



351

DB12

L'état des lieux et la gestion de l'amiante
et des résidus miniers amiantés

6212-02-009



European
Asbestos
Forum

The Impact of Asbestos on Society

Health Problems and solutions

Based on the European Asbestos Forum November 2019



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President
International Commission on Occupational Health
Commission Internationale de la Santé au Travail
Comisión Internacional de Salud en el Trabajo

Action today – less cancers in future

Asbestos related
disease trends, now and in future

Asbestos caused cancer is
a long-latency disease: 20-55 years

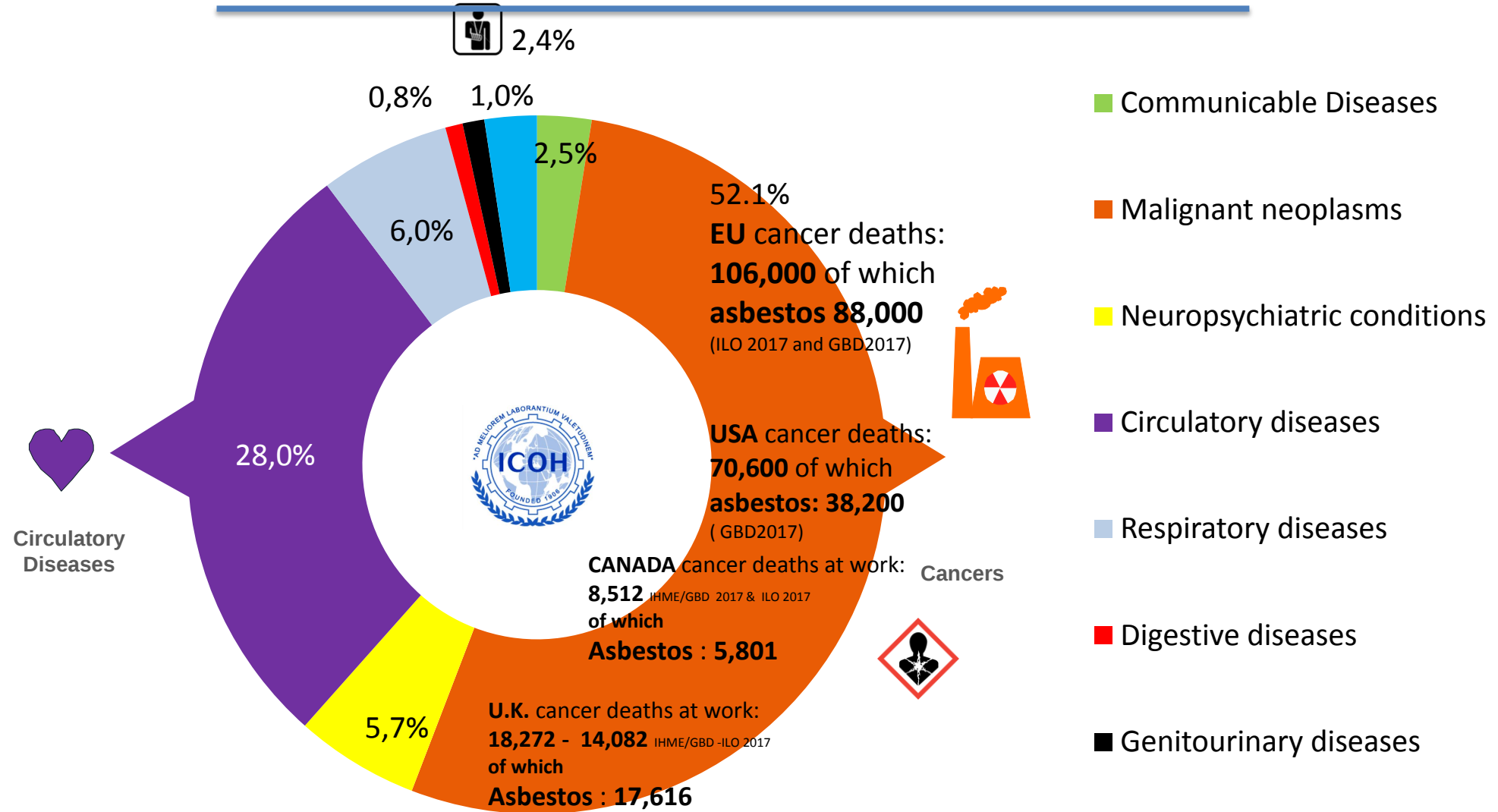
Measures to be taken: ban asbestos,
manage asbestos in existing infrastructure



What we know

- In the EU 28 88,000 people die annually by past exposures of asbestos. Globally 233,000 – 247,000 deaths
- **Mortality continues to increase until late 2020's and 2030's**
- The number of workers exposed to asbestos depends on what we define as exposure. Past exposures varied from 0.0001 – 180 fibres/cubic centimetre. The limit has been in the past: 0.1 fibre/cc. This is equal 100,000 fibres/cubic meter. Geneva park street: 900 fibres/ m³
- Asbestos causes 55-85 % of lung cancers at work.

Work-related Deaths caused by Illness and Injury, EU and High Income countries



In EU28, cardiovascular and circulatory diseases accounts for 28% and cancers at 52%. They were the top illnesses responsible for 4/5 of deaths from work-related diseases. Occupational injuries and infectious diseases together account for less than 5%.

