0.008%	0.007%	0.007%	0.006%	0.006%	0.007%	0.006%	0.003%	0.001%
United Kingdom	0.007%	0.006%	0.004%	0.003%	0.002%	0.002%	0.004%	0.003%	0.001%	0.000%
TOTAL	0.007%	0.006%	0.005%	0.005%	0.004%	0.004%	0.005%	0.004%	0.002%	0.000%

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060
Attributable Deaths										
Austria	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	1	1	1	1	1	1	1	1	0	0
Denmark	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	3	3	3	2	2	1	3	2	1	0
Germany	4	4	4	4	4	3	4	4	2	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060
Greece	0	0	0	0	0	0	0	0	0	0
Hungary	1	1	1	1	1	1	1	1	0	0
Ireland	0	0	0	0	0	0	0	0	0	0
Italy	3	3	3	3	3	3	3	3	1	0
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0
Poland	2	2	3	3	2	2	2	2	1	0
Portugal	0	0	0	0	0	0	0	0	0	0
Romania	0	0	0	0	0	0	0	0	0	0
Slovakia	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	0	1	1	1	1	1	1	1	0	0
Sweden	0	0	0	0	0	0	0	0	0	0
United Kingdom	2	2	2	2	1	1	2	2	1	0
TOTAL	18	19	20	19	17	16	20	16	8	1

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Registrations									
Austria	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	1	1	1	1	1	1	1	1	0	0
Denmark	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	3	3	3	2	2	1	3	2	1	0
Germany	4	5	5	5	4	4	5	4	2	0
Greece	0	0	0	0	0	0	0	0	0	0
Hungary	1	1	1	1	1	1	1	1	0	0
Ireland	0	0	0	0	0	0	0	0	0	0
Italy	3	3	4	4	3	3	4	3	1	0
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0
Poland	2	3	3	3	3	2	3	2	1	0
Portugal	0	0	0	0	0	0	0	0	0	0
Romania	0	0	0	0	0	0	0	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Slovakia	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	0	1	1	1	1	1	1	1	0	0
Sweden	0	0	0	0	0	0	0	0	0	0
United Kingdom	3	3	3	2	2	1	3	2	1	0
TOTAL	20	22	22	20	18	16	22	17	8	1

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lost (YLLs)									
Austria	3	3	3	3	3	3	3	3	1	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	2	2	2	2	2	2	2	2	1	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	15	15	16	15	13	11	15	12	5	0
Denmark	2	2	2	2	2	2	2	2	1	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	1	1	1	1	1	1	1	1	0	0
France	53	49	41	33	26	21	41	28	11	0
Germany	57	62	62	57	50	45	62	47	21	2
Greece	1	1	1	1	1	1	1	1	1	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Hungary	11	11	11	10	9	8	11	9	4	0
Ireland	1	1	1	1	1	1	1	1	1	1
Italy	38	42	43	41	37	33	43	34	16	2
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	3	3	3	3	2	2	3	2	1	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	3	3	3	3	2	2	3	2	1	0
Poland	31	34	35	34	32	28	35	28	14	1
Portugal	2	2	2	1	1	1	1	1	0	0
Romania	6	7	7	6	5	4	7	5	2	0
Slovakia	3	3	3	3	2	2	3	2	1	0
Slovenia	1	1	1	1	1	1	1	1	0	0
Spain	8	10	13	15	15	14	13	12	6	0
Sweden	4	5	5	5	5	4	5	4	2	1
United Kingdom	35	34	29	23	17	13	29	20	8	1
TOTAL	287	297	292	265	229	202	290	221	101	11

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lived with Disability (DALYs)									
Austria	3	3	4	3	3	3	4	3	1	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	2	3	3	2	2	2	3	2	1	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	16	16	16	15	13	11	16	13	6	0
Denmark	2	2	2	2	2	2	2	2	1	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	1	1	1	1	1	1	1	1	0	0
France	55	51	43	34	27	22	43	29	12	0
Germany	60	64	65	60	52	47	64	49	22	2
Greece	1	1	1	1	1	1	1	1	1	0
Hungary	11	12	12	11	9	8	12	9	4	0
Ireland	1	1	1	1	1	1	1	1	1	1
Italy	40	44	45	43	39	35	45	36	17	2
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	3	3	3	3	3	2	3	2	1	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	3	3	3	3	3	2	3	2	1	0
Poland	33	35	36	36	34	30	36	30	14	1
Portugal	2	2	2	1	1	1	2	1	0	0
Romania	7	7	7	6	5	4	7	5	2	0
Slovakia	3	3	3	3	2	2	3	2	1	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060
Slovenia	1	1	1	1	1	1	1	1	0	0
Spain	8	10	14	16	16	15	14	12	6	0
Sweden	5	5	5	5	5	5	5	4	2	1
United Kingdom	37	35	30	24	18	14	30	21	9	1
TOTAL	299	311	305	276	240	211	303	231	105	12

Table 8.4.16 Results for baseline, forecast and intervention [(1)] scenario (2) for rubber process fumes for laryngeal cancer, by country, men plus women

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Fraction									
Austria	0.02%	0.02%	0.02%	0.02%	0.02%	0.01%	0.02%	0.01%	0.01%	0.00%
Belgium	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%
Bulgaria	0.02%	0.02%	0.02%	0.02%	0.02%	0.01%	0.02%	0.01%	0.01%	0.00%
Cyprus	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Czech Republic	0.07%	0.06%	0.06%	0.05%	0.04%	0.04%	0.06%	0.04%	0.02%	0.01%
Denmark	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%
Estonia	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%
Finland	0.02%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%
France	0.04%	0.03%	0.03%	0.02%	0.02%	0.01%	0.03%	0.02%	0.01%	0.00%
Germany	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.01%	0.00%

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060
Greece	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hungary	0.03%	0.03%	0.03%	0.03%	0.02%	0.02%	0.03%	0.02%	0.01%	0.00%
Ireland	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Italy	0.03%	0.03%	0.03%	0.02%	0.02%	0.02%	0.03%	0.02%	0.01%	0.00%
Latvia	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.01%	0.00%	0.00%	0.00%
Lithuania	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Luxembourg	0.35%	0.31%	0.26%	0.22%	0.18%	0.15%	0.26%	0.18%	0.09%	0.03%
Malta	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Netherlands	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%
Poland	0.03%	0.03%	0.03%	0.03%	0.03%	0.02%	0.03%	0.02%	0.01%	0.00%
Portugal	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%
Romania	0.02%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%
Slovakia	0.03%	0.03%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.01%	0.00%
Slovenia	0.03%	0.03%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.01%	0.01%
Spain	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%
Sweden	0.04%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.01%	0.01%
United Kingdom	0.03%	0.03%	0.02%	0.01%	0.01%	0.01%	0.02%	0.01%	0.01%	0.00%
TOTAL	0.03%	0.03%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.01%	0.00%

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Deaths									
Austria	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	0	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	0	0	0	0	0	0	0	0	0	0
Germany	0	0	0	0	0	0	0	0	0	0
Greece	0	0	0	0	0	0	0	0	0	0
Hungary	0	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0
Italy	0	0	0	0	0	0	0	0	0	0
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0
Poland	0	0	0	0	0	0	0	0	0	0
Portugal	0	0	0	0	0	0	0	0	0	0
Romania	0	0	0	0	0	0	0	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Slovakia	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	0	0	0	0	0	0	0	0	0	0
Sweden	0	0	0	0	0	0	0	0	0	0
United Kingdom	0	0	0	0	0	0	0	0	0	0
TOTAL	2	2	2	2	2	2	2	2	1	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Registrations									
Austria	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	0	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	2	2	2	2	1	1	2	1	1	0
Germany	2	2	2	2	2	1	2	1	1	0
Greece	0	0	0	0	0	0	0	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Hungary	0	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0
Italy	2	2	2	2	2	2	2	2	1	0
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0
Poland	1	1	1	1	1	1	1	1	1	0
Portugal	0	0	0	0	0	0	0	0	0	0
Romania	0	0	0	0	0	0	0	0	0	0
Slovakia	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	0	1	1	1	1	1	1	1	0	0
Sweden	0	0	0	0	0	0	0	0	0	0
United Kingdom	1	1	1	1	0	0	1	1	0	0
TOTAL	10	11	11	10	9	8	11	8	5	2

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Attributable Years of Life Lost (YLLs)										
Austria	11	13	13	13	12	11	13	11	6	2
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	9	9	10	9	8	7	10	8	4	1
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	59	62	63	60	53	46	63	51	27	9
Denmark	7	8	8	8	7	7	8	7	4	1
Estonia	1	1	1	1	1	1	1	1	1	0
Finland	5	5	5	4	4	3	5	4	2	1
France	214	202	172	142	114	96	171	123	62	22
Germany	223	242	245	228	202	183	244	193	100	31
Greece	4	5	5	5	5	5	5	4	3	1
Hungary	43	44	45	42	37	32	44	35	18	6
Ireland	2	3	3	4	4	4	3	4	4	4
Italy	150	163	171	163	149	135	170	138	73	22
Latvia	1	1	1	1	1	1	1	1	0	0
Lithuania	1	1	1	1	1	1	1	1	0	0
Luxembourg	11	12	12	11	10	9	12	10	5	2
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	11	12	13	12	10	9	12	10	5	2
Poland	122	132	137	136	129	116	137	115	64	19
Portugal	6	7	6	6	5	4	6	5	3	1
Romania	26	26	27	25	22	18	27	22	11	4

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Slovakia	10	11	11	11	10	9	11	9	5	2
Slovenia	5	6	6	5	4	3	5	4	3	1
Spain	31	41	56	64	67	66	55	53	33	16
Sweden	17	18	19	19	18	17	19	16	9	4
United Kingdom	138	131	113	89	68	54	113	79	37	9
TOTAL	1,128	1,177	1,168	1,073	948	849	1,162	915	485	162

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Attributable Years of Life Lived with Disability (DALYs)										
Austria	11	13	13	13	12	11	13	11	6	2
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	9	10	10	9	8	7	10	8	4	1
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	60	63	64	61	54	47	64	52	28	9
Denmark	7	8	8	8	8	7	8	7	4	1
Estonia	1	1	1	1	1	1	1	1	1	0
Finland	5	5	5	4	4	3	5	4	2	1
France	219	208	176	146	117	99	176	126	64	23
Germany	226	246	249	232	206	186	247	196	102	31
Greece	4	5	5	5	5	5	5	4	3	1

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Hungary	44	44	45	42	37	33	45	36	19	6
Ireland	2	3	3	4	4	4	3	4	4	4
Italy	154	167	176	168	153	138	175	142	75	23
Latvia	1	1	1	1	1	1	1	1	0	0
Lithuania	1	1	1	1	1	1	1	1	0	0
Luxembourg	11	12	13	12	10	9	12	10	5	2
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	11	13	13	12	10	9	13	10	5	2
Poland	125	135	141	140	132	119	140	118	65	20
Portugal	7	7	7	6	5	4	7	5	3	1
Romania	26	27	28	26	22	19	28	22	11	4
Slovakia	10	11	12	11	10	9	12	10	5	2
Slovenia	5	6	6	5	4	4	6	4	3	1
Spain	32	42	57	66	69	68	57	55	34	16
Sweden	17	18	19	19	18	18	19	16	9	4
United Kingdom	140	133	115	91	69	55	115	80	37	9
TOTAL	1,152	1,202	1,192	1,095	967	866	1,186	934	495	165

