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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

Hydrazine

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SUMMARY

Exposure to hydrazine may cause lung and colorectal cancer. Hydrazine has been classified as a group 2b carcinogen (Possibly carcinogenic to humans) by the International Agency for Research on Cancer and as a Cat 2 carcinogens in the EU under the classification and labelling legislation, and it is therefore within the scope of the EU Carcinogens Directive. This report considers the likely health, socioeconomic and environmental impacts associated with possible changes to the EU Carcinogens Directive, in particular the possible introduction of an occupational exposure limit (OEL) of either 0.013 mg/m^3 (0.01 ppm) or 0.13 mg/m^3 (0.1 ppm).

Both lung and colorectal cancer are relatively common and they are generally diagnosed on people over 60 years of age. In the EU, these cancers make up about 25% of all cancer incidence. About half of all people diagnosed with colorectal cancer will die from their disease within 5-years and about 90% of lung cancer patients die in the same timeframe.

The main uses of hydrazine include chemical blowing agents, agricultural pesticides, and water treatment. In the EU the largest producers are located in Germany and France. There are probably about 23 thousand tonnes of hydrazine produced in Europe each year. We estimated that in 2006, a total of 2.1 million individuals are exposed to low levels of hydrazine, about 15,000 to medium levels and around 800 to high levels.

There is very little information available on current hydrazine exposure levels in industry. However based on the available data we estimate that the upper estimate of exposure in the high group industries is probably about 0.7 mg/m^3 and the corresponding levels in the medium and low groups are 0.1 and 0.06 mg/m^3, respectively. Overall, we consider there are about 75% of workers exposed above 0.013 mg/m^3 and about 8% above 0.13 mg/m^3. Exposures were assumed to be decreasing by about 7% per annum.

We estimate that in 2010 there will be 18 cases of lung cancer (16 deaths) from past exposure to hydrazine and 131 cases of colorectal cancer (27 deaths). Over the next 40 years the incidence of cancers attributable to hydrazine decreases to zero for both types of cancer. The corresponding DALYs for lung cancer decrease from 267 in 2010 to zero in 2050 and beyond, and from 698 to zero over the same time period for colorectal cancer. Health costs associated with these cancers are between about €500m and €3,000m, aggregated over the period 2010 to 2069. These costs fall mainly on France, Germany, Italy, Poland, Romania, Spain and the UK.

There are no important health benefits from introducing a limit at either 0.013 or 0.13 mg/m^3, mainly because exposures are predicted to continue to decrease over the next 20 years and the additional impact of any limit is judged to be negligible. The monetised health benefits are very small (<€0.02m). Costs of compliance with the higher suggested OEL range from €15m to €47m and for the lower OEL from €62 to €196m.

It is not expected that there will be any important social, macro-economic or environmental impacts.

1 PROBLEM DEFINITION

1.1 OUTLINE OF THE INVESTIGATION

Hydrazine may cause lung and colorectal cancer. Exposure to hydrazine has been classified as a group 2b carcinogen (Possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC)[1] and as Cat 2 carcinogens in the EU under the classification and labelling legislation[2]. Hydrazine is therefore already regulated as a carcinogen throughout the EU. In this assessment we consider the impacts of introducing an exposure limit for hydrazine 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 a regulatory exposure limit for hydrazine of 0.013 mg/m^3 (0.01 ppm) and 0.13 mg/m^3 (0.1 ppm).

1.2 OELS/EXPOSURE CONTROL

Existing national occupational exposure limits (OELs) in EU member states are presented in Table 1.1. These are expressed as long-term limits, averaged over an 8-hour working day (OEL TWA) or short-term exposure limits (STELs), i.e. 15 minutes. OELs from the NIOSH and OSHA, and Quebec care also presented for comparison.

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

	OEL TWA- 8 hrs mg/m³	**OEL STEL mg/m³**	**Remarks**
Austria	0.13	0.52	TRK value (based on technical feasibility)
Belgium	0.013		
Denmark	0.013	0.026	
France	0.1		
Hungary		0.13	
Poland	0.05	0.1	
Spain	0.13		skin, sensitivity
Switzerland	0.13		
UK	0.03	0.13	
Canada - Quebec	0.13		
USA - NIOSH		0.04	ceiling limit value (120 min)
USA - OSHA	1	1.3	
USA- ACGIH	0.013		Skin

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

The OELs varied widely across the EU member states; the 8-hrs OELs ranged from 0.013 mg/m^3 (0.01 ppm) in Denmark and Belgium to in 0.13 mg/m^3 (0.1 ppm) in Austria, Spain and Switzerland.

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

For the purposes of this project we have chosen to assess two potential OELs: 0.013 mg/m^3 (0.01 ppm) and 0.13 mg/m^3 (0.1 ppm).

1.3 DESCRIPTION OF DIFFERENT USES

The principal applications of hydrazine solutions include chemical blowing agents, 40%; agricultural pesticides, 25%; and water treatment, 20%. The remaining 15% is used in a variety of fields including pharmaceuticals, explosives, polymers and polymer additives, antioxidants, metal reductants, hydrogenation of organic groups, photography, xerography and dyes (IARC, 1999). The compound is used as an oxygen scavenger in boiler waters. Anhydrous hydrazine is used as an important component of high-energy fuels and rocket propellants (Choudhary 1998).

In the EU the largest producers of hydrazine are Germany and France. Production capacity estimates for hydrazine hydrate in 1988 were 10,000 tonnes in Germany, 10,000 tonnes in France and 3,000 tonnes in the UK (Schirmann, 1989). The estimates for the UK contrast with information published by the UK Health and Safety Executive (HSE, 1997), where it is indicated that hydrazine is not manufactured in the UK, though 1,000 tonnes are imported annually. Around half of that amount was used as an oxygen scavenger in boiler feed water in the electricity generation industry. Most of the remainder was used in chemical synthesis, mainly in the agrochemical and pharmaceutical industries (HSE, 1997).

A study by Kauppinen *et al* (2007) reported that the use of hydrazine as anticorrosive agent in water systems of power plants has been replaced with several other chemicals, e.g. morpholine, oximes and amines.

The production capacity in Europe for hydrazine solutions in 1992 were 6,400 tonnes in Germany and 6,100 tonnes in France (Schiessl, 1995, as reported in IARC, 1999)

1.4 RISKS TO HUMAN HEALTH

1.4.1 Introduction

Hydrazine may increase the risk of lung and colorectal cancer, both of which are common causes of death in the EU (combined they make up about 25% of all cancer incidence).

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

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

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.

Colorectal cancer is the third commonest cause of cancer and the second commonest cause of cancer mortality (Ferlay *et al*, 2007). About two-thirds of these tumours occur in the colon with about a third located in the rectum. More than 80% of people diagnosed with this disease are over 60 years of age. Diet (a diet high in fat and low in fibre, fruits, and vegetables probably increases risk) and genetic factors are the main known causes of colorectal cancer.

Incidence of colorectal cancer differs between European countries; Southern Europe has the lowest incidence and mortality (e.g. Greece) while Eastern Europe has the highest (e.g. Czech Republic, Hungary, Slovakia). These differences probably relate to differences in diet and the stage at which the tumour is diagnosed. Men have higher incidence and mortality than women, which may be mainly due to participation in screening initiatives. Improved treatment has resulted in better survival, although there are still only about half of people who survive for 5-years[3].

1.4.2 Summary of the available epidemiological literature on risk

The evidence of hydrazine carcinogenicity in humans was evaluated by IARC (1999) as being inadequate i.e. class 2B. A preliminary report of an epidemiological study of men engaged in hydrazine manufacture revealed no unusual excess of cancer. This study consisted of 423 men. None of the five cancers reported (three stomach, one prostatic and one neurogenic) occurred in the group with the highest exposure (Roe 1978). A follow-up study of this cohort to 1982 found reduced mortality from all causes with an excess of lung cancer in the highest exposure category based on 2 cases (RR= 1.2, 95%CI, 0.2-4.5) (Wald *et al* 1984).

A cohort of 427 men who worked at a hydrazine plant in the United Kingdom for at least six months between 1945 and 1971 was followed up until 1992 (Morris *et al*, 1995). Follow-up was complete for *95%.* Based on job history records, 78 of the workers were classified as having been exposed to high levels of hydrazine (estimated at about 1-10 ppm) and the remaining 375 to moderate or low exposure (< 1 ppm). Among the whole group, no increase was observed for all-cause mortality (86 deaths, standardized mortality ratio (SMR), 0.8), or for mortality from lung cancer (8 deaths; SMR, 0.7), cancer of the digestive tract (9 deaths; SMR, 1.0) or other cancers (8 deaths; SMR, 0.8), after comparison with the rates for England and Wales. Restricting attention to the high-risk group, the SMR for all-cause mortality was 0.7 (20 deaths) and that for lung cancer was 1.1 (3 deaths). No deaths from cancer of the digestive tract were observed. The SMR for other cancers was 0.8 (2 deaths). None of the SMRs was significantly different from 1.0. Of the three lung cancer cases in the high-exposure group, two occurred in workers with less than two years of occupational exposure to hydrazine.

Since the IARC monograph a retrospective cohort study of 6,107 aerospace workers with exposure to chemicals (primarily hydrazine fuels, but also trichloroethylene (TCE)

[3] Available at: http://www2.lse.ac.uk/LSEHealthAndSocialCare/LSEHealth/pdf/colorectal/ColorectalCancerReport%2025JUNE2008.pdf

and other chemicals) during rocket-engine fueling has been carried out (Ritz *et al*, 1999, 2006). In the first follow-up, the estimated rate ratio for lung cancer mortality, adjusted for other risk factors and comparing exposed to unexposed workers from the same facility, ranged from 1.68 (95% confidence interval, 1.12 to 2.52) to 2.10 (95% confidence interval, 1.36 to 3.25), depending on job-duration threshold (6 or 24 months) and lag time (0 to 15 years) (Ritz *et al*, 1999). Results for hemato- and lymphopoietic cancer and for bladder and kidney cancer mortality were considered imprecise.

The extension of this study to 2001 also included cancer incidence (Ritz *et al* 2006). Estimated hydrazine exposure was assessed using a job-exposure matrix and generated a time-dependent intensity score for each occupational chemical exposure and workers. Rate-ratio estimates were derived from Cox proportional hazards and random-effects models using time-dependent exposure measures for hydrazine adjusting for trichloroethylene, polycyclic aromatic hydrocarbons, benzene, and mineral oil exposures. Exposures to hydrazine were positively associated with lung cancer incidence (estimated rate ratio for high vs. low exposure with 20-year lag = 2.5; 95% CI1.3-4.9) and with colorectal cancer incidence (2.2; 1.0-4.6) (Table 1). Dose-response associations were observed for lung cancer and for incidence for colorectal cancer (Table 1.2).

Table 1.2 Risk ratios for lung cancer and colorectal cancer by exposure score

Exposure	Rate ratio (95% confidence interval)			
	Zero lag		20 year lag	
	Mortality	Incidence	Mortality	Incidence
Lung cancer				
Low (score ≤ 3)	1	1	1	1
Medium (score >3 ≤ 12)	1.46 (0.96, 2.22)	1.15 (0.60, 2.20)	1.24 (0.78, 1.96)	1.18 (0.62, 2.24)
High (score ≥ 12	1.49 (0.94, 2.35)	2.31 (1.21, 4.43)	1.67 (0.99, 2.83)	2.49 (1.28, 4.86)
Test for trend	0.07	0.01	0.03	0.003
Colorectal cancer				
Low (score ≤ 3)	1	1	1	1
Medium (score >3 ≤ 12)	0.90 (0.41, 2.01)	1.60 (0.86, 3.11)	0.83 (0.35, 1.95)	1.75 (0.93, 3.30)
High (score ≥ 12	1.02 (0.47, 3.07)	2.09 (1.07, 4.31)	1.55 (0.61, 3.90)	2.16 (1.02, 4.59)
Test for trend	0.97	0.04	0.48	0.04

Effect estimates for cancers of the blood and lymph system, and kidneys were based on only small numbers and patterns were less clear. Consistently increased rate-ratios (all non-significant) were found for cancer of the pancreas; risk estimates for cancer of the pancreas when cumulative exposure was treated as a continuous variable were 1.5 (95%CI 1, 1.2) for mortality and 1.7 (95%CI 1.3, 2.4) for incidence per 10 units of exposure score (zero lag). There was also a tendency for risk ratios to increase for colorectal cancer although patterns were not consistent or statistically significant.

We note that in this cohort "Workers with job titles that indicated technical or mechanical work on rocket engines were presumed to have been exposed to hydrazine rocket fuels. High exposure to TCE also occurred at the rocket engine test stands that involved the cleaning (''flushing out'') of rocket engines." (Zhao *et al* (2005). TCE is an IARC 2A carcinogen with good evidence of an association between exposure and a

risk for kidney, liver and biliary cancer and NHL. However, TCE is not considered to be a potential cause of lung or colorectal cancer.

1.4.3 Choice of risk estimates to assess health impact

There has been additional epidemiological evidence for hydrazine since the IARC evaluation in 1999, which has enabled us to make recommendations for relative risk estimates for both lung and colorectal cancers; results for other cancer sites are less robust. The risk estimates for a 20-year lag for cancer incidence are for lung cancer 2.49 for high exposure, 1.18 for medium exposure and 1 for low exposure. The corresponding relative risk estimates for colorectal cancer are 2.16, 1.75 and 1 (all figures taken form the final column of Table 1.2).

2 BASELINE SCENARIOS

2.1 STRUCTURE OF THE SECTOR

Table 2.1 shows the total number of people employed, number of enterprises and turnover in the chemical manufacturing sector based on information from Eurostat. This is the only sector classified as having a high risk of exposure to hydrazine.

Table 2.1 Statistics of the sectors used in this study

Sector	NACE code	Total number of employees in sector	Number of enterprises	Turnover
Manufacture of basic chemicals	24	1,856,966	30,990	700,000

Notes:
1) This gives the total number of employees employed in the sector and does not represent the number of personnel exposed to hydrazine (as shown in Table 2.2)
Source: Eurostat data for year 2006

NACE 1 (Agriculture, hunting and related service activities) is classified with a medium risk. Data in Eurostat is not available in the same way for the agricultural sector (typically based on farm size and by ha). Eurostat data (2006) gathered suggests around 26.8m people are employed within this NACE code.

2.2 PREVALENCE OF HYDRAZINE EXPOSURE IN EU

We estimated the prevalence of exposure to hydrazine in the manufacture of basic chemicals (NACE code 24) based on the Finnish CAREX estimate of 2009, as this was the most recent data available for this industry. The Finnish exposure prevalence data may not be applicable to all countries in Europe; however it was the only data on prevalence of exposure available to us.

The estimated exposure prevalence for the EU member states based on 2006 employment data is shown in Table 2.2. We estimated that a total of 2,133,538 individuals are exposed in EU to low levels of hydrazine, 14,674 to medium levels and 833 to high levels.

The estimated exposure prevalence for the Manufacture of base chemicals (NACE code 24) industry is based on 2006 employment data. Data on the number of employees was not available for Albania, Malta and Portugal. Estimates on the number of employees in the manufacturing industry for these countries was estimated based on the number of exposed employees in countries with similar figures for their gross domestic product (GDP) contribution from industry and the number of people working in industry. Information on these figures as well as on whether there was industrial activity in the country was obtained from the fact world section in the CIA website[4].

For exposure prevalence in the Agriculture (NACE code 1) industry there were not data in the Finnish, Spanish or Italian CAREX databases. In the agricultural industry, hydrazine is used as a pesticide. We assumed the exposure prevalence is similar to that of the fungicide captafol (Italian CAREX database 2005).

For the remaining industries, when data for 2006 was not available in the Eurostat database[5], data from other years was used. The exposure prevalence for NACE code 25 (Manufacture of rubber and plastic products) was not available in the Finnish, Spanish or Italian CAREX databases. We estimated the number of exposed individuals based on the exposure prevalence of 1,3-butadiene (Finnish CAREX database 2006). Hydrazine derivatives are used in the rubber and plastic industry as blowing agents. We assumed the exposure prevalence of hydrazine in this industry is similar to that of 1,3-butadiene, as 1,3-butadiene is also used as in the production of rubber and plastic. It is likely that the exposure prevalence for hydrazine is lower than that for 1,3-butadiene, as hydrazine is used as an additive whereas 1,3-butadiene is an essential compound in the production of synthetic rubber. However, we considered this is a good estimate.

The estimated number of male and female employees in each industry group in each EU member state is shown in Appendix 8.1. The proportion of male and female employees exposed to hydrazine was estimated based on the reported proportions for the manufacturing industry in the Labour Force Survey on the Eurostat Database[6]. The number of females and males employees was not available for Malta. In this case the average figure estimated for Europe for each industry was used.

[4] Available at: https://www.cia.gov/library/publications/the-world-factbook/
[5] Available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/european_business/introduction
[6] Available at: http://epp.eurostat.ec.europa.eu

Table 2.2 Number of workers exposed to hydrazine by country and NACE code (NA = Not Available)

	NACE Rev1											
	1	**15**	**21**	**24**	**25**	**32**	**40**	**41**	**73**	**74**	**80**	**Grand Total**
Albania	NA	NA	NA	3	NA	NA	9,071	582	NA	29	NA	9,682
Austria	258	NA	287	12	12,932	314	23,017	295	886	2595	7	40,333
Belgium	99	1,238	232	30	12,431	199	13,291	680	1,024	3652	12	32,759
Bulgaria	298	1,410	179	11	10,953	68	30,729	2,020	55	1104	7	46,526
Cyprus	17	164	13	1	547	1	932	38	NA	122	1	1,817
Czech Republic	212	NA	325	18	38,999	404	29,626	2,200	1,020	3171	9	75,754
Denmark	99	1,095	122	13	9,535	79	11,037	362	1,060	2242	7	25,539
Estonia	36	221	30	1	2,373	75	5,321	176	74	368	2	8,640
Finland	134	514	518	8	7,044	431	11,041	249	534	1269	6	21,606
France	1,087	8,350	1,278	118	106,342	1,362	127,880	3,880	6,955	21419	58	277,524
Germany	997	10,570	2,338	196	174,209	1,699	187,648	4,582	15,599	29129	68	425,840
Greece	617	1,103	122	8	5,398	54	NA	NA	1,483	2473	10	10,643
Hungary	221	1,567	280	14	18,894	609	26,288	2,345	1,065	2867	10	53,925
Ireland	136	636	55	11	4,615	103	7,814	820	404	1262	4	15,713
Italy	1,128	5,671	1,285	85	92,469	988	71,112	2,859	4,400	17459	50	196,294
Latvia	142	452	26	2	2,121	13	10,434	222	203	387	3	13,860
Lithuania	219	661	37	3	4,378	71	15,472	665	122	498	4	21,908
Luxembourg	4	NA	NA	0	2,834	NA	756	13	269	356	0	4,228
Malta	3	NA	NA	1	NA	38	NA	NA	54	72	0	164
Netherlands	307	1,633	353	27	15,038	350	15,356	535	5,615	11106	18	50,003
Poland	2,729	5,762	719	46	69,217	484	125,479	5,231	684	5992	37	213,605
Portugal	699	1,378	195	24	11,883	152	8,415	1,470	211	4162	10	27,877
Romania	3,380	2,648	265	21	21,662	112	76,763	3,903	3,833	2595	14	111,796
Slovakia	120	604	124	5	9,599	159	20,688	1,423	739	623	5	33,963
Slovenia	109	251	87	6	6,253	62	6,165	441	431	479	2	14,171
Spain	1,063	5,018	899	60	55,232	300	31,347	3,359	2,773	16929	35	115,892
Sweden	114	NA	669	19	13,166	347	23,310	120	1,887	3153	16	42,667
United Kingdom	446	5,667	1,197	92	95,755	805	88,435	2,875	17,132	28862	83	240,811
Total	**14,674**	**56,613**	**11,635**	**833**	**803,877**	**9,277**	**977,427**	**41,344**	**68,513**	**164,374**	**479**	**2,133,538**

2.3 LEVEL OF EXPOSURE TO HYDRAZINE

2.3.1 Estimation of exposure levels

Little information on current occupational exposure levels was identified. A literature review in the databases PubMed and Science Direct using the search terms "hydrazine" and "exposure" did not retrieve any recent (after 1995) information on exposure to hydrazine in the EU. The most recent data on exposure data were reported by Nomiyama *et al* (1998) from four production plants of hydrazine hydrate in Japan. Personal exposure concentrations ranged from below the limit of detection to 0.2 ppm (0.266 mg/m^3). The AM and GM were 0.011 ppm and 0.0013 ppm. The GSD was 8.4. Only 1.5% of workers were exposed to concentrations over 0.10 ppm and 21.5 % were exposed to concentrations above 0.01 ppm.

Wald *et al* (1984) estimated concentrations in a production plant in the UK between 1945 and 1971 to be in the range of 1 to 10 ppm (1.3 – 13 mg/m^3), with concentrations near storage vessels estimated to be up to 100 ppm. This estimation was derived by the simulation of spillages and calculations using data on the saturated vapour pressure of hydrazine at 20°C, which suggest that maximum levels of 100 ppm are possible.

The US ATSDR review[7] of hydrazine notes that as most hydrazine production processes take place within closed systems, the potential for exposure is generally low (citing Fajen and McCammon 1988). The main potential exposures result from process sampling giving rise to levels as 8hr TWA concentrations between 0.05 to 0.35 mg/m^3 (0.04 to 0.27 ppm). They also note that in areas where hydrazine was added to the boiler systems long-term exposure levels were generally below about 0.13 mg/m^3 (0.1 ppm), although short-term concentrations could range up to about 0.3 mg/m^3 (0.23 ppm).

The health and safety guide published by the WHO in 1999 estimated similar exposure levels in manufacturing with concentrations up to 0.35 mg/m^3 during production under normal conditions, and that, exceptionally, concentrations of up to 1.18 mg/m^3 may occur (WHO, 1999).

Due to the lack of current exposure data it is difficult to estimate typical values over a working day. However, it is likely that current exposure concentrations are now much lower than those reported in the previous studies. We adopt a conservative estimate and assume that the highest reported concentrations by the WHO were typical in 1999 in the EU (i.e. AM=0.35 mg/m^3). From this AM and assuming a GSD=3, which is fairly typical for occupational exposure data, we estimated the GM as described in Lavoué *et al* (2007); the estimated GM is 0.19 mg/m^3. Assuming a reduction of 7% per year between 1999 and 2006 (based on data from a review carried out by Creely *et al*, 2007), exposure concentrations (GM) in 2010 would be 0.086 mg/m^3, with a typical GSD=3 giving an estimated 99th percentile of the exposure distribution of 0.7 mg/m^3. The corresponding conservative level in the "medium" and "low" exposed jobs might be 0.1 and 0.06 mg/m^3, respectively.

The overall weighted GM and GSD was estimated across high and medium exposure industries and across all industries across the EU using @Risk © (Palisade Corporation, New York). Exposures were simulated using the GM and GSD for each

[7] Available at: http://www.atsdr.cdc.gov/toxprofiles/tp100-c5.pdf

country. The number of values each industry contributed was weighted according to the number of workers exposed in that industry. The estimated weighted GM and GSDs are presented in Table 2.3. The exposure distributions for high and medium exposure industries and for all industries were simulated using Monte Carlo simulation. The percentage of workers who are expected to be exposed above the typical OELs (0.013 mg/m^3 and 0.13 mg/m^3) was estimated with the simulated distributions (Table 2.2).

Table 2.3 Overall weighted exposure distributions for high and medium exposure industries and for all industries and the estimated percentage of workers exposed above typical OELs

Industries	GM (mg/m^3)	GSD	% Over OEL	
			0.013 mg/m^3	0.13 mg/m^3
Low Only	0.027	3	75.0	7.6
Medium Only	0.045	3	87.0	17.0
High Only	0.086	3	96.0	35.0
High and Medium Only	0.047	3	88.0	18.0
High, Medium and Low	0.027	3	74.0	7.6

Classification of Industries by Exposure Level

Industries in which hydrazine exposure may occur have been classified as high, medium or low (historic) exposure based on an evaluation of the peer-reviewed literature and expert judgement. The exposure classification by industry is presented in Table 2.4. The industries, grouped by NACE code, were identified from the Finnish CAREX database and data from the available published literature. The two most likely occupational exposure routes are inhalation and dermal contact (Keller *et al* 1988). High exposure levels were estimated to be only likely in manufacturing of basic chemicals (NACE code 24). We assumed exposure in the rest of the industries is low as hydrazine is kept and transported in enclosed systems. In agriculture hydrazine derivatives are used as pesticides. Pesticide spraying might result in higher exposure than when it is contained in enclosed system and therefore we have been classified the level of exposure as medium.

The NACE codes 27 (Manufacture of basic iron and steel and of ferro-alloys), 52 (Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods) 85 (Human Health Activities) and 90 (Sewage and refuse disposal, sanitation and similar activities), had very low exposure prevalence and are therefore not included in Table 2.4.

Some studies have shown potential for exposure in the aerospace industry (Zelnick *et al* 2003, Krishnadasan *et al* 2007). However there are few testing aerospace facilities in the EU and most of the tests are carried out outside EU in Kourou in the French Guiana[8]. The number of people employed by the European Space Agency (EAS) is 2,000 including administration. Personnel working in the launching area are equipped with full body suits and full-face masks. Therefore, we assumed there are very few people exposed and at very low, concentrations.