See "Global estimates": <https://goo.gl/hTZaW5>



Fibre Paradigm

Thin

Small aerodynamic diameter
enables deposition beyond the
ciliated airways

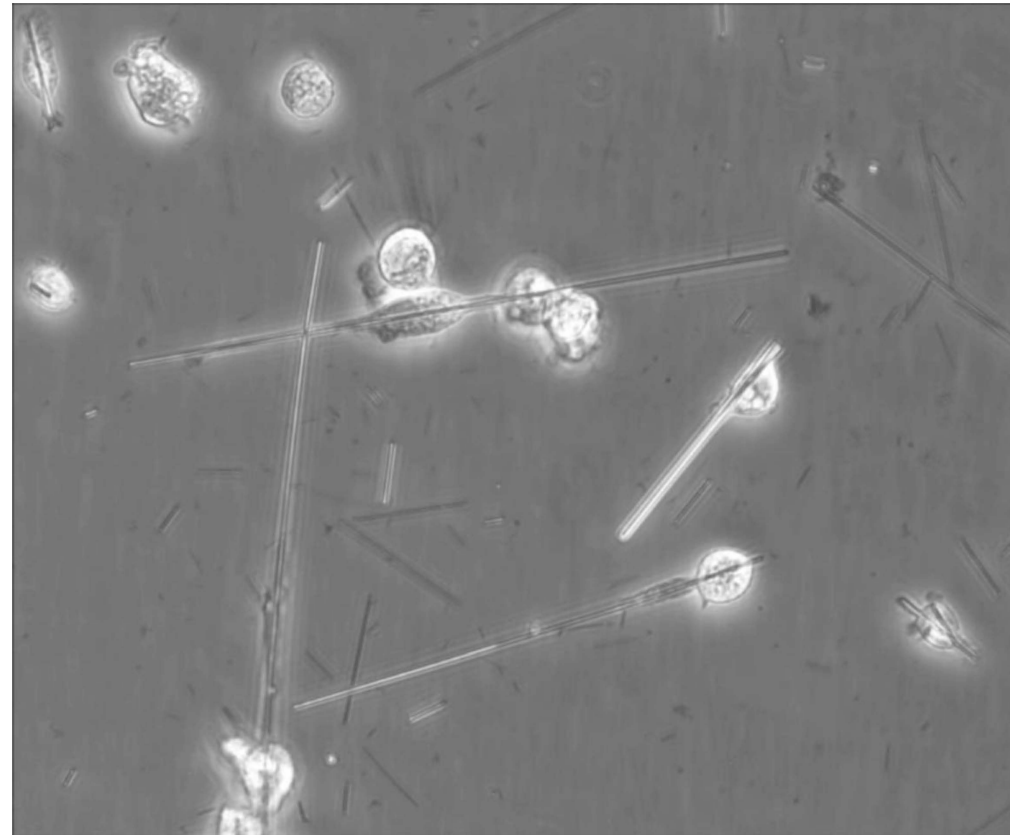
Bio-persistent

Retains its long
term shape over
long-term
residence in the
lungs

Long

Cannot be completely enclosed
by a macrophages producing
frustrated phagocytosis

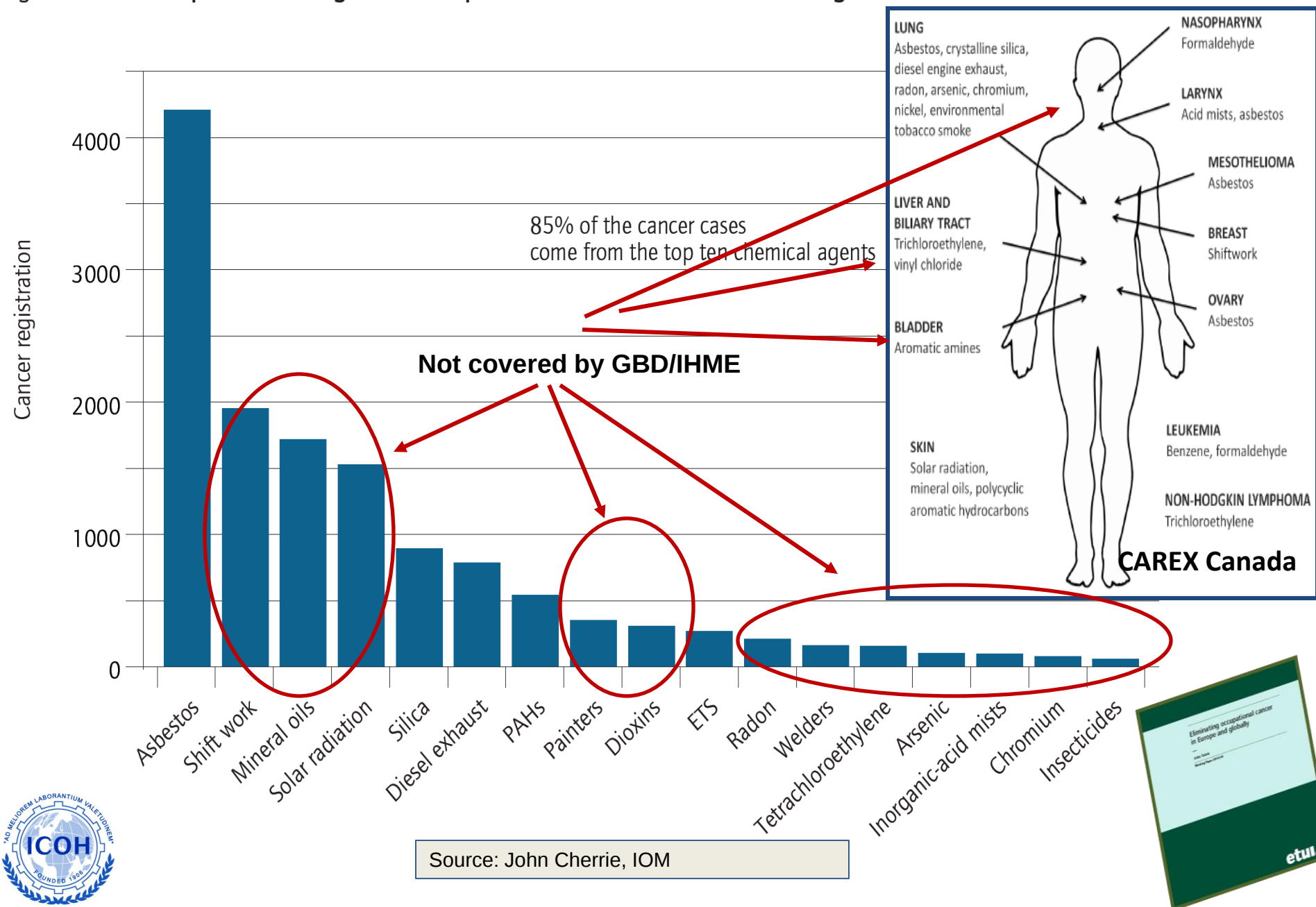
Longer than 15-20µm



High Aspect represents an attribute conveying enhanced toxicity to a particle due to the physical hindrance of normal clearance from the deep lung and interaction with cells

Craig Poland, IOM

Figure 4 Most frequent carcinogens and exposures at work in the United Kingdom



Estimated Global **Mesothelioma Deaths** (annual, based on WHO data

* Reported N* in 59 countries, estimated M* in 172 countries, Odgerel,Takahashi et al¹⁷

Deaths at Work/All

Extrapolation method	Reported Global	Non-reported, adjusted Global	China/EU28
(1) Best estimate, asbestos consumption adjusted	15,011*	23,377	
(2) Estimates based on asbestos use, All GBD 2016 and best estimates Work $AF_{\text{meso.work}} = 91.4.9\%$ GBD2016	30,208 (IHME) - 38,388 (new) 27,612 (IHME) - 35,087 (new)		China: 2,747 (GBD/IHME 2016, all) EU28: 10,700 (GBD/IHME 2015 all)
(3) Reported/Estimated by continent, employment and asbestos adjusted, other EU estimates, all	15,011	21,247- 23,377	EU: 8,363 Odgerel, Takahashi et al 2016 all EU: 10,368 Takala 2015 all

Asbestos related lung cancer and other asbestos related deaths (Takala et al, modified from CEJOEM)

Methods of estimated lung cancer deaths using mesothelioma as a proxy for asbestos use	Lung cancer/ mesothelioma rate	Asbestos related lung, other cancer (and other asbestosis) deaths	
		World	China
McCormack, Peto et al. (2013) average estimate using chrysotile, lung cancer, all , GBD 2015 Study	6.1	197,475	
McCormack, Peto et al. (2013), low - high estimates, lung cancer, all, GBD	2.0-10	64,746 – 323,730	
GBD2016 based rate between (global asbestos-related lung cancer, ovary and larynx cancers, asbestosis),and mesothelioma death numbers at work, GBD2016,	6.92	222,322 _{work} – 247,363 _{work}	<i>based on GBD/IHME 2016_{work}</i> Area Meso/ARLC/Ova/Lary/Asbestosis China 2,178/17,971/270/198/323 Earth 27,612/181,450/6022/3743/3495
		www.mdpi.com/1660-4601/15/5/1000	
Global asbestos deaths, work: 222,321 - 242,802 Mid-point 232,562 All asbestos exposed, global: 243,223 - 260,029 Mid-point 251,626			

EU28 Increase of asbestos –related cancer deaths

Eliminating occupational cancer
in Europe and globally

Jukka Takala

Working Paper 2015.10

[See: goo.gl/fuUXsl](https://goo.gl/fuUXsl)

etui.

1. 47,000 deaths in 2015 (Takala)
2. 48,375 deaths in 2000 (GBD est 2013)
3. 53,718 deaths in 2010 (GBD est 2013)
4. 55,487 deaths in 2013 (GBD est 2013)
5. 58,885 deaths in 2015 (Takahashi et al.)
6. 59,748 deaths in 2015 (GBD est 2013)
7. 66,900 deaths in 2015 (GBD est 2015)
8. 85,914 deaths in 2016 (GBD est 2016)
9. 87,995 deaths in 2016 (GBD est 2018)



Table 1 Rough division of occupational cancer by EU28 member states and subterritories within the EU in 2011 **And new ILO data released in 2017**

Source:
goo.gl/fuUXsl

Source new,
ILO:
goo.gl/hTZaW5

Source new,
GBD/IHME:
goo.gl/isCng3

etui.