Table 8.4.17 Results for baseline, forecast and intervention [1] scenario (2) for rubber process fumes for leukaemia, by country, men plus women

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Attributable Fraction										
Austria	0.04%	0.04%	0.03%	0.03%	0.03%	0.03%	0.01%	0.01%	0.01%	0.01%
Belgium	0.03%	0.02%	0.02%	0.02%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%
Bulgaria	0.04%	0.04%	0.04%	0.04%	0.04%	0.05%	0.01%	0.01%	0.01%	0.01%
Cyprus	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Czech Republic	0.13%	0.12%	0.10%	0.09%	0.10%	0.11%	0.02%	0.02%	0.02%	0.02%
Denmark	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.01%	0.01%	0.01%	0.01%
Estonia	0.03%	0.03%	0.03%	0.03%	0.03%	0.03%	0.00%	0.00%	0.00%	0.00%
Finland	0.03%	0.02%	0.02%	0.02%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%
France	0.06%	0.05%	0.04%	0.03%	0.03%	0.03%	0.01%	0.01%	0.01%	0.01%
Germany	0.07%	0.06%	0.06%	0.05%	0.06%	0.06%	0.01%	0.01%	0.01%	0.01%
Greece	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%
Hungary	0.07%	0.06%	0.06%	0.05%	0.06%	0.06%	0.01%	0.01%	0.01%	0.01%
Ireland	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%
Italy	0.06%	0.05%	0.05%	0.04%	0.05%	0.05%	0.01%	0.01%	0.01%	0.01%
Latvia	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%
Lithuania	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%
Luxembourg	0.56%	0.46%	0.37%	0.31%	0.30%	0.28%	0.05%	0.05%	0.05%	0.04%
Malta	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Netherlands	0.02%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%
Poland	0.07%	0.06%	0.05%	0.05%	0.06%	0.06%	0.01%	0.01%	0.01%	0.01%

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Portugal	0.02%	0.02%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%
Romania	0.04%	0.03%	0.03%	0.03%	0.03%	0.03%	0.00%	0.00%	0.01%	0.01%
Slovakia	0.06%	0.05%	0.04%	0.04%	0.04%	0.05%	0.01%	0.01%	0.01%	0.01%
Slovenia	0.05%	0.04%	0.04%	0.03%	0.04%	0.04%	0.01%	0.01%	0.01%	0.01%
Spain	0.03%	0.03%	0.02%	0.02%	0.03%	0.03%	0.00%	0.01%	0.01%	0.01%
Sweden	0.08%	0.08%	0.07%	0.07%	0.07%	0.06%	0.02%	0.01%	0.01%	0.01%
United Kingdom	0.05%	0.03%	0.02%	0.02%	0.02%	0.02%	0.00%	0.00%	0.00%	0.00%
TOTAL	0.05%	0.04%	0.04%	0.03%	0.04%	0.04%	0.01%	0.01%	0.01%	0.01%

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Attributable Deaths										
Austria	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	1	1	1	1	1	2	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	3	3	3	3	3	3	1	1	1	1

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Germany	5	5	5	6	6	6	1	1	1	1
Greece	0	0	0	0	0	0	0	0	0	0
Hungary	0	0	0	0	1	1	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0
Italy	3	4	4	4	5	5	0	1	1	1
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0
Poland	1	2	2	2	2	3	0	0	0	0
Portugal	0	0	0	0	0	0	0	0	0	0
Romania	0	0	0	0	0	0	0	0	0	0
Slovakia	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	1	1	1	1	2	2	0	0	0	0
Sweden	1	1	1	1	1	1	0	0	0	0
United Kingdom	2	2	2	1	1	2	0	0	0	0
TOTAL	19	20	20	21	24	25	3	4	4	5

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Attributable Registrations										
Austria	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	2	2	2	2	2	2	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0
France	5	5	4	3	3	4	1	1	1	1
Germany	8	8	8	8	8	8	1	1	1	1
Greece	0	0	0	0	0	0	0	0	0	0
Hungary	1	1	1	1	1	1	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0
Italy	5	5	5	5	6	6	1	1	1	1
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0
Poland	2	2	2	2	2	3	0	0	0	0
Portugal	0	0	0	0	0	0	0	0	0	0
Romania	0	0	0	0	0	1	0	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Slovakia	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0
Spain	1	1	2	2	2	2	0	0	0	0
Sweden	1	1	1	1	1	1	0	0	0	0
United Kingdom	3	3	2	2	2	2	0	0	0	0
TOTAL	31	30	29	28	30	31	5	5	5	6

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lost (YLLs)									
Austria	4	4	4	4	4	5	1	1	1	1
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	2	2	2	2	2	2	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	12	12	12	12	13	14	2	2	2	3
Denmark	2	2	2	2	2	2	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	2	2	2	1	1	1	0	0	0	0
France	43	38	35	30	32	32	6	6	7	7
Germany	61	64	64	64	69	69	9	10	11	11
Greece	1	1	1	1	1	1	0	0	0	0

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Hungary	6	6	6	6	6	7	1	1	1	1
Ireland	1	1	1	1	2	2	1	1	2	2
Italy	47	47	46	46	51	53	6	7	8	8
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	3	3	3	3	3	3	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	3	3	3	3	3	3	0	0	0	0
Poland	21	22	22	23	25	28	3	3	4	4
Portugal	2	2	2	2	2	2	0	0	0	0
Romania	5	5	4	4	4	5	1	1	1	1
Slovakia	2	2	2	2	3	3	0	0	1	1
Slovenia	1	1	1	1	1	1	0	0	0	0
Spain	11	13	15	17	19	21	3	4	4	4
Sweden	8	8	9	9	9	10	2	2	2	2
United Kingdom	30	24	19	16	17	18	3	2	3	3
TOTAL	265	259	251	245	267	278	39	43	47	49

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lived with Disability (DALYs)									
Austria	4	4	4	4	5	5	1	1	1	1
Belgium	0	0	0	0	0	0	0	0	0	0
Bulgaria	2	2	2	2	2	2	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0
Czech Republic	14	14	13	13	15	16	2	2	3	3
Denmark	2	2	2	2	2	2	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0
Finland	2	2	2	1	2	2	0	0	0	0
France	48	42	39	33	35	35	7	7	7	7
Germany	68	71	70	70	76	76	10	11	12	12
Greece	1	1	1	1	1	2	0	0	0	0
Hungary	7	7	7	7	7	8	1	1	1	1
Ireland	1	1	1	1	2	2	1	1	2	2
Italy	52	52	51	51	56	58	7	8	8	9
Latvia	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0
Luxembourg	3	3	3	3	3	3	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0
Netherlands	3	3	3	3	3	3	0	0	0	0
Poland	23	24	24	24	27	30	3	4	4	5
Portugal	2	2	2	2	2	2	0	0	0	1
Romania	5	5	5	4	5	5	1	1	1	1

Scenario	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Country	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Slovakia	3	3	3	3	3	3	0	1	1	1
Slovenia	1	1	1	1	1	1	0	0	0	0
Spain	12	14	16	19	21	23	3	4	5	5
Sweden	9	9	10	10	10	11	2	2	2	2
United Kingdom	33	27	21	18	19	19	3	3	3	3
TOTAL	292	285	276	269	293	305	43	48	52	54

[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 8.4.18 Numbers and proportions of the EU population ever exposed to rubber process fumes for lung and laryngeal cancer, by industry, men plus women

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Number ever exposed in the REP									
Manufacture of rubber tyres and tubes	252,164	254,862	258,815	258,875	257,936	258,186	258,815	258,875	257,936	258,186
Retreading and rebuilding of rubber tyres	23,851	24,258	24,759	24,763	24,744	24,771	24,759	24,763	24,744	24,771
Manufacture of other rubber products	427,386	431,074	435,421	431,305	427,499	425,866	435,421	431,305	427,499	425,866
'Background' exposed = Workers Not Exposed	793,195	800,856	810,780	806,210	800,839	799,309	810,780	806,210	800,839	799,309

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Proportion of the population exposed									
Manufacture of rubber tyres and tubes	0.070%	0.067%	0.067%	0.066%	0.066%	0.067%	0.067%	0.066%	0.066%	0.067%
Retreading and rebuilding of rubber tyres	0.007%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%	0.006%
Manufacture of other rubber products	0.118%	0.113%	0.112%	0.110%	0.109%	0.111%	0.112%	0.110%	0.109%	0.111%
'Background' exposed = Workers Not Exposed	0.220%	0.210%	0.209%	0.205%	0.204%	0.208%	0.209%	0.205%	0.204%	0.208%

Table 8.4.19 Numbers and proportions of the EU population ever exposed to rubber process fumes for leukaemia, by industry, men plus women

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Number ever exposed in the REP									
Manufacture of rubber tyres and tubes	179,416	178,474	179,180	178,095	178,095	178,095	179,180	178,095	178,095	178,095
Retreading and rebuilding of rubber tyres	17,107	17,048	17,084	17,106	17,106	17,106	17,084	17,106	17,106	17,106
Manufacture of other rubber products	302,001	297,823	295,711	293,755	293,755	293,755	295,711	293,755	293,755	293,755
'Background' exposed = Workers Not Exposed	562,164	556,325	554,779	551,375	551,375	551,375	554,779	551,375	551,375	551,375

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Proportion of the population exposed									
Manufacture of rubber tyres and tubes	0.045%	0.044%	0.044%	0.044%	0.046%	0.048%	0.044%	0.044%	0.046%	0.048%
Retreading and rebuilding of rubber tyres	0.004%	0.004%	0.004%	0.004%	0.004%	0.005%	0.004%	0.004%	0.004%	0.005%
Manufacture of other rubber products	0.076%	0.073%	0.072%	0.073%	0.076%	0.079%	0.072%	0.073%	0.076%	0.079%
'Background' exposed = Workers Not Exposed	0.141%	0.137%	0.136%	0.137%	0.143%	0.148%	0.136%	0.137%	0.143%	0.148%

Table 8.4.20 Occupation attributable fractions, deaths, registrations, YLLs and DALYs for exposure to rubber process fumes for lung cancer by industry, men plus women

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Fraction									
Manufacture of rubber tyres and tubes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Retreading and rebuilding of rubber tyres	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Manufacture of other rubber products	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
'Background' exposed = Workers Not Exposed	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Deaths									
Manufacture of rubber tyres and tubes	0	0	0	0	0	0	0	0	0	0
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	18	19	20	19	17	16	20	16	8	1
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Registrations									
Manufacture of rubber tyres and tubes	0	0	0	0	0	0	0	0	0	0
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	20	22	22	20	18	16	22	17	8	1
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Attributable Years of Life Lost (YLLs)										
Manufacture of rubber tyres and tubes	0	0	0	0	0	0	0	0	0	0
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	287	297	292	265	229	202	290	221	101	11
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Attributable Years of Life Lived with Disability (DALYs)										
Manufacture of rubber tyres and tubes	0	0	0	0	0	0	0	0	0	0
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	299	311	305	276	240	211	303	231	105	12
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Table 8.4.21 Occupation attributable fractions, deaths, registrations, YLLs and DALYs for exposure to rubber process fumes for laryngeal cancer by industry, men plus women