[8] Available at: www.esa.int

Table 2.4 Classification of industries by exposure level

Industry	NACE (rev 1)	Historical Exposure Classification	Number of People Exposed 2006
Manufacture of Food Products and Beverages	15	L	56,613
Manufacture of pulp, paper and paper products	21	L	11,635
Manufacture of basic chemicals	24	**H**	833
Manufacture of rubber and plastic products	25	L	803,877
Manufacture of radio, television and communication equipment and apparatus	32	L	9,277
Electricity, gas, steam and hot water supply	40	L	977,427
Collection, purification and distribution of water	41	L	41,344
Research and development	73	L	68,513
Other business activities	74	L	164,374
Education	80	L	479
Agriculture, hunting and related service activities	1	M	14,674

2.3.2 Temporal change in exposure

There is no information about the temporal change in exposure to hydrazine, but we have good data that suggests that in almost all situations exposure decreases over time (Creely, 2007). In this review the annual percentage change in exposure for vapours ranged from -19% to +4% per annum, with a median reduction of 7% each year. We have therefore applied a decline of 7% per year in exposure to the hydrazine exposure estimates.

2.4 HEALTH IMPACT FROM CURRENT EXPOSURES

2.4.1 Background data

The occupation cancer associated with hydrazine exposure is shown in Table 2.5, along with a summary of the information used in the health impact assessment.

Table 2.5 Occupational cancers association with exposure to Hydrazine

Cancer site	Lung		Colorectal	
ICD-10 code	C33-C34		C18, C19-C21	
IARC group for carcinogen	2B		2B	
Strength of evidence for cancer site [(1)]	-		-	
Latency assumption	10-50 yrs		10-50 yrs	
Source of forecast numbers - deaths	Eurostat, 2006		Eurostat, 2006	
Source of forecast numbers - registrations	GLOBOCAN, 2002[9]		GLOBOCAN, 2002[9]	
Exposure levels	Relative Risk (RR)	Source of RR	Relative Risk (RR)	Source of RR
"High"	2.49 (1.28, 4.86)	Ritz *et al* 2006	2.16 (1.02, 4.59)	Ritz *et al* 2006
"Medium"	1.18 (0.62, 2.24)	Ritz *et al* 2006	1.75 (0.93, 3.30)	Ritz *et al* 2006
"Low"	1		1	

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

2.4.2 Exposed numbers and exposure levels

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 2.4 in the previous section on exposure. The estimated average exposure level (GM) and measure of variability (GSD) for NACE industries used are 0.027 and 3 mg/m^3 respectively.

We present data for a "baseline" scenario which for all industries assumes a 7% annual decline in exposure levels and standard change in employed numbers up to the 2021-30 estimation interval and constant levels thereafter.

2.4.3 Forecast cancer numbers

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

2.4.4 Results

The cancer deaths and registrations attributed to occupational exposure to hydrazine 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. In the absence of data for colorectal cancer, for estimating YLDs data for kidney cancer, with similar survival times, was used.

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

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

A summary of the results for lung and colorectal cancers for the total EU is in Table 2.6 below.

Table 2.6 Results for the baseline forecast scenario, total EU (27 countries), men plus women[10]

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**
Numbers ever exposed	8,362,105	8,530,017	8,752,663	8,830,261	8,869,957	8,905,278
Proportion of the population exposed	2.31%	2.24%	2.25%	2.24%	2.26%	2.32%
Lung cancer						
Attributable Fraction	0.00588%	0.00286%	0.00028%	0.00002%	0.00000%	0.00000%
Attributable deaths	16	9	1	0	0	0
Attributable registrations	18	10	1	0	0	0
'Avoided' cancers						
YLLs	256	142	16	1	0	0
DALYs	267	148	16	1	0	0
Colorectal cancer						
Attributable Fraction	0.01969%	0.00971%	0.00102%	0.00008%	0.00001%	0.00000%
Attributable deaths	27	16	2	0	0	0
Attributable registrations	131	75	9	1	0	0
'Avoided' cancers						
YLLs	380	215	25	2	0	0
DALYs	489	277	33	3	0	0

The attributable deaths in the EU 2010 from previous hydrazine exposure were small for both lung and colorectal cancers, with a predicted 16 deaths from lung cancer and 27 deaths from colorectal cancer in 2010. The estimated deaths and cancer registrations decrease to zero for both cancers by 2060. The corresponding estimated attributable fraction decreases for both cancers from approximately 0.006% in 2010 for lung cancer to 0.0% in 2060 and from about 0.02% in 2010 for colorectal cancer to 0.0% in 2060. DALYs are also predicted to decrease in the baseline scenario from 267 years in 2010 for lung cancer to 0 years in 2060 and from 498 years in 2010 for colorectal cancer to 0 years in 2060.

[10] 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.

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 relatively small number of cancer registrations and YLLs from lung and colorectal cancer resulting from predicted exposure to hydrazine. There is predicted to be a decline in registrations and YLLs over time as a result of predicted exposure reduction owing to implementation of existing and on-going risk management measures across the EU.

Method in brief

Using the health data (cancer registrations and Years of Life Lost - 'YLL'), 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[11]). 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 publically 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 2.7 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)[12].

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

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

Table 2.7 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[13]. In order to assess the effect that discounting has on the results ('sensitivity analysis), we have also presented estimates that take into consideration a declining discount rate for impacts occurring after 30 years and no discounting.

The health data shown in section 2.4 are 'snap-shots' (i.e. 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

The health costs under the baseline scenario are presented in Table 2.8. Health-related costs are predicted to decline over time and are predominately the result of past exposure. In Section 2.4 the number of cancer registrations and YLLs are estimated to decline over time, accounted for by risk management measures (RMMs) already imposed (as applied at production and end use) over the past 10-20 years.

The introduction of an EU-wide OEL is not expected to have a significant impact in the short term given that the main Member States already have a national OEL in place (the stringency varies by Member State). Table 2.8 sets out the ranges of health costs for each representative decade. The ranges are based on the high and low cost scenarios (see Table 2.7). The results are also illustrated in Figure 2.1.

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

Table 2.8 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	110 to 818	50 to 378	5 to 36	0 to 2	0 to 0	0 to 0	165 to 1,234
Male	218 to 1140	101 to 533	9 to 46	1 to 3	0 to 0	0 to 0	330 to 1,722
Total	328 to 1,958	151 to 911	14 to 82	1 to 5	0 to 0	0 to 0	495 to 2,956

Notes:

- All costs are presented in present value using a discount rate of 4%. The low range is based on low estimates for costs of illness and life years lost. The upper range of costs relate to WTP estimates to avoid having cancer, which include intangible costs associated with having cancer.
- Totals may not match to sums of females and male costs due to underlying small differences in raw data and rounding to whole number

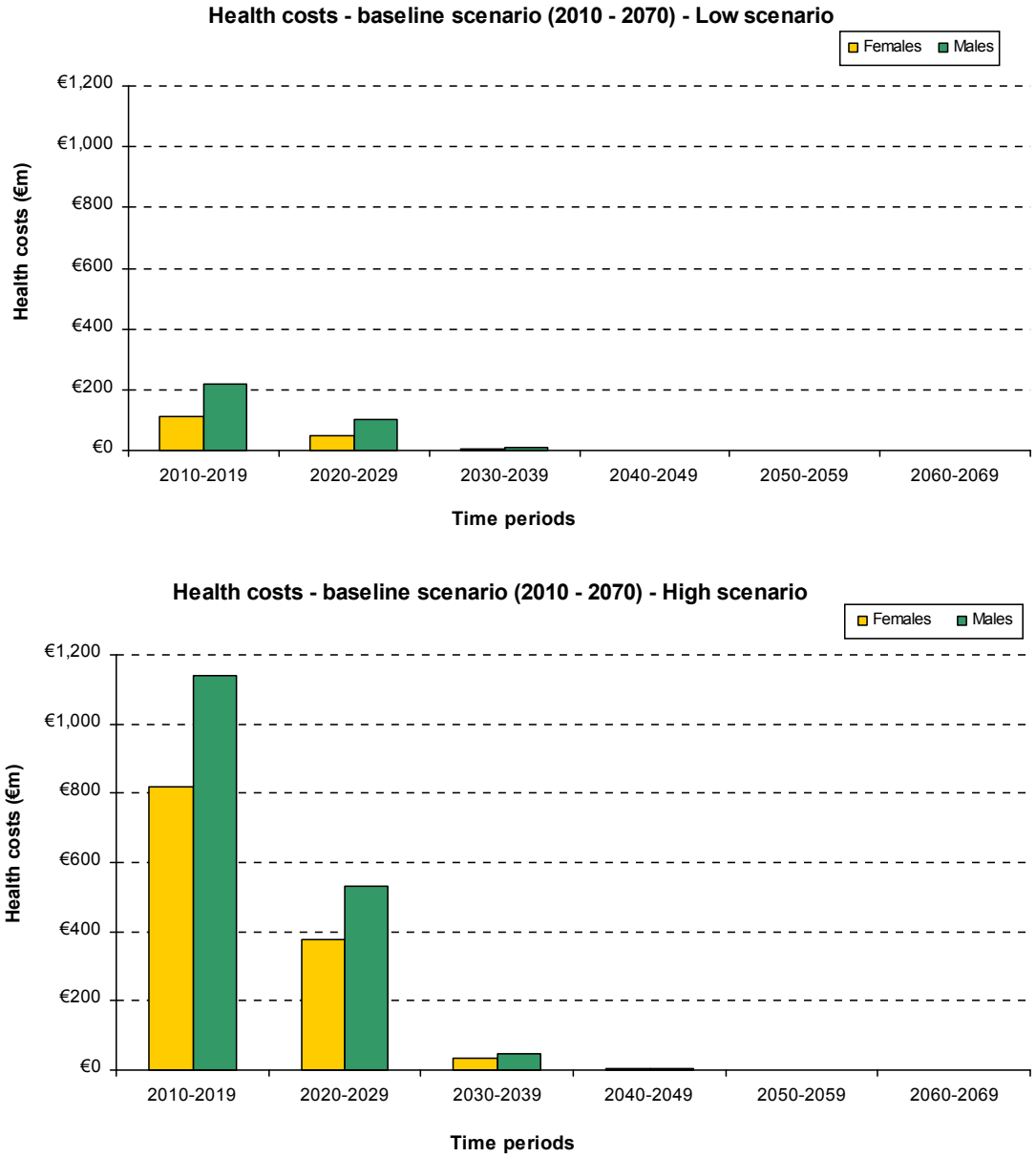

Figure 2.1 Health costs - baseline scenario – 2010 to 2070
(Present Value – 2010 €m prices)

These 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 2.2 shows that France, Germany, Italy, Poland, Romania, Spain and the UK are predicted to have relatively high health costs. The industrial sectors estimated to be most affected under the baseline is the agricultural and manufacture or chemicals sectors. This is shown in Figure 2.3.

Detailed tables are included in Appendix 8.3.

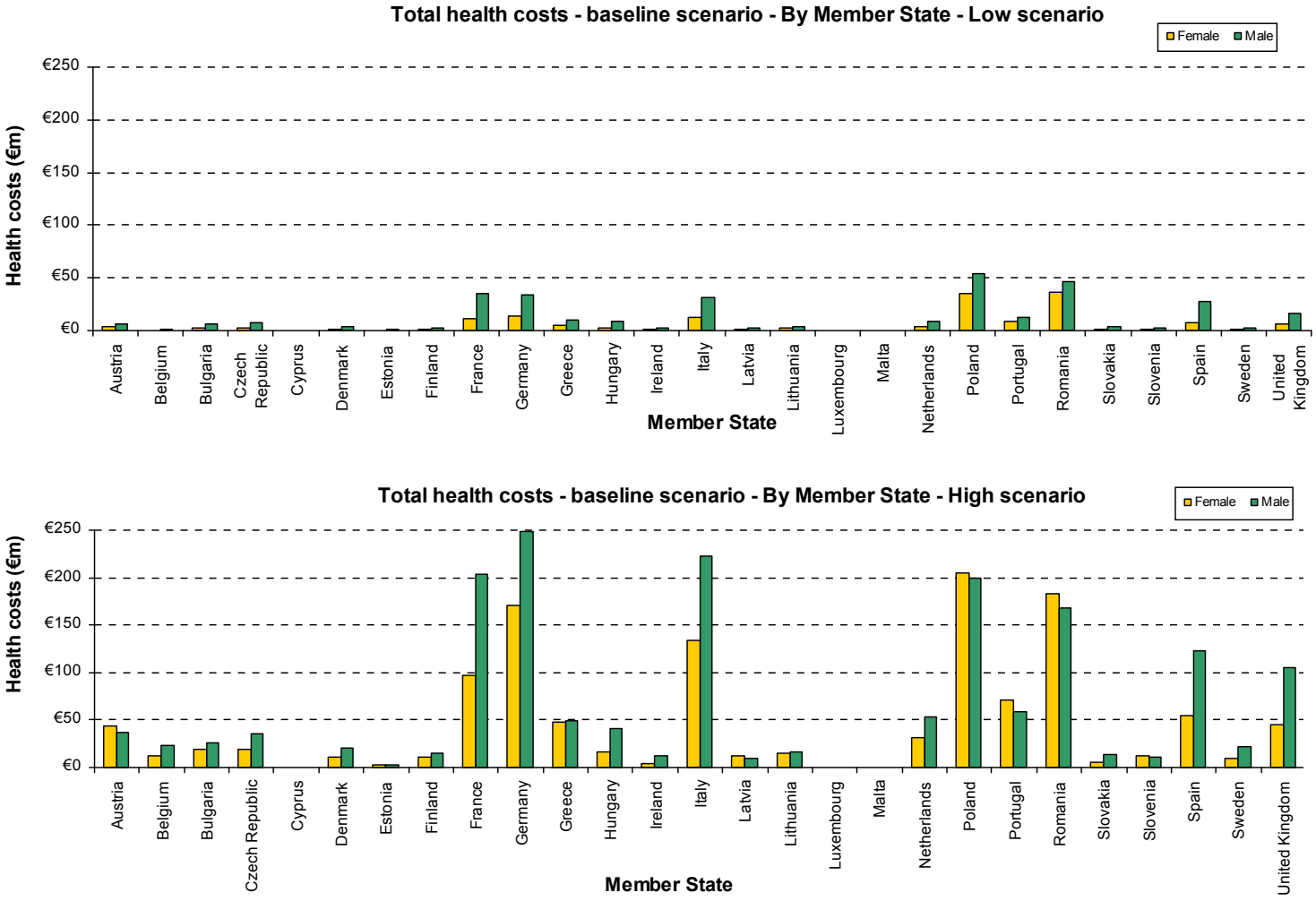

Figure 2.2 Total health costs- baseline scenario – By Member State (Present Value – 2010 €m prices)

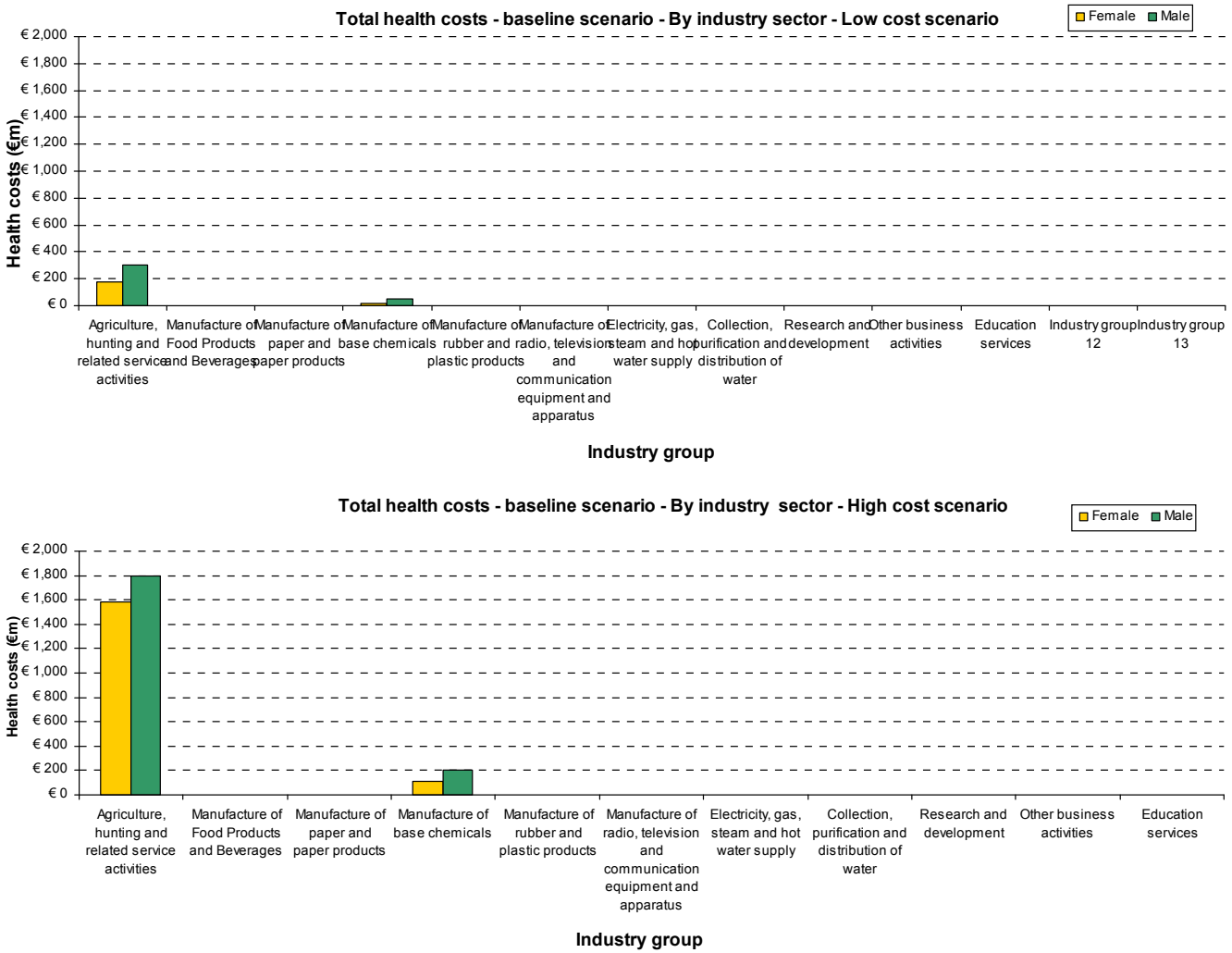

Figure 2.3 Total health costs - baseline scenario - by industry group (Present Value – 2010 €m prices)

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 2.4, 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. As the number of registrations and YLLs decline over time, the difference between using discounting and with no discounting becomes less evident. However, when there are more significant registrations and YLLs (as seen in years between 2010 and 2030) the impacts of discounting become more apparent.

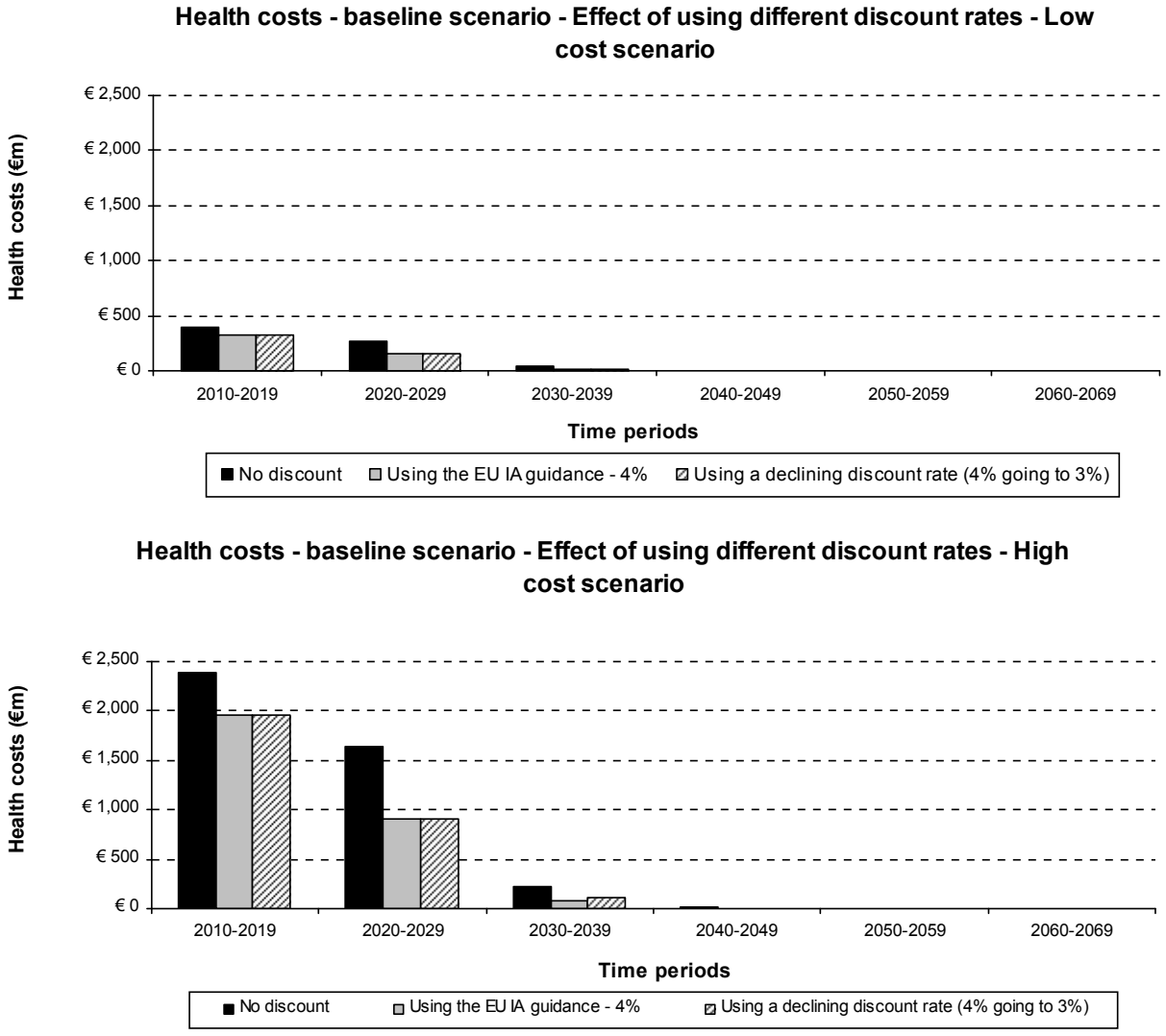

Figure 2.4 Impacts of discounting

3 POLICY OPTIONS

3.1 DESCRIPTION OF MEASURES

Agricultural use

Maleic hydrazide is used as a plant growth regulator and herbicide. It is used as a plant growth regulator to control sucker growth on tobacco, to retard the growth of turf, and to inhibit sprout growth in stored onions and potatoes, as well as on non-bearing apple and citrus trees, forest trees, and ornamental plants. Maleic hydrazide is used as a herbicide to control quack grass, wild onions, wild garlic, and other undesirable weeds on residential lawns, in terrestrial non-food crops and industrial areas, and along roadsides and other rights-of-way. Maleic hydrazide can be applied by air or by ground equipment, by farm workers and by professional (custom) applicators.

Occupational inhalation exposures can occur during the mixing of wettable powders, dusts or granules, loading of equipment and in the spraying and application of pesticides or by entering treated sites prematurely.

PPE is the first line of defence against potential exposure. Agriculture PPE includes the use of:

- Masks
- Half face/ full face respirators (different filters are required for different chemical formulations)
- PVC gloves
- Overalls/ aprons
- Impervious footwear

Preparing and mixing and handling concentrate
Need appropriately designed pouring systems for transferring chemicals to minimise fugitive emissions/ splashing. Handling powders or concentrates and mixing should be done in a well-ventilated area. Stand up-wind while opening, pouring and mixing;

Application
Prevent over-application of pesticide/ herbicide. New spray applicators have electronically controlled metered dosage applicators.

Pesticides should be applied only in open, well-ventilated areas. Manage spray drift by carefully assessing wind direction and strength. Never spray in high winds, assess for weather conditions, and stop spraying if weather conditions deteriorate[14].

[14] Department of Commerce Australia website: http://www.commerce.wa.gov.au/worksafe/Content/Safety_Topics/Hazardous_substances/Additional_resources/Pesticides_in_agrigulture-safe.html

A restricted-entry interval to protect workers entering treated sites prematurely[15]

Industrial use

OELs in the EU range from 0.13 to 0.013 mg/m^3 as an 8hr TWA concentration. It is likely that most of the manufacturing sites have low exposure concentrations under normal operating conditions. Higher exposures are likely to occur only in the case of leaks or during sampling. The significance of these short-term exposures depends on frequency of spills and what measures are taken to reduce the exposure. The options available for risk management include:

- closed systems;
- use of tightly-closed containers for storage;
- local exhaust ventilation in storage and production areas;
- personal protective equipment (body covering clothes, gloves and face-shield and eye protection);
- use of respirators, particularly in the case of spills.

4 ANALYSIS OF IMPACTS

4.1 HEALTH IMPACTS FROM CHANGES TO THE EU DIRECTIVE

4.1.1 Health information

For Hydrazine, OELs of 0.013 mg/m^3 and 0.13 mg/m^3 will be tested. Lung and colorectal cancer numbers will therefore be estimated given current (baseline) and full compliance[16] to these OELs. Baseline for all industries assumes a 7% annual decline in exposure levels and standard change in employed numbers up to the 2021-30 estimation interval and constant levels thereafter.

The two scenarios to be tested are described in Table 4.1 below.