Country	Occupational cancer deaths	
Andorra	17	17
Austria	1896	1820
Belgium	2098	2079
Bulgaria	1481	1445
Croatia	849	742
Cyprus	183	179
Czech Republic	2326	2238
Denmark	1285	1242
Estonia	303	292
Finland	1163	1135
France	12,623	12035
Germany	18,180	17706
Gibraltar		5
Greece	1678	2131
Greenland	13	14
Guernsey		13
Hungary	1860	1808
Ireland	968	928
Isle of Man	18	18

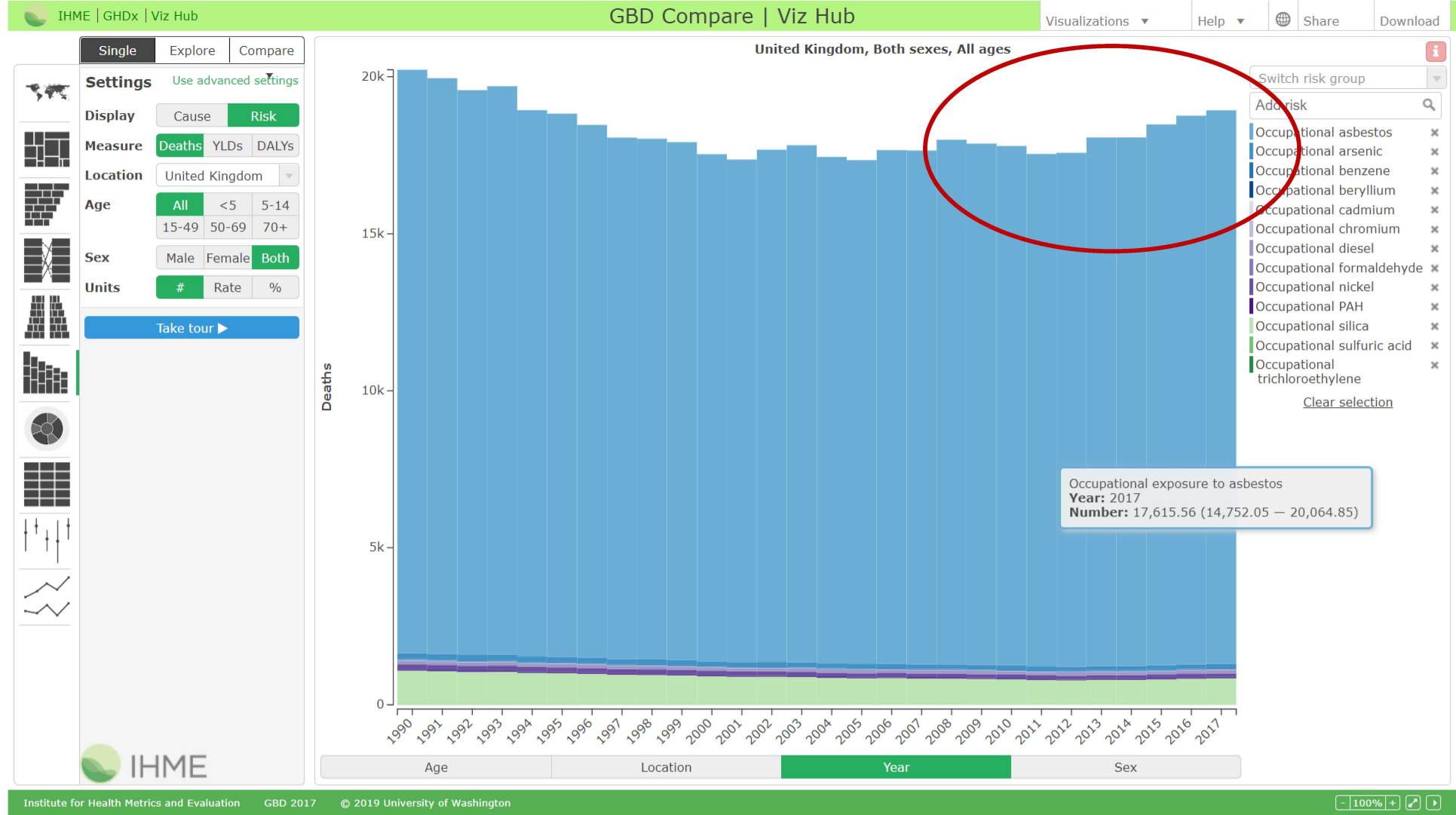
Country	Occupational cancer deaths	
Italy	11,057	10609
Jersey	23	23
Latvia	510	491
Lithuania	710	694
Luxembourg	110	98
Malta	80	75
Monaco	23	21
Netherlands	3879	3721
Poland ^{Norway 759}	7874	7501
Portugal	2457	2371
Romania	4498	4233
San Marino	10	0
Slovakia	1211	1150
Slovenia	446	442
Spain ^{Switzerland 1905}	10,248	9807
Sweden	2201	2103
United Kingdom	14,082	13330
Total EU	106,307	102,517