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Fraction									
Manufacture of rubber tyres and tubes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Retreading and rebuilding of rubber tyres	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Manufacture of other rubber products	0.03%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.01%	0.00%
'Background' exposed = Workers Not Exposed	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Deaths									
Manufacture of rubber tyres and tubes	0	0	0	0	0	0	0	0	0	0
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	2	2	2	2	2	2	2	2	1	0
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Registrations									
Manufacture of rubber tyres and tubes	0	0	0	0	0	0	0	0	0	0
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	10	10	10	10	8	8	10	8	4	1
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	***2010***	***2020***	***2030***	***2040***	***2050***	***2060***	***2030***	***2040***	***2050***	***2060***
	Attributable Years of Life Lost (YLLs)									
Manufacture of rubber tyres and tubes	34	38	42	44	44	44	42	44	44	44
Retreading and rebuilding of rubber tyres	3	4	4	4	4	4	4	4	4	4
Manufacture of other rubber products	1,091	1,136	1,122	1,025	899	801	1,116	867	436	113
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
					Attributable Years of Life Lived with Disability (DALYs)					
Manufacture of rubber tyres and tubes	35	39	43	45	45	45	43	45	45	45
Retreading and rebuilding of rubber tyres	3	4	4	4	4	4	4	4	4	4
Manufacture of other rubber products	1,114	1,159	1,146	1,046	918	817	1,139	885	445	116
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Table 8.4.22 Occupation attributable fractions, deaths, registrations, YLLs and DALYs for exposure to rubber process fumes for leukaemia by industry, men plus women

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
					Attributable Fraction					
Manufacture of rubber tyres and tubes	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Retreading and rebuilding of rubber tyres	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Manufacture of other rubber products	0.05%	0.04%	0.04%	0.03%	0.03%	0.04%	0.00%	0.00%	0.00%	0.00%
'Background' exposed = Workers Not Exposed	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Deaths									
Manufacture of rubber tyres and tubes	1	1	1	1	1	1	1	1	1	1
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	19	19	19	20	23	24	2	3	3	3
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Registrations									
Manufacture of rubber tyres and tubes	1	1	1	1	1	1	1	1	1	1
Retreading and rebuilding of rubber tyres	0	0	0	0	0	0	0	0	0	0
Manufacture of other rubber products	30	29	28	27	29	30	3	4	4	4
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lost (YLLs)									
Manufacture of rubber tyres and tubes	8	9	10	11	12	13	10	11	12	13
Retreading and rebuilding of rubber tyres	1	1	1	1	1	1	1	1	1	1
Manufacture of other rubber products	256	249	240	233	254	264	28	31	34	35
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

Scenarios	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) – Full compliance for OEL = 6 mg/m^3			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lived with Disability (DALYs)									
Manufacture of rubber tyres and tubes	9	10	11	12	13	14	11	12	13	14
Retreading and rebuilding of rubber tyres	1	1	1	1	1	1	1	1	1	1
Manufacture of other rubber products	282	274	264	256	278	290	31	34	37	39
'Background' exposed = Workers Not Exposed	0	0	0	0	0	0	0	0	0	0

[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

8.5 VALUING HEALTH BENEFITS – INTERVENTION SCENARIOS

8.5.1 Rubber dust

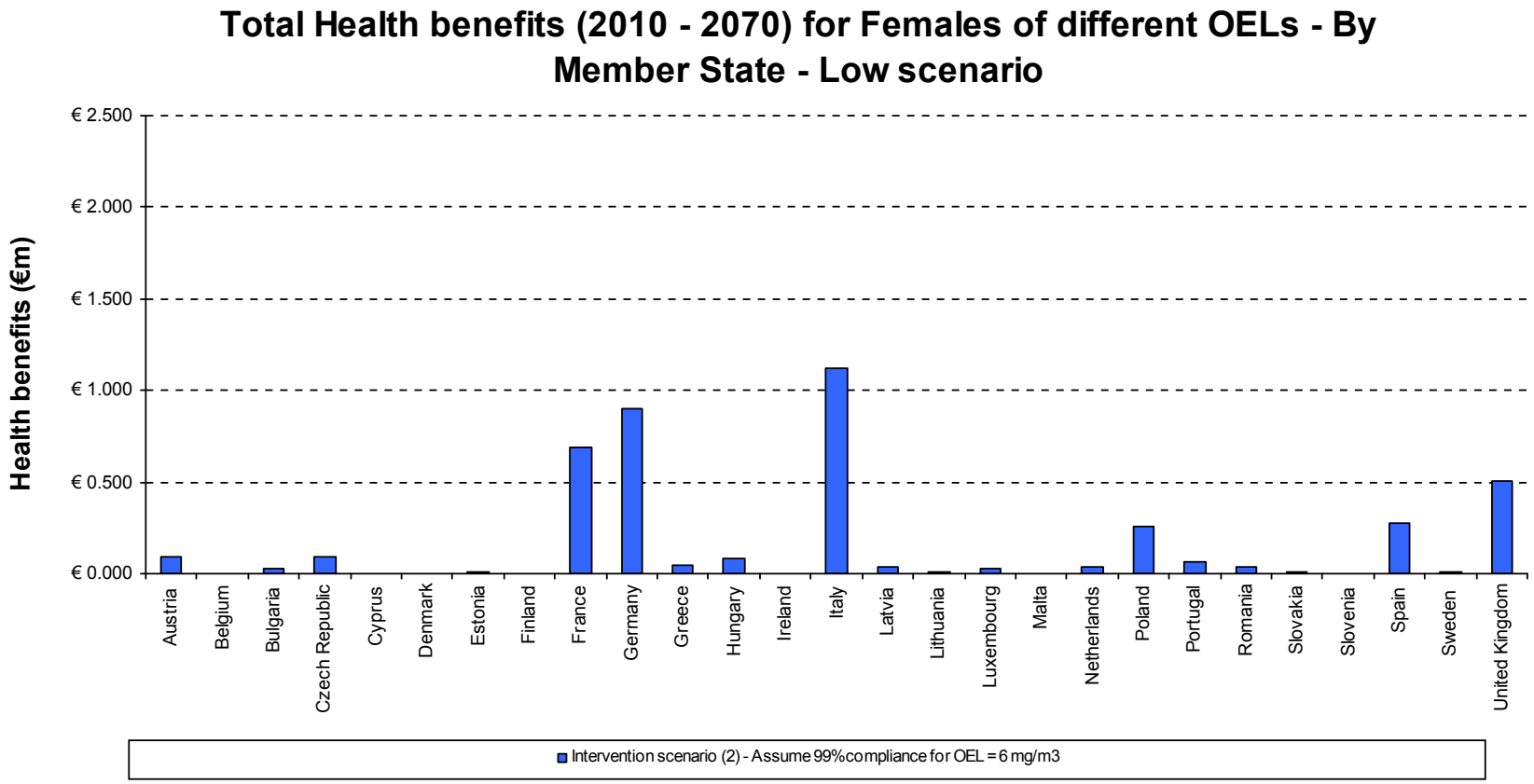

Figure 8.5.1 Total health benefits to females of introducing an EU wide OEL – By Member State – Low Scenario (Present Value – 2010 €m prices)

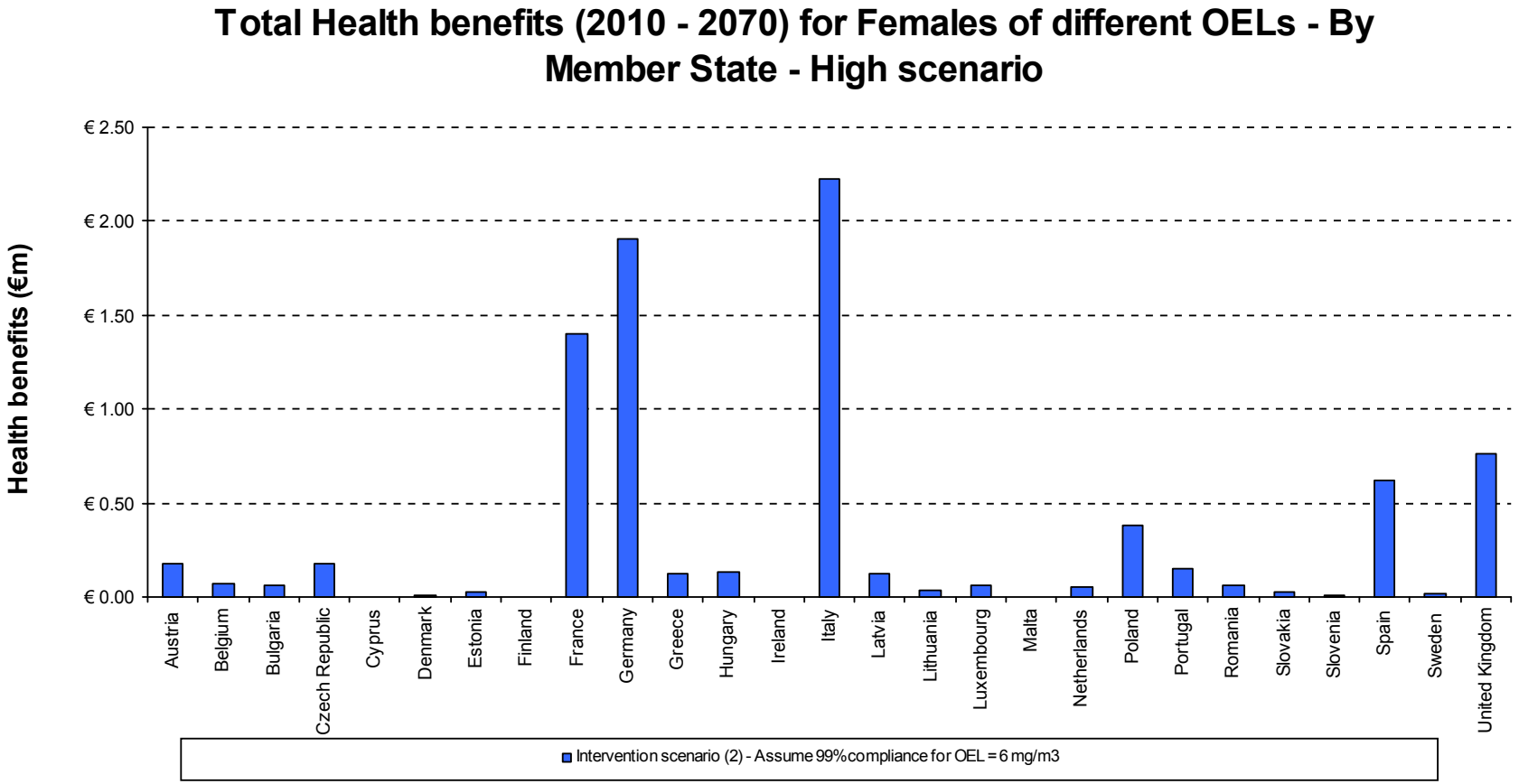

Figure 8.5.2 Total health benefits for females of introducing an EU wide OEL – By Member State – High Scenario (Present Value – 2010 €m prices)