Table 4.1 Baseline and intervention scenarios

Carcinogen	Hydrazine
Intervention scenarios[(1)]	
Baseline (trend) scenario (1)	Linear employment and exposure level trends assumed to 2021-30, constant thereafter.
Intervention scenario (2)	Full compliance for OEL = 0.013 mg/m^3
Intervention scenario (3)	Full compliance for OEL = 0.13 mg/m^3

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

[15] http://www.hc-sc.gc.ca/cps-spc/alt_formats/pacrb-dgapcr/pdf/pubs/pest/decisions/rvd-drv/rvd2009-01-eng.pdf

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

Results for the baseline scenario (1) and intervention scenarios compared to the baseline scenario are in Figure 4.1 (attributable registrations), Figure 4.2 (attributable fractions) and Figure 4.3 (DALYs) for lung cancer and Figure 4.4, Figure 4.5 and Figure 4.6 for colorectal cancer for men plus women for the total EU (27 countries). A summary of the results for lung 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.

Introducing full compliance with the trial OELs in 2010 will not avoid any additional cancers occurring from 2040 onwards as the continuing annual 7% reduction in exposure levels results in very low proportions exposed above either of the trial levels (Figure 4.1 and Figure 4.2 for lung cancer and Figure 4.4 and Figure 4.5 for colorectal cancer). Attributable fractions are low as very few (only 2% currently) are exposed at high (manufacture of basic chemicals) or medium (agriculture) levels and therefore with any excess risk (RR>1).

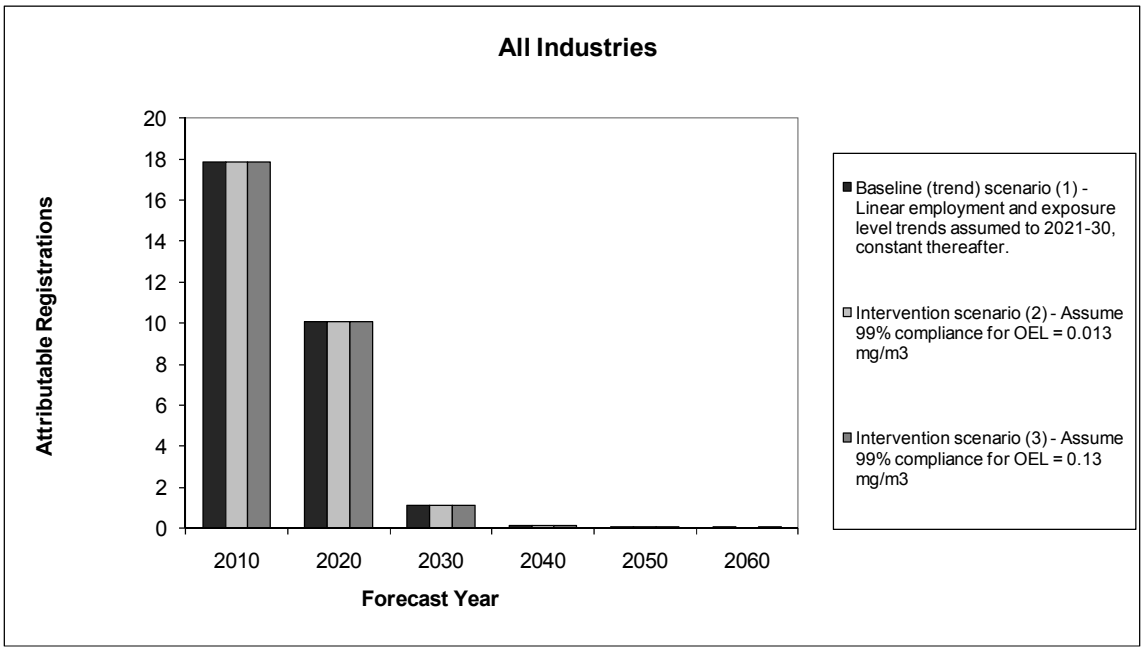

Figure 4.1 Results for intervention scenarios compared to the baseline scenario (2) – Occupation Attributable cancer registrations, Lung cancer, men plus women

Figure 4.1 shows the number of registrations for lung cancer attributable to hydrazine exposure decreasing rapidly for the baseline and the intervention scenarios over the next 50 years.

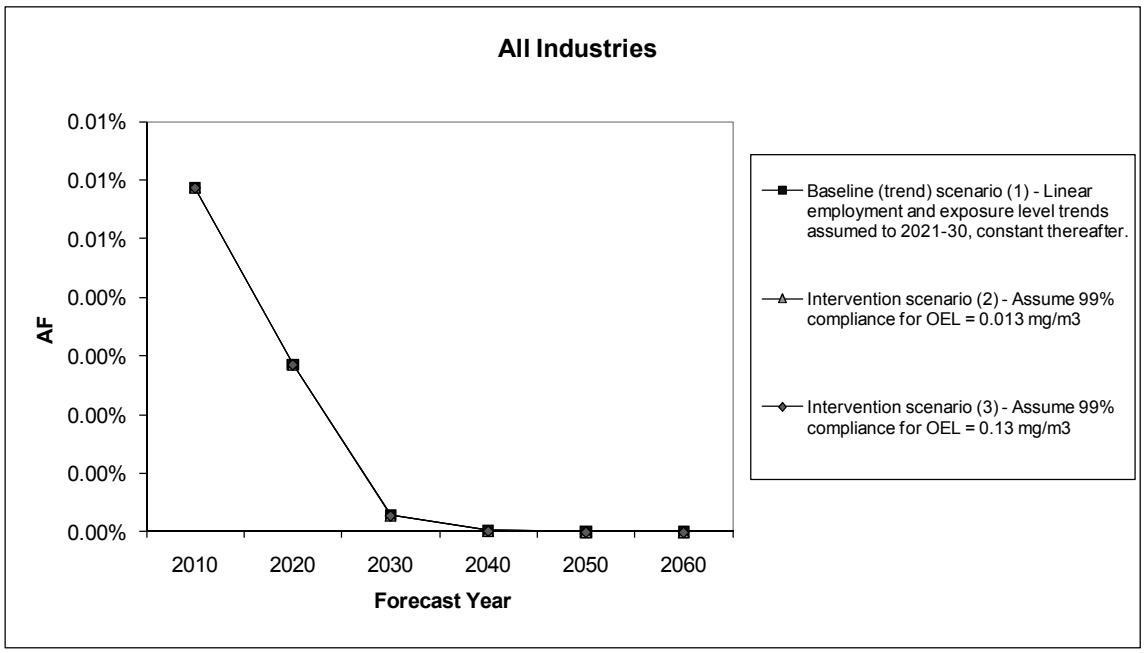

Figure 4.2 Occupation Attributable Fractions, Lung cancer

Figure 4.2 shows that in addition to the number of lung cancer registrations, the attributable fraction also decrease rapidly over the period up to 2060. By 2060, it is predicted that 0.0% of all lung cancer cases can be attributed to hydrazine exposure, regardless of which scenario is followed.

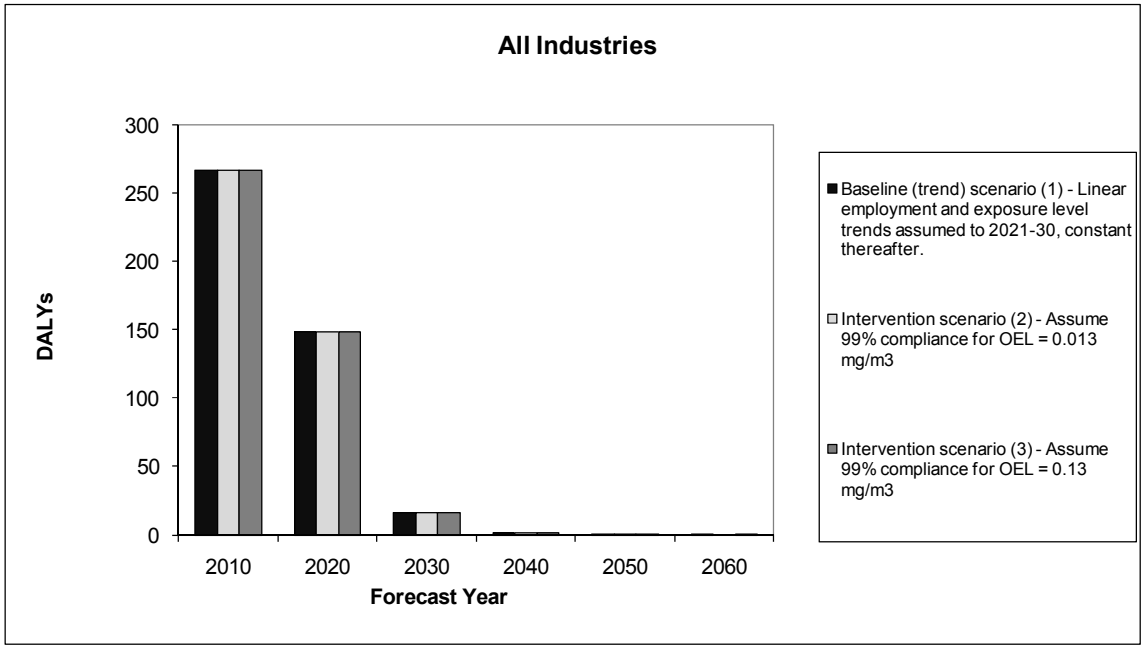

Figure 4.3 Occupation Attributable DALYs, Lung cancer

The estimated DALYs for lung cancer due to hydrazine exposure decrease from over 250 years in 2010 to zero years in 2060.

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

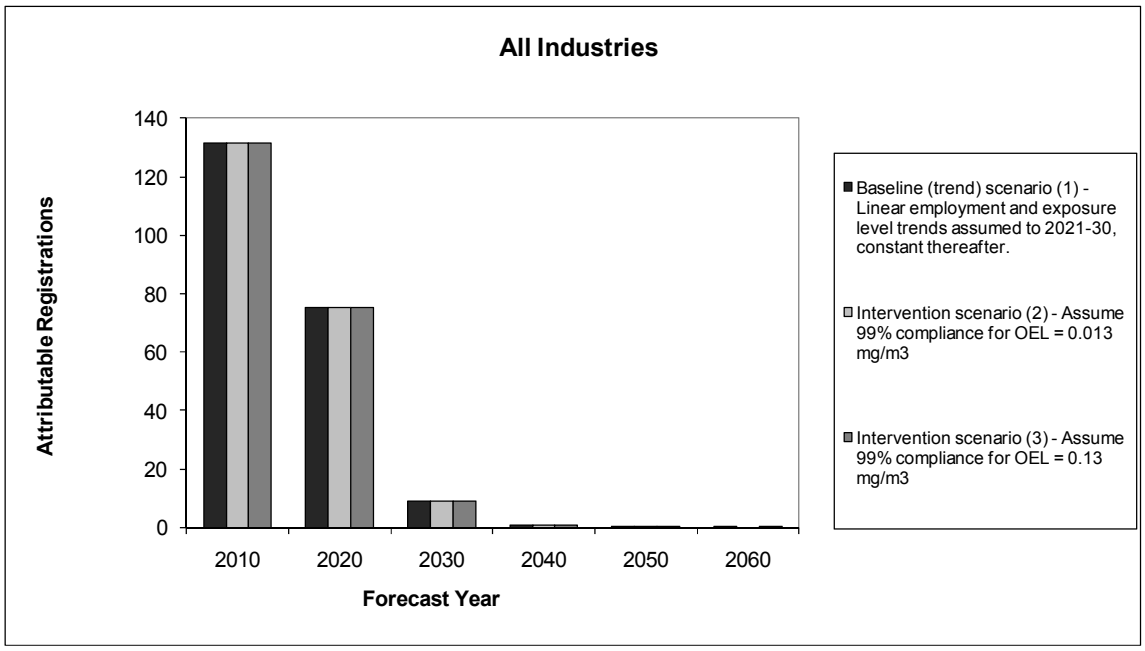

Figure 4.4 Results for intervention scenarios compared to the baseline scenario (2) – Occupation Attributable cancer registrations, Colorectal cancer, men plus women

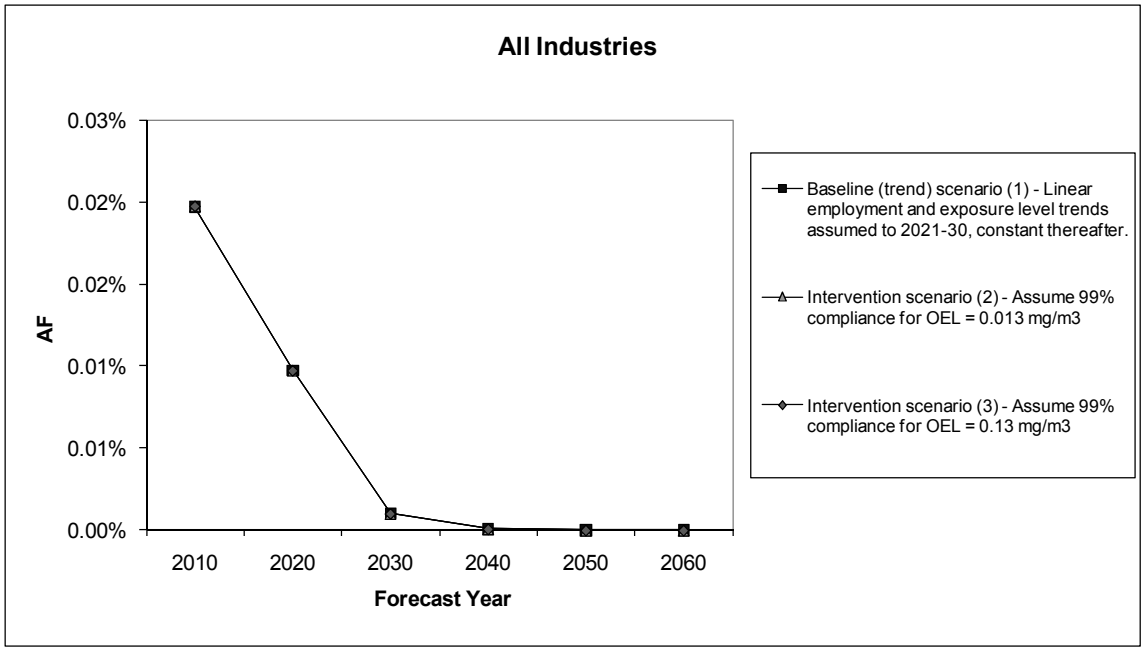

Figure 4.5 Occupation Attributable Fractions, Colorectal cancer

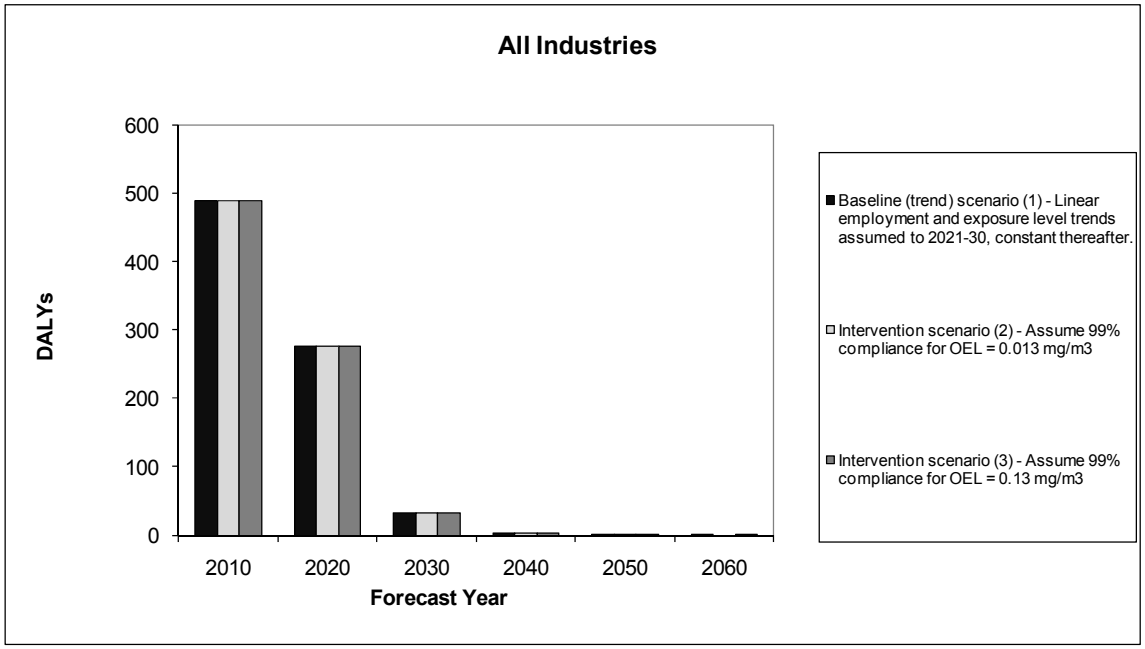

Figure 4.6 Occupation Attributable DALYs, Colorectal cancer

Table 4.2 summarises the data shown in the previous figures. The data for the first two time periods (2010, 2020) are identical to the baseline scenario, and then the data specific to the intervention scenarios are shown in the next two groups of four columns (2030-2060). Attributable deaths for lung cancer decrease from 16 deaths in 2010 to 0 deaths in 2060 for intervention scenario (2) (introduce OEL of 0.013 mg/m^3 with full compliance) and to 0 deaths in 2060 for intervention scenario (3) (introduce OEL of 0.13 mg/m^3 with full compliance). Attributable deaths for colorectal cancer follow a similar pattern with 27 deaths in 2010 decreasing to zero deaths in 2060 for both scenarios.

In Table 8.4.1 in Appendix 8.4 are the estimated proportions exposed above the OELs to be tested, currently and as estimated under the baseline forecast scenario (2). Under the alternative change scenarios they behave as determined by the scenarios. For hydrazine we have estimated a separate exposure level GM by country, from the country-specific proportions exposed (in 1975) above the M/L boundary exposure level, which is estimated for the EU as a whole. Therefore proportions exposed above the OELs differ by country.

Full results are given in Appendix 8.4 for men plus women by country in Tables 8.4.2, 8.4.3 (for lung cancer) and 8.4.4 (for colorectal cancer). A breakdown of attributable numbers by industry is in Tables 8.4.5, 8.4.6 (for lung cancer) and 8.4.7 (for colorectal cancer). Estimates of numbers of cancer registrations 'avoided' in each of the forecast target years from 2030 onwards relative to the baseline scenario can be obtained by subtraction. Data for men and women separately, and by industry within country, are available in supplementary spreadsheets (*Hydrazine Report data.xls*) if required.

Table 4.2 Results for the intervention scenarios, total EU (27 countries), men plus women[17]

Scenario	All scenarios		Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m3				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m3			
EU Total	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
Numbers ever exposed	8,362,105	8,530,017	8,752,663	8,830,261	8,869,957	8,905,278	8,752,663	8,830,262	8,869,959	8,905,280
Proportion of the population exposed	2.31%	2.24%	2.25%	2.24%	2.26%	2.32%	2.25%	2.24%	2.26%	2.32%
Lung cancer										
Attributable Fraction	0.00588%	0.00286%	0.00028%	0.00002%	0.00000%	0.00000%	0.00028%	0.00002%	0.00000%	0.00000%
Attributable deaths	16	9	1	0	0	0	1	0	0	0
Attributable registrations	18	10	1	0	0	0	1	0	0	0
'Avoided' cancers			0	0	0	0	0	0	0	0
YLLs	256	142	16	1	0	0	16	1	0	0
DALYs	267	148	16	1	0	0	16	1	0	0
Colorectal cancer										
Attributable Fraction	0.01969%	0.00971%	0.00102%	0.00008%	0.00001%	0.00000%	0.00102%	0.00008%	0.00001%	0.00000%
Attributable deaths	27	16	2	0	0	0	2	0	0	0
Attributable registrations	131	75	9	1	0	0	9	1	0	0
'Avoided' cancers			0	0	0	0	0	0	0	0
YLLs	380	215	25	2	0	0	25	2	0	0
DALYs	489	277	33	3	0	0	33	3	0	0

[17] 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.

4.1.2 Monetised health benefits

The possible health benefits (i.e. avoided healthcare costs and effects of having cancer) for the introduction of an EU wide OEL at 0.013 mg/m^3 and 0.13 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 therefore limited.

There is only estimated to be a very small benefit to introducing an EU wide OEL. The impacts of introducing an OEL are estimated to have limited benefits as there is already estimated to be a reduction towards 0.013mg/m^3 and below under the baseline scenario. The results are also illustrated in Figure 4.7.

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

Costs by Gender (€m)	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069	Totals
Intervention option 1 - Introduce OEL=0.013 mg/m^3 in 2010							
Female	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0.01	0 to 0	0 to 0.01
Male	0 to 0	0 to 0	0 to 0	0 to 0.01	0 to 0.01	0 to 0.01	0 to 0.02
Total	0 to 0	0 to 0	0 to 0	0 to 0.01	0 to 0.02	0 to 0.01	0.01 to 0.04
Intervention option 2 - Introduce OEL=0.13 mg/m^3 in 2010							
Female	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0.01
Male	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0.01
Total	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0.01	0 to 0	0 to 0.02

Notes:

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

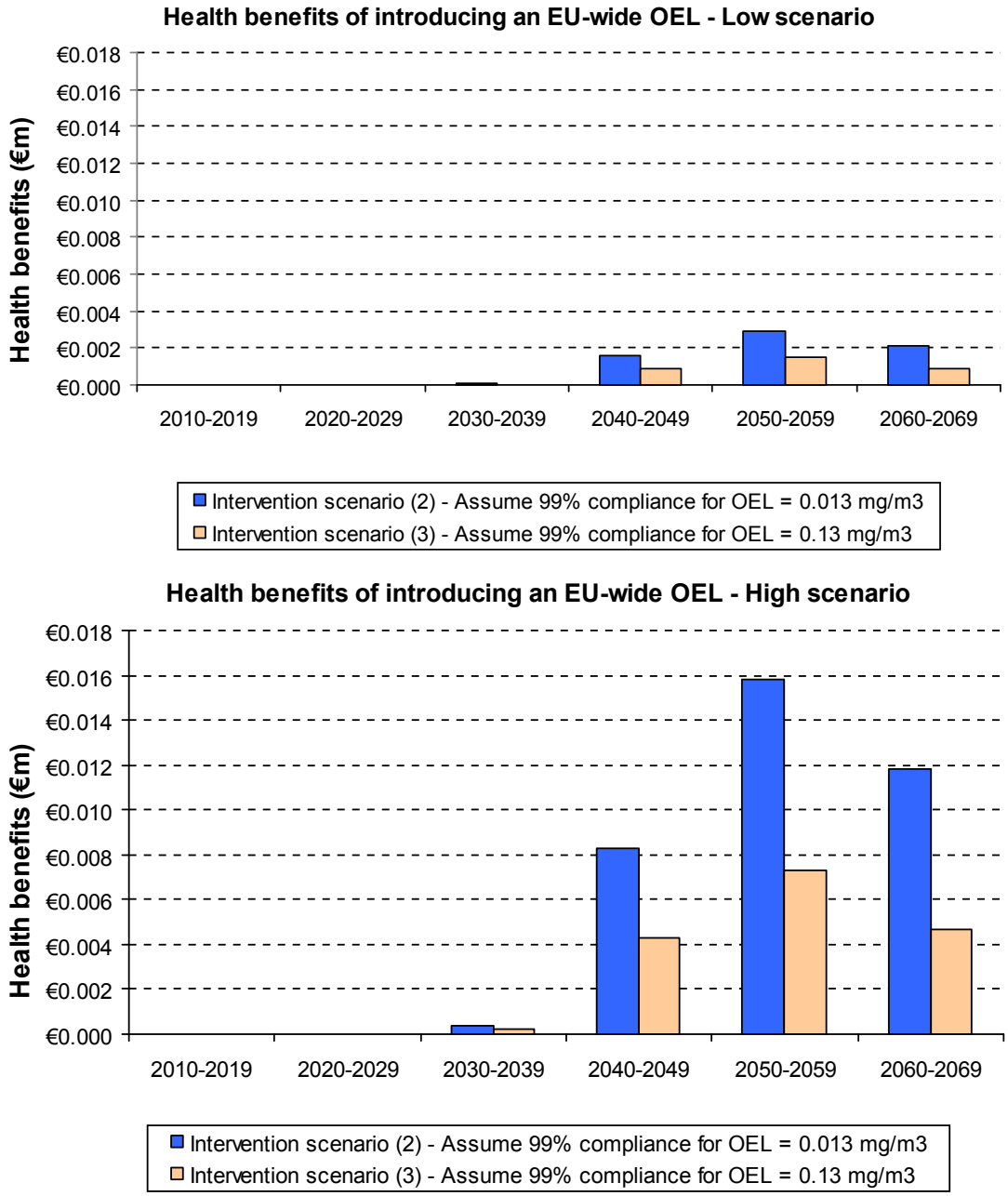

Figure 4.7 Health benefits over time of introducing an EU wide OEL (Present Value – 2010 €m prices)

These benefits will affect Member States differently depending upon the overall number of workers within affected industry groups, existing risk management measures (RMMs) and the proportion of males and females within these groups. The total benefits by Member State are shown in Figure 4.8 (low scenario) and Figure 4.9 (high scenario), where the Greece, Poland, Portugal and Romania are predicted to particularly benefit from the OEL assuming full compliance (99%)[18].

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

The monetised benefits of a revised OEL for hydrazine are likely to affect men more than women given the industrial sectors most exposed to hydrazine. The industrial sector estimated to benefit from a revised OEL (and full compliance) is the manufacture of base chemicals. This is shown in Figure 4.10 (low scenario) and Figure 4.11 (high scenario).