GBD/IHME
in 2017 asbestos only

17,616

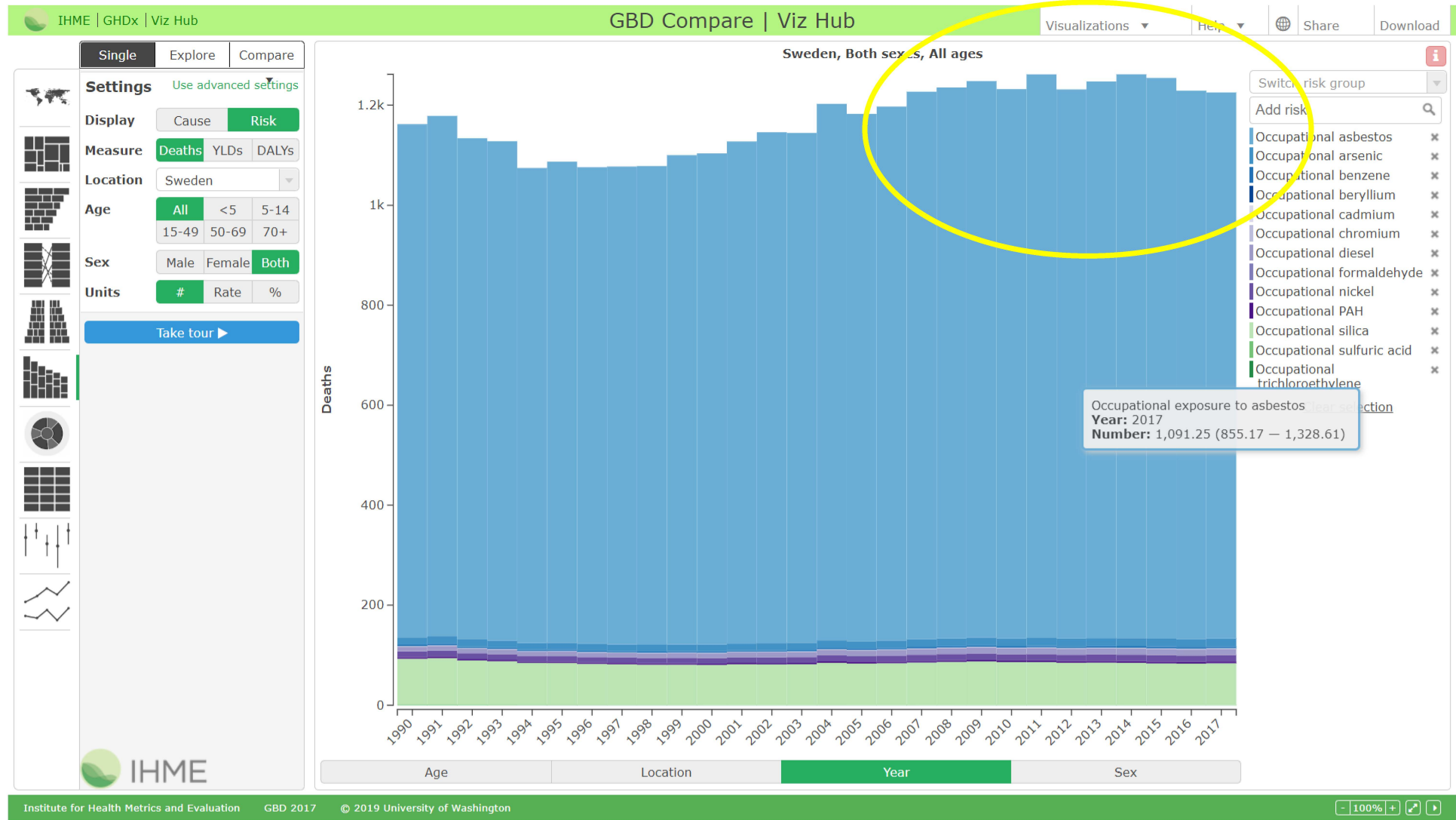
87,955

Trends in all asbestos deaths in U.K. 1990 -2017

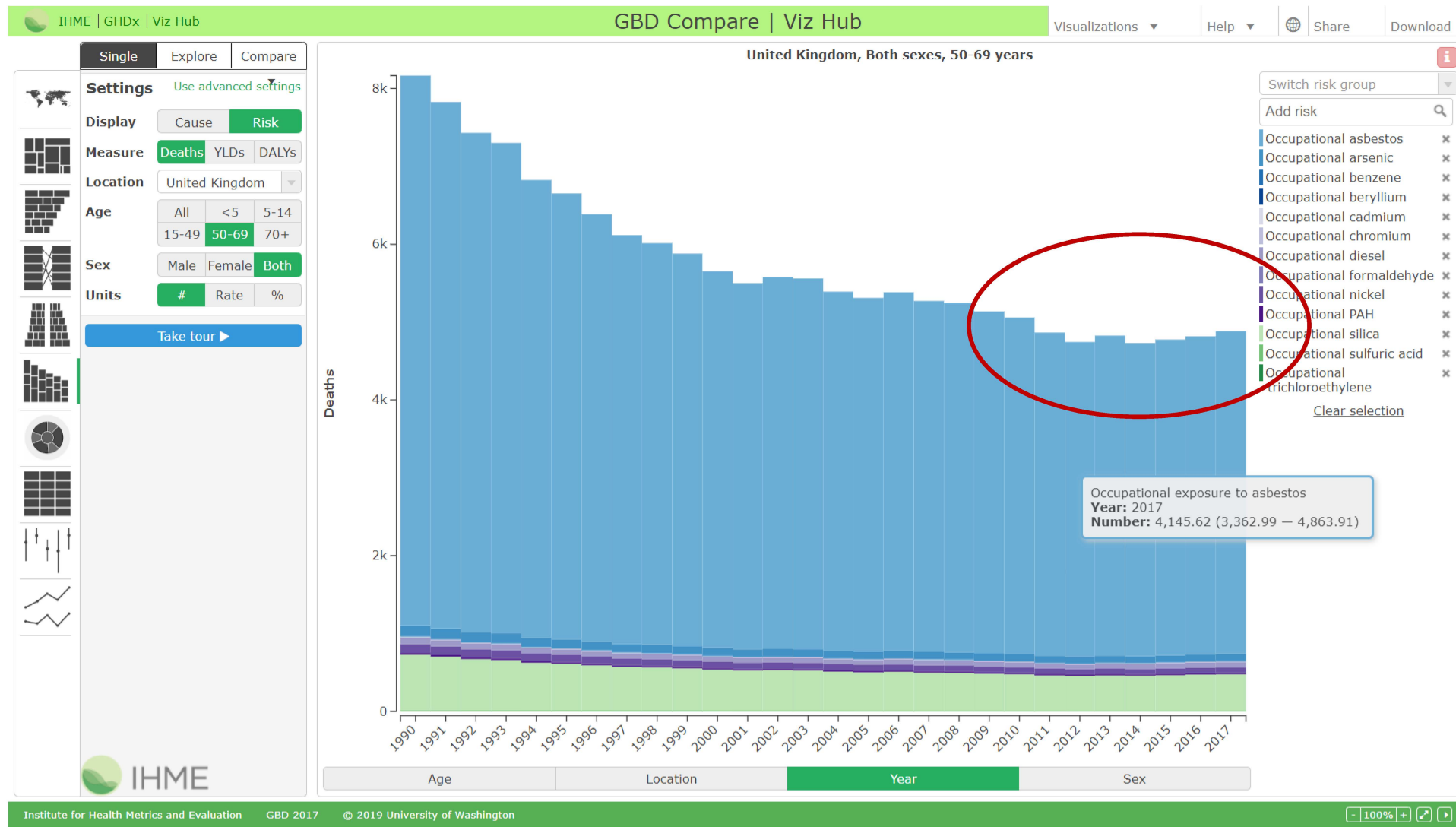


Source: <https://vizhub.healthdata.org/gbd-compare/>

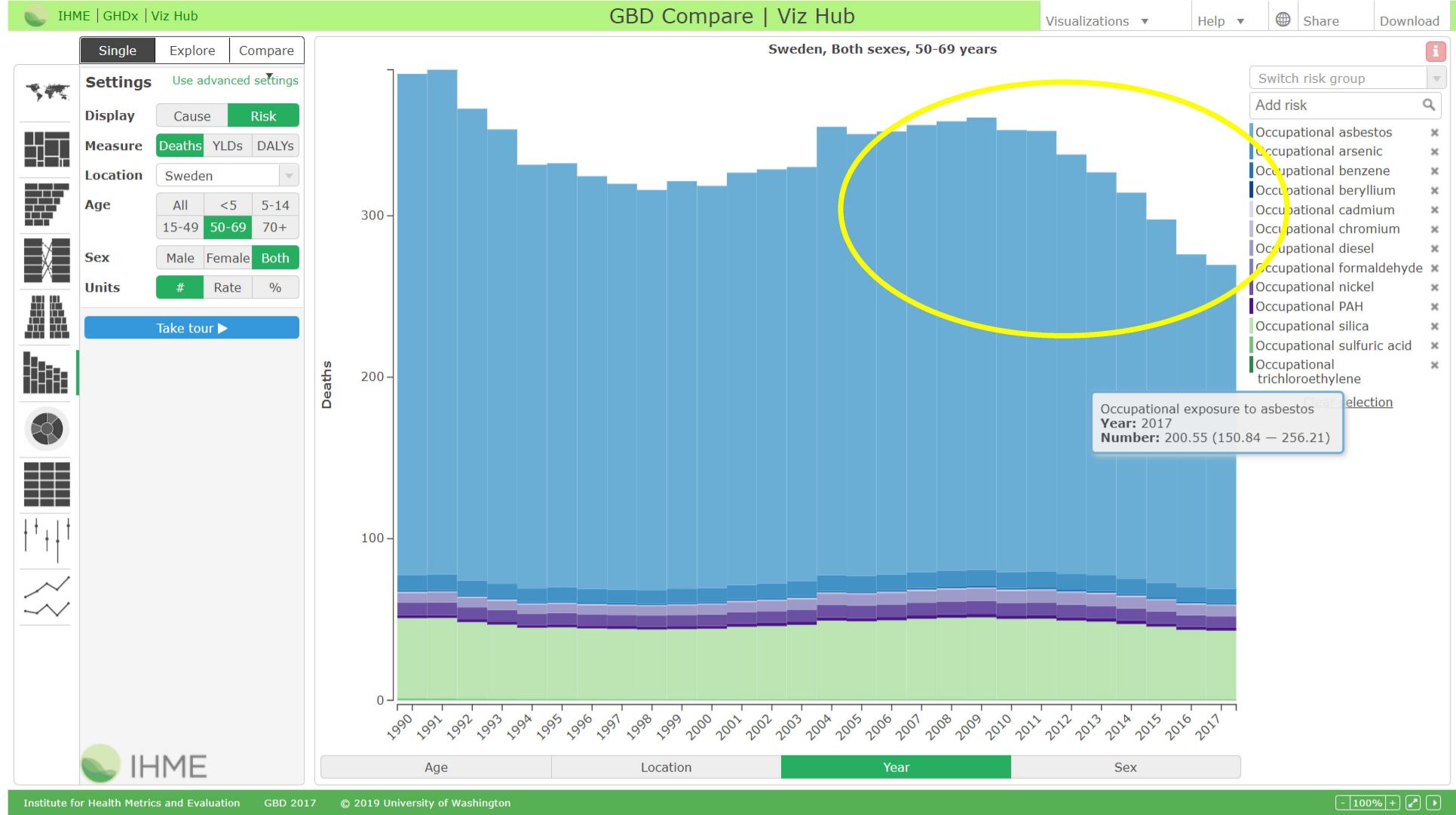
Trends in all asbestos deaths in Sweden 1990 -2017