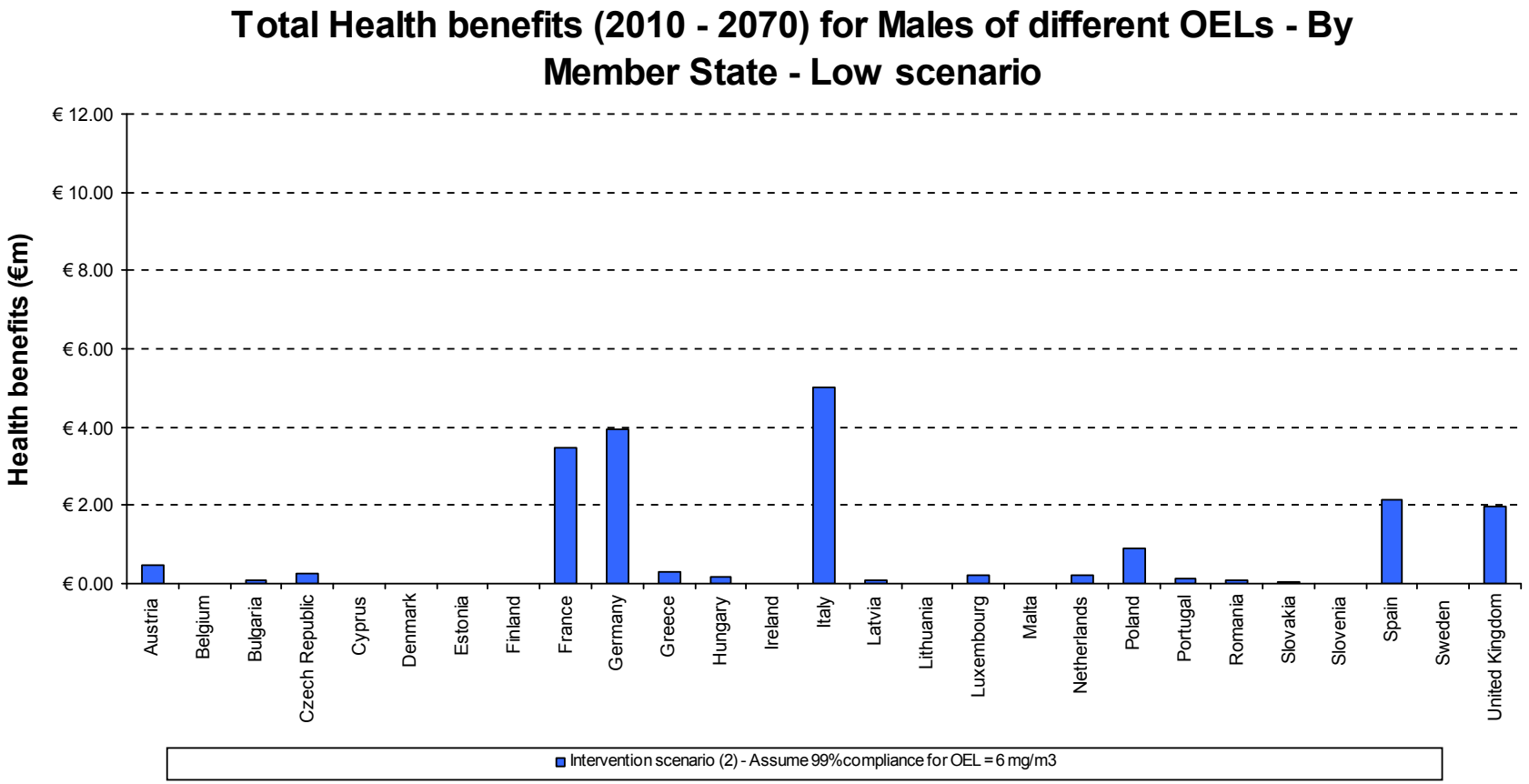

Figure 8.5.3 Total health benefits to males of introducing an EU wide OEL – By Member State – Low Scenario (Present Value – 2010 €m prices)

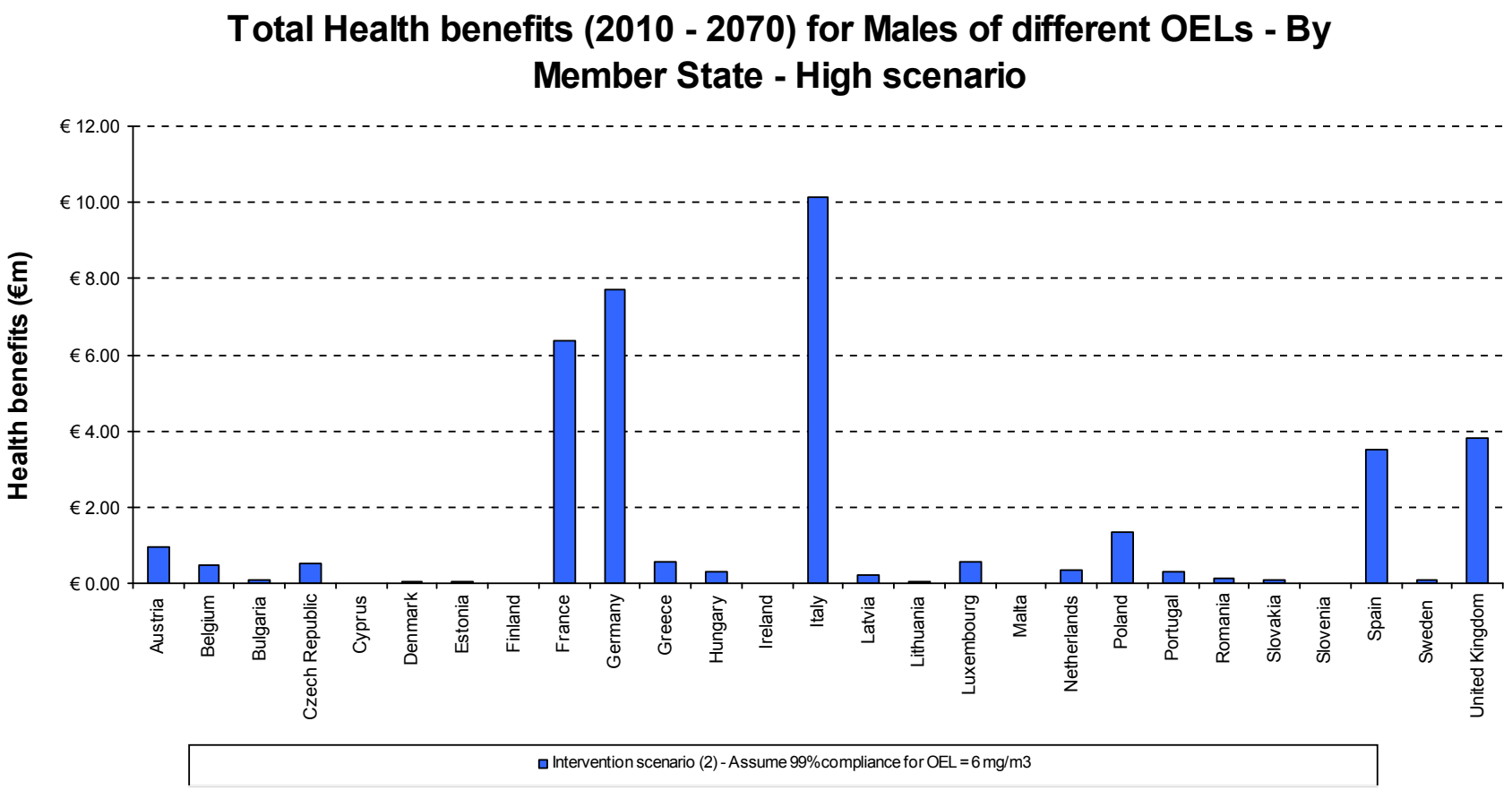

Figure 8.5.4 Total health benefits for males of introducing an EU wide OEL – By Member State – High Scenario (Present Value – 2010 €m prices)

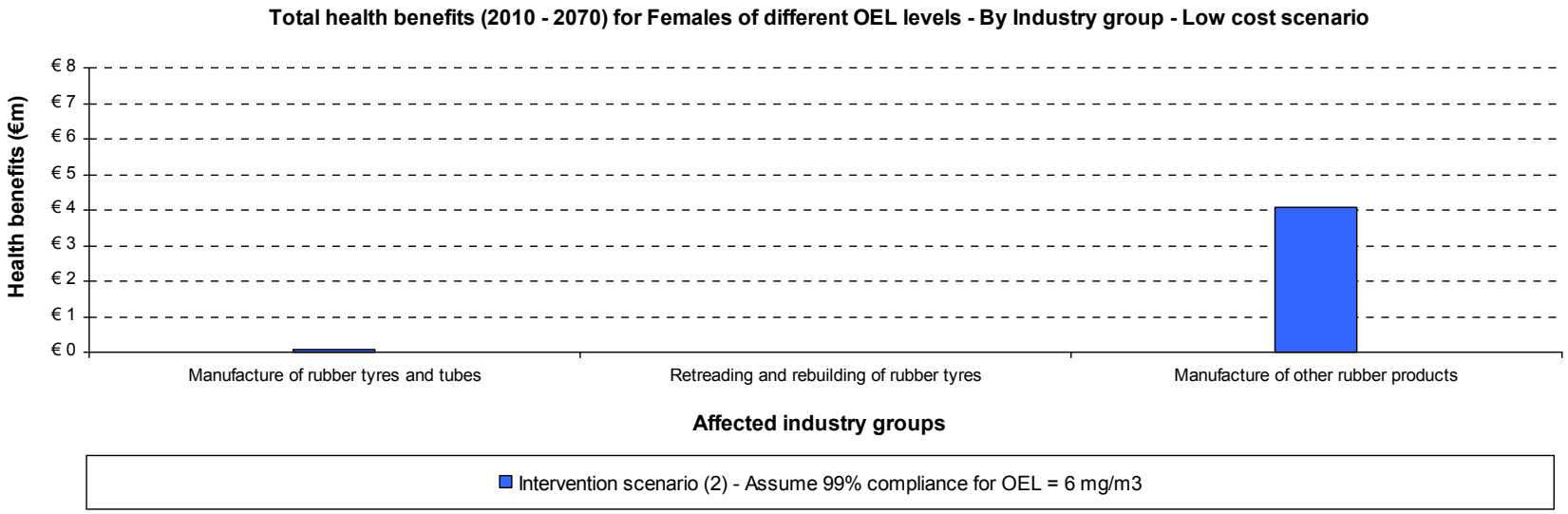

Figure 8.5.5 Total health benefits to females of introducing an EU wide OEL – By Industry Group – Low Scenario (Present Value – 2010 €m prices)