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

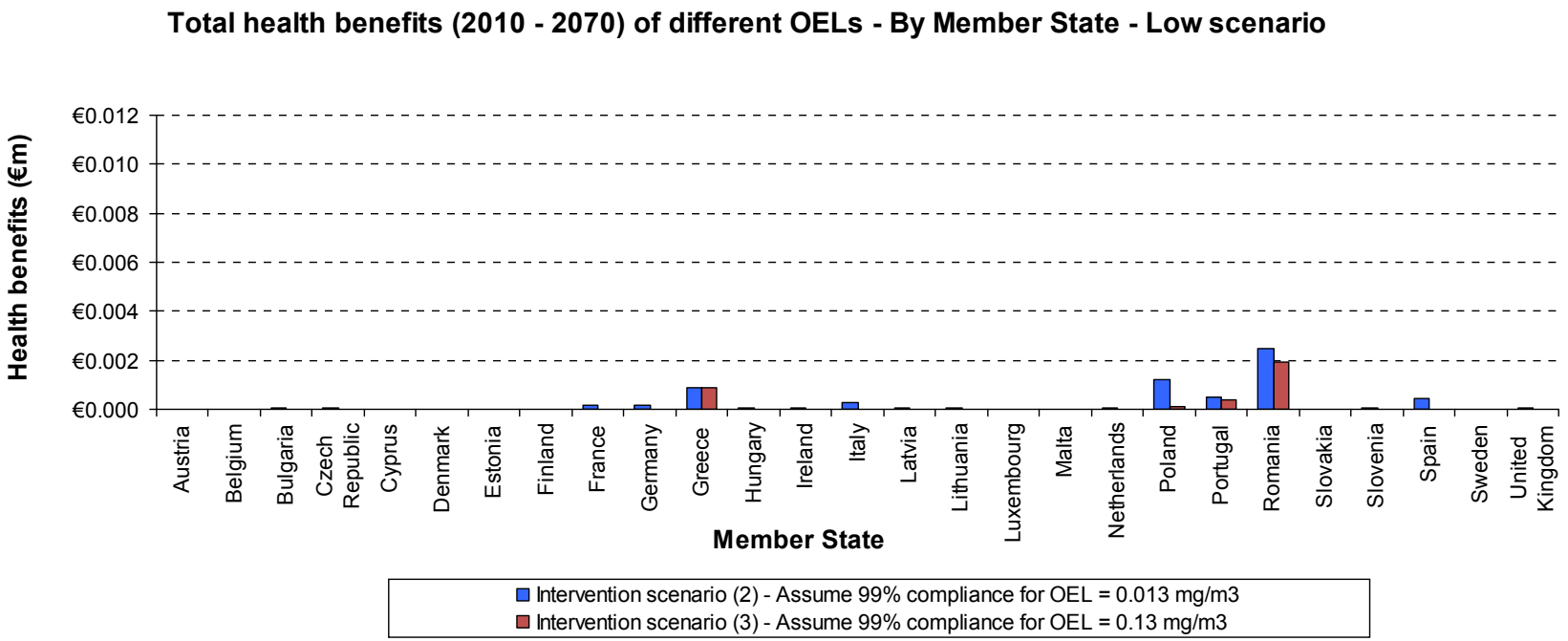

Figure 4.8 Total health benefits of introducing an EU wide OEL – By Member State – Low Scenario (Present Value – 2010 €m prices)

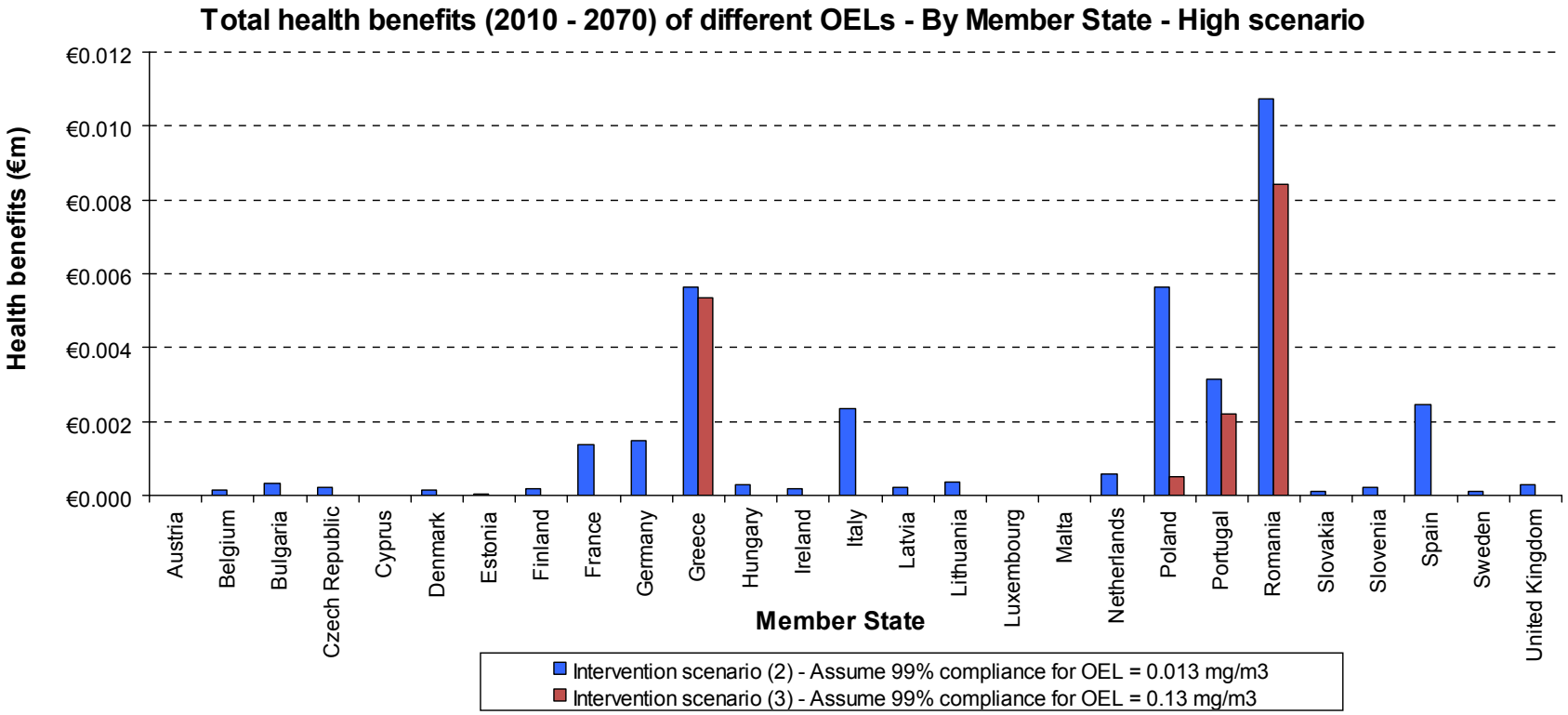

Figure 4.9 Total health benefits of introducing an EU wide OEL – By Member State – High Scenario (Present Value – 2010 €m prices)

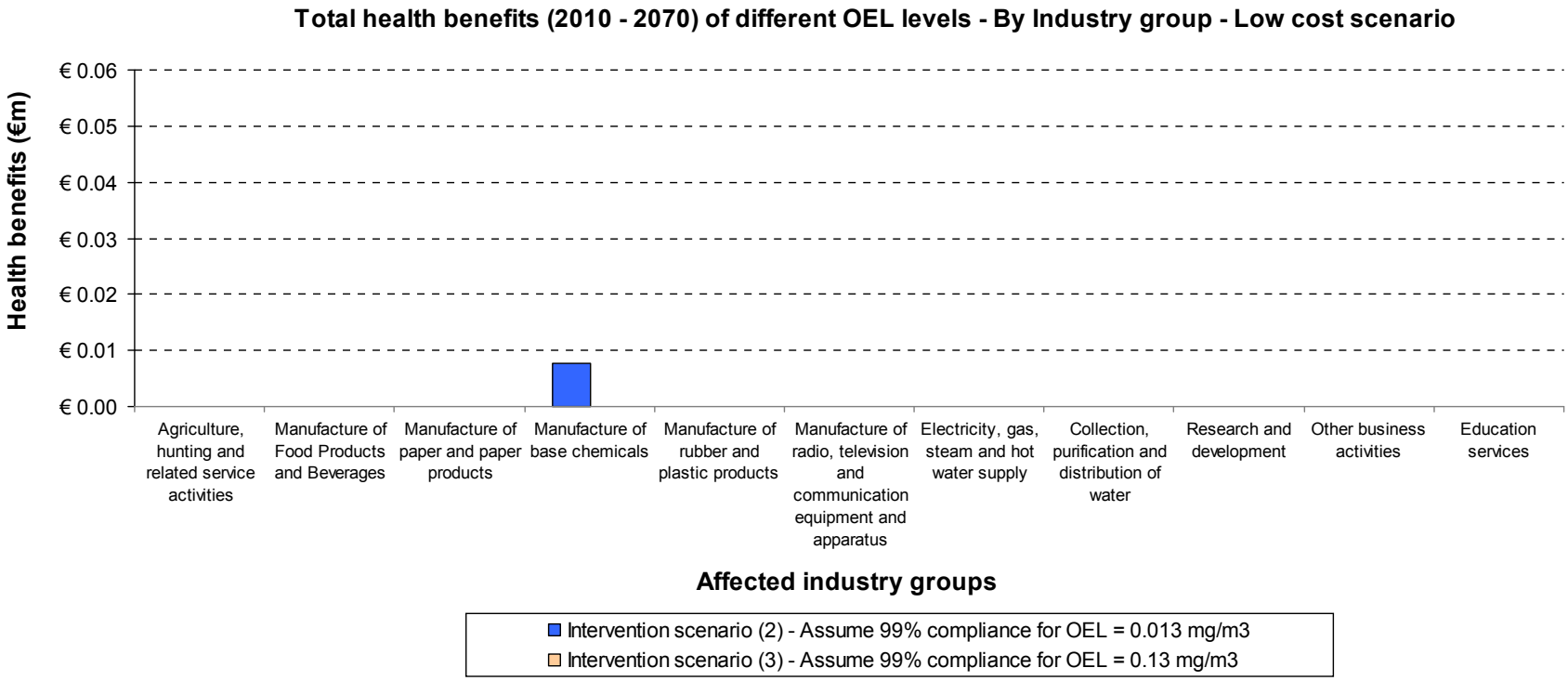

Figure 4.10 Total health benefits of introducing an EU wide OEL – By Industry Group – Low Scenario (Present Value – 2010 €m prices)

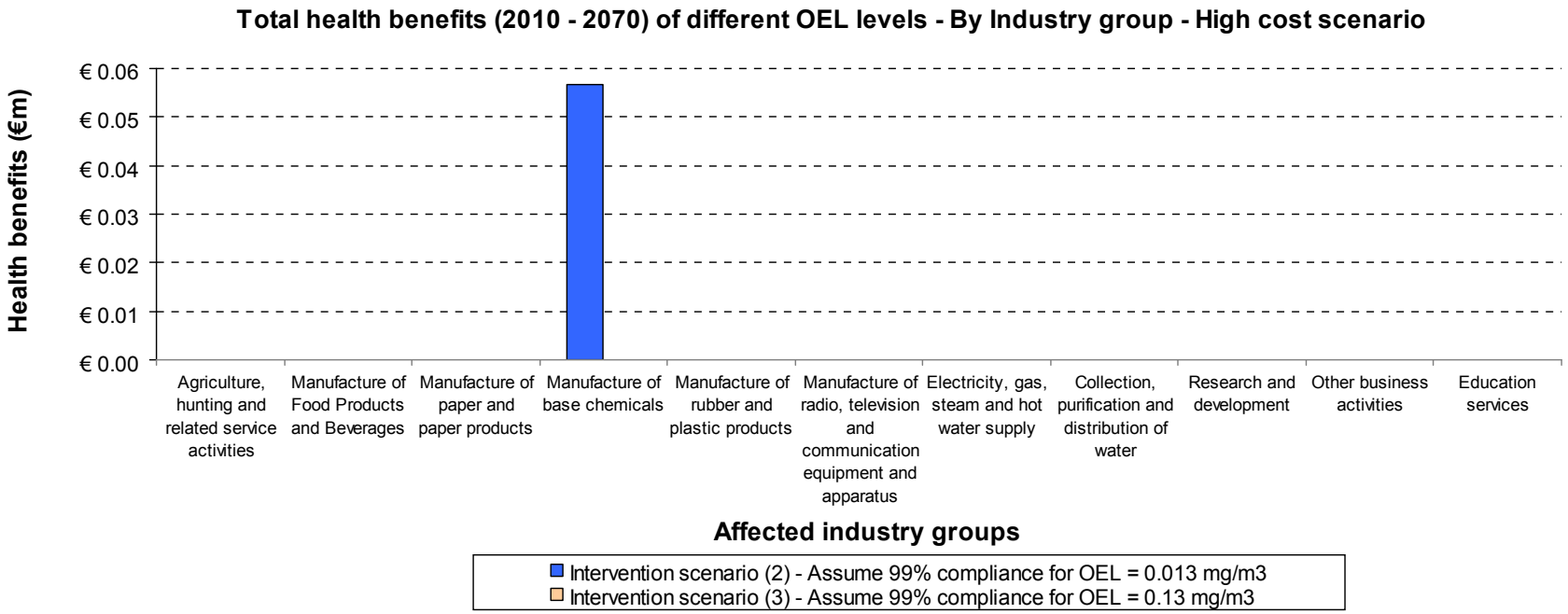

Figure 4.11 Total health benefits of introducing an EU wide OEL – By Industry Group – High Scenario (Present Value – 2010 €m prices)

As with the baseline scenario, in order to present all costs and benefits consistently in present value, 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 4.12 for introducing an OEL of 0.013 mg/m^3
- Figure 4.13 for introducing an OEL of 0.13 mg/m^3

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

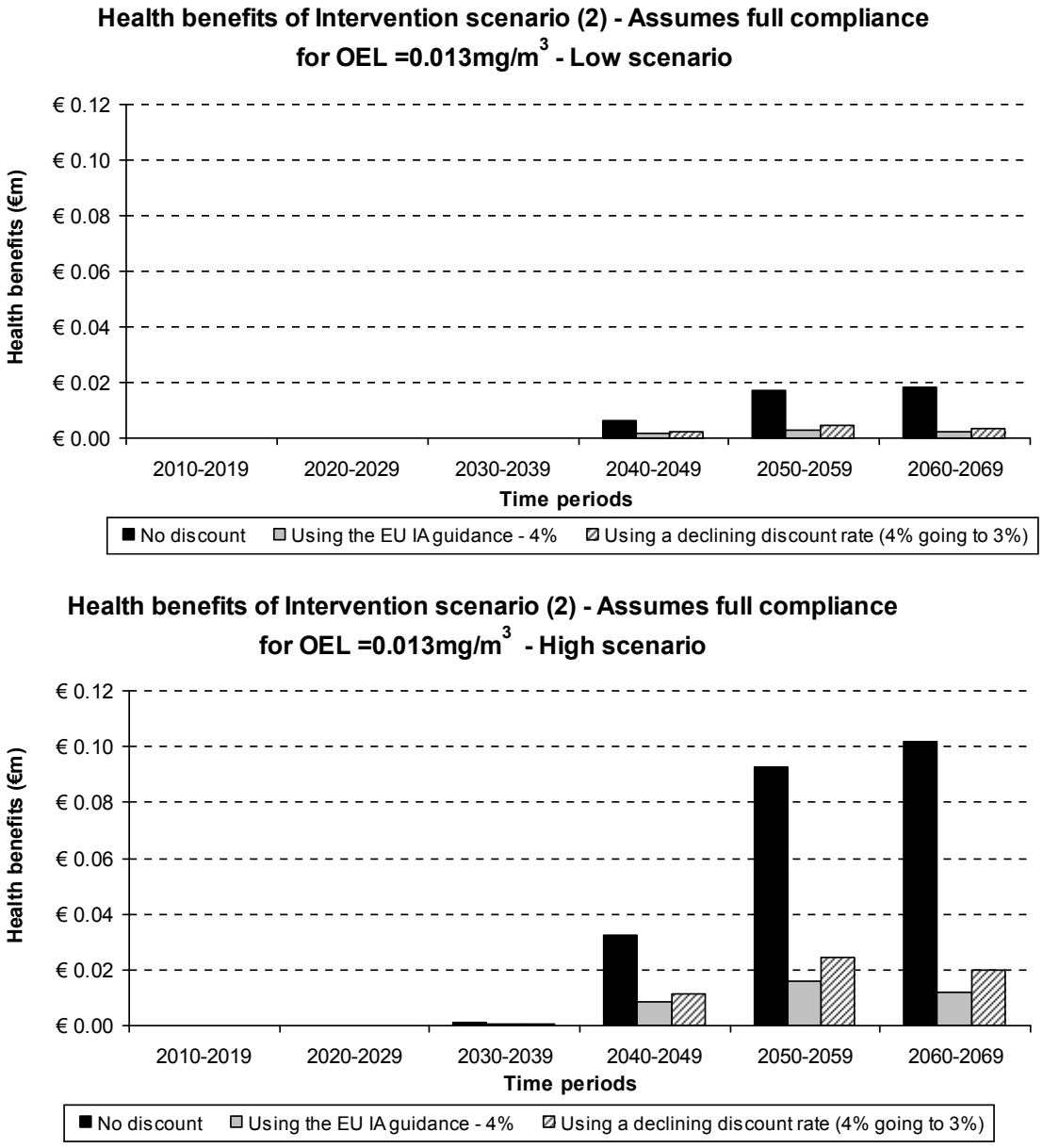

Figure 4.12 Impacts of discounting – Introducing an OEL of 0.013mg/m^3

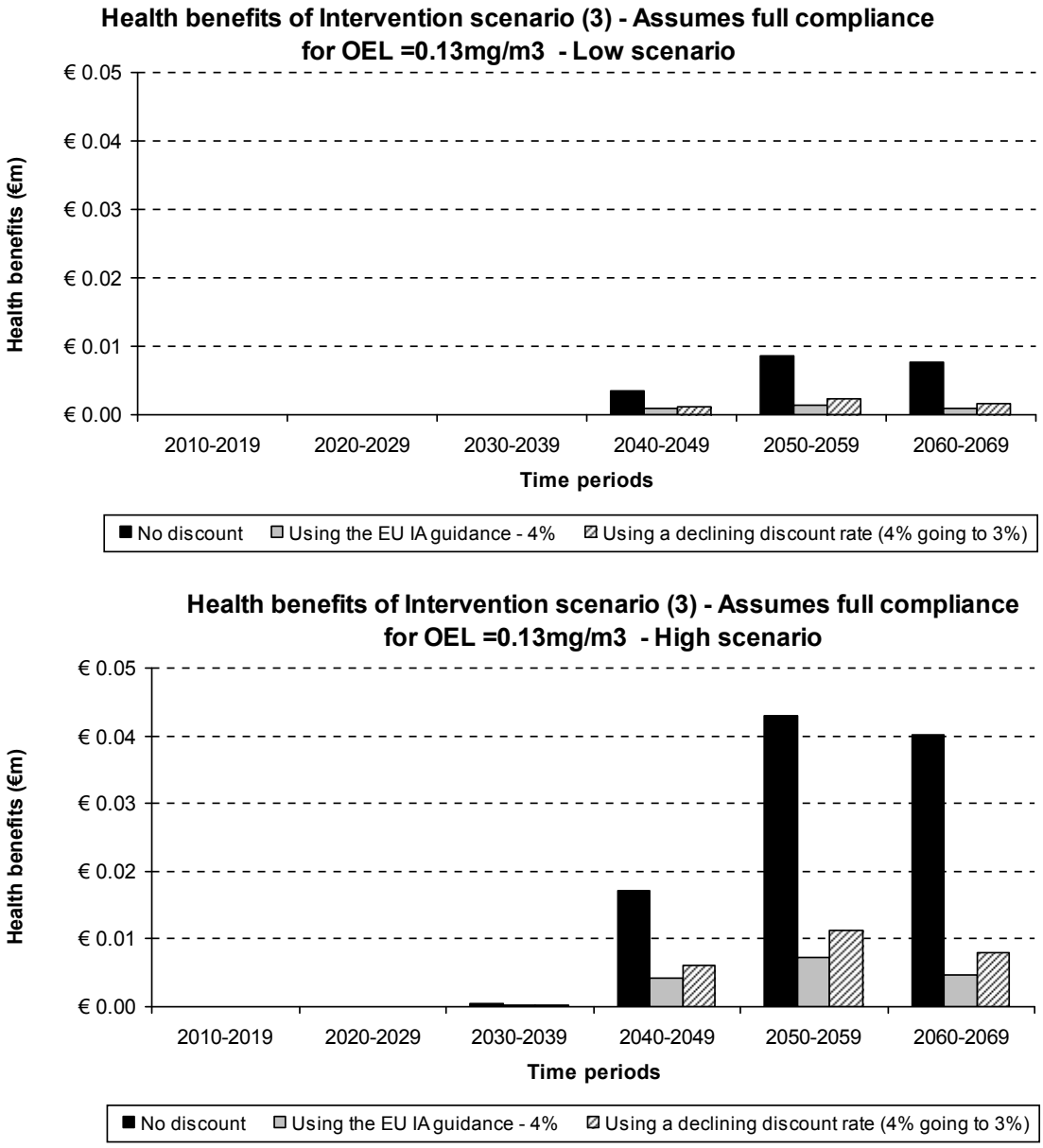

Figure 4.13 Impacts of discounting – Introducing an OEL of 0.13mg/m^3

Since the benefits of introducing a more stringent OEL are mostly realised from 2040, the level of discounting has a significant impact on the overall size of health benefits. A limitation is that the benefits of any 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

The largest industry sectors where workers are exposed to hydrazine are those involved with its manufacture (NACE 24) and those who use it as a herbicide in the agricultural sector (NACE 1). Based on exposure data presented in Table 2.3, it is estimated that most workers (96% and 87% respectively) exposed to hydrazine at some level, will be exposed above the OEL at 0.013mg/m^3 and a much smaller proportion (35% and 17% respectively) of workers exposed above the OEL at 0.13mg/m^3. Note this is very different to the number of workers in these sectors, as many of these workers will not be exposed to hydrazine.

Using the estimates of the number of workers exposed and Eurostat data on the distribution of firms by size (based on number of employees per enterprise) it was possible to broadly estimate the number of enterprises requiring further action to comply with each proposed OEL (Table 4.4 and Table 4.5).

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.

The following tables set out the estimated number of firms affected (by size and NACE code) for each proposed OEL. In total there is expected to be around:

- 2,126 firms affected by an OEL at 0.013mg/m^3
- 426 firms affected by an OEL at 0.13mg/m^3

Table 4.4 Number of enterprises affected in NACE code 24

NACE 251 **No: of employees bands**	**Average composition of enterprises for all affected NACE sectors**	**0.013mg/m^3** **No of enterprises affected**	**0.13mg/m^3** **No of enterprises affected**
Between 1 and 9	58%	92	34
Between 10 and 19	14%	7	3
Between 20 and 49	12%	3	1
Between 50 and 250	12%	1	0
Greater than 250	5%	0	0
Total affected	-	103	38
Percentage of affected firms relative to total number of firms in the sector	-	0.3%	0.1%

Table 4.5 Number of enterprises affected in NACE code 1

NACE 23 **No: of employees bands**	**Average composition of enterprises for all affected NACE sectors**	**0.013mg/m^3** **No of enterprises affected**	**0.13mg/m^3** **No of enterprises affected**
Between 1 and 9	75%	1,907	366
Between 10 and 19	11%	94	18
Between 20 and 49	5%	17	3
Between 50 and 250	7%	6	1
Greater than 250	3%	1	0
Total	-	2,024	388
Percentage of affected firms relative to total number of firms in the sector	75%	unknown	unknown

Costs of compliance

As noted earlier the limited health benefits are the result of anticipated measures adopted (under the baseline scenarios) in these sectors to reduce exposure by 7% per year over the period 2010-70. The introduction of the OEL (with full compliance) will ensure reduced exposure below the OEL and there will now be more certainty that the costs of these measures will be incurred, as well as being early than planned with further intervention. Therefore many of the costs set out below *may* also be incurred in the future under our baseline assumptions without further intervention.

As set out in section 3.1 it is anticipated the costs related to use of hydrazine as a herbicide can be controlled through good practice and use of appropriate personal protective equipment (PPE). There are not expected to be any significant additional

costs associated with PPE, which in any case would be considered to be good practice. It is assumed that costs range between €1,000 and €3,000 per year per enterprise (including costs of equipment, training and the cost of time spent of labour (e.g. administration costs associated with being on the Directive).

It is expected that local exhaust systems (LEVs) may be required for firms affected in NACE 24. The use of LEVs capture and remove process emissions at or close to their source of generation and prior to their escape into the workplace environment. Cost data for ventilation units are based on estimates from ventilation suppliers. Costs per unit for hydrazine 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 4.6.

Table 4.6 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)

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 expert judgement in the absence of better data:

- All the affected NACE code 1 firms only incur costs of PPE to comply with the proposed OELs.
- 20% of affected firms in NACE code 24 have LEV but do not necessary use/maintain their system properly. Therefore costs to properly maintain and use of their LEVs will be sufficient to comply with the OEL.
- 80% of affected firms in NACE code 24 will incur costs associated with purchase, maintenance and use of LEV.

These estimates are subject to high uncertainty. Using this breakdown in approaches to compliance the costs of each possible OEL scenario is summarised below in Table 4.7.

Table 4.7 Summary of total costs of compliance

OEL (in mg/m^3)	Number of firms affected	Total annual costs for all firms affected (€m in 2010)		Total costs for all firms affected over the period 2010-2070 (€m)	
		Low	High	Low	High
0.013	2,126	€ 3	€ 8	€ 62	€ 196
0.13	426	€ 1	€ 2	€ 15	€ 47

Note: Costs are round to nearest euro. Table 4.8 presents costs to 2d.p.