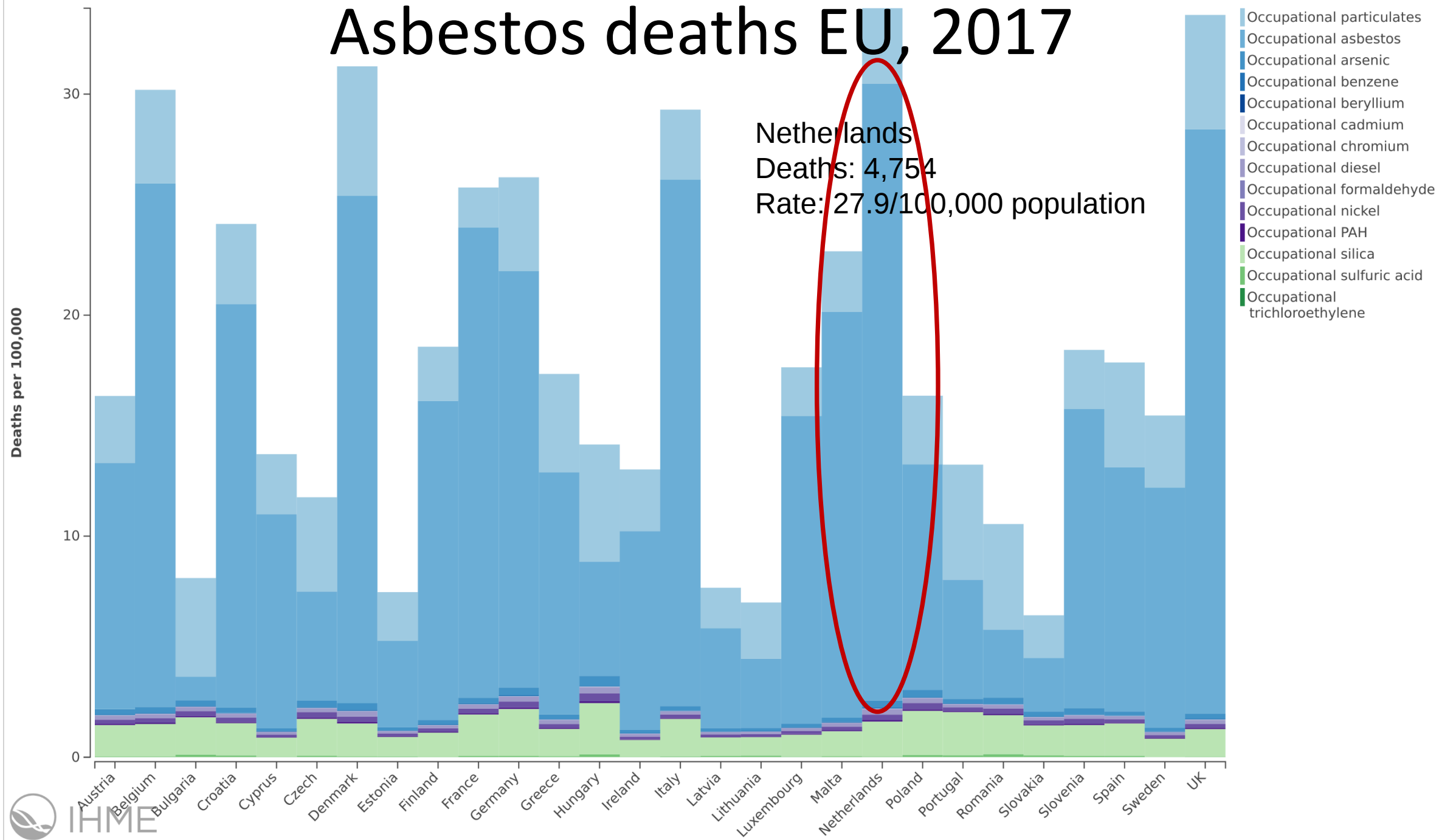
Trends in asbestos deaths of 50-69 years old in U.K. 1990 -2017



Trends in asbestos deaths of 50-69 years old in Sweden 1990 -2017



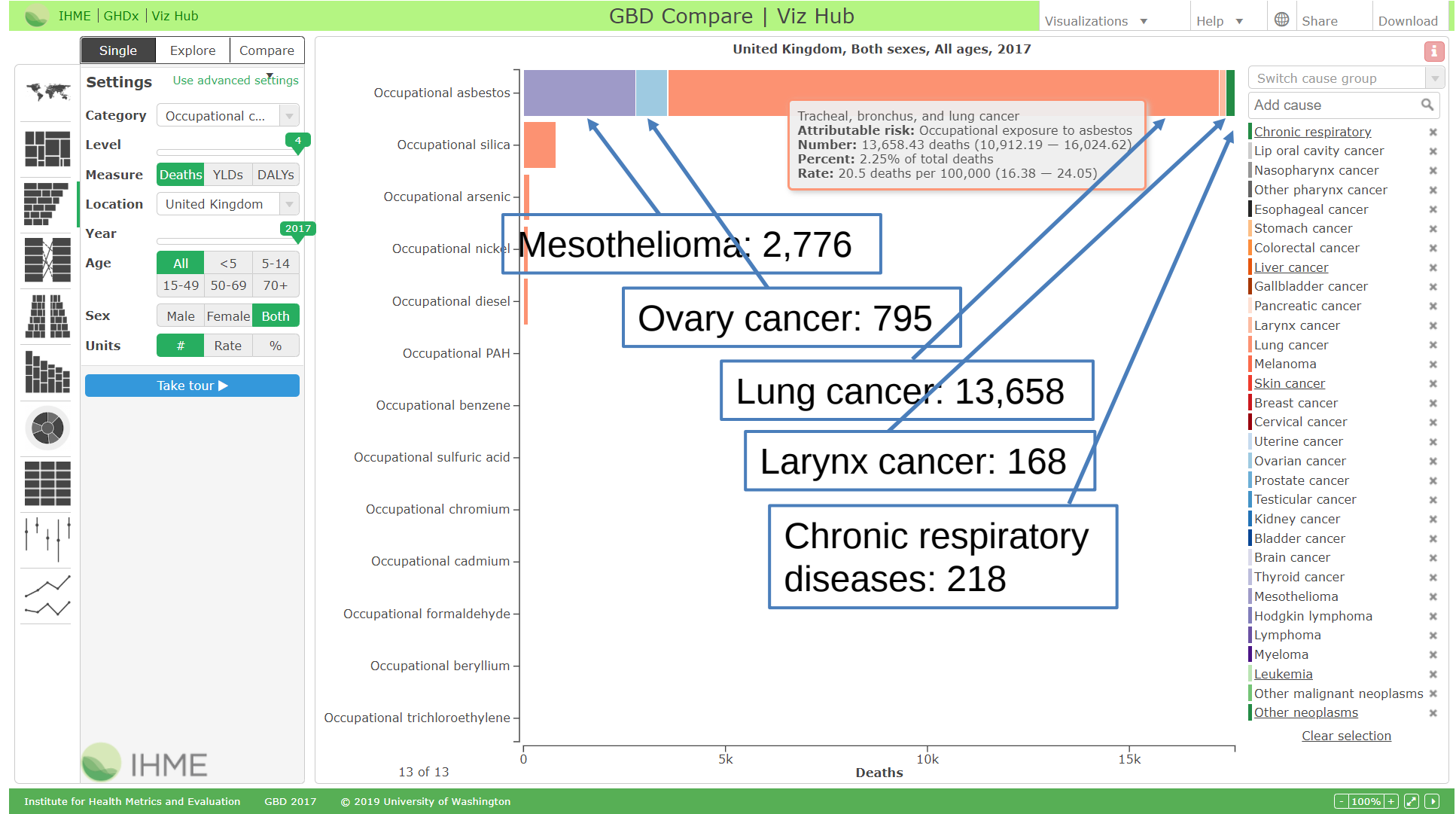
Asbestos deaths EU, 2017



Diseases causing asbestos deaths in U.K.2017

And:

Kidney
Renal pelvis
Colon
Rectum
Pleural paques
Peritoneum
Atelectosis
....