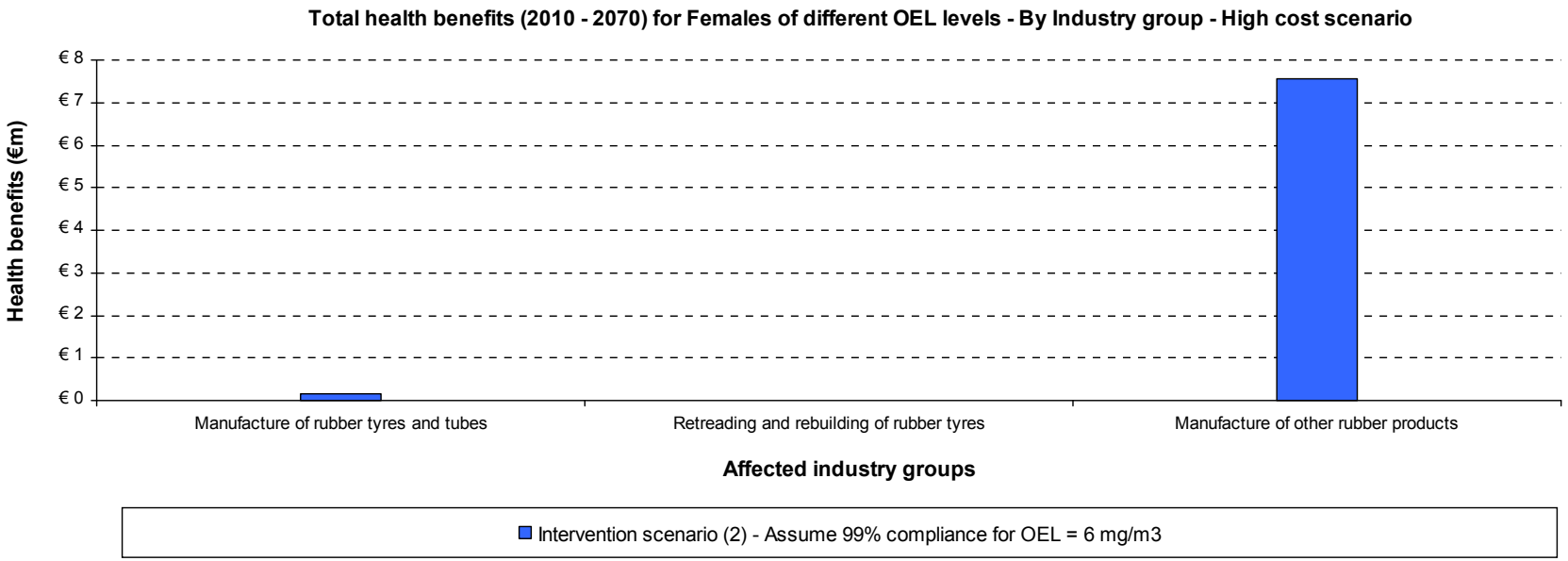

Figure 8.5.6 Total health benefits for females of introducing an EU wide OEL – By Industry Group – High Scenario (Present Value – 2010 €m prices)

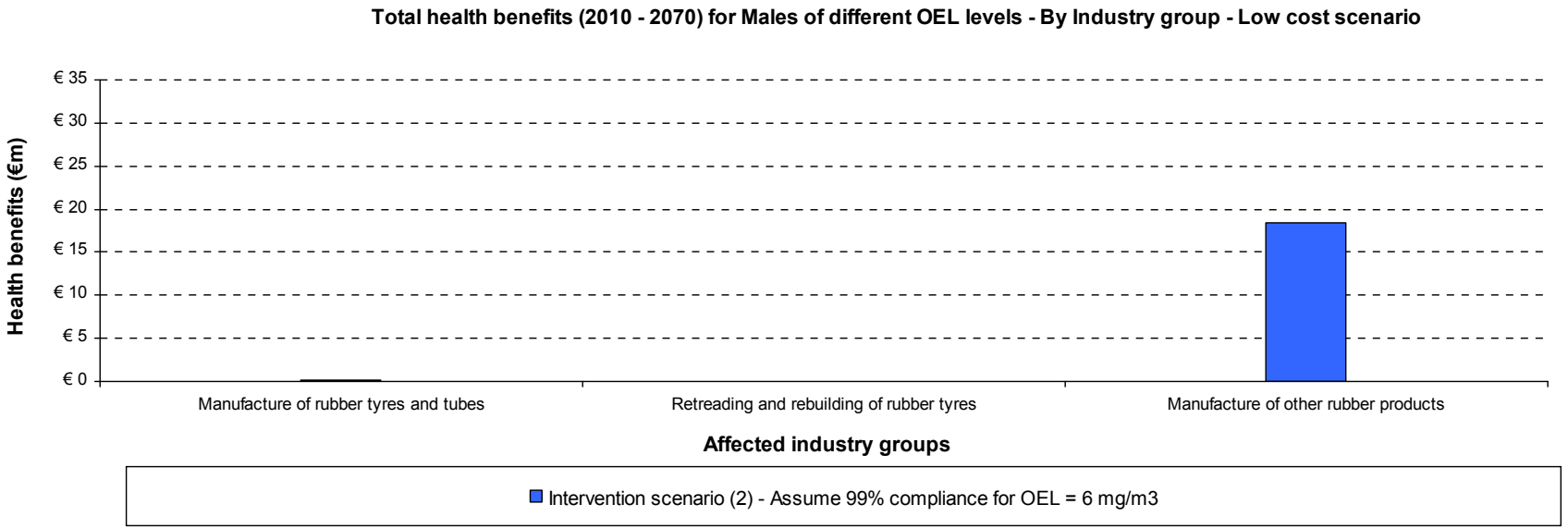

Figure 8.5.7 Total health benefits to males of introducing an EU wide OEL – By Industry Group – Low Scenario (Present Value – 2010 €m prices)

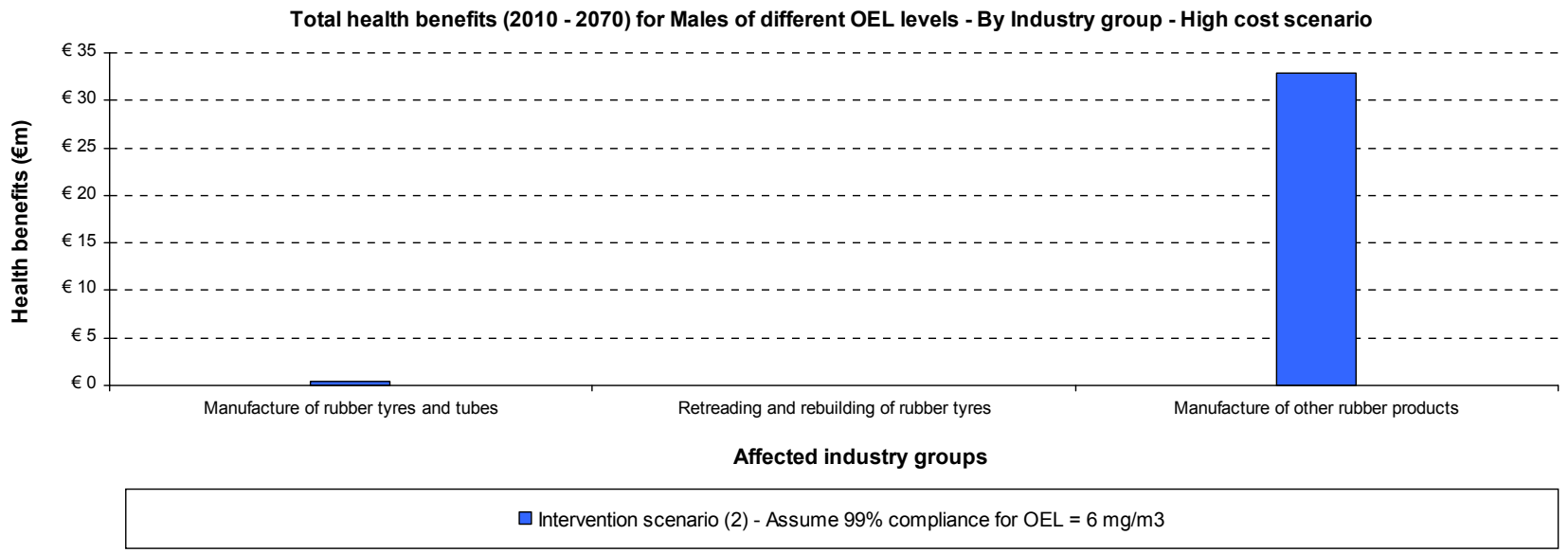

Figure 8.5.8 Total health benefits for males of introducing an EU wide OEL – By Member State – High Scenario (Present Value – 2010 €m prices)

8.5.2 Rubber fumes

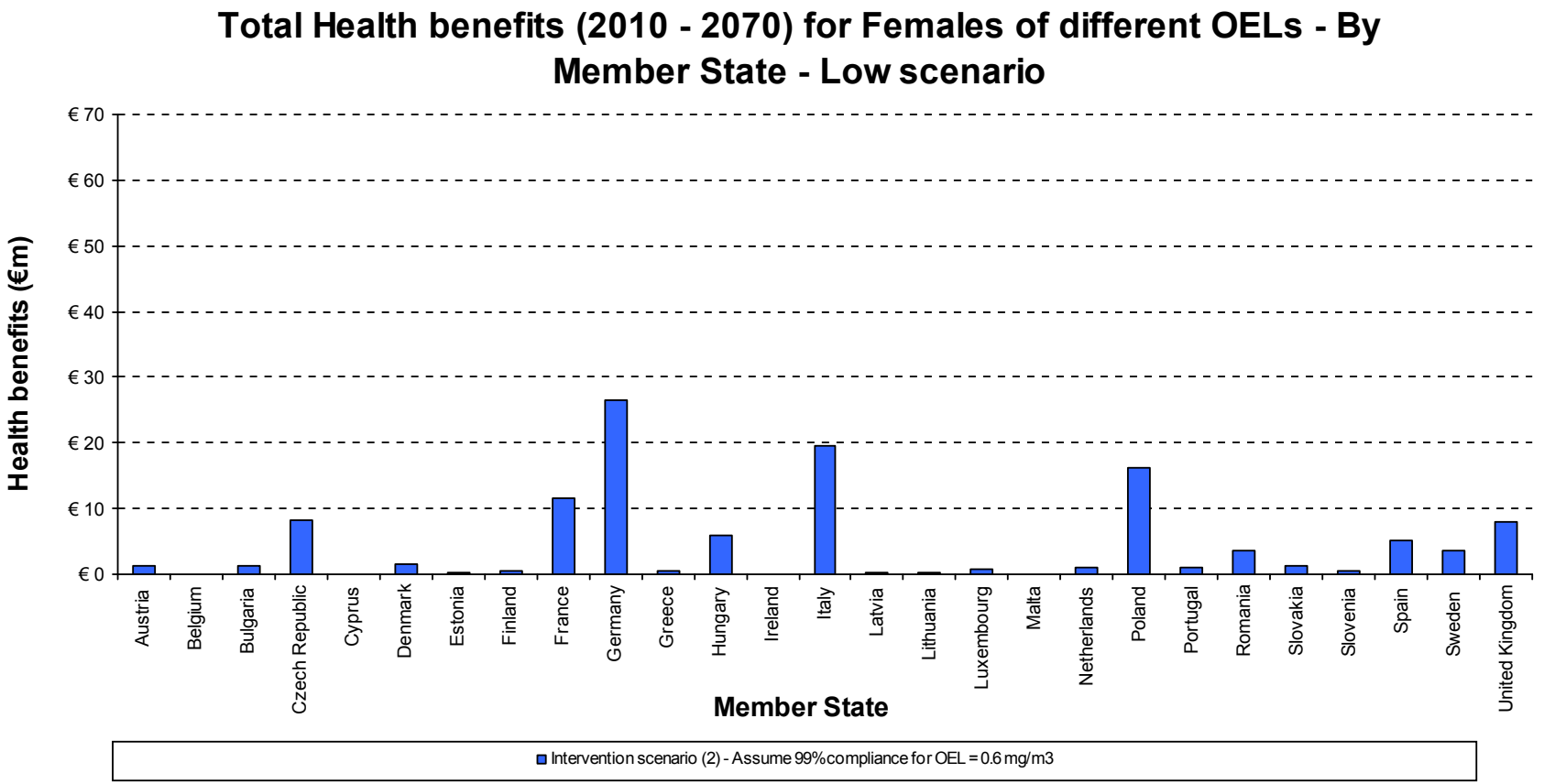

Figure 8.5.9 Total health benefits to females of introducing an EU wide OEL – By Member State – Low Scenario (Present Value – 2010 €m prices)