A more detailed breakdown of costs are also set out below by type of action required in the following tables (Table 4.8 and Table 4.9):

Table 4.8 Detailed breakdown of total costs of compliance with proposed EU wide OEL of 0.013mg/m^3

Number of enterprises affected by an OEL of 0.013mg/m^3	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
2,024	PPE (NACE 1 sector)	€ 1,000	€ 3,000	€ 2.02	€ 6.07	€ 48	€ 143
21	Proper use of existing LEV (NACE 24)	£3,123	£7,123	€ 0.06	€ 0.15	€ 2	€ 4
82	Install and use LEV (NACE 24)	€ 6,214	€ 25,666	€ 0.51	€ 2.11	€ 13	€ 49
2,126	-	-	-	€ 2.60	€ 8.32	€ 62	€ 196

Table 4.9 Detailed breakdown of total costs of compliance with proposed EU wide OEL of 0.13mg/m^3

Number of enterprises affected by an OEL of 0.13mg/m^3	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
388	PPE (NACE 1 sector)	€ 1,000	€ 3,000	€ 0.39	€ 1.17	€ 9	€ 27
8	Proper use of existing LEV (NACE 24)	£3,123	£7,123	€ 0.02	€ 0.05	€ 1	€ 1
30	Install and use LEV (NACE 24)	€ 6,214	€ 25,666	€ 0.19	€ 0.78	€ 5	€ 18
426	-	-	-	€ 0.60	€ 2.00	€ 15	€ 47

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 to airborne particulates is minimised. There may also be additional training required to ensure that employees minimise their exposure by adhering to good practice in order to reducing exposure (e.g. good personal hygiene and wearing protective clothing).

Potential for closure of companies

As indicated in Table 4.4, less than 0.3% of all firms in NACE code 24 (manufacture of base chemicals) are likely to be affected by the introduction of the most stringent proposed EU-wide OEL (0.013mg/m^3). Therefore there is unlikely to be any significant change in risks of closures.

In Table 4.5 around 2,000 firms could be affected in the agriculture sector (NACE 1) by the introduction of the most stringent proposed EU-wide OEL (0.013mg/m^3). However the costs of compliance per enterprise (€1-3k) with the use of PPE and changes to use and handling of herbicides are not thought to be prohibitive.

Potential impacts for specific types of companies

The costs of compliance are likely to initially fall on those sectors that produce hydrazine (NACE 24) and those who use hydrazine as a herbicide (NACE 1). It is possible, however, that any additional costs may be passed on to downstream users/consumers. It may also be possible for farmers to use alternative herbicide which does not contain hydrazine.

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.

Administrative costs to employers and public authorities

The following table (Table 4.10) describes the administrative burden to employers already subject to the Carcinogens Directive but will now incur costs of introducing an EU wide OEL on to Annex III.

Table 4.10 Administrative burdens to employers

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

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

The following table (Table 4.11) describes the administrative burden to competent authorities already enforcing the Carcinogens Directive but will now incur costs of introducing an EU wide OEL on to Annex III.

Table 4.11 Administrative burdens to Competent Authorities

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

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

Third countries

There is not expected to be a significant change relative to the baseline to third countries given the low costs to NACE code 1 and low numbers affected in NACE 24.

4.2.2 Impact on innovation and research

It is possible that introducing an EU wide OEL for may stimulate further R&D in protective equipment and LEV. However, Given that the industry is predominately made up of smaller companies it is considered likely that these companies would tend to adopt products and compliance techniques that are already being applied within other parts of the industry.

4.2.3 Macroeconomic impact

Since compliance with an OEL would not involve changing the current manufacturing process there is unlikely to be any significant change to macro-economic impacts.

4.3 SOCIAL IMPACTS

4.3.1 Employment and labour markets

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

There are not expected to be any noticeable changes to jobs skills, patterns or the numbers of workers required as a result of using of ventilation systems or use of PPE. 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[19].

4.3.2 Changes in end products

There are not expected to be any noticeable changes to the end product since control measures do not change the characteristics of the product. Since there is not expected to be any closure of companies, there should not be any change in supply of products relative to the baseline scenario.

4.4 ENVIRONMENTAL IMPACTS

Hydrazine is degraded rapidly in air through reactions with ozone, hydroxyl radicals and nitrogen dioxide. The degradation rate of hydrazine in water is dependent on a number of factors including pH, temperature, oxygen content, alkalinity, hardness and the presence of organic material and metallic ions. Hydrazine is degraded rapidly under aerobic conditions in the presence of organic material, and/or in alkaline or hard water. It is more persistent in soft, metal-free water. Available data are inadequate to describe the behaviour of hydrazine in soil. According to the EPA (2000) "hydrazine rapidly degrades in the environment and is rarely encountered"[20].

Hydrazine is biodegradable by micro-organisms in activated sludge. However, at concentrations above 1 mg/litre, hydrazine is also toxic for these micro-organisms, especially for nitrifying bacteria. Hydrazine does not bio-accumulate. Hydrazine can inhibit germination in plants, and is toxic for plants in both air and water. Hydrazine may present a hazard for aquatic organisms (WHO, 1991)[21].

The increased use of LEVs will mean more hydrazine will be sent to air although this is not expected to have a significant environmental impact as hydrazine is degraded rapidly in air. The use of PPE and best practice when using hydrazine as a herbicide may reduce risks to soil (e.g. over spraying, exposure to soil from storage transfer) but overall there is not expected to be a significant environmental impact relative to the baseline.

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).

[19] "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.)
[20] EPA 2000, Available at: http://www.epa.gov/ttnatw01/hlthef/hydrazin.html#ref2
[21] WHO, 1991, Available at: http://www.inchem.org/documents/hsg/hsg/hsg056.htm

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

Baseline Scenario		Intervention scenario (2) – Assumes full compliance for OEL = 0.013mg/m^3		Intervention scenario (3) – Assumes full compliance for OEL = 0.13mg/m^3	
Health Costs	**Health Benefits**	**Health Costs**	**Health Benefits**	**Health Costs**	**Health Benefits**
As set out in section 2.5, the health costs of cancer (lung and colorectal) over the period 2010-70 are estimated to be: • Females: €165 – 1,234m • Males: €330 –1,722m • Total: €495 – 2,956m However over 95% of costs occur prior to 2030 and are the result of past exposure. Health costs of future exposure are estimated to be limited. 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 assumed that exposures fall by 7% per year in the future, continuing the historical trend in reduced exposure. Therefore there is expected to be a significant reduction in health costs going forward in the absence of further regulatory intervention.	None	There is estimated to be little to no benefit to introducing an EU wide OEL. The impacts of introducing an OEL are estimated to have no/limited benefits as there is already estimated to be a reduction towards 0.013mg/m^3 and below under the baseline scenario. Even without discounting health benefits over time the benefits are estimated to be limited.	None	There is estimated to be little to no benefit to introducing an EU wide OEL. The impacts of introducing an OEL are estimated to have no/limited benefits as there is already estimated to be a reduction towards 0.013mg/m3 and below under the baseline scenario. Even without discounting health benefits over time the benefits are estimated to be limited.

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 (2) – Assumes full compliance for OEL = 0.013mg/m^3		Intervention scenario (3) – Assumes full compliance for OEL = 0.13mg/m^3	
Economic Costs	**Economic Benefits**	**Economic Costs**	**Economic Benefits**	**Economic Costs**	**Economic Benefits**
There are expected to be costs to sectors exposed to hydrazine due to expected further spending on control measures to reduce exposure. These costs might relate to improving working practice (PPE) or installation and use of engineering control measures (e.g. improved ventilation, improved loading/ unloading equipment).	-	The largest industry sectors where workers are exposed to hydrazine are those involved with its manufacture (NACE 24) and those who use it as a herbicide in the agricultural sector (NACE 1). It is estimated that around 2,126 firms may be affected by an OEL at 0.013mg/m^3 with 2,024 from NACE 1 and 103 from NACE 24. These represent a very small proportion of the sector (<1%). Annual costs of RPE and compliance with the carcinogens Directive per enterprise in NACE code 1 over the period 2010-2069 (NPV) is estimated at €1-3k. Annual costs of use/installation of local exhaust ventilation (LEVs) and compliance with the carcinogens Directive per enterprise in NACE code 24 over the period 2010-2069 (NPV) is estimated at €3-7k p.a for those who have existing LEVs but not being properly used/maintained. The costs are around €6-25k p.a. for those that need to install an LEV. The total costs over the period 2010-2069 (NPV) are estimated at between €62– 196m. However these costs are subject to high uncertainty as many of the costs set out above *may* also be occurred under the baseline in the future without further intervention.	Having an EU-wide OEL level will remove any EU competitive distortions between EU Member States with different OELs.	The largest industry sectors where workers are exposed to hydrazine are those involved with its manufacture (NACE 24) and those who use it as a herbicide in the agricultural sector (NACE 1). It is estimated that around 426 firms may be affected by an OEL at 0.13mg/m^3 with 388 from NACE 1 and 38 from NACE 24. These represent a very small proportion of the sector (<1%). Annual costs of RPE and compliance with the carcinogens Directive per enterprise in NACE code 1 over the period 2010-2069 (NPV) is estimated at €1-3k. Annual costs of use/installation of local exhaust ventilation (LEVs) and compliance with the carcinogens Directive per enterprise in NACE code 24 over the period 2010-2069 (NPV) is estimated at €3-7k p.a for those who have existing LEVs but not being properly used/maintained. The costs are around €6-25k p.a. for those that need to install an LEV. The total costs over the period 2010-2069 (NPV) are estimated at between €15– 47m. However these costs are subject to high uncertainty as many of the costs set out above *may* also be occurred under the baseline in the future without further intervention.	Having an EU-wide OEL level will remove any EU competitive distortions between EU Member States with different OELs.

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 (Present Value – 2010 €m prices)

Baseline Scenario		Intervention scenario (2) – Assumes full compliance for OEL = 0.013mg/m^3		Intervention scenario (3) – Assumes full compliance for OEL = 0.13mg/m^3	
Social Costs	**Social Benefits**	**Social Costs**	**Social Benefits**	**Social Costs**	**Social Benefits**
There are not expected to be any noticeable social impacts under the baseline scenario at an EU level. At an installation level, some personnel may change their working practices (e.g. wearing PPE or using LEVs) to reduce risks of inhalation exposure regardless of further intervention over the period 2010-2070.		There are not expected to be any noticeable changes to the numbers of workers required as a result of introducing an EU-wide OEL. However, job patterns may be altered as it is recognised that in order to meet the OEL, behavioural change amongst employees and updating health and safety training will be required.	Mechanical ventilation may be better for workers than natural ventilation as air change rates and flow can be controlled. If the mechanical ventilation includes a heat exchanger with high efficiency this might typically reduce the ventilation heat loss. The sectors (NACE 24 and 1) that experience the highest impact and thus cost are those that would experience the largest benefits from the control of exposure and meeting the OEL.	There are not expected to be any noticeable changes to the numbers of workers required as a result of introducing an EU-wide OEL. However, job patterns may be altered as it is recognised that in order to meet the OEL, behavioural change amongst employees and updating health and safety training will be required.	Mechanical ventilation may be better for workers than natural ventilation as air change rates and flow can be controlled. If the mechanical ventilation includes a heat exchanger with high efficiency this might typically reduce the ventilation heat loss. The sectors (NACE 24 and 1) that experience the highest impact and thus cost are those that would experience the largest benefits from the control of exposure and meeting the OEL.

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

Table 5.4 Comparison of macro-economic impacts by scenario (Present Value – 2010 €m prices)

Baseline Scenario		Intervention scenario (2) – Assumes full compliance for OEL = 0.013mg/m^3		Intervention scenario (3) – Assumes full compliance for OEL = 0.13mg/m^3	
Macro-economic Costs	**Macro-economic Benefits**	**Macro-economic Costs**	**Macro-economic Benefits**	**Macro-economic Costs**	**Macro-economic Benefits**
There are not expected to be any noticeable macroeconomic impacts under the baseline scenario.		Since compliance with an OEL would not involve changing the current manufacturing or agricultural process there is unlikely to be any significant change to macro-economic impacts.			

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 (Present Value – 2010 €m prices)

Baseline Scenario		Intervention scenario (2) – Assumes full compliance for OEL = 0.013mg/m^3		Intervention scenario (3) – Assumes full compliance for OEL = 0.13mg/m^3	
Environmental Costs	**Environmental Benefits**	**Environmental Costs**	**Environmental Benefits**	**Environmental Costs**	**Environmental Benefits**
Not estimated		The increased use of LEVs will mean more hydrazine will be sent to air although this is not expected to have a significant environmental impact as hydrazine is degraded rapidly in air. The use of PPE and best practice when using hydrazine as a herbicide may reduce risks to soil (e.g. over spraying, exposure to soil from storage transfer) but overall there is not expected to be a significant environmental impact relative to the baseline.			

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

6 CONCLUSIONS

Exposure to hydrazine may cause lung and colorectal cancer. This report considers the likely health, socioeconomic and environmental impacts associated with possible changes to the EU Carcinogens Directive, in particular the possible introduction of an occupational exposure limit (OEL) of either 0.013 mg/m^3 (0.01 ppm) or 0.13 mg/m^3 (0.1 ppm).

There are diverse uses of hydrazine with about 23 thousand tonnes being produced in Europe each year. We estimated that in 2006 more than 2.1 million individuals were exposed in EU to low levels of hydrazine, about 15,000 to medium levels and around 800 to high levels. Overall, we consider there are about 75% of workers exposed above 0.013 mg/m^3 and about 8% above 0.13 mg/m^3. Exposures were assumed to be decreasing by about 7% per annum.

We estimate that in 2010 there will be 18 cases of lung cancer (16 deaths) from past exposure to hydrazine and 131 cases of colorectal cancer (27 deaths). Over the next 40 years the incidence of cancers attributable to hydrazine decreases to zero for both types of cancer. The corresponding DALYs for lung cancer decrease from 267 in 2010 to zero in 2050 and beyond and form 698 to zero over the same time period for colorectal cancer. Health costs associated with these cancers are between about €500m and €3,000m, aggregated over the period 2010 to 2070. These costs fall mainly on France, Germany, Italy, Poland, Romania, Spain and the UK.

There are no important health benefits from introducing a limit at either 0.013 or 0.13 mg/m^3, mainly because exposures are predicted to continue to decrease over the next 20 years and the additional impact of any limit is judged to be negligible. The monetised health benefits are very small (<€0.02m). Costs of compliance with the higher suggested OEL range from €15m to €47m and for the lower OEL from €62 to €196m.

It are not expected that there will be any important social, macro-economic or environmental impacts.

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8 APPENDIX

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

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

NACE Code	1			15			21			24			25			32		
	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females
Austria	258	139	119	Not available			287	233	55	12	8	3	12,932	10,475	2,457	314	254	60
Belgium	99	69	30	1,238	1,003	235	232	188	44	30	21	9	12,431	10,069	2,362	199	161	38
Bulgaria	298	194	104	1,410	733	677	179	93	86	11	8	3	10,953	5,696	5,257	68	35	32
Cyprus	17	13	4	164	123	41	13	10	3	1	1	0	547	411	137	1	0	0
Czech Republic	212	149	64	Not available			325	211	114	18	12	5	38,999	25,349	13,650	404	262	141
Denmark	99	76	23	1,095	799	296	122	89	33	13	9	4	9,535	6,960	2,574	79	58	21
Estonia	36	24	11	221	121	99	30	17	14	1	1	0	2,373	1,305	1,068	75	41	34
Finland	134	96	37	514	380	134	518	383	135	8	5	2	7,044	5,213	1,832	431	319	112
France	1,087	794	294	8,350	6,430	1,921	1,278	984	294	118	82	35	106,342	81,884	24,459	1,362	1,049	313
Germany	997	718	279	10,570	8,139	2,431	2,338	1,800	538	196	137	59	174,209	134,141	40,068	1,699	1,308	391
Greece	617	358	259	1,103	838	265	122	93	29	8	5	2	5,398	4,103	1,296	54	41	13
Hungary	221	174	46	1,567	987	580	280	176	104	14	10	4	18,894	11,903	6,991	609	384	225
Ireland	136	109	27	636	477	159	55	41	14	11	7	3	4,615	3,461	1,154	103	77	26
Italy	1,128	778	350	5,671	4,254	1,418	1,285	964	321	85	60	26	92,469	69,352	23,117	988	741	247
Latvia	142	89	52	452	262	190	26	15	11	2	1	1	2,121	1,230	891	13	7	5
Lithuania	219	138	81	661	344	317	37	19	18	3	2	1	4,378	2,276	2,101	71	37	34
Luxembourg	4	3	1	Not available			Not available			0	0	0	2,834	2,466	368	Not available		
Malta	3	2	1	Not available			Not available			1	0	0	Not available			38	27	11
Netherlands	307	215	92	1,633	1,339	294	353	289	64	27	19	8	15,038	12,331	2,707	350	287	63
Poland	2,729	1,556	1,174	5,762	3,861	1,902	719	482	237	46	32	14	69,217	46,375	22,841	484	324	160

NACE Code	1			15			21			24			25			32		
	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females
Portugal	699	350	350	1,378	813	565	195	115	80	24	17	7	11,883	7,011	4,872	152	90	62
Romania	3,380	1,758	1,622	2,648	1,430	1,218	265	143	122	21	15	6	21,662	11,697	9,964	112	61	52
Slovakia	120	92	28	604	386	217	124	79	45	5	4	2	9,599	6,143	3,456	159	102	57
Slovenia	109	58	51	251	165	85	87	57	29	6	4	2	6,253	4,127	2,126	62	41	21
Spain	1,063	776	287	5,018	3,914	1,104	899	701	198	60	42	18	55,232	43,081	12,151	300	234	66
Sweden	114	92	22	Not available			669	522	147	19	13	6	13,166	10,269	2,896	347	271	76
United Kingdom	446	352	94	5,667	4,590	1,077	1,197	970	227	92	64	28	95,755	77,562	18,193	805	652	153
Total	14,674	9,172	5,502	56,613	41,389	15,224	11,635	8,675	2,960	833	583	250	803,877	594,888	208,988	9,277	6,863	2,414

NACE Code	40			41			73			74			80			Grand Total		
	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females
Austria	23,017	20,024	2,992	295	256	38	886	603	284	2595	1765	831	7	5	2	**40,333**	**33,615**	**6,718**
Belgium	13,291	11,563	1,728	680	592	88	1,024	686	338	3652	2447	1205	12	8	4	**32,759**	**26,717**	**6,042**
Bulgaria	30,729	26,735	3,995	2,020	1,758	263	55	37	18	1104	740	364	7	5	2	**46,526**	**35,831**	**10,695**
Cyprus	932	858	75	38	35	3	Not available			122	72	50	1	0	0	**1,817**	**1,508**	**309**
Czech Republic	29,626	25,182	4,444	2,200	1,870	330	1,020	612	408	3171	1903	1268	9	6	4	**75,754**	**55,395**	**20,359**
Denmark	11,037	8,830	2,207	362	290	72	1,060	689	371	2242	1457	785	7	5	2	**25,539**	**19,177**	**6,362**
Estonia	5,321	4,789	532	176	159	18	74	42	33	368	206	162	2	1	1	**8,640**	**6,680**	**1,960**
Finland	11,041	9,496	1,546	249	214	35	534	315	219	1269	749	520	6	3	2	**21,606**	**17,072**	**4,534**
France	127,880	98,467	29,412	3,880	2,988	892	6,955	4,382	2573	21419	13494	7925	58	37	21	**277,524**	**209,713**	**67,811**
Germany	187,648	163,253	24,394	4,582	3,986	596	15,599	8,891	6707	29129	16603	12525	68	39	29	**425,840**	**338,160**	**87,679**
Greece	Not available			Not available			1,483	875	608	2473	1459	1014	10	6	4	**10,643**	**7,415**	**3,229**

NACE Code	40			41			73			74			80			Grand Total		
	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females	Total	Males	Females
Hungary	26,288	22,082	4,206	2,345	1,969	375	1,065	703	362	2867	1892	975	10	7	4	**53,925**	**40,104**	**13,821**
Ireland	7,814	7,501	313	820	787	33	404	271	133	1262	845	416	4	3	1	**15,713**	**13,464**	**2,249**
Italy	71,112	61,868	9,245	2,859	2,487	372	4,400	2,772	1628	17459	10999	6460	50	32	19	**196,294**	**153,468**	**42,826**
Latvia	10,434	8,451	1,982	222	180	42	203	107	95	387	205	182	3	2	1	**13,860**	**10,460**	**3,400**
Lithuania	15,472	11,914	3,559	665	512	153	122	65	57	498	264	234	4	2	2	**21,908**	**15,433**	**6,475**
Luxembourg	756	703	53	13	12	1	269	167	102	356	221	135	0	0	0	**4,228**	**3,568**	**660**
Malta		Not available			Not available		54	34	20	72	46	27	0	0	0	**164**	**107**	**58**
Netherlands	15,356	12,285	3,071	535	428	107	5,615	3,706	1909	11106	7330	3776	18	12	6	**50,003**	**38,006**	**11,996**
Poland	125,479	106,657	18,822	5,231	4,446	785	684	438	246	5992	3835	2157	37	24	13	**213,605**	**166,442**	**47,163**
Portugal	8,415	7,321	1,094	1,470	1,279	191	211	124	87	4162	2456	1706	10	6	4	**27,877**	**19,215**	**8,662**
Romania	76,763	63,713	13,050	3,903	3,239	663	3,833	2,492	1342	2595	1687	908	14	9	5	**111,796**	**84,471**	**27,324**
Slovakia	20,688	17,584	3,103	1,423	1,210	213	739	436	303	623	367	255	5	3	2	**33,963**	**26,311**	**7,652**
Slovenia	6,165	5,179	986	441	371	71	431	263	168	479	292	187	2	2	1	**14,171**	**10,496**	**3,675**
Spain	31,347	26,959	4,389	3,359	2,889	470	2,773	1,442	1331	16929	8803	8126	35	18	17	**115,892**	**88,041**	**27,851**
Sweden	23,310	18,648	4,662	120	96	24	1,887	1,283	604	3153	2144	1009	16	11	5	**42,667**	**33,243**	**9,424**
United Kingdom	88,435	75,169	13,265	2,875	2,444	431	17,132	11,479	5654	28862	19337	9524	83	56	27	**240,811**	**192,259**	**48,553**
Total	977,427	822,979	154,448	41,344	34,992	6,352	68,513	42,912	25,601	164,374	101,636	62,738	479	299	181	**2,133,538**	**1,654,633**	**478,905**

Table 8.1.2 Estimated percentages of female and male employees by industry and Member State

	A Agriculture		D Manufacturing		E Electricity, gas and water supply		G Wholesale and retail trade		K Real Estate, Renting and Business Activities		M Education		N Health and social work		O Other community, social and personal service activities	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Albania	0.69	0.32	0.70	0.30	0.85	0.15	0.68	0.32	0.63	0.37	0.28	0.72	0.21	0.79	0.48	0.52
Austria	0.54	0.46	0.81	0.19	0.87	0.13	0.62	0.38	0.68	0.32	0.29	0.71	0.24	0.76	0.47	0.53
Belgium	0.70	0.30	0.81	0.19	0.87	0.13	0.75	0.25	0.67	0.33	0.31	0.69	0.25	0.75	0.52	0.48
Bulgaria	0.65	0.35	0.52	0.48	0.87	0.13	0.90	0.10	0.67	0.33	0.32	0.68	0.27	0.73	0.63	0.37
Cyprus	0.75	0.25	0.75	0.25	0.92	0.08	0.81	0.19	0.59	0.41	0.31	0.69	0.31	0.69	0.45	0.55
Czech Republic	0.70	0.30	0.65	0.35	0.85	0.15	0.70	0.30	0.60	0.40	0.25	0.75	0.20	0.80	0.49	0.51
Denmark	0.77	0.23	0.73	0.27	0.80	0.20	0.78	0.22	0.65	0.35	0.42	0.58	0.18	0.82	0.54	0.46
Estonia	0.68	0.32	0.55	0.45	0.90	0.10	0.63	0.37	0.56	0.44	0.15	0.85	0.10	0.90	0.35	0.65
Finland	0.72	0.28	0.74	0.26	0.86	0.14	0.64	0.36	0.59	0.41	0.33	0.67	0.11	0.89	0.40	0.60
France	0.73	0.27	0.77	0.23	0.77	0.23	0.70	0.30	0.63	0.37	0.32	0.68	0.27	0.73	0.57	0.43
Germany	0.72	0.28	0.77	0.23	0.87	0.13	0.62	0.38	0.57	0.43	0.36	0.64	0.28	0.71	0.54	0.46
Greece	0.58	0.42	0.76	0.24	0.89	0.11	0.79	0.21	0.59	0.41	0.37	0.63	0.36	0.64	0.45	0.55
Hungary	0.79	0.21	0.63	0.37	0.84	0.16	0.36	0.64	0.66	0.34	0.25	0.75	0.24	0.76	0.47	0.53
Ireland	0.80	0.20	0.75	0.25	0.96	0.04	0.79	0.21	0.67	0.33	0.27	0.73	0.19	0.81	0.50	0.50
Italy	0.69	0.31	0.75	0.25	0.87	0.13	0.75	0.25	0.63	0.37	0.24	0.76	0.32	0.68	0.48	0.52
Latvia	0.63	0.37	0.58	0.42	0.81	0.19	0.49	0.51	0.53	0.47	0.18	0.82	0.16	0.84	0.41	0.59
Lithuania	0.63	0.37	0.52	0.48	0.77	0.23	0.62	0.38	0.53	0.47	0.18	0.82	0.14	0.86	0.32	0.68
Luxembourg	0.73	0.27	0.87	0.13	0.93	0.07	0.75	0.25	0.62	0.38	0.34	0.66	0.26	0.74	0.51	0.49
Malta	0.68	0.32	0.71	0.29	0.86	0.14	0.69	0.31	0.63	0.37	0.28	0.72	0.21	0.79	0.48	0.52
Netherlands	0.70	0.30	0.82	0.18	0.80	0.20	0.71	0.29	0.66	0.34	0.41	0.59	0.21	0.79	0.55	0.45