Single

Explore

Compare

Settings

Use advanced settings

Category

Occupational carcinogens

Level

4

Measure

Deaths

YLDs

DALYs

Location

Netherlands

Year

2017

Age

All

<5

5-14

15-49

50-69

70+

Sex

Male

Female

Both

Units

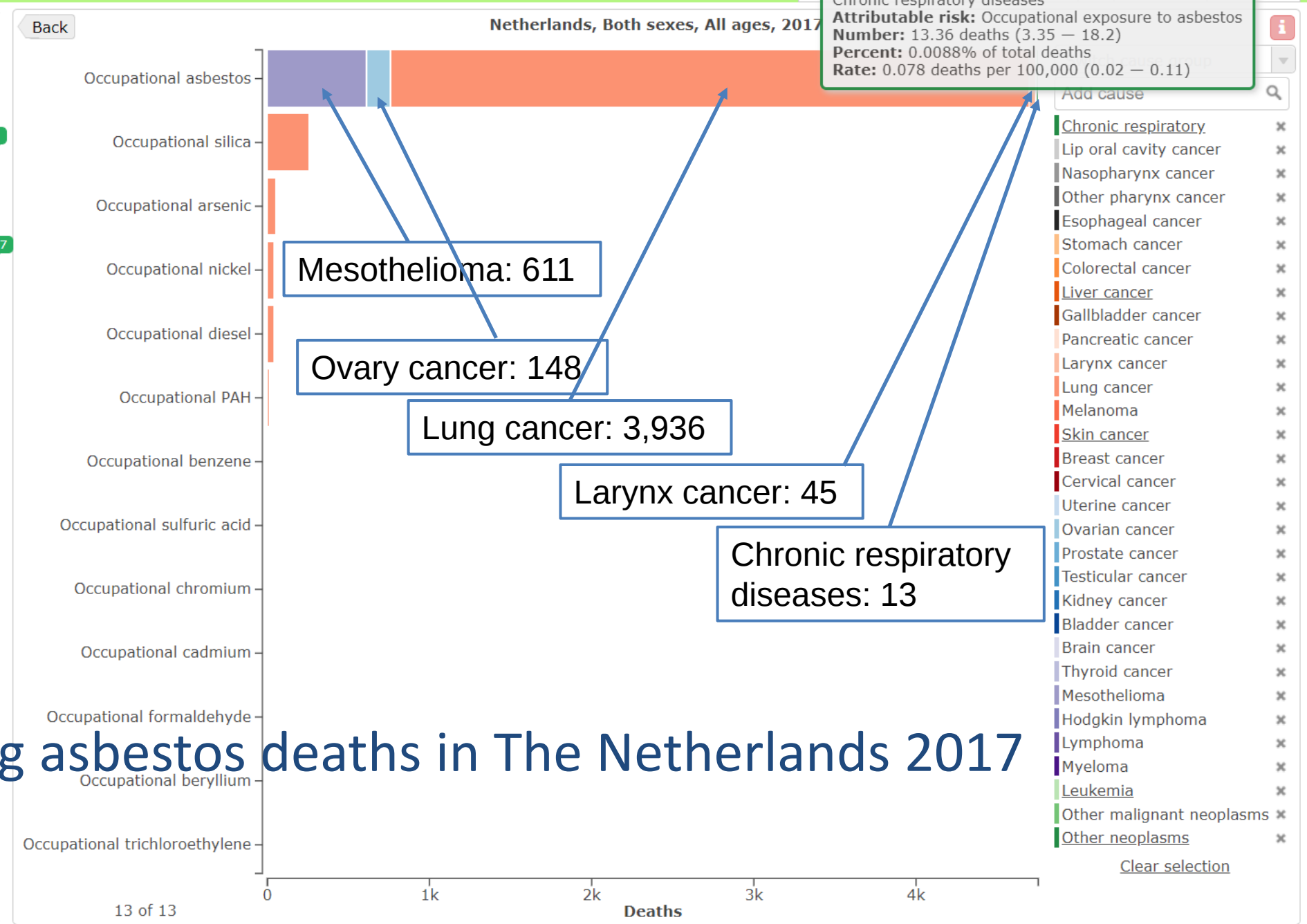
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Rate

%

Take tour

IHME



Diseases causing asbestos deaths in The Netherlands 2017

Single

Explore

Compare ▾

Settings

Use advanced settings

Category

Occupational carcinogens

Level

Measure

Deaths

YLDs

DALYs

Location

Canada

Year

Age

All

<5

5-14

15-49

50-69

70+

Sex

Male

Female

Both

Units

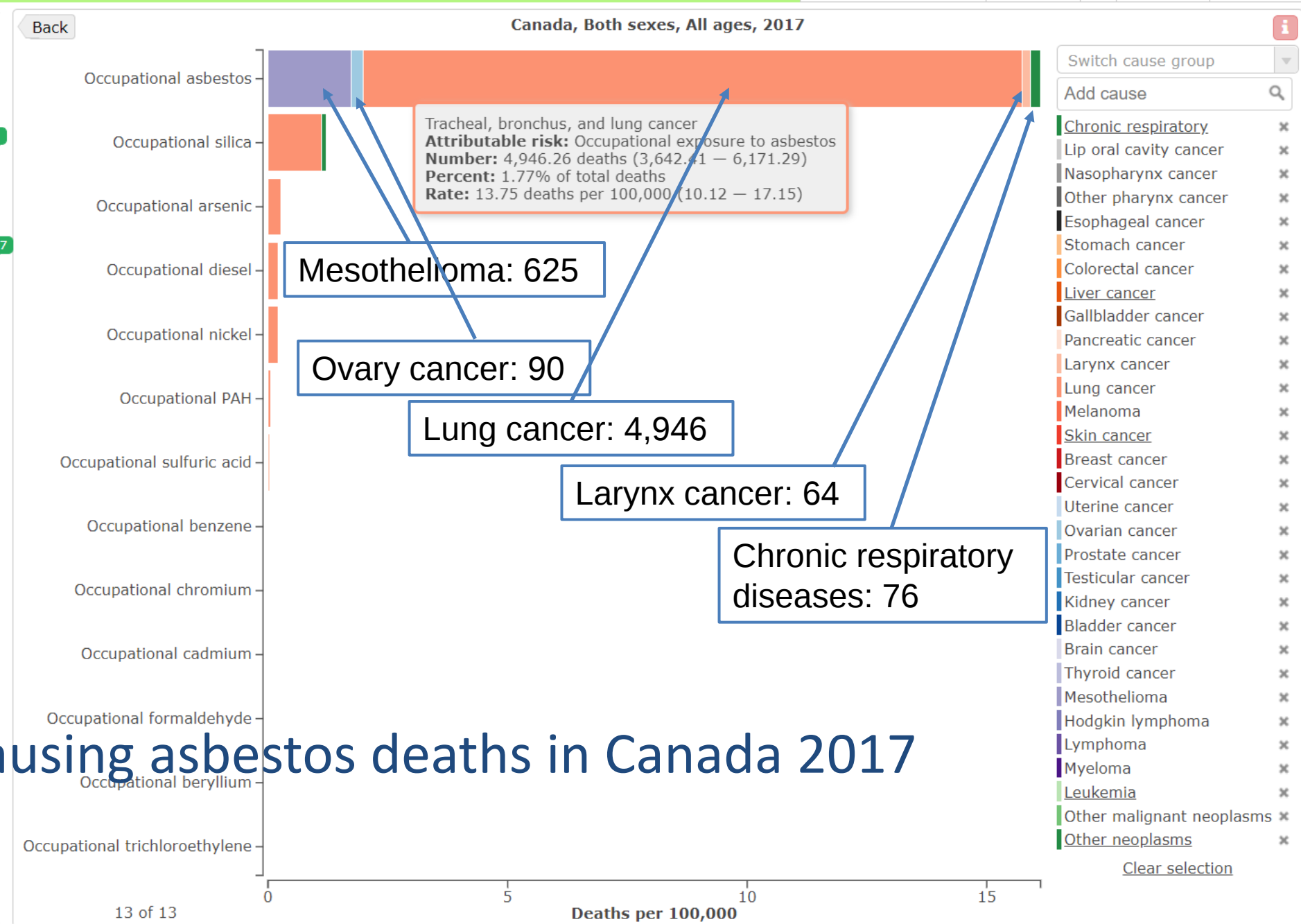
#

Rate

%

Take tour ▶

IHME



Example of poor emphasis on work exposures

Combined effect of exposures to asbestos and smoking on lung cancer

Applicable to selected other carcinogens

Age-standardized lung cancer death rates

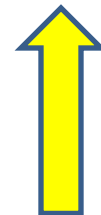
Death rate (per 100,000)	Non-smoker	Smoker
No asbestos	11	123
Asbestos	58	602