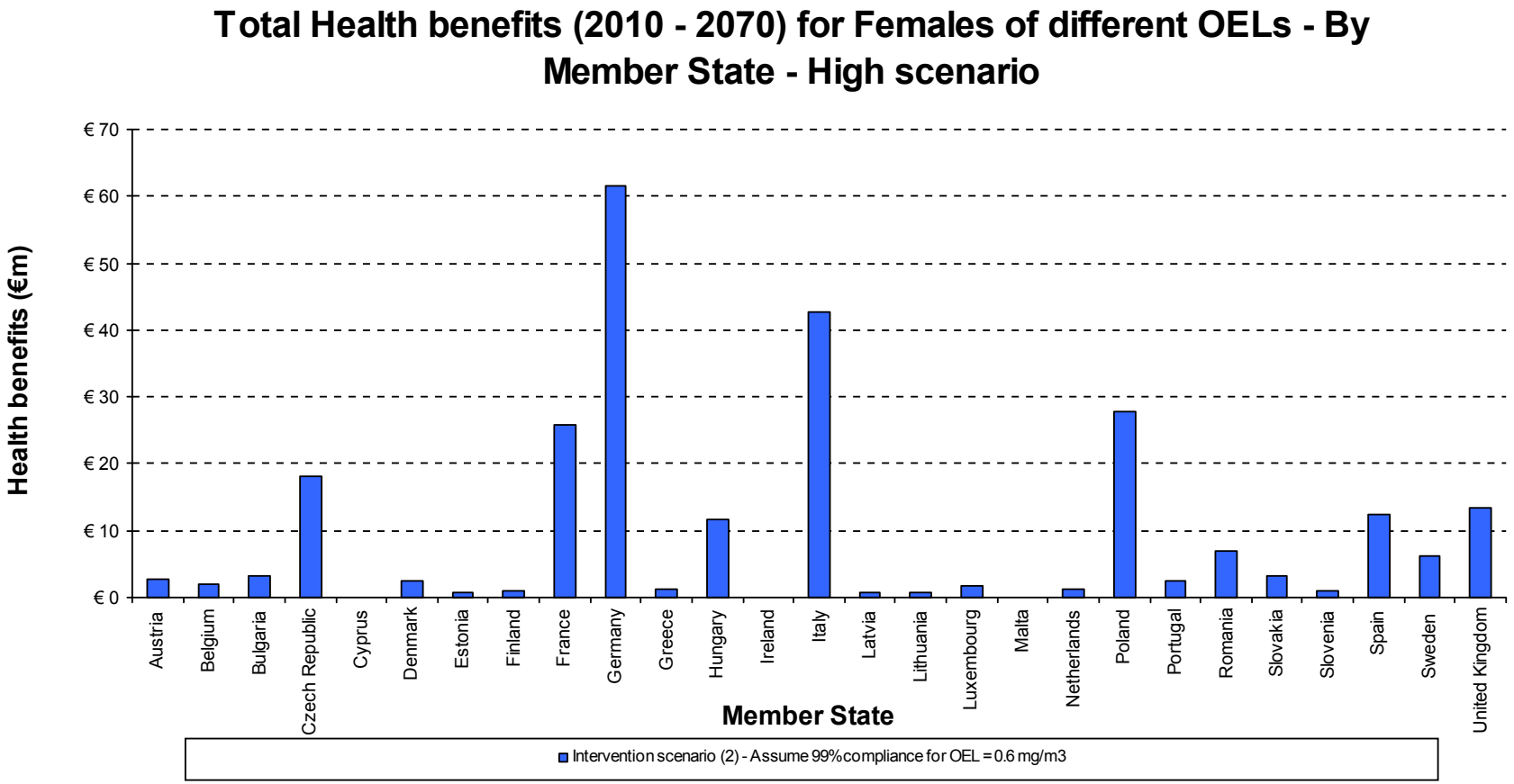

Figure 8.5.10 Total health benefits for females of introducing an EU wide OEL – By Member State – High Scenario (Present Value – 2010 €m prices)

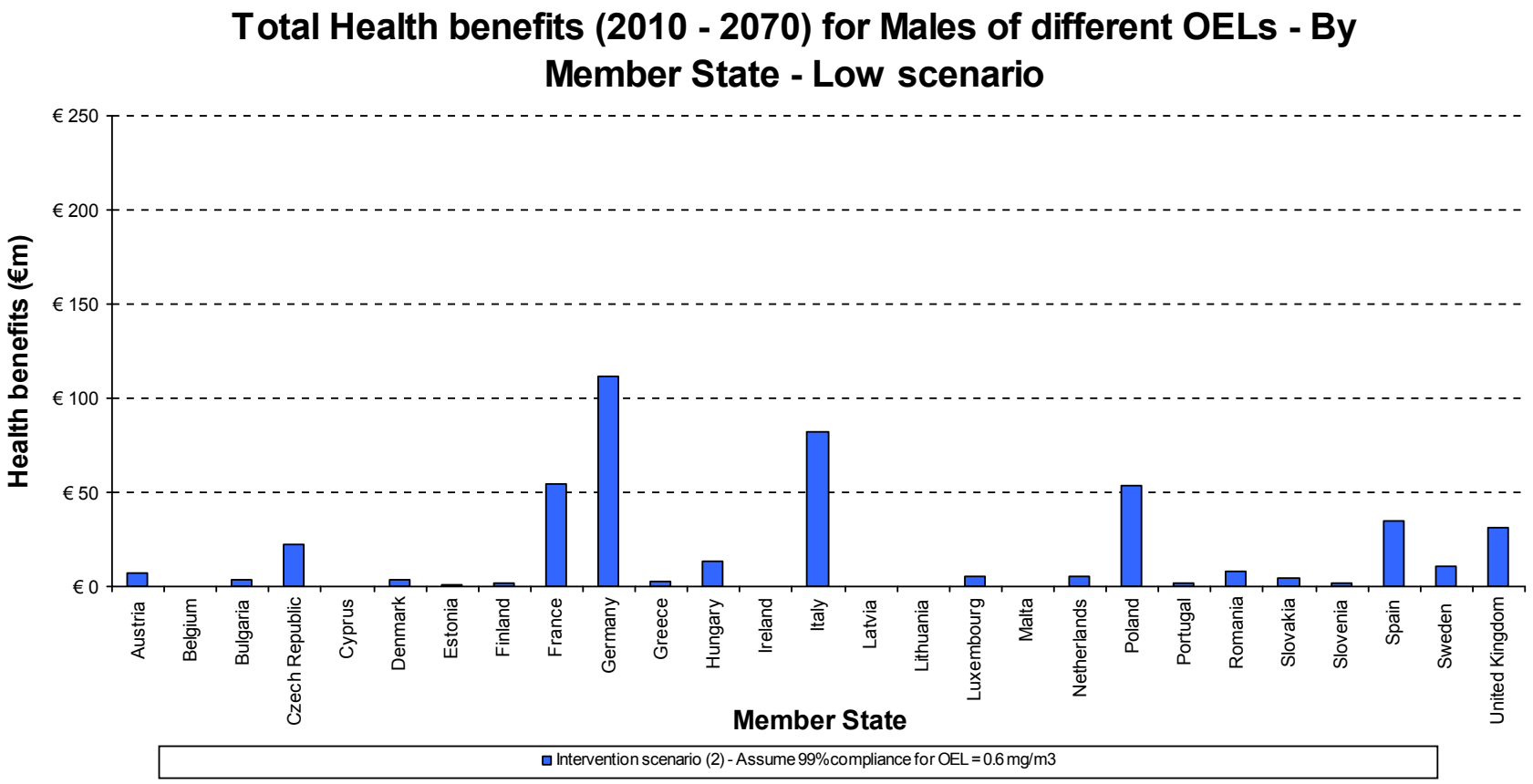

Figure 8.5.11 Total health benefits to males of introducing an EU wide OEL – By Member State – Low Scenario (Present Value – 2010 €m prices)