	A Agriculture		D Manufacturing		E Electricity, gas and water supply		G Wholesale and retail trade		K Real Estate, Renting and Business Activities		M Education		N Health and social work		O Other community, social and personal service activities	
	Male	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**	**Male**	**Female**
Poland	0.57	0.43	0.67	0.33	0.85	0.15	0.69	0.31	0.64	0.36	0.24	0.76	0.20	0.80	0.53	0.47
Portugal	0.50	0.50	0.59	0.41	0.87	0.13	0.47	0.53	0.59	0.41	0.27	0.73	0.18	0.82	0.43	0.57
Romania	0.52	0.48	0.54	0.46	0.83	0.17	0.67	0.33	0.65	0.35	0.27	0.73	0.23	0.77	0.60	0.40
Slovakia	0.77	0.23	0.64	0.36	0.85	0.15	0.67	0.33	0.59	0.41	0.20	0.80	0.19	0.81	0.47	0.53
Slovenia	0.53	0.47	0.66	0.34	0.84	0.16	0.62	0.38	0.61	0.39	0.22	0.78	0.20	0.80	0.56	0.44
Spain	0.73	0.27	0.78	0.22	0.86	0.14	0.73	0.27	0.52	0.48	0.37	0.63	0.30	0.70	0.69	0.31
Sweden	0.81	0.19	0.78	0.22	0.80	0.20	0.80	0.20	0.68	0.32	0.25	0.75	0.17	0.83	0.47	0.53
United Kingdom	0.79	0.21	0.81	0.19	0.85	0.15	0.72	0.28	0.67	0.33	0.36	0.64	0.27	0.73	0.62	0.38
Total	**0.68**	**0.32**	**0.70**	**0.30**	**0.85**	**0.15**	**0.68**	**0.32**	**0.62**	**0.38**	**0.29**	**0.71**	**0.22**	**0.78**	**0.50**	**0.50**

8.2 ESTIMATED DEATHS AND REGISTRATIONS IN THE EU FROM LUNG AND COLORECTAL CANCERS

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

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

Lung cancer deaths	MEN						WOMEN					
FTY	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060
Slovakia	1,963	2,488	3,057	3,508	3,884	3,932	438	508	608	709	742	773
Slovenia	944	1,168	1,406	1,545	1,581	1,552	282	317	353	379	379	370
Spain	20,051	24,629	30,491	36,512	40,400	40,734	2,942	3,503	4,051	4,536	4,903	5,021
Sweden	2,078	2,503	2,886	3,122	3,340	3,542	1,659	1,862	2,064	2,198	2,302	2,390
United Kingdom	21,915	26,107	30,805	34,784	38,234	41,219	15,291	17,180	19,778	22,297	24,098	25,562
European Union (27 countries)	210,064	249,072	289,493	323,680	342,919	348,763	70,053	79,186	88,770	96,845	100,598	100,564

Lung cancer 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
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

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

Colorectal cancer deaths	MEN						WOMEN					
FTY	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060
Austria	1,378	1,728	2,164	2,584	2,946	2,951	827	940	1,090	1,263	1,337	1,332
Belgium	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	1,393	1,446	1,577	1,710	1,836	1,859	998	1,049	1,128	1,177	1,214	1,206
Cyprus	49	68	92	114	142	173	34	45	59	72	83	98
Czech Republic	2,707	3,375	4,175	4,755	5,308	5,778	1,580	1,857	2,147	2,287	2,482	2,559
Denmark	1,122	1,428	1,749	1,929	2,051	2,071	779	930	1,062	1,146	1,171	1,163
Estonia	212	234	273	319	361	409	185	194	208	216	220	223
Finland	618	793	996	1,079	1,095	1,137	402	477	541	551	538	546
France	9,456	11,415	14,036	16,164	17,413	18,226	5,592	6,354	7,452	8,273	8,572	8,616
Germany (including ex-	15,365	19,252	21,931	25,068	26,365	24,969	10,208	11,440	12,499	13,751	13,622	12,947

Colorectal cancer deaths	MEN						WOMEN					
FTY	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060
GDR from 1991)												
Greece	1,256	1,482	1,698	2,037	2,354	2,510	854	980	1,090	1,231	1,342	1,360
Hungary	2,661	3,028	3,488	3,969	4,472	4,826	1,942	2,134	2,332	2,432	2,572	2,628
Ireland	635	867	1,163	1,493	1,858	2,182	335	436	571	715	872	1,004
Italy	10,740	12,858	15,043	17,453	19,620	19,843	6,551	7,347	8,200	9,148	9,638	9,338
Latvia	339	371	422	495	561	622	325	333	349	369	377	382
Lithuania	471	526	614	734	822	882	424	459	502	563	582	580
Luxembourg	57	75	98	120	134	145	51	59	76	94	104	112
Malta	58	77	97	110	119	131	44	54	62	66	69	72
Netherlands	2,714	3,537	4,506	5,124	5,404	5,304	1,864	2,247	2,678	2,959	2,970	2,892
Poland	5,689	7,075	8,870	10,305	11,372	12,572	4,208	4,890	5,850	6,425	6,700	7,026
Portugal	2,081	2,475	2,943	3,504	4,000	4,320	1,179	1,351	1,540	1,738	1,879	1,920
Romania	2,734	3,028	3,554	4,152	4,734	5,040	2,164	2,349	2,676	2,918	3,170	3,226
Slovakia	1,110	1,411	1,855	2,274	2,611	2,904	715	854	1,058	1,193	1,304	1,373
Slovenia	433	576	718	853	918	941	280	322	369	404	413	403
Spain	8,388	10,242	12,771	16,037	19,138	20,525	4,324	5,073	6,059	7,221	8,106	8,199
Sweden	1,417	1,718	2,045	2,230	2,413	2,568	955	1,103	1,212	1,303	1,354	1,414
United Kingdom	9,217	11,047	13,182	15,047	16,717	17,950	5,532	6,220	7,115	8,060	8,583	9,129
European Union (27 countries)	83,890	101,704	121,509	141,053	155,287	161,235	53,599	60,742	69,536	77,365	81,149	81,590

Colorectal cancer registrations	MEN						WOMEN					
FTY	2010	2020	2030	2040	2050	2060	2010	2020	2030	2040	2050	2060
Austria	6,057	7,259	8,757	9,807	10,127	10,281	7,568	8,427	9,994	11,243	11,590	11,612
Belgium	7,551	9,056	10,686	11,735	12,187	12,665	9,457	10,789	12,500	13,741	14,236	14,593
Bulgaria	3,045	3,160	3,352	3,559	3,701	3,633	3,548	3,752	3,907	4,011	4,069	3,952
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	7,394	8,843	10,014	11,004	11,624	11,556	7,391	8,614	9,437	10,104	10,642	10,694

Colorectal cancer registrations	*MEN*						*WOMEN*					
FTY	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Denmark	4,365	5,297	5,918	6,240	6,242	6,437	5,178	6,099	6,868	7,355	7,380	7,508
Estonia	432	468	528	585	647	686	1,011	1,066	1,132	1,170	1,206	1,219
Finland	2,300	2,888	3,193	3,248	3,296	3,382	3,497	4,252	4,725	4,811	4,776	4,808
France	42,554	52,317	60,336	66,020	68,342	71,056	45,799	54,491	62,535	68,669	69,934	70,489
Germany (including ex-GDR from 1991)	84,840	96,604	109,364	115,365	112,769	108,581	117,533	126,352	141,984	150,286	146,968	141,083
Greece	4,082	4,633	5,289	6,023	6,447	6,315	5,126	5,775	6,402	7,095	7,441	7,227
Hungary	6,478	7,164	7,894	8,710	9,401	9,592	8,860	9,701	10,242	10,730	11,235	11,313
Ireland	1,455	1,929	2,459	3,009	3,547	3,813	1,302	1,684	2,142	2,605	3,112	3,381
Italy	53,073	61,248	70,014	78,239	80,314	78,790	59,890	67,033	74,658	82,657	84,738	82,093
Latvia	565	592	668	740	793	832	1,421	1,433	1,516	1,571	1,616	1,632
Lithuania	935	1,017	1,190	1,344	1,455	1,532	1,701	1,795	1,995	2,128	2,155	2,165
Luxembourg	295	379	471	547	595	637	357	431	542	647	713	764
Malta	140	176	202	215	230	239	181	222	254	266	279	290
Netherlands	11,059	13,935	16,086	17,033	16,798	16,911	12,403	15,064	17,562	19,015	18,780	18,598
Poland	10,820	12,979	15,094	16,324	17,668	18,118	16,093	19,140	21,972	23,210	24,639	24,990
Portugal	5,489	6,351	7,393	8,389	9,106	9,236	5,629	6,431	7,278	8,048	8,562	8,526
Romania	5,253	5,702	6,333	7,136	7,624	7,612	5,817	6,338	6,892	7,613	8,023	8,012
Slovakia	2,231	2,724	3,249	3,658	3,965	3,992	2,244	2,667	3,122	3,413	3,659	3,697
Slovenia	1,162	1,416	1,639	1,760	1,785	1,709	1,301	1,478	1,662	1,772	1,798	1,725
Spain	22,986	27,978	34,333	40,676	44,464	43,599	23,431	27,713	33,072	38,543	42,077	41,483
Sweden	7,104	8,487	9,468	10,214	10,715	11,477	8,464	9,722	10,801	11,685	12,125	12,917
United Kingdom	42,887	50,766	58,285	64,372	68,640	75,053	46,106	52,341	60,324	67,691	71,668	77,278
European Union (27 countries)	313,100	368,782	425,089	469,975	491,776	497,989	374,946	427,356	485,506	533,507	553,857	555,005

8.3 SUPPLEMENTARY TABLES - COSTS UNDER THE BASELINE SCENARIO

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

Low	Female	Male	Total	High	Female	Male	Total
Austria	€ 4.2	€ 5.9	€ 10.2	Austria	€ 43.8	€ 37.6	€ 81.3
Belgium	€ 0.4	€ 0.6	€ 1.0	Belgium	€ 12.9	€ 22.9	€ 35.8
Bulgaria	€ 2.7	€ 6.2	€ 8.9	Bulgaria	€ 18.4	€ 26.1	€ 44.5
Czech Republic	€ 2.5	€ 7.0	€ 9.5	Czech Republic	€ 18.5	€ 36.2	€ 54.7
Cyprus	€ 0.0	€ 0.2	€ 0.2	Cyprus	€ 0.0	€ 0.0	€ 0.0
Denmark	€ 1.5	€ 3.3	€ 4.7	Denmark	€ 10.8	€ 21.0	€ 31.7
Estonia	€ 0.4	€ 0.7	€ 1.1	Estonia	€ 3.2	€ 3.3	€ 6.4
Finland	€ 1.0	€ 2.5	€ 3.5	Finland	€ 10.4	€ 14.5	€ 24.9
France	€ 11.0	€ 35.2	€ 46.2	France	€ 97.5	€ 204.2	€ 301.7
Germany	€ 14.2	€ 34.5	€ 48.8	Germany	€ 170.4	€ 249.1	€ 419.5
Greece	€ 5.2	€ 10.2	€ 15.4	Greece	€ 47.8	€ 48.8	€ 96.6
Hungary	€ 2.5	€ 9.0	€ 11.5	Hungary	€ 16.9	€ 41.4	€ 58.2
Ireland	€ 0.8	€ 3.0	€ 3.8	Ireland	€ 4.3	€ 12.9	€ 17.2
Italy	€ 12.6	€ 31.7	€ 44.3	Italy	€ 133.5	€ 222.8	€ 356.2
Latvia	€ 1.5	€ 2.5	€ 3.9	Latvia	€ 11.8	€ 9.4	€ 21.2
Lithuania	€ 2.0	€ 3.8	€ 5.8	Lithuania	€ 15.3	€ 15.9	€ 31.2
Luxembourg	€ 0.0	€ 0.1	€ 0.1	Luxembourg	€ 0.4	€ 0.7	€ 1.0
Malta	€ 0.0	€ 0.1	€ 0.1	Malta	€ 0.2	€ 0.3	€ 0.5
Netherlands	€ 4.1	€ 8.5	€ 12.6	Netherlands	€ 31.1	€ 52.9	€ 84.0
Poland	€ 35.3	€ 53.6	€ 88.9	Poland	€ 205.5	€ 199.2	€ 404.7
Portugal	€ 9.3	€ 12.1	€ 21.4	Portugal	€ 70.6	€ 58.8	€ 129.5
Romania	€ 36.3	€ 47.0	€ 83.3	Romania	€ 182.7	€ 167.8	€ 350.5
Slovakia	€ 0.8	€ 3.2	€ 4.0	Slovakia	€ 4.8	€ 14.3	€ 19.1
Slovenia	€ 1.8	€ 2.5	€ 4.4	Slovenia	€ 12.9	€ 11.5	€ 24.5
Spain	€ 7.3	€ 27.3	€ 34.5	Spain	€ 55.1	€ 123.6	€ 178.7
Sweden	€ 1.1	€ 2.9	€ 4.0	Sweden	€ 10.0	€ 22.4	€ 32.3
United Kingdom	€ 6.3	€ 16.2	€ 22.5	United Kingdom	€ 45.4	€ 104.9	€ 150.3
TOTAL	€ 165.0	€ 329.8	€ 494.8	**TOTAL**	€ 1,234.0	€ 1,722.3	€ 2,956.3

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

Low	Female	Male	Total
Agriculture, hunting and related service activities	€ 173.1	€ 301.0	€ 474.1
Manufacture of base chemicals	€ 16.7	€ 49.4	€ 66.1
TOTAL	€ 189.9	€ 350.4	€ 540.2

High	Female	Male	Total
Agriculture, hunting and related service activities	€ 1,584.8	€ 1,795.0	€ 3,379.8
Manufacture of base chemicals	€ 107.4	€ 206.7	€ 314.0
TOTAL	€ 1,692.1	€ 2,001.7	€ 3,693.8

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

Low	Female	Male	Total	High	Female	Male	Total
Austria	€ 4.3	€ 6.0	€ 10.2	Austria	€ 44.0	€ 37.8	€ 81.8
Belgium	€ 0.4	€ 0.6	€ 1.0	Belgium	€ 12.9	€ 23.1	€ 36.0
Bulgaria	€ 2.7	€ 6.3	€ 9.0	Bulgaria	€ 18.6	€ 26.3	€ 44.8
Czech Republic	€ 2.5	€ 7.0	€ 9.6	Czech Republic	€ 18.6	€ 36.4	€ 55.0
Cyprus	€ 0.0	€ 0.2	€ 0.2	Cyprus	€ 0.0	€ 0.0	€ 0.0
Denmark	€ 1.5	€ 3.3	€ 4.8	Denmark	€ 10.8	€ 21.1	€ 31.9
Estonia	€ 0.4	€ 0.7	€ 1.1	Estonia	€ 3.2	€ 3.3	€ 6.5
Finland	€ 1.0	€ 2.5	€ 3.5	Finland	€ 10.5	€ 14.6	€ 25.1
France	€ 11.1	€ 35.4	€ 46.5	France	€ 98.2	€ 205.5	€ 303.7
Germany	€ 14.3	€ 34.7	€ 49.0	Germany	€ 171.5	€ 250.5	€ 421.9
Greece	€ 5.2	€ 10.3	€ 15.6	Greece	€ 48.5	€ 49.5	€ 98.1
Hungary	€ 2.5	€ 9.0	€ 11.6	Hungary	€ 17.0	€ 41.6	€ 58.6
Ireland	€ 0.8	€ 3.0	€ 3.9	Ireland	€ 4.3	€ 13.0	€ 17.3
Italy	€ 12.7	€ 31.9	€ 44.6	Italy	€ 134.4	€ 224.4	€ 358.8
Latvia	€ 1.5	€ 2.5	€ 4.0	Latvia	€ 11.9	€ 9.5	€ 21.4
Lithuania	€ 2.0	€ 3.8	€ 5.8	Lithuania	€ 15.4	€ 16.1	€ 31.5
Luxembourg	€ 0.0	€ 0.1	€ 0.1	Luxembourg	€ 0.4	€ 0.7	€ 1.0
Malta	€ 0.0	€ 0.1	€ 0.1	Malta	€ 0.2	€ 0.3	€ 0.5
Netherlands	€ 4.2	€ 8.5	€ 12.7	Netherlands	€ 31.4	€ 53.3	€ 84.7
Poland	€ 35.6	€ 54.2	€ 89.8	Poland	€ 207.5	€ 201.3	€ 408.8
Portugal	€ 9.4	€ 12.2	€ 21.6	Portugal	€ 71.3	€ 59.6	€ 130.9
Romania	€ 36.8	€ 47.6	€ 84.4	Romania	€ 184.8	€ 169.9	€ 354.8
Slovakia	€ 0.8	€ 3.2	€ 4.0	Slovakia	€ 4.8	€ 14.4	€ 19.2
Slovenia	€ 1.8	€ 2.5	€ 4.4	Slovenia	€ 13.0	€ 11.6	€ 24.7
Spain	€ 7.3	€ 27.5	€ 34.8	Spain	€ 55.6	€ 124.6	€ 180.1
Sweden	€ 1.1	€ 2.9	€ 4.0	Sweden	€ 10.0	€ 22.5	€ 32.5
United Kingdom	€ 6.3	€ 16.3	€ 22.6	United Kingdom	€ 45.7	€ 105.5	€ 151.2
TOTAL	€ 166.5	€ 332.6	€ 499.0	**TOTAL**	€ 1,244.7	€ 1,736.2	€ 2,980.9

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

Low	Female	Male	Total
Agriculture, hunting and related service activities	€ 174.4	€ 302.8	€ 477.2
Manufacture of base chemicals	€ 17.2	€ 50.6	€ 67.8
TOTAL	€ 191.6	€ 353.4	€ 545.0

High	Female	Male	Total
Agriculture, hunting and related service activities	€ 1,596.6	€ 1,806.2	€ 3,402.8
Manufacture of base chemicals	€ 111.7	€ 213.6	€ 325.3
TOTAL	€ 1,708.3	€ 2,019.7	€ 3,728.0

Table 8.3.5 Summary

Costs by Gender (€m)	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
Female	110 to 818	50 to 378	6 to 45	0 to 3	0 to 0	0 to 0
Male	218 to 1140	101 to 533	12 to 59	1 to 4	0 to 0	0 to 0
Total	328 to 1958	151 to 911	18 to 104	1 to 8	0 to 0	0 to 0

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

Low	Female	Male	Total	High	Female	Male	Total
Austria	€ 6.0	€ 8.5	€ 14.5	Austria	€ 62.1	€ 53.6	€ 115.7
Belgium	€ 0.5	€ 0.9	€ 1.4	Belgium	€ 18.4	€ 32.8	€ 51.2
Bulgaria	€ 3.8	€ 8.9	€ 12.8	Bulgaria	€ 26.5	€ 37.4	€ 63.9
Czech Republic	€ 3.6	€ 10.0	€ 13.6	Czech Republic	€ 26.5	€ 51.8	€ 78.3
Cyprus	€ 0.1	€ 0.2	€ 0.3	Cyprus	€ 0.0	€ 0.0	€ 0.0
Denmark	€ 2.1	€ 4.7	€ 6.8	Denmark	€ 15.5	€ 30.0	€ 45.5
Estonia	€ 0.5	€ 1.0	€ 1.6	Estonia	€ 4.5	€ 4.7	€ 9.2
Finland	€ 1.5	€ 3.6	€ 5.0	Finland	€ 15.1	€ 21.0	€ 36.1
France	€ 15.8	€ 50.2	€ 66.0	France	€ 140.3	€ 292.9	€ 433.2
Germany	€ 20.2	€ 49.3	€ 69.5	Germany	€ 242.7	€ 355.2	€ 597.8
Greece	€ 7.6	€ 15.1	€ 22.7	Greece	€ 70.7	€ 72.4	€ 143.2
Hungary	€ 3.6	€ 12.8	€ 16.4	Hungary	€ 24.3	€ 59.0	€ 83.3
Ireland	€ 1.2	€ 4.3	€ 5.5	Ireland	€ 6.2	€ 18.7	€ 24.9
Italy	€ 18.1	€ 45.5	€ 63.6	Italy	€ 191.4	€ 320.1	€ 511.5
Latvia	€ 2.1	€ 3.6	€ 5.7	Latvia	€ 16.9	€ 13.6	€ 30.5
Lithuania	€ 2.8	€ 5.5	€ 8.3	Lithuania	€ 21.9	€ 23.0	€ 44.9
Luxembourg	€ 0.1	€ 0.1	€ 0.2	Luxembourg	€ 0.5	€ 1.0	€ 1.5
Malta	€ 0.0	€ 0.1	€ 0.1	Malta	€ 0.3	€ 0.4	€ 0.7
Netherlands	€ 5.9	€ 12.2	€ 18.2	Netherlands	€ 45.0	€ 76.6	€ 121.5
Poland	€ 50.9	€ 78.1	€ 129.0	Poland	€ 298.4	€ 290.4	€ 588.8
Portugal	€ 13.5	€ 17.7	€ 31.1	Portugal	€ 102.5	€ 86.3	€ 188.8
Romania	€ 52.9	€ 68.8	€ 121.7	Romania	€ 266.6	€ 245.5	€ 512.1
Slovakia	€ 1.2	€ 4.6	€ 5.8	Slovakia	€ 6.9	€ 20.6	€ 27.5
Slovenia	€ 2.6	€ 3.7	€ 6.3	Slovenia	€ 18.6	€ 16.8	€ 35.4

Low	Female	Male	Total	High	Female	Male	Total
Spain	€ 10.5	€ 39.3	€ 49.8	Spain	€ 79.3	€ 178.1	€ 257.4
Sweden	€ 1.6	€ 4.1	€ 5.7	Sweden	€ 14.3	€ 31.8	€ 46.1
United Kingdom	€ 9.0	€ 23.1	€ 32.0	United Kingdom	€ 65.1	€ 149.4	€ 214.5
TOTAL	€ 237.8	€ 475.9	€ 713.6	**TOTAL**	€ 1,780.4	€ 2,482.9	€ 4,263.3

Table 8.3.7 Health costs – baseline scenario – Industry group breakdown - Based on a declining discount rate

Low	Female	Male	Total
Agriculture, hunting and related service activities	€ 248.0	€ 430.0	€ 678.0
Manufacture of base chemicals	€ 26.1	€ 76.0	€ 102.1
TOTAL	€ 274.1	€ 506.0	€ 780.1

High	Female	Male	Total
Agriculture, hunting and related service activities	€ 2,275.4	€ 2,568.1	€ 4,843.5
Manufacture of base chemicals	€ 175.5	€ 329.4	€ 504.9
TOTAL	€ 2,450.9	€ 2,897.5	€ 5,348.4

Table 8.3.8 Summary

Costs by Gender (€m)	2010-2019	2020-2029	2030-2039	2040-2049	2050-2059	2060-2069
Female	134 to 995	90 to 681	13 to 95	1 to 9	0 to 1	0 to 0
Male	266 to 1387	183 to 959	25 to 123	3 to 13	0 to 1	0 to 0
Total	399 to 2383	273 to 1640	37 to 217	4 to 21	0 to 2	0 to 0

8.4 VALUING HEALTH BENEFITS – INTERVENTION SCENARIOS

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

Forecast Scenario	**1971-80**	**1981-90**	**1991-00**	**2001-10**	**2011-20**	**2021-30**	**1971-80**	**1981-90**	**1991-00**	**2001-10**	**2011-20**	**2021-30**
OEL			***0.013 mg/m3***						***0.13 mg/m3***			
Austria	0.99	0.94	0.82	0.60	0.34	0.14	0.56	0.30	0.12	0.03	0.01	0.00
Belgium	0.98	0.92	0.77	0.53	0.28	0.11	0.49	0.24	0.09	0.02	0.00	0.00
Bulgaria	0.99	0.94	0.82	0.60	0.34	0.14	0.56	0.30	0.12	0.03	0.01	0.00
Cyprus	0.99	0.96	0.86	0.66	0.40	0.18	0.62	0.36	0.15	0.05	0.01	0.00
Czech Republic	0.98	0.91	0.74	0.50	0.25	0.09	0.45	0.22	0.07	0.02	0.00	0.00
Denmark	0.98	0.92	0.78	0.55	0.29	0.11	0.50	0.25	0.09	0.02	0.00	0.00
Estonia	0.98	0.92	0.78	0.54	0.29	0.11	0.50	0.25	0.09	0.02	0.00	0.00
Finland	0.99	0.94	0.82	0.60	0.34	0.14	0.56	0.30	0.12	0.03	0.01	0.00
France	0.98	0.92	0.78	0.54	0.29	0.11	0.50	0.25	0.09	0.02	0.00	0.00
Germany	0.97	0.90	0.73	0.49	0.24	0.09	0.44	0.21	0.07	0.02	0.00	0.00
Greece	1.00	0.99	0.96	0.87	0.69	0.43	0.85	0.64	0.39	0.17	0.05	0.01
Hungary	0.98	0.92	0.78	0.54	0.29	0.11	0.50	0.25	0.09	0.02	0.00	0.00
Ireland	0.99	0.96	0.85	0.65	0.39	0.17	0.61	0.35	0.15	0.04	0.01	0.00
Italy	0.99	0.94	0.81	0.59	0.33	0.14	0.55	0.29	0.11	0.03	0.01	0.00
Latvia	0.99	0.96	0.86	0.66	0.41	0.18	0.62	0.36	0.16	0.05	0.01	0.00
Lithuania	0.99	0.96	0.86	0.66	0.40	0.18	0.62	0.36	0.15	0.05	0.01	0.00
Luxembourg	0.95	0.84	0.63	0.37	0.16	0.05	0.33	0.14	0.04	0.01	0.00	0.00
Malta	1.00	0.98	0.91	0.76	0.52	0.27	0.72	0.47	0.23	0.08	0.02	0.00
Netherlands	0.99	0.94	0.82	0.60	0.34	0.14	0.56	0.30	0.12	0.03	0.01	0.00
Poland	0.99	0.97	0.88	0.69	0.44	0.21	0.65	0.39	0.18	0.06	0.01	0.00
Portugal	1.00	0.98	0.93	0.78	0.55	0.30	0.75	0.50	0.26	0.09	0.02	0.00

Forecast Scenario	1971-80	1981-90	1991-00	2001-10	2011-20	2021-30	1971-80	1981-90	1991-00	2001-10	2011-20	2021-30
OEL			*0.013 mg/m3*						*0.13 mg/m3*			
Romania	1.00	0.99	0.93	0.80	0.57	0.32	0.77	0.53	0.28	0.11	0.03	0.01
Slovakia	0.98	0.92	0.76	0.52	0.27	0.10	0.48	0.24	0.08	0.02	0.00	0.00
Slovenia	0.99	0.95	0.84	0.63	0.37	0.16	0.59	0.33	0.13	0.04	0.01	0.00
Spain	0.99	0.96	0.85	0.65	0.40	0.18	0.61	0.35	0.15	0.04	0.01	0.00
Sweden	0.98	0.91	0.75	0.50	0.25	0.09	0.45	0.22	0.08	0.02	0.00	0.00
United Kingdom	0.97	0.89	0.71	0.46	0.22	0.08	0.41	0.19	0.06	0.01	0.00	0.00
TOTAL	1.00	0.98	0.91	0.747	0.50	0.26	0.71	0.46	0.22	0.0763	0.02	0.00

Table 8.4.2 Numbers and proportions of the population ever exposed for baseline and intervention[1] scenarios (2) to (3), by country, men plus women

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Number ever exposed in the REP													
Austria	147,703	152,859	159,393	162,011	163,875	165,007	159,393	162,011	163,875	165,007	159,393	162,011	163,875	165,007
Belgium	118,368	123,631	130,492	134,374	137,155	138,865	130,492	134,374	137,155	138,865	130,492	134,374	137,155	138,865
Bulgaria	179,449	184,144	189,809	190,414	190,832	191,070	189,809	190,414	190,832	191,070	189,809	190,414	190,832	191,070
Cyprus	6,724	6,938	7,204	7,291	7,352	7,388	7,204	7,291	7,352	7,388	7,204	7,291	7,352	7,388
Czech Republic	293,556	302,806	314,318	317,730	320,170	321,663	314,318	317,730	320,170	321,663	314,318	317,730	320,170	321,663
Denmark	96,040	100,049	105,237	107,964	109,916	111,116	105,237	107,964	109,916	111,116	105,237	107,964	109,916	111,116
Estonia	32,837	33,847	35,101	35,450	35,699	35,850	35,101	35,450	35,699	35,850	35,101	35,450	35,699	35,850
Finland	80,850	83,670	87,242	88,664	89,679	90,297	87,242	88,664	89,679	90,297	87,242	88,664	89,679	90,297
France	1,252,810	1,220,582	1,191,120	1,165,928	1,130,147	1,116,853	1,191,120	1,165,928	1,130,147	1,116,853	1,191,120	1,165,928	1,130,147	1,116,853
Germany	1,568,405	1,630,205	1,709,658	1,748,121	1,775,705	1,792,692	1,709,658	1,748,121	1,775,705	1,792,692	1,709,658	1,748,121	1,775,705	1,792,692
Greece	41,777	44,257	47,622	50,279	52,153	53,269	47,622	50,279	52,153	53,269	47,622	50,279	52,153	53,269
Hungary	207,082	214,023	222,749	225,859	228,081	229,438	222,749	225,859	228,081	229,438	222,749	225,859	228,081	229,438
Ireland	56,595	58,721	61,445	62,706	63,604	64,150	61,445	62,706	63,604	64,150	61,445	62,706	63,604	64,150
Italy	731,760	760,197	796,720	814,278	826,825	834,500	796,720	814,278	826,825	834,500	796,720	814,278	826,825	834,500
Latvia	53,872	55,366	57,194	57,539	57,779	57,919	57,194	57,539	57,779	57,919	57,194	57,539	57,779	57,919
Lithuania	87,749	90,011	92,736	93,007	93,191	93,289	92,736	93,007	93,191	93,289	92,736	93,007	93,191	93,289
Luxembourg	14,914	15,610	16,521	17,060	17,447	17,686	16,521	17,060	17,447	17,686	16,521	17,061	17,448	17,688
Malta	547	624	733	840	916	962	733	840	916	962	733	840	916	962
Netherlands	176,311	189,147	206,592	220,565	230,578	236,740	206,592	220,565	230,578	236,740	206,592	220,565	230,578	236,740
Poland	827,304	848,117	873,133	875,228	876,581	877,222	873,133	875,228	876,581	877,222	873,133	875,228	876,581	877,222

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Portugal	111,253	115,552	121,108	123,992	126,023	127,227	121,108	123,992	126,023	127,227	121,108	123,992	126,023	127,227
Romania	448,162	458,713	471,358	472,223	472,651	472,669	471,358	472,223	472,651	472,669	471,358	472,223	472,651	472,669
Slovakia	129,329	133,119	137,782	138,837	139,588	140,045	137,782	138,837	139,588	140,045	137,782	138,837	139,588	140,045
Slovenia	54,985	56,702	58,841	59,489	59,948	60,224	58,841	59,489	59,948	60,224	58,841	59,489	59,948	60,224
Spain	276,440	343,153	435,720	528,526	597,750	643,830	435,720	528,526	597,750	643,830	435,720	528,526	597,750	643,830
Sweden	158,351	164,772	173,049	177,217	180,202	182,037	173,049	177,217	180,202	182,037	173,049	177,217	180,202	182,037
United Kingdom	1,208,932	1,143,201	1,049,786	954,671	886,113	843,270	1,049,786	954,671	886,113	843,270	1,049,786	954,671	886,113	843,270
TOTAL	8,362,105	8,530,017	8,752,663	8,830,261	8,869,957	8,905,278	8,752,663	8,830,261	8,869,957	8,905,278	8,752,663	8,830,262	8,869,959	8,905,280

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Proportion of the population exposed													
Austria	2.41%	2.34%	2.35%	2.34%	2.35%	2.40%	2.35%	2.34%	2.35%	2.40%	2.35%	2.34%	2.35%	2.40%
Belgium	1.54%	1.52%	1.53%	1.53%	1.53%	1.54%	1.53%	1.53%	1.53%	1.54%	1.53%	1.53%	1.53%	1.54%
Bulgaria	3.20%	3.35%	3.66%	3.83%	4.08%	4.42%	3.66%	3.83%	4.08%	4.42%	3.66%	3.83%	4.08%	4.42%
Cyprus	1.20%	1.02%	0.94%	0.85%	0.79%	0.75%	0.94%	0.85%	0.79%	0.75%	0.94%	0.85%	0.79%	0.75%
Czech Republic	3.85%	3.77%	3.94%	3.99%	4.11%	4.31%	3.94%	3.99%	4.11%	4.31%	3.94%	3.99%	4.11%	4.31%
Denmark	2.50%	2.49%	2.52%	2.56%	2.59%	2.59%	2.52%	2.56%	2.59%	2.59%	2.52%	2.56%	2.59%	2.59%
Estonia	3.48%	3.52%	3.79%	3.86%	3.98%	4.18%	3.79%	3.86%	3.98%	4.18%	3.79%	3.86%	3.98%	4.18%
Finland	2.13%	2.10%	2.16%	2.20%	2.24%	2.27%	2.16%	2.20%	2.24%	2.27%	2.16%	2.20%	2.24%	2.27%
France	2.89%	2.66%	2.48%	2.34%	2.22%	2.17%	2.48%	2.34%	2.22%	2.17%	2.48%	2.34%	2.22%	2.17%
Germany	2.54%	2.58%	2.73%	2.86%	3.03%	3.23%	2.73%	2.86%	3.03%	3.23%	2.73%	2.86%	3.03%	3.23%
Greece	0.49%	0.50%	0.54%	0.56%	0.59%	0.62%	0.54%	0.56%	0.59%	0.62%	0.54%	0.56%	0.59%	0.62%
Hungary	2.84%	2.89%	3.05%	3.13%	3.23%	3.38%	3.05%	3.13%	3.23%	3.38%	3.05%	3.13%	3.23%	3.38%
Ireland	1.87%	1.64%	1.55%	1.44%	1.37%	1.33%	1.55%	1.44%	1.37%	1.33%	1.55%	1.44%	1.37%	1.33%
Italy	1.60%	1.61%	1.65%	1.66%	1.71%	1.78%	1.65%	1.66%	1.71%	1.78%	1.65%	1.66%	1.71%	1.78%
Latvia	3.34%	3.40%	3.73%	3.88%	4.07%	4.38%	3.73%	3.88%	4.07%	4.38%	3.73%	3.88%	4.07%	4.38%
Lithuania	3.76%	3.73%	3.97%	4.12%	4.31%	4.65%	3.97%	4.12%	4.31%	4.65%	3.97%	4.12%	4.31%	4.65%
Luxembourg	4.31%	4.01%	3.80%	3.61%	3.46%	3.33%	3.80%	3.61%	3.46%	3.33%	3.80%	3.61%	3.47%	3.33%
Malta	0.19%	0.20%	0.22%	0.26%	0.28%	0.30%	0.22%	0.26%	0.28%	0.30%	0.22%	0.26%	0.28%	0.30%
Netherlands	1.52%	1.55%	1.63%	1.73%	1.84%	1.91%	1.63%	1.73%	1.84%	1.91%	1.63%	1.73%	1.84%	1.91%
Poland	3.08%	2.97%	3.08%	3.15%	3.29%	3.51%	3.08%	3.15%	3.29%	3.51%	3.08%	3.15%	3.29%	3.51%

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Portugal	1.41%	1.39%	1.40%	1.40%	1.42%	1.45%	1.40%	1.40%	1.42%	1.45%	1.40%	1.40%	1.42%	1.45%
Romania	2.96%	2.94%	3.07%	3.14%	3.27%	3.50%	3.07%	3.14%	3.27%	3.50%	3.07%	3.14%	3.27%	3.50%
Slovakia	3.40%	3.26%	3.36%	3.43%	3.57%	3.82%	3.36%	3.43%	3.57%	3.82%	3.36%	3.43%	3.57%	3.82%
Slovenia	3.63%	3.60%	3.78%	3.88%	4.07%	4.36%	3.78%	3.88%	4.07%	4.36%	3.78%	3.88%	4.07%	4.36%
Spain	0.80%	0.90%	1.10%	1.28%	1.45%	1.60%	1.10%	1.28%	1.45%	1.60%	1.10%	1.28%	1.45%	1.60%
Sweden	2.42%	2.33%	2.37%	2.35%	2.32%	2.31%	2.37%	2.35%	2.32%	2.31%	2.37%	2.35%	2.32%	2.31%
United Kingdom	2.81%	2.46%	2.14%	1.86%	1.65%	1.52%	2.14%	1.86%	1.65%	1.52%	2.14%	1.86%	1.65%	1.52%
TOTAL	2.31%	2.24%	2.25%	2.24%	2.26%	2.32%	2.25%	2.24%	2.26%	2.32%	2.25%	2.24%	2.26%	2.32%

Table 8.4.3 Results for baseline, forecast and intervention [1] scenarios (1) to (4a) for lung cancer, by country, men plus women

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Fraction													
Austria	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Belgium	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bulgaria	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cyprus	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Czech Republic	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Denmark	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Estonia	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Finland	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
France	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Germany	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Greece	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Hungary	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ireland	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Italy	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Latvia	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Lithuania	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Luxembourg	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Malta	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Netherlands	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Poland	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Portugal	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Romania	0.02%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slovakia	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slovenia	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Spain	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sweden	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
United Kingdom	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
TOTAL	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Deaths													
Austria	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0	0	0	0	0
France	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Germany	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Greece	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Hungary	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Italy	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Latvia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Poland	3	2	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Romania	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Slovakia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spain	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Sweden	0	0	0	0	0	0	0	0	0	0	0	0	0	0
United Kingdom	1	1	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	16	9	1	0	0	0	1	0	0	0	1	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Registrations													
Austria	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0	0	0	0	0
France	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Germany	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Greece	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Hungary	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Italy	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Latvia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Poland	3	2	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Portugal	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Romania	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Slovakia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spain	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Sweden	0	0	0	0	0	0	0	0	0	0	0	0	0	0
United Kingdom	1	1	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	18	10	1	0	0	0	1	0	0	0	1	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Years of Life Lost (YLLs)													
Austria	3	2	0	0	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	4	2	0	0	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	4	2	0	0	0	0	0	0	0	0	0	0	0	0
Denmark	3	1	0	0	0	0	0	0	0	0	0	0	0	0
Estonia	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Finland	2	1	0	0	0	0	0	0	0	0	0	0	0	0
France	28	15	1	0	0	0	1	0	0	0	1	0	0	0
Germany	25	13	1	0	0	0	1	0	0	0	1	0	0	0
Greece	9	5	1	0	0	0	1	0	0	0	1	0	0	0
Hungary	6	3	0	0	0	0	0	0	0	0	0	0	0	0
Ireland	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Italy	21	12	1	0	0	0	1	0	0	0	1	0	0	0
Latvia	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Lithuania	3	1	0	0	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	7	4	0	0	0	0	0	0	0	0	0	0	0	0
Poland	47	27	3	0	0	0	3	0	0	0	3	0	0	0
Portugal	7	4	1	0	0	0	1	0	0	0	1	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Romania	38	22	3	0	0	0	3	0	0	0	3	0	0	0
Slovakia	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Slovenia	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Spain	16	9	1	0	0	0	1	0	0	0	1	0	0	0
Sweden	2	1	0	0	0	0	0	0	0	0	0	0	0	0
United Kingdom	15	8	1	0	0	0	1	0	0	0	1	0	0	0
TOTAL	256	142	16	1	0	0	16	1	0	0	16	1	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Years of Life Lived with Disability (DALYs)													
Austria	4	2	0	0	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	4	2	0	0	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	4	2	0	0	0	0	0	0	0	0	0	0	0	0
Denmark	3	1	0	0	0	0	0	0	0	0	0	0	0	0
Estonia	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Finland	2	1	0	0	0	0	0	0	0	0	0	0	0	0
France	29	15	1	0	0	0	1	0	0	0	1	0	0	0
Germany	26	14	1	0	0	0	1	0	0	0	1	0	0	0
Greece	9	5	1	0	0	0	1	0	0	0	1	0	0	0
Hungary	6	3	0	0	0	0	0	0	0	0	0	0	0	0
Ireland	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Italy	22	12	1	0	0	0	1	0	0	0	1	0	0	0
Latvia	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Lithuania	3	1	0	0	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	7	4	0	0	0	0	0	0	0	0	0	0	0	0
Poland	49	28	3	0	0	0	3	0	0	0	3	0	0	0
Portugal	7	4	1	0	0	0	1	0	0	0	1	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Romania	40	22	4	0	0	0	4	0	0	0	4	0	0	0
Slovakia	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Slovenia	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Spain	17	10	1	0	0	0	1	0	0	0	1	0	0	0
Sweden	2	1	0	0	0	0	0	0	0	0	0	0	0	0
United Kingdom	16	8	1	0	0	0	1	0	0	0	1	0	0	0
TOTAL	267	148	16	1	0	0	16	1	0	0	16	1	0	0

Table 8.4.4 Results for baseline, forecast and intervention (1) scenarios (1) to (4a) for colorectal cancer, by country, men plus women

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Fraction													
Austria	0.02%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Belgium	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Bulgaria	0.03%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Cyprus	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Czech Republic	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Denmark	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Estonia	0.02%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Finland	0.02%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
France	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Germany	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Greece	0.03%	0.02%	0.00%	0.00%	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%	0.00%	0.00%	0.00%	0.00%
Ireland	0.02%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Italy	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Latvia	0.04%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Lithuania	0.04%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Luxembourg	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Malta	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Netherlands	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Poland	0.05%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Portugal	0.04%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Romania	0.10%	0.05%	0.01%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%
Slovakia	0.02%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Slovenia	0.03%	0.02%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Spain	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Sweden	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
United Kingdom	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
TOTAL	0.02%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Deaths													
Austria	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Denmark	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Finland	0	0	0	0	0	0	0	0	0	0	0	0	0	0
France	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Germany	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Greece	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Hungary	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ireland	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Italy	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Latvia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lithuania	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Poland	5	3	0	0	0	0	0	0	0	0	0	0	0	0
Portugal	1	1	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Romania	5	3	0	0	0	0	0	0	0	0	0	0	0	0
Slovakia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slovenia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Spain	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Sweden	0	0	0	0	0	0	0	0	0	0	0	0	0	0
United Kingdom	1	1	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	27	16	2	0	0	0	2	0	0	0	2	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Registrations													
Austria	3	2	0	0	0	0	0	0	0	0	0	0	0	0
Belgium	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Denmark	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Estonia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Finland	1	1	0	0	0	0	0	0	0	0	0	0	0	0
France	11	6	1	0	0	0	1	0	0	0	1	0	0	0
Germany	16	9	1	0	0	0	1	0	0	0	1	0	0	0
Greece	3	2	0	0	0	0	0	0	0	0	0	0	0	0
Hungary	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Ireland	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Italy	13	7	1	0	0	0	1	0	0	0	1	0	0	0
Latvia	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Lithuania	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	3	2	0	0	0	0	0	0	0	0	0	0	0	0
Poland	13	8	1	0	0	0	1	0	0	0	1	0	0	0
Portugal	5	3	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Romania	12	7	1	0	0	0	1	0	0	0	1	0	0	0
Slovakia	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Slovenia	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Spain	6	4	0	0	0	0	0	0	0	0	0	0	0	0
Sweden	1	1	0	0	0	0	0	0	0	0	0	0	0	0
United Kingdom	5	3	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	131	75	9	1	0	0	9	1	0	0	9	1	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Years of Life Lost (YLLs)													
Austria	6	3	0	0	0	0	0	0	0	0	0	0	0	0
Belgium	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	7	4	0	0	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	8	4	0	0	0	0	0	0	0	0	0	0	0	0
Denmark	3	2	0	0	0	0	0	0	0	0	0	0	0	0
Estonia	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Finland	2	1	0	0	0	0	0	0	0	0	0	0	0	0
France	28	16	1	0	0	0	1	0	0	0	1	0	0	0
Germany	30	17	1	0	0	0	1	0	0	0	1	0	0	0
Greece	9	5	1	0	0	0	1	0	0	0	1	0	0	0
Hungary	9	5	0	0	0	0	0	0	0	0	0	0	0	0
Ireland	3	2	0	0	0	0	0	0	0	0	0	0	0	0
Italy	29	17	2	0	0	0	2	0	0	0	2	0	0	0
Latvia	3	2	0	0	0	0	0	0	0	0	0	0	0	0
Lithuania	5	3	0	0	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	8	5	0	0	0	0	0	0	0	0	0	0	0	0
Poland	65	37	5	0	0	0	5	0	0	0	5	0	0	0
Portugal	19	11	2	0	0	0	2	0	0	0	2	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Romania	67	38	6	1	0	0	6	1	0	0	6	1	0	0
Slovakia	3	2	0	0	0	0	0	0	0	0	0	0	0	0
Slovenia	3	2	0	0	0	0	0	0	0	0	0	0	0	0
Spain	27	15	2	0	0	0	2	0	0	0	2	0	0	0
Sweden	3	2	0	0	0	0	0	0	0	0	0	0	0	0
United Kingdom	13	7	1	0	0	0	1	0	0	0	1	0	0	0
TOTAL	380	215	25	2	0	0	25	2	0	0	25	2	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
	Attributable Years of Life Lived with Disability (DALYs)													
Austria	8	5	0	0	0	0	0	0	0	0	0	0	0	0
Belgium	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Bulgaria	9	5	0	0	0	0	0	0	0	0	0	0	0	0
Cyprus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Czech Republic	9	5	0	0	0	0	0	0	0	0	0	0	0	0
Denmark	4	2	0	0	0	0	0	0	0	0	0	0	0	0
Estonia	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Finland	3	2	0	0	0	0	0	0	0	0	0	0	0	0
France	37	21	2	0	0	0	2	0	0	0	2	0	0	0
Germany	43	24	2	0	0	0	2	0	0	0	2	0	0	0
Greece	12	7	1	0	0	0	1	0	0	0	1	0	0	0
Hungary	10	6	1	0	0	0	1	0	0	0	1	0	0	0
Ireland	4	2	0	0	0	0	0	0	0	0	0	0	0	0
Italy	40	23	2	0	0	0	2	0	0	0	2	0	0	0
Latvia	4	2	0	0	0	0	0	0	0	0	0	0	0	0
Lithuania	6	3	0	0	0	0	0	0	0	0	0	0	0	0
Luxembourg	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malta	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Netherlands	11	6	1	0	0	0	1	0	0	0	1	0	0	0
Poland	75	44	6	0	0	0	6	0	0	0	6	0	0	0
Portugal	23	13	2	0	0	0	2	0	0	0	2	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Country	2010	2020	2030	2040	2050	2060	2030	2040	2050	2060	2030	2040	2050	2060
Romania	77	43	7	1	0	0	7	1	0	0	7	1	0	0
Slovakia	4	2	0	0	0	0	0	0	0	0	0	0	0	0
Slovenia	4	2	0	0	0	0	0	0	0	0	0	0	0	0
Spain	32	18	2	0	0	0	2	0	0	0	2	0	0	0
Sweden	4	2	0	0	0	0	0	0	0	0	0	0	0	0
United Kingdom	17	9	1	0	0	0	1	0	0	0	1	0	0	0
TOTAL	489	277	33	3	0	0	33	3	0	0	33	3	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

Table 8.4.5 Numbers and proportions of the EU population ever exposed, by industry, men plus women

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Number ever exposed in the REP													
Agriculture, hunting and related service activities	93,250	79,427	59,914	40,401	25,602	15,447	59,914	40,401	25,602	15,447	59,914	40,401	25,602	15,447
Manufacture of Food Products and Beverages	230,974	233,222	235,992	234,473	232,925	232,431	235,992	234,473	232,925	232,431	235,992	234,473	232,925	232,431
Manufacture of paper and paper products	47,041	47,537	48,120	47,764	47,442	47,318	48,120	47,764	47,442	47,318	48,120	47,764	47,442	47,318
Manufacture of base chemicals	3,480	3,501	3,524	3,483	3,446	3,430	3,524	3,483	3,446	3,430	3,524	3,482	3,445	3,428
Manufacture of rubber and plastic products	3,308,437	3,326,906	3,346,506	3,303,796	3,267,022	3,249,843	3,346,506	3,303,796	3,267,022	3,249,843	3,346,506	3,303,797	3,267,024	3,249,845
Manufacture of radio, television and communication equipment and apparatus	38,305	38,486	38,672	38,090	37,582	37,326	38,672	38,090	37,582	37,326	38,672	38,090	37,582	37,326
Electricity, gas, steam and hot water supply	3,791,941	3,807,789	3,822,964	3,762,167	3,710,194	3,683,508	3,822,964	3,762,167	3,710,194	3,683,508	3,822,964	3,762,167	3,710,195	3,683,509
Collection, purification and distribution of water	153,379	155,903	159,029	158,912	158,638	158,715	159,029	158,912	158,638	158,715	159,029	158,912	158,638	158,715
Research and development	203,742	245,340	304,150	363,700	406,457	432,870	304,150	363,700	406,457	432,870	304,150	363,701	406,457	432,871
Other business activities	490,129	590,187	731,661	874,928	977,802	1,041,359	731,661	874,928	977,802	1,041,359	731,661	874,928	977,802	1,041,360
Education services	1,427	1,718	2,130	2,547	2,847	3,032	2,130	2,547	2,847	3,032	2,130	2,547	2,847	3,032

Scenario[1]	*All Scenarios*		*Baseline (trend) scenario (1)*[2] *- Linear employment and exposure level trends assumed to 2021-30, constant thereafter.*				*Intervention scenario (2) - Assume 99 compliance for OEL = 0.013 mg/m5*				*Intervention scenario (3) - Assume 99 compliance for OEL = 0.13 mg/m5*			
Industry Sector	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*	*2030*	*2040*	*2050*	*2060*	*2030*	*2040*	*2050*	*2060*
	Proportion of the population exposed (%)													
Agriculture, hunting and related service activities	0.026	0.021	0.015	0.010	0.007	0.004	0.015	0.010	0.007	0.004	0.015	0.010	0.007	0.004
Manufacture of Food Products and Beverages	0.064	0.061	0.061	0.060	0.059	0.061	0.061	0.060	0.059	0.061	0.061	0.060	0.059	0.061
Manufacture of paper and paper products	0.013	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012	0.012
Manufacture of base chemicals	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Manufacture of rubber and plastic products	0.916	0.874	0.861	0.839	0.833	0.846	0.861	0.839	0.833	0.846	0.861	0.839	0.833	0.846
Manufacture of radio, television and communication equipment and apparatus	0.011	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
Electricity, gas, steam and hot water supply	1.050	1.000	0.983	0.955	0.947	0.959	0.983	0.955	0.947	0.959	0.983	0.955	0.947	0.959
Collection, purification and distribution of water	0.042	0.041	0.041	0.040	0.040	0.041	0.041	0.040	0.040	0.041	0.041	0.040	0.040	0.041
Research and development	0.056	0.064	0.078	0.092	0.104	0.113	0.078	0.092	0.104	0.113	0.078	0.092	0.104	0.113
Other business activities	0.072	0.083	0.101	0.119	0.133	0.145	0.188	0.222	0.249	0.271	0.188	0.222	0.249	0.271
Education services	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