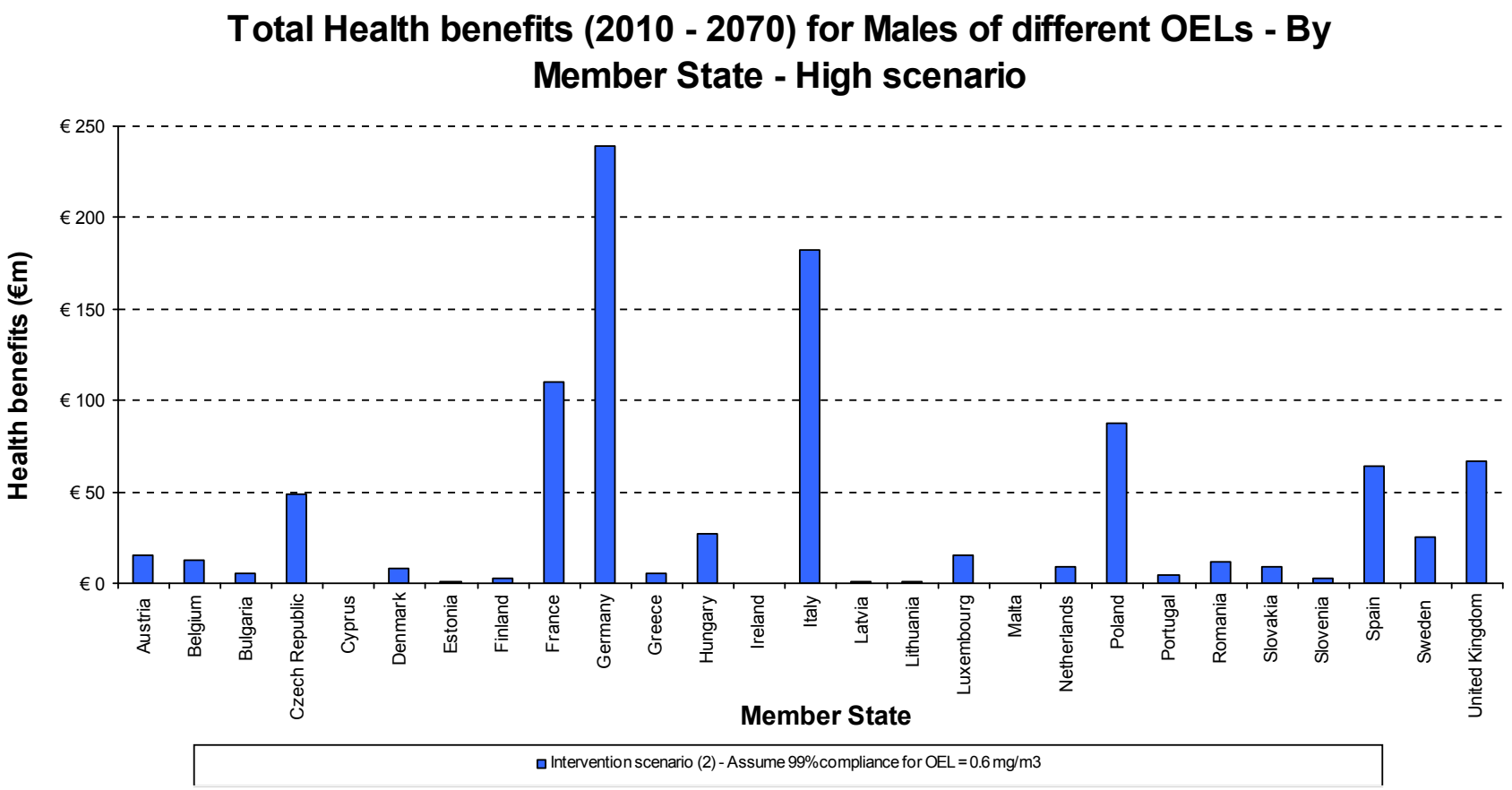

Figure 8.5.12 Total health benefits for males of introducing an EU wide OEL – By Member State – High Scenario (Present Value – 2010 €m prices)

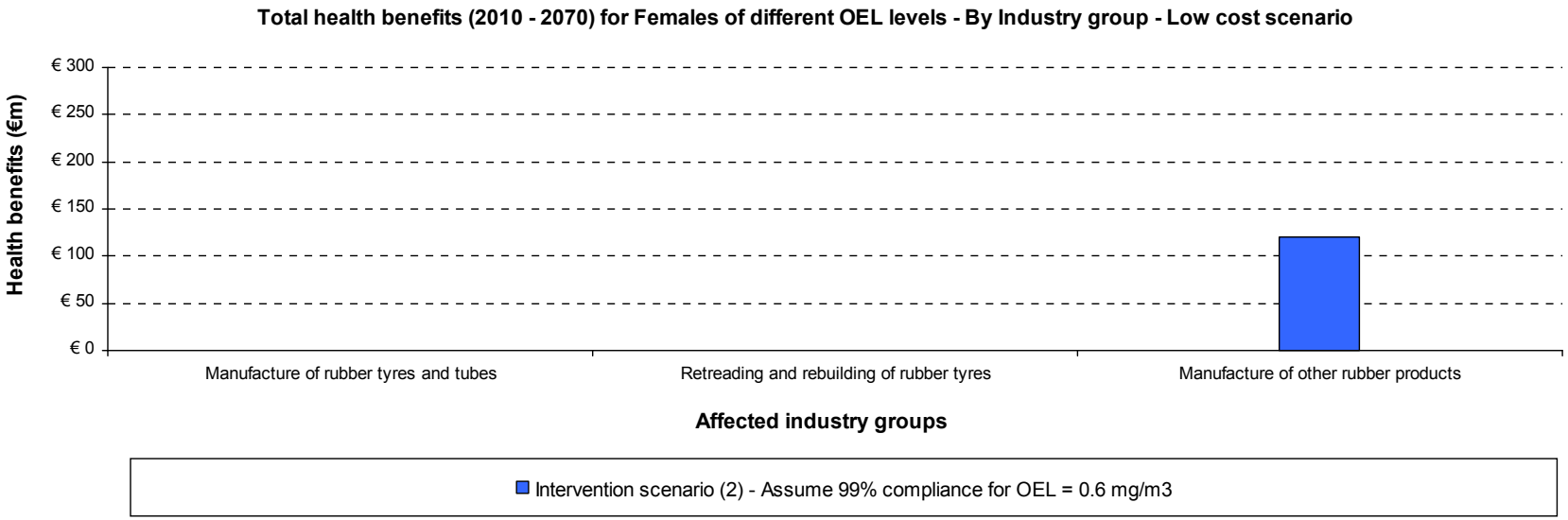

Figure 8.5.13 Total health benefits to females of introducing an EU wide OEL – By Industry Group – Low Scenario (Present Value – 2010 €m prices)

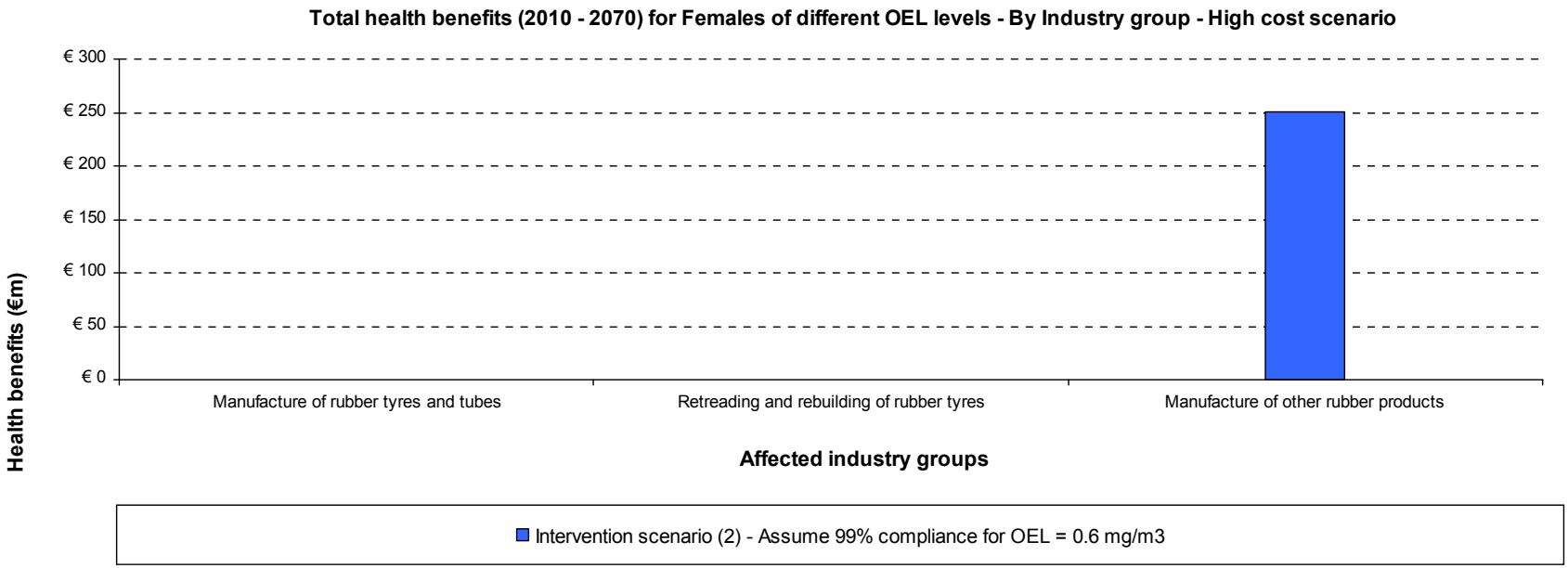

Figure 8.5.14 Total health benefits for females of introducing an EU wide OEL – By Industry Group – High Scenario (Present Value – 2010 €m prices)

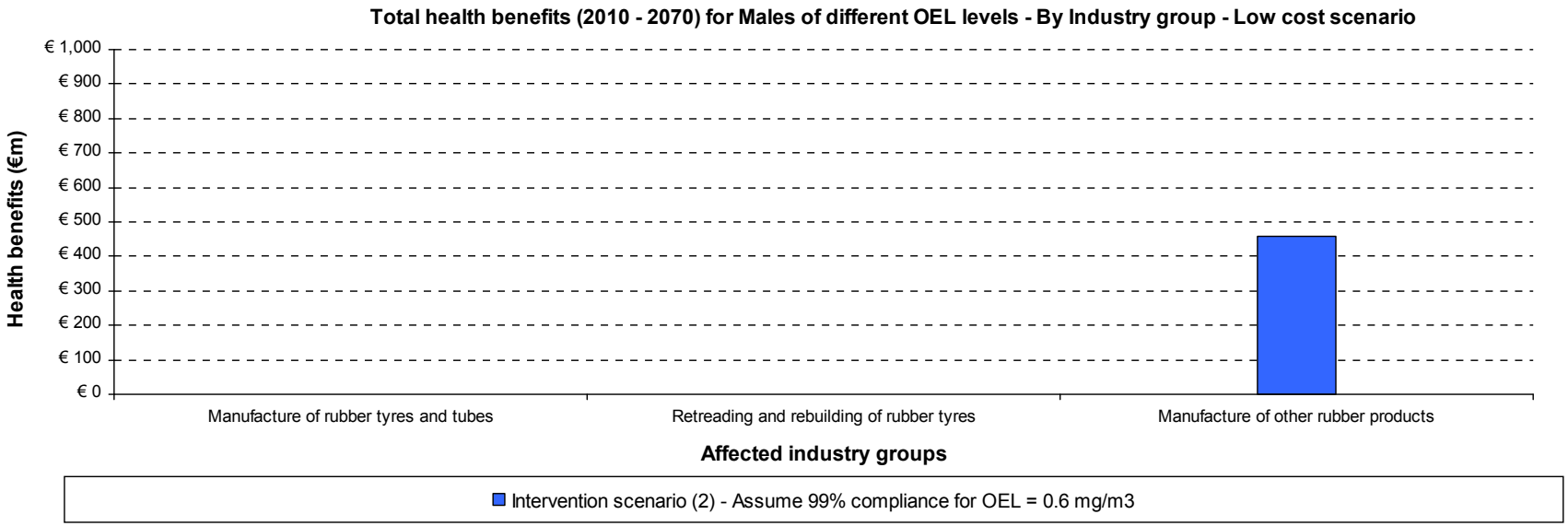

Figure 8.5.15 Total health benefits to males of introducing an EU wide OEL – By Industry Group – Low Scenario (Present Value – 2010 €m prices)