Table 8.4.6 Occupation attributable fractions, deaths, registrations, YLLs and DALYs for lung cancer by industry, men plus women

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99 compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99 compliance for OEL = 0.13 mg/m5			
Industry sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Fraction (%)													
Agriculture, hunting and related service activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of Food Products and Beverages	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of paper and paper products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of base chemicals	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of rubber and plastic products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of radio, television and communication equipment and apparatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity, gas, steam and hot water supply	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Collection, purification and distribution of water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Research and development	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other business activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Education services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Scenario[1]	*All Scenarios*		*Baseline (trend) scenario (1)*[2] *- Linear employment and exposure level trends assumed to 2021-30, constant thereafter.*				*Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5*				*Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5*			
Industry Sector	*2010*	*2020*	*2030*	*2040*	*2050*	*2060*	*2030*	*2040*	*2050*	*2060*	*2030*	*2040*	*2050*	*2060*
	Attributable Deaths													
Agriculture, hunting and related service activities	13	7	1	0	0	0	1	0	0	0	1	0	0	0
Manufacture of Food Products and Beverages	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of paper and paper products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of base chemicals	4	2	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of rubber and plastic products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of radio, television and communication equipment and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity, gas, steam and hot water supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other business activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Education services	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Industry Sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Registrations													
Agriculture, hunting and related service activities	14	8	1	0	0	0	1	0	0	0	1	0	0	0
Manufacture of Food Products and Beverages	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of paper and paper products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of base chemicals	4	2	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of rubber and plastic products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of radio, television and communication equipment and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity, gas, steam and hot water supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other business activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Education services	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Industry Sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lost (YLLs)													
Agriculture, hunting and related service activities	200	110	9	0	0	0	9	0	0	0	9	0	0	0
Manufacture of Food Products and Beverages	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of paper and paper products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of base chemicals	56	32	6	1	0	0	6	1	0	0	6	1	0	0
Manufacture of rubber and plastic products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of radio, television and communication equipment and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity, gas, steam and hot water supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other business activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Education services	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Industry Sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lived with Disability (DALYs)													
Agriculture, hunting and related service activities	209	114	10	0	0	0	10	0	0	0	10	0	0	0
Manufacture of Food Products and Beverages	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of paper and paper products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of base chemicals	58	34	6	1	0	0	6	1	0	0	6	1	0	0
Manufacture of rubber and plastic products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of radio, television and communication equipment and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity, gas, steam and hot water supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other business activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Education services	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 8.4.7 Occupation attributable fractions, deaths, registrations, YLLs and DALYs for colorectal cancer by industry, men plus women

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99 compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99 compliance for OEL = 0.13 mg/m5			
Industry Sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Fraction (%)													
Agriculture, hunting and related service activities	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of Food Products and Beverages	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of paper and paper products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of base chemicals	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of rubber and plastic products	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Manufacture of radio, television and communication equipment and apparatus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electricity, gas, steam and hot water supply	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Collection, purification and distribution of water	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Research and development	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other business activities	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Education services	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Industry Sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Deaths													
Agriculture, hunting and related service activities	26	15	1	0	0	0	1	0	0	0	1	0	0	0
Manufacture of Food Products and Beverages	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of paper and paper products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of base chemicals	1	1	1	0	0	0	1	0	0	0	1	0	0	0
Manufacture of rubber and plastic products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of radio, television and communication equipment and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity, gas, steam and hot water supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other business activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Education services	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Industry Sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Registrations													
Agriculture, hunting and related service activities	125	70	7	0	0	0	7	0	0	0	7	0	0	0
Manufacture of Food Products and Beverages	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of paper and paper products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of base chemicals	7	5	3	1	0	0	3	1	0	0	3	1	0	0
Manufacture of rubber and plastic products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of radio, television and communication equipment and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity, gas, steam and hot water supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other business activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Education services	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Industry Sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lost (YLLs)													
Agriculture, hunting and related service activities	360	199	18	1	0	0	18	1	0	0	18	1	0	0
Manufacture of Food Products and Beverages	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of paper and paper products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of base chemicals	20	15	7	2	0	0	7	2	0	0	7	2	0	0
Manufacture of rubber and plastic products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of radio, television and communication equipment and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity, gas, steam and hot water supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other business activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Education services	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Scenario[1]	All Scenarios		Baseline (trend) scenario (1)[2] - Linear employment and exposure level trends assumed to 2021-30, constant thereafter.				Intervention scenario (2) - Assume 99% compliance for OEL = 0.013 mg/m5				Intervention scenario (3) - Assume 99% compliance for OEL = 0.13 mg/m5			
Industry Sector	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**	**2030**	**2040**	**2050**	**2060**
	Attributable Years of Life Lived with Disability (DALYs)													
Agriculture, hunting and related service activities	464	257	24	1	0	0	24	1	0	0	24	1	0	0
Manufacture of Food Products and Beverages	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of paper and paper products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of base chemicals	26	20	9	2	0	0	9	2	0	0	9	2	0	0
Manufacture of rubber and plastic products	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacture of radio, television and communication equipment and apparatus	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity, gas, steam and hot water supply	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Collection, purification and distribution of water	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Research and development	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other business activities	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Education services	0	0	0	0	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

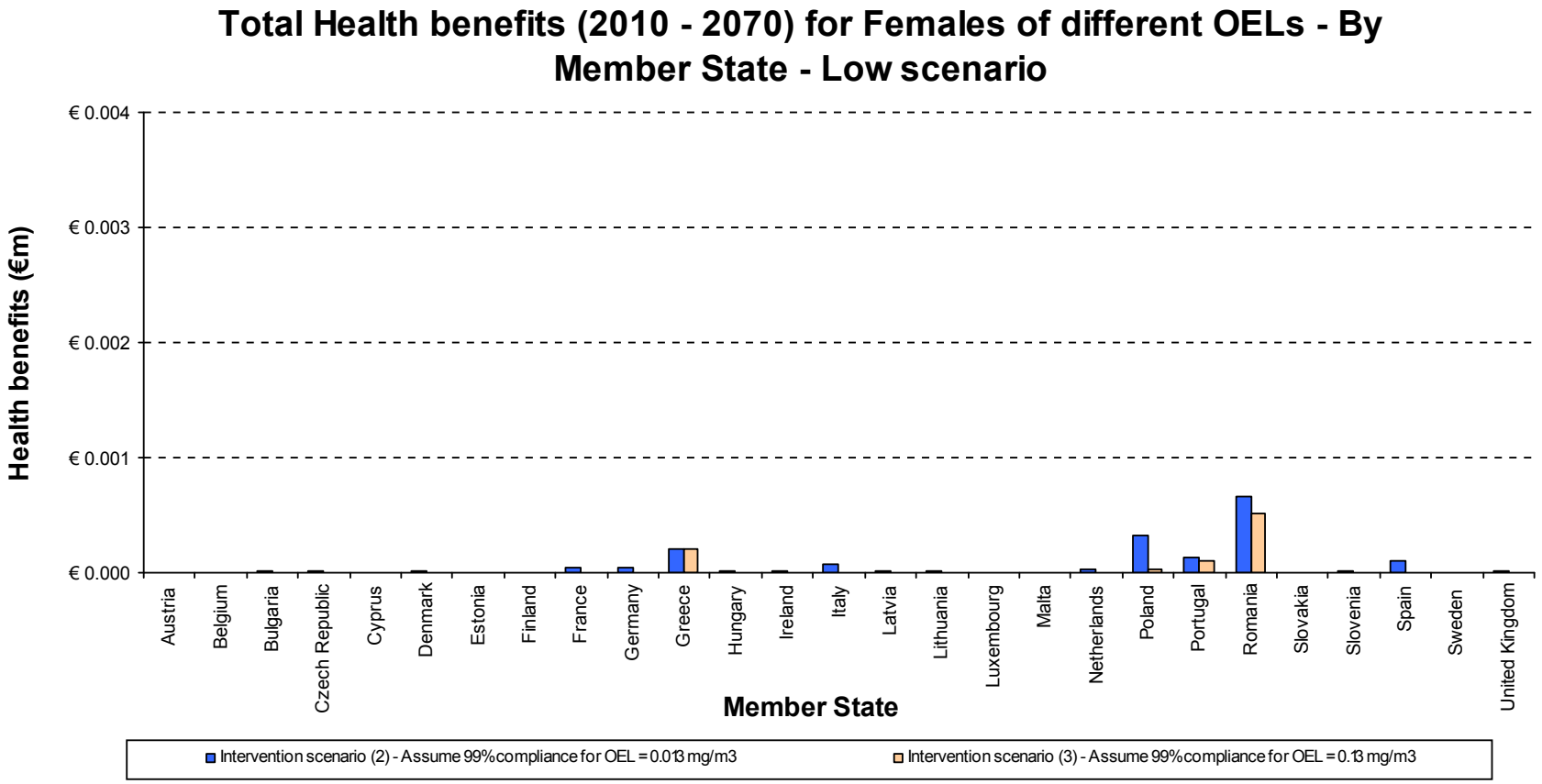

Figure 8.1 Total health benefits to females of introducing an EU wide OEL – By Member State – Low Scenario (Present Value – 2010 €m prices)

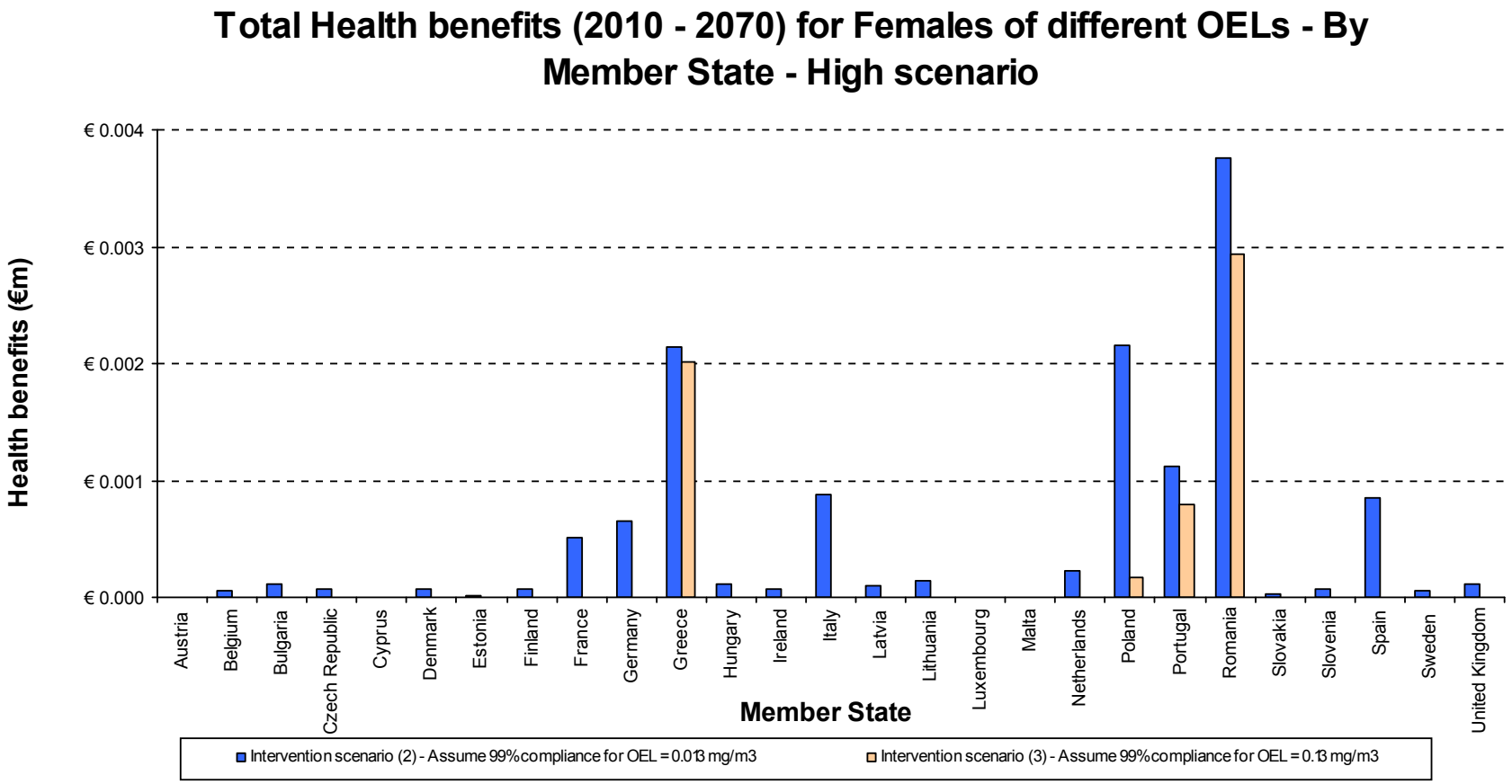

Figure 8.2 Total health benefits for females of introducing an EU wide OEL – By Member State – High Scenario (Present Value – 2010 €m prices)

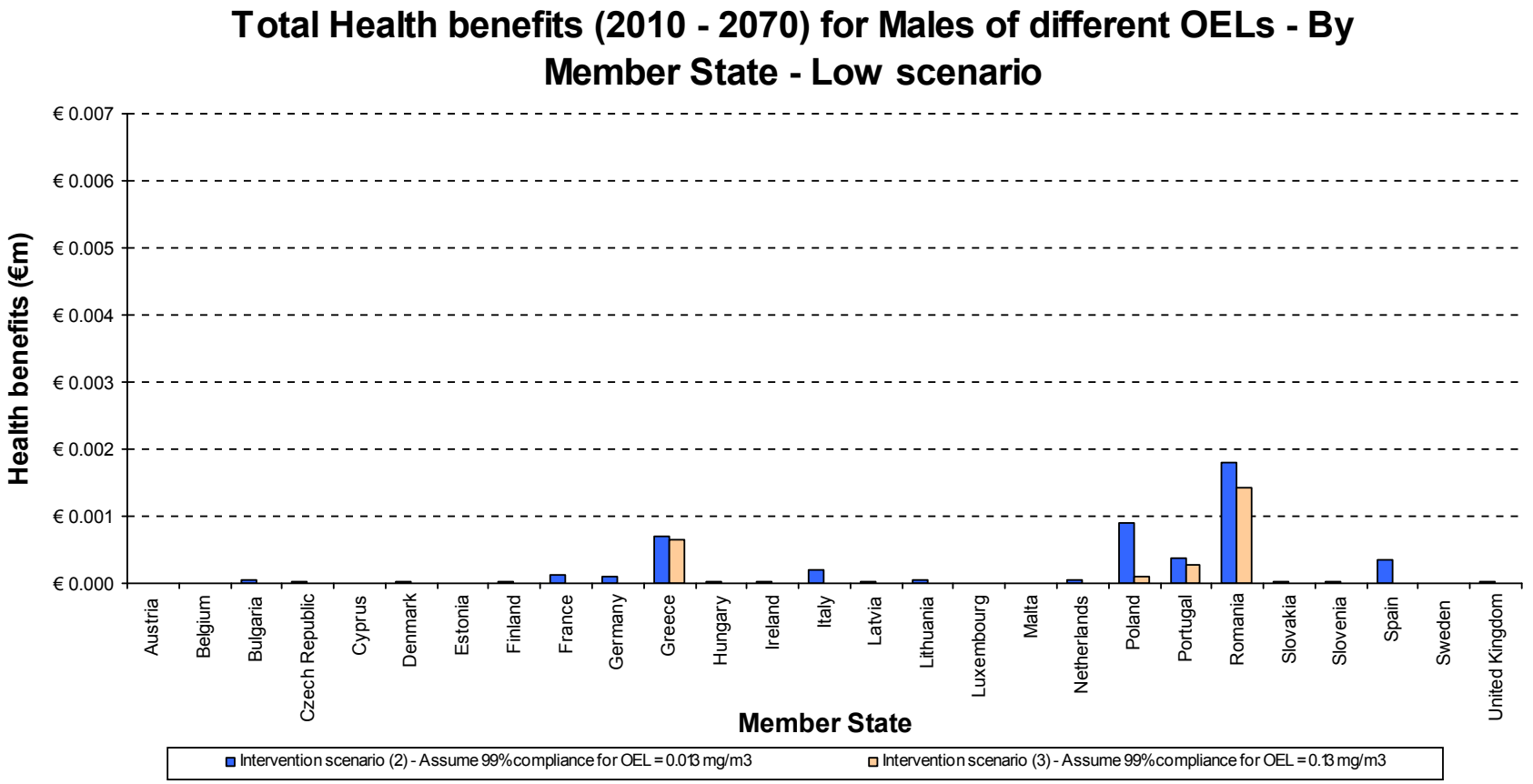

Figure 8.3 Total health benefits to males of introducing an EU wide OEL – By Member State – Low Scenario (Present Value – 2010 €m prices)

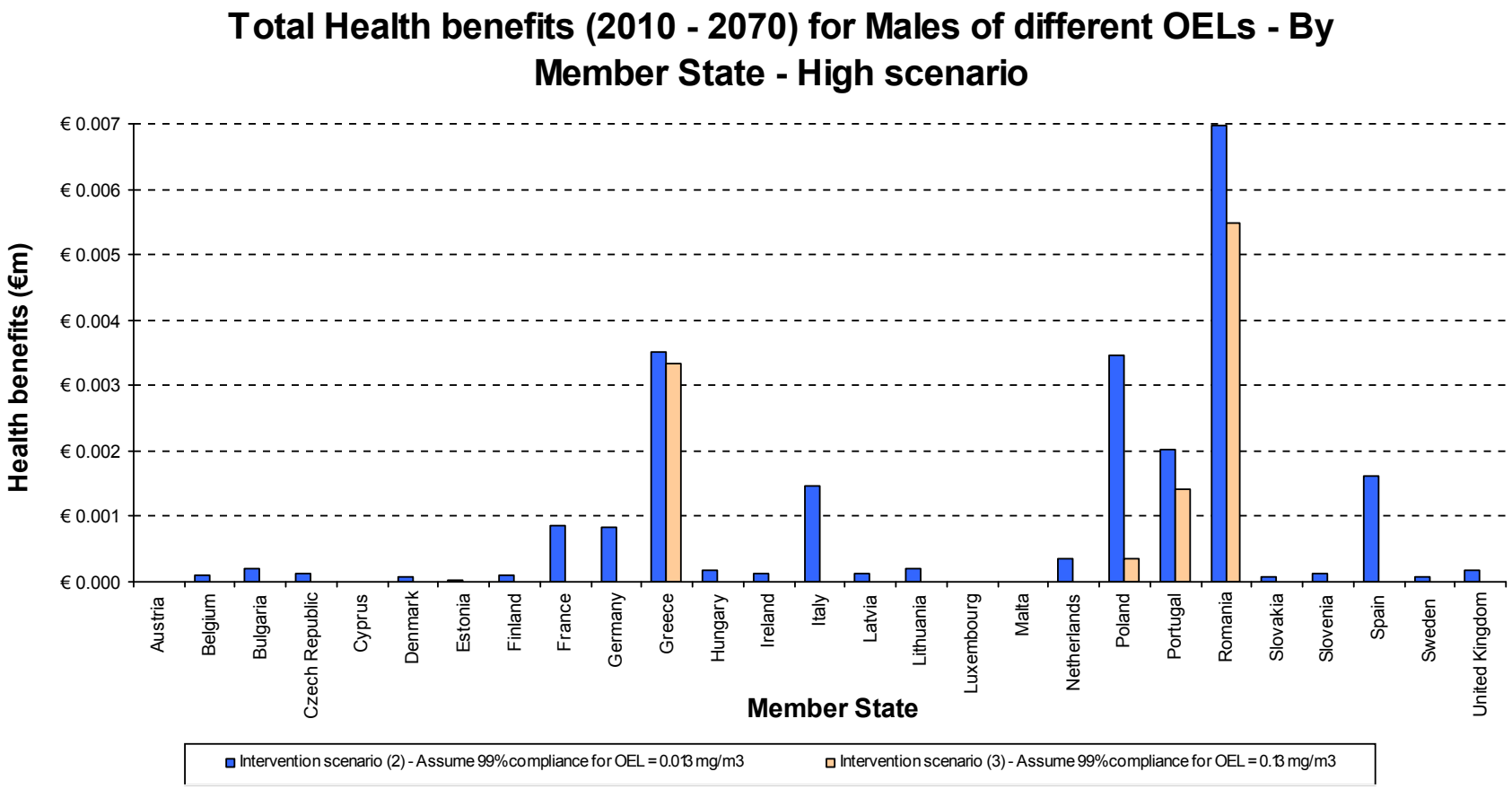

Figure 8.4 Total health benefits for males of introducing an EU wide OEL – By Member State – High Scenario (Present Value – 2010 €m prices)

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%)

Introducing an OEL of 0.13mg/m^3

Hydrazine		Intervention option 1 - Introduce OEL=0.13 mg/m^3 in 2010					
Range of costs (€m)	**Gender**	**2010-2019**	**2020-2029**	**2030-2039**	**2040-2049**	**2050-2059**	**2060-2069**
	Females	0 to 0	0 to 0	0 to 0	0 to 0.01	0 to 0.03	0 to 0.04
	Males	0 to 0	0 to 0	0 to 0	0 to 0.02	0.01 to 0.06	0.01 to 0.06
	Totals	0 to 0	0 to 0	0 to 0	0.01 to 0.03	0.02 to 0.09	0.02 to 0.1
	Gender	**2010-2019**	**2020-2029**	**2030-2039**	**2040-2049**	**2050-2059**	**2060-2069**
	Females	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0.01	0 to 0
	Males	0 to 0	0 to 0	0 to 0	0 to 0.01	0 to 0.01	0 to 0.01
	Totals	0 to 0	0 to 0	0 to 0	0 to 0.01	0 to 0.02	0 to 0.01
	Gender	**2010-2019**	**2020-2029**	**2030-2039**	**2040-2049**	**2050-2059**	**2060-2069**
	Females	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0.01	0 to 0.01
	Males	0 to 0	0 to 0	0 to 0	0 to 0.01	0 to 0.02	0 to 0.01
	Totals	0 to 0	0 to 0	0 to 0	0 to 0.01	0 to 0.02	0 to 0.02

Member State	Low cost	High cost	Low cost	High cost	Low cost	High cost
Austria	€ 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
Bulgaria	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Czech Republic	€ 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
Denmark	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Estonia	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Finland	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
France	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Germany	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Greece	€ 0.01	€ 0.01	€ 0.00	€ 0.01	€ 0.00	€ 0.01
Hungary	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Ireland	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Italy	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Latvia	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00

Member State	Low cost	High cost	Low cost	High cost	Low cost	High cost
Lithuania	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Luxembourg	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Malta	€ 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
Poland	€ 0.01	€ 0.00	€ 0.00	€ 0.01	€ 0.00	€ 0.01
Portugal	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Romania	€ 0.02	€ 0.01	€ 0.00	€ 0.01	€ 0.00	€ 0.02
Slovakia	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Slovenia	€ 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
Sweden	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
United Kingdom	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00

Industry Group	Low cost	High cost	Low cost	High cost	Low cost	High cost
Manufacture of base chemicals	€ 0.05	€ 0.36	€ 0.01	€ 0.06	€ 0.1	€ 0.09
All other industry sectors	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0

Introducing an OEL of 0.13mg/m^3

Hydrazine		Intervention option 2 - Introduce OEL=0.13 mg/m^3 in 2010					
Range of costs (€m)	**Gender**	**2010-2019**	**2020-2029**	**2030-2039**	**2040-2049**	**2050-2059**	**2060-2069**
	Females	0 to 0	0 to 0	0 to 0	0 to 0.01	0 to 0.02	0 to 0.01
	Males	0 to 0	0 to 0	0 to 0	0 to 0.01	0.01 to 0.03	0.01 to 0.03
	Totals	0 to 0	0 to 0	0 to 0	0 to 0.02	0.01 to 0.04	0.01 to 0.04
	Gender	**2010-2019**	**2020-2029**	**2030-2039**	**2040-2049**	**2050-2059**	**2060-2069**
	Females	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0
	Males	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0
	Totals	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0.01	0 to 0
	Gender	**2010-2019**	**2020-2029**	**2030-2039**	**2040-2049**	**2050-2059**	**2060-2069**
	Females	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0
	Males	0 to 0	0 to 0	0 to 0	0 to 0	0 to 0.01	0 to 0.01
	Totals	0 to 0	0 to 0	0 to 0	0 to 0.01	0 to 0.01	0 to 0.01

Member State	Low cost	High cost	Low cost	High cost	Low cost	High cost
Austria	€ 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
Bulgaria	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Czech Republic	€ 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
Denmark	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Estonia	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Finland	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
France	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Germany	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Greece	€ 0.01	€ 0.00	€ 0.00	€ 0.01	€ 0.00	€ 0.01
Hungary	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Ireland	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Italy	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Latvia	€ 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
Luxembourg	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Malta	€ 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
Poland	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Portugal	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Romania	€ 0.01	€ 0.00	€ 0.00	€ 0.01	€ 0.00	€ 0.01
Slovakia	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
Slovenia	€ 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
Sweden	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00
United Kingdom	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00	€ 0.00

Industry Group	Low cost	High cost	Low cost	High cost	Low cost	High cost
Manufacture of base chemicals	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0
All other industry sectors	€ 0	€ 0	€ 0	€ 0	€ 0	€ 0

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