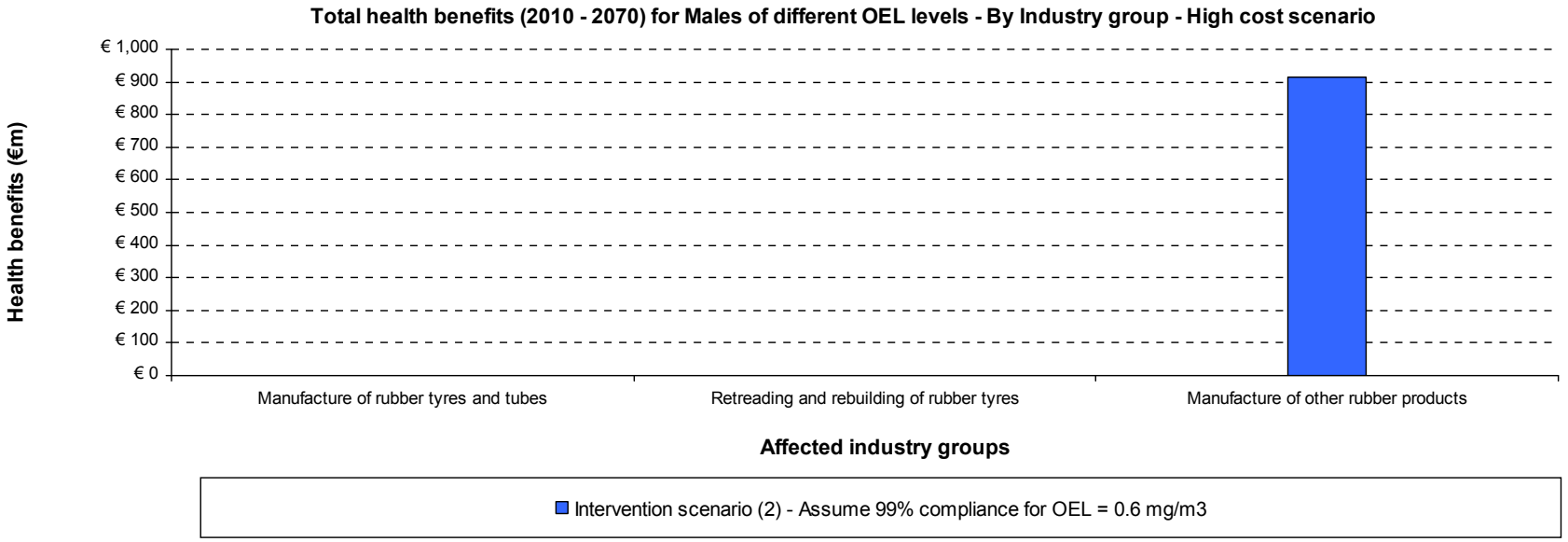

Figure 8.5.16 Total health benefits for males of introducing an EU wide OEL – By Member State – High Scenario (Present Value – 2010 €m prices)

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%)

8.6.1 Rubber dust

Rubber dust		Intervention option					
Range of costs (€m)	Gender	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
	Females	0 to 0	0 to 2	3 to 10	3 to 5	7 to 8	9 to 11
	Males	0 to 0	1 to 4	9 to 35	14 to 25	37 to 49	49 to 65
	Totals	0 to 0	2 to 6	12 to 45	17 to 30	43 to 57	58 to 76
	Gender	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
	Females	0 to 0	0 to 1	1 to 4	1 to 1	1 to 1	1 to 1
	Males	0 to 0	1 to 2	3 to 13	4 to 6	6 to 8	6 to 8
	Totals	0 to 0	1 to 3	5 to 17	4 to 8	7 to 10	7 to 9
	Gender	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
	Females	0 to 0	0 to 1	1 to 5	1 to 2	2 to 2	2 to 2
	Males	0 to 0	1 to 2	4 to 17	5 to 9	10 to 13	10 to 13
	Totals	0 to 0	1 to 3	6 to 21	6 to 11	11 to 15	11 to 15

Member State	Low cost	High cost	Low cost	High cost	Low cost	High cost
Austria	€ 3.13	€ 5.36	€ 0.57	€ 1.14	€ 0.84	€ 1.62
Belgium	€ 0.08	€ 0.03	€ 0.01	€ 0.55	€ 0.02	€ 0.79
Bulgaria	€ 0.60	€ 0.26	€ 0.11	€ 0.17	€ 0.16	€ 0.24
Czech Republic	€ 2.06	€ 0.91	€ 0.37	€ 0.68	€ 0.55	€ 0.97
Cyprus	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Denmark	€ 0.02	€ 0.00	€ 0.01	€ 0.03	€ 0.01	€ 0.03
Estonia	€ 0.17	€ 0.09	€ 0.03	€ 0.06	€ 0.04	€ 0.08
Finland	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
France	€ 22.54	€ 9.53	€ 4.17	€ 7.77	€ 6.17	€ 10.82
Germany	€ 26.65	€ 11.60	€ 4.85	€ 9.63	€ 7.22	€ 13.55
Greece	€ 2.05	€ 0.97	€ 0.35	€ 0.69	€ 0.53	€ 1.00
Hungary	€ 1.54	€ 0.70	€ 0.27	€ 0.45	€ 0.40	€ 0.64
Ireland	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Italy	€ 33.66	€ 14.64	€ 6.13	€ 12.38	€ 9.12	€ 17.54
Latvia	€ 0.71	€ 0.34	€ 0.12	€ 0.33	€ 0.18	€ 0.47
Lithuania	€ 0.17	€ 0.08	€ 0.03	€ 0.08	€ 0.05	€ 0.11
Luxembourg	€ 1.41	€ 0.67	€ 0.24	€ 0.63	€ 0.37	€ 0.91
Malta	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Netherlands	€ 1.46	€ 0.70	€ 0.25	€ 0.41	€ 0.38	€ 0.60
Poland	€ 6.85	€ 3.13	€ 1.18	€ 1.71	€ 1.79	€ 2.48

Member State	Low cost	High cost	Low cost	High cost	Low cost	High cost
Portugal	€ 1.12	€ 0.47	€ 0.21	€ 0.44	€ 0.31	€ 0.61
Romania	€ 0.73	€ 0.32	€ 0.13	€ 0.18	€ 0.19	€ 0.26
Slovakia	€ 0.28	€ 0.13	€ 0.05	€ 0.10	€ 0.07	€ 0.14
Slovenia	€ 0.10	€ 0.05	€ 0.02	€ 0.03	€ 0.03	€ 0.04
Spain	€ 13.79	€ 6.25	€ 2.41	€ 4.12	€ 3.63	€ 5.93
Sweden	€ 0.05	€ 0.00	€ 0.02	€ 0.08	€ 0.03	€ 0.09
United Kingdom	€ 13.47	€ 5.84	€ 2.46	€ 4.56	€ 3.66	€ 6.41

Industry Group	Low cost	High cost	Low cost	High cost	Low cost	High cost
Manufacture of rubber tyres and tubes	€ 2	€ 2.6	€ 0.3	€ 0.5	€ 0.5	€ 0.8
Retreading and rebuilding of rubber tyres	€ 0.0	€ 0.0	€ 0.0	€ 0.0	€ 0.0	€ 0.0
Manufacture of other rubber products	€ 124.8	€ 185.0	€ 22.6	€ 40.5	€ 33.7	€ 57.0

8.6.2 Rubber fumes

Rubber fumes		Intervention option					
Range of costs (€m)	Gender	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
	Females	0 to 0	7 to 25	54 to 183	95 to 227	200 to 338	314 to 464
	Males	0 to 0	17 to 65	150 to 573	342 to 814	847 to 1447	1408 to 2169
	Totals	0 to 0	24 to 90	204 to 756	437 to 1041	1046 to 1785	1722 to 2632
	Gender	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
	Females	0 to 0	4 to 14	20 to 69	24 to 57	34 to 58	36 to 54
	Males	0 to 0	9 to 36	56 to 215	87 to 206	145 to 248	163 to 251
	Totals	0 to 0	13 to 50	77 to 284	111 to 264	179 to 306	199 to 304
	Gender	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
	Females	0 to 0	4 to 14	26 to 87	34 to 81	53 to 89	62 to 91
	Males	0 to 0	9 to 36	72 to 274	122 to 289	224 to 383	277 to 427
	Totals	0 to 0	13 to 50	98 to 361	155 to 370	277 to 472	339 to 518

Member State	Low cost	High cost	Low cost	High cost	Low cost	High cost
Austria	€ 48.72	€ 93.18	€ 8.32	€ 17.96	€ 12.63	€ 26.31
Belgium	€ 2.15	€ 0.91	€ 0.41	€ 14.87	€ 0.60	€ 21.86
Bulgaria	€ 27.28	€ 13.87	€ 4.51	€ 8.31	€ 6.91	€ 12.24
Czech Republic	€ 184.15	€ 93.40	€ 30.67	€ 67.07	€ 46.89	€ 98.64
Cyprus	€ 0.06	€ 0.03	€ 0.01	€ 0.00	€ 0.02	€ 0.00
Denmark	€ 27.23	€ 13.87	€ 4.56	€ 10.46	€ 6.96	€ 15.23
Estonia	€ 5.24	€ 2.67	€ 0.88	€ 1.81	€ 1.34	€ 2.66
Finland	€ 14.16	€ 6.75	€ 2.49	€ 3.81	€ 3.75	€ 5.54

Member State	Low cost	High cost	Low cost	High cost	Low cost	High cost
France	€ 384.92	€ 186.41	€ 66.54	€ 136.17	€ 100.56	€ 197.10
Germany	€ 806.46	€ 396.56	€ 137.84	€ 301.09	€ 209.08	€ 439.01
Greece	€ 17.51	€ 9.09	€ 2.88	€ 6.19	€ 4.42	€ 9.11
Hungary	€ 118.71	€ 62.25	€ 19.27	€ 38.62	€ 29.70	€ 57.19
Ireland	€ 0.03	€ 0.02	€ 0.01	€ 0.01	€ 0.01	€ 0.01
Italy	€ 596.30	€ 296.03	€ 101.40	€ 225.27	€ 154.02	€ 330.65
Latvia	€ 3.67	€ 1.88	€ 0.61	€ 1.76	€ 0.93	€ 2.59
Lithuania	€ 3.07	€ 1.56	€ 0.51	€ 1.47	€ 0.78	€ 2.17
Luxembourg	€ 38.09	€ 19.11	€ 6.44	€ 17.33	€ 9.80	€ 25.35
Malta	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Netherlands	€ 36.46	€ 18.44	€ 6.11	€ 10.33	€ 9.33	€ 15.22
Poland	€ 432.26	€ 228.97	€ 69.77	€ 115.10	€ 107.70	€ 172.62
Portugal	€ 18.04	€ 8.62	€ 3.16	€ 7.21	€ 4.75	€ 10.50
Romania	€ 69.24	€ 35.25	€ 11.44	€ 18.89	€ 17.54	€ 28.01
Slovakia	€ 32.66	€ 16.62	€ 5.44	€ 12.58	€ 8.32	€ 18.65
Slovenia	€ 11.28	€ 5.61	€ 1.91	€ 3.24	€ 2.90	€ 4.77
Spain	€ 244.54	€ 127.22	€ 40.09	€ 76.64	€ 61.59	€ 113.82
Sweden	€ 80.64	€ 38.47	€ 14.22	€ 31.31	€ 21.36	€ 45.31
United Kingdom	€ 230.05	€ 113.87	€ 39.38	€ 79.99	€ 59.67	€ 116.54

Industry Group	Low cost	High cost	Low cost	High cost	Low cost	High cost
Manufacture of rubber tyres and tubes	€ 0	€ 0.6	€ 0.1	€ 0.1	€ 0.1	€ 0.2
Retreading and rebuilding of rubber tyres	€ 0.0	€ 0.1	€ 0.0	€ 0.0	€ 0.0	€ 0.0
Manufacture of other rubber products	€ 3,432.1	€ 6,089.5	€ 577.5	€ 1,166.6	€ 880.0	€ 1,711.0

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