Attributable Fraction, AF is based on risk ratio, RR

$$AF = (RR-1)/RR$$



AF Principle



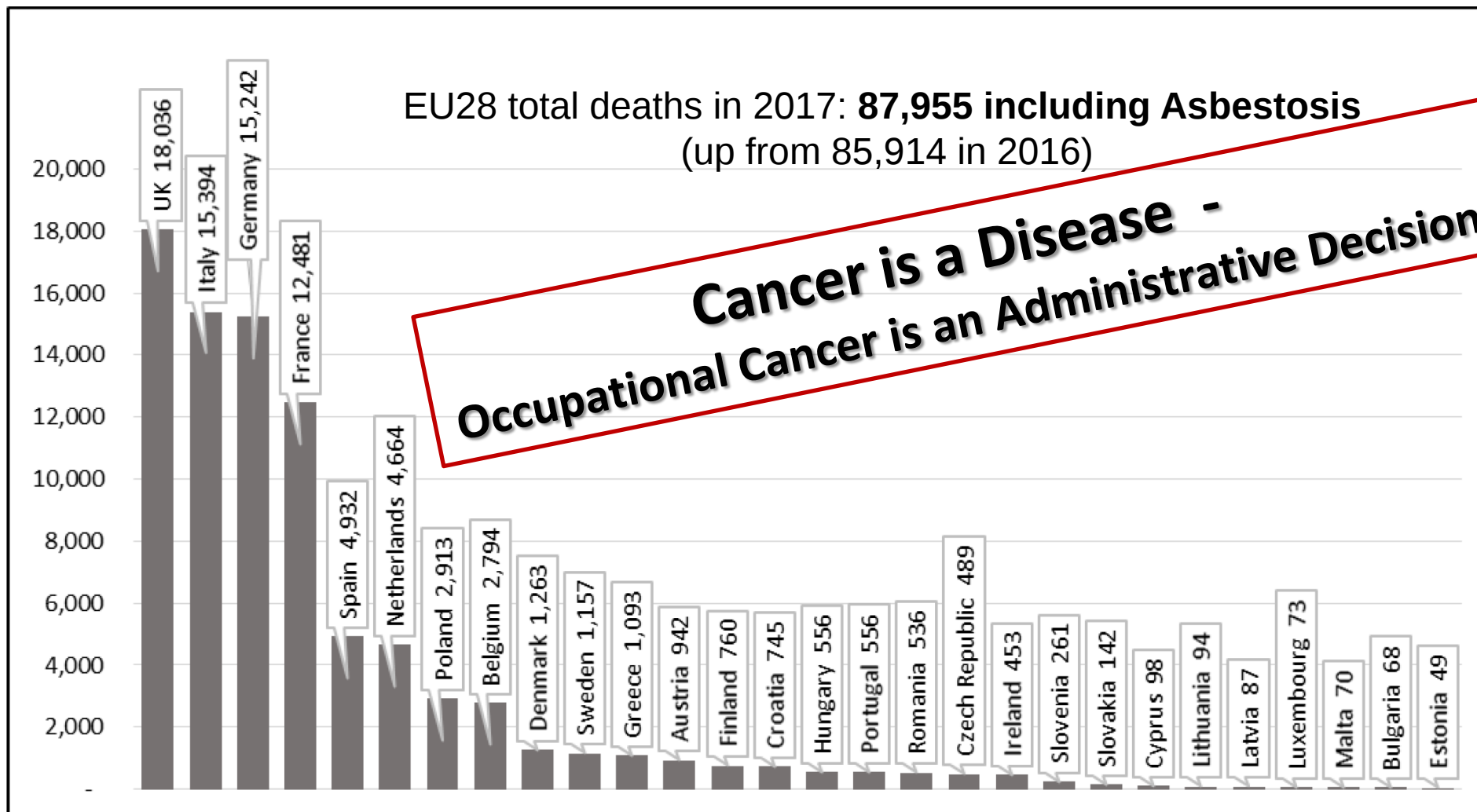
Smoking adjusted



Hammond EC, Selikoff IJ, Seidman H. Asbestos exposure, cigarette smoking and death rates.

Ann N Y Acad Sci 1979;330:473-90.

Asbestos cancer deaths in EU28 in 2016



Sources:

Global asbestos disaster *Int. J. Environ. Res. Public Health* **2018**, 15(5),1000; <https://doi.org/10.3390/ijerph15051000>
and Supplementary tables ZIP document from the website <http://www.mdpi.com/1660-4601/15/5/1000>

Asbestos deaths at work, 2017

detailed table located at the end of this presentation

NEW 2018 Data

	Lung cancer	Mesothelioma	Ovary	Larynx	Asbestosis +Chronic	TOTAL
USA	33,348	3,029	790	437	617	38,221
EU28	72,295	10,367*	3,009	1,327	957	87,955
China	21,161	2,229	367	2,222	285	26,264
UK	13,658	2,776	795	168	218	17,615
Finland	642	98	29	6	23	798
Netherlands	3,936	611	148	45	13	4,754
Canada	4,946	625	90	64	76	5,801
Earth	191,335	27,447	6,292	3,975	3,393	233,240

Sources: GBD 2017 <https://vizhub.healthdata.org/gbd-compare/> The Lancet 2018; 390:

Global asbestos disaster *Int. J. Environ. Res. Public Health* **2018**, 15(5),1000; <https://doi.org/10.3390/ijerph15051000>

and *Supplementary tables ZIP document* from the website <http://www.mdpi.com/1660-4601/15/5/1000>

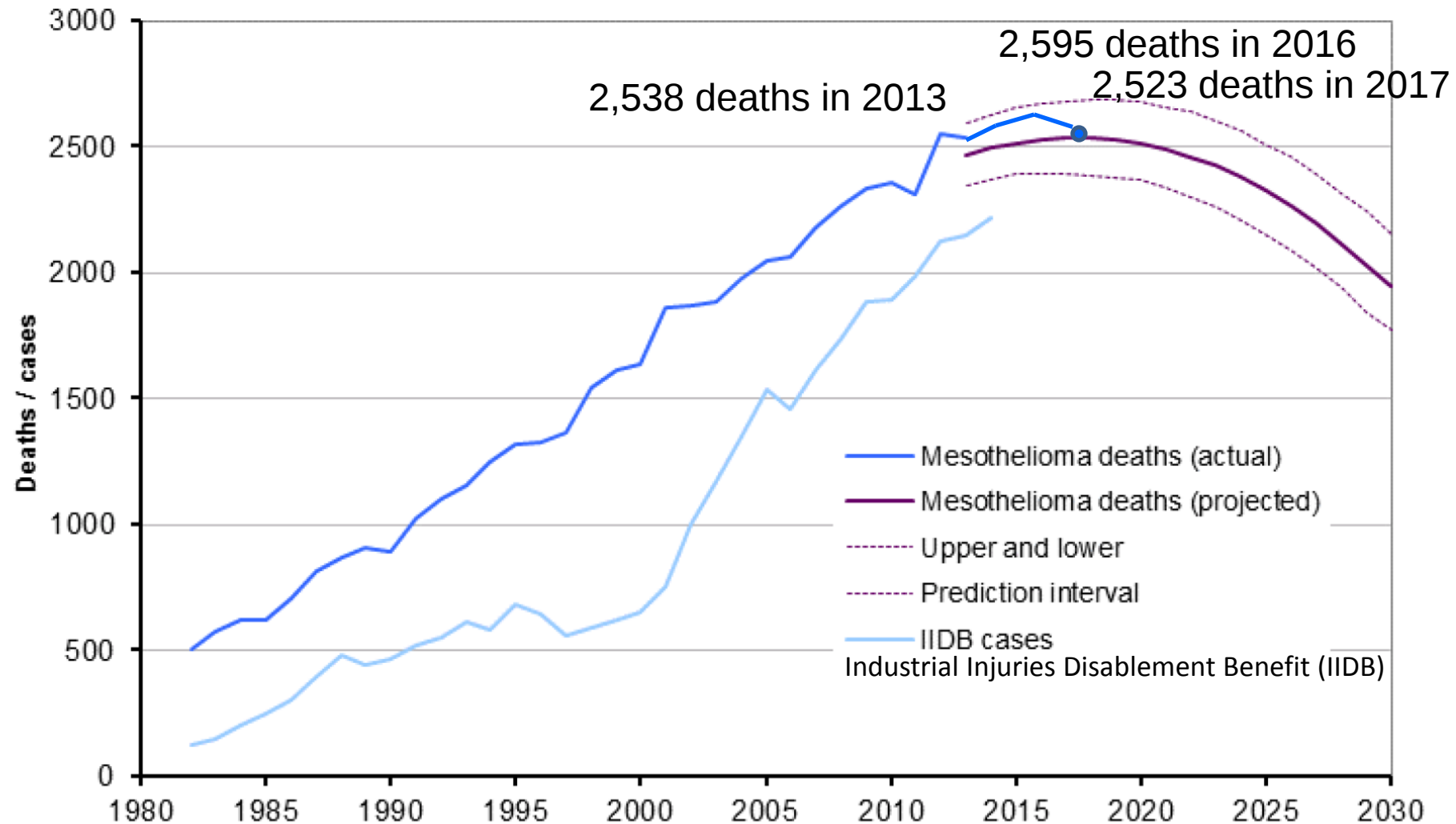
* EU 28 Estimate in 2014 **10,368**, source:

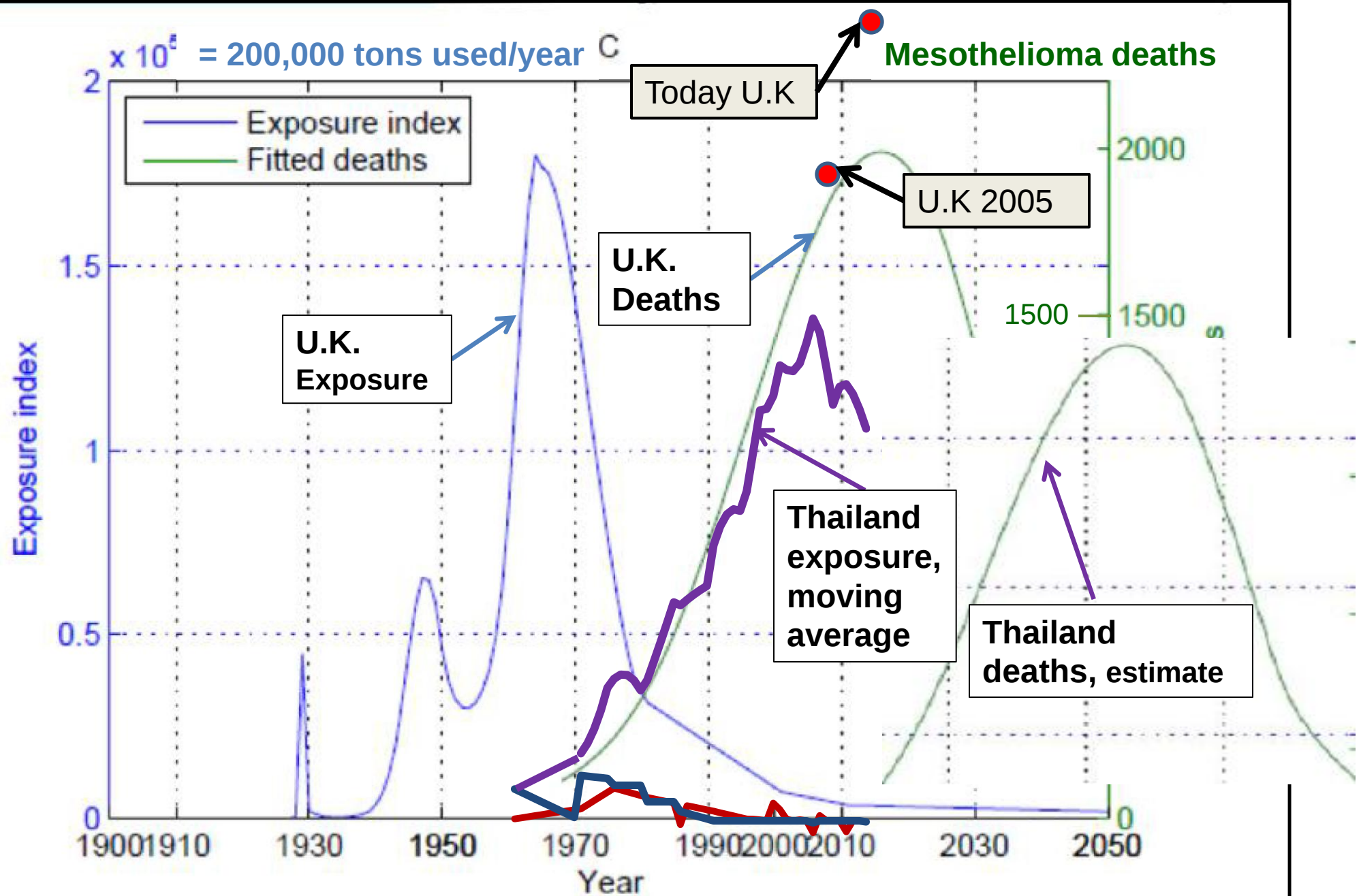


Mesothelioma in the U.K., Recorded Numbers

world trend for all asbestos related diseases

Figure 1 – Mesothelioma annual deaths, IIDB cases and projected future deaths to 2030 in GB world

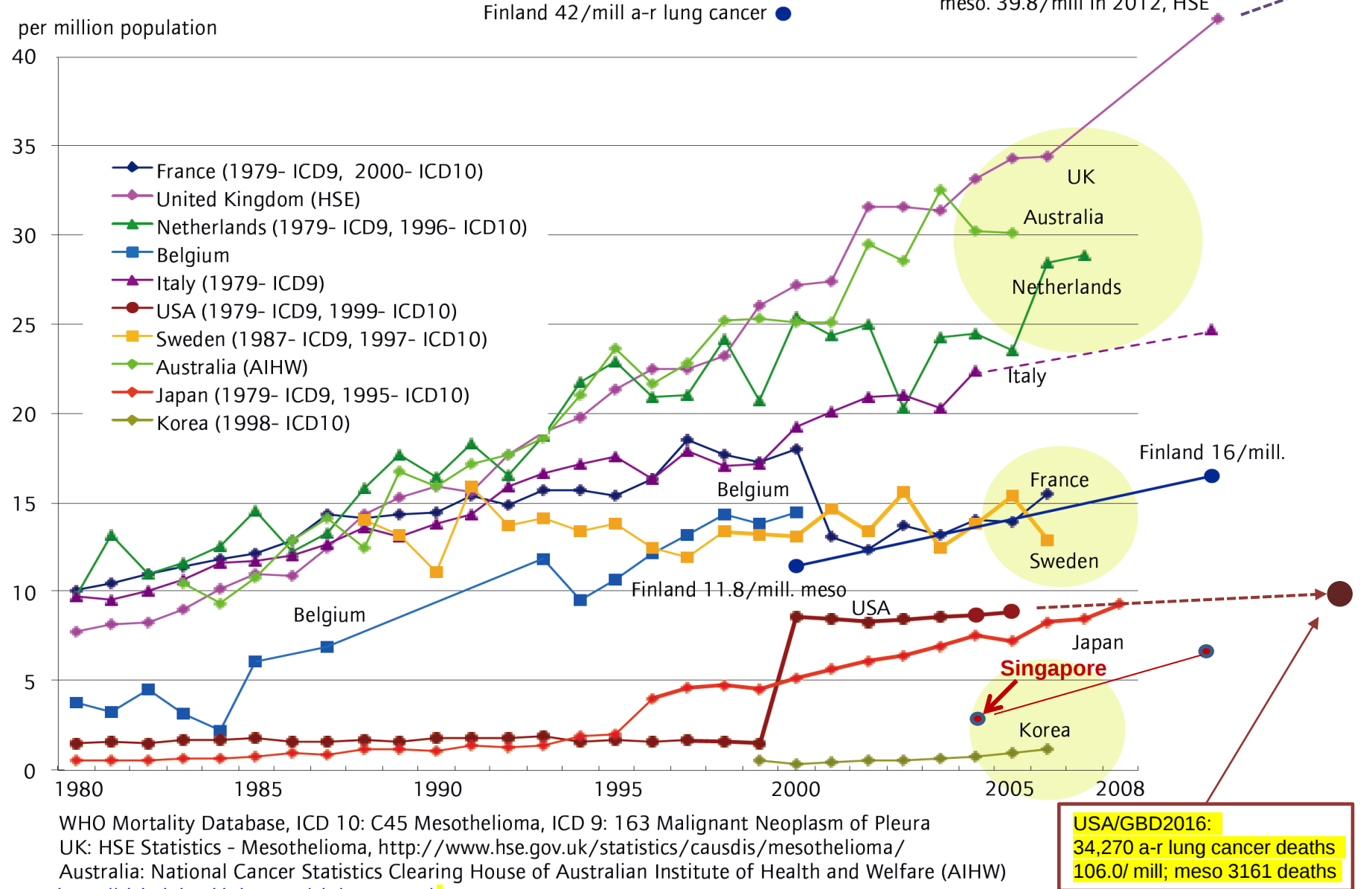




<http://goo.gl/hnEKnC>

Figure 5 Mesothelioma and related asbestos-related lung cancer mortality and proposed groups

<http://goo.gl/hnEKnC>



Sources: Figure elaborated by Sugio Furuya, additions by Takala and Goh 2014. The last figure for Italy is taken from Takahashi *et al.*

In EU 1990 there were 1.5 million asbestos exposed workers (CAREX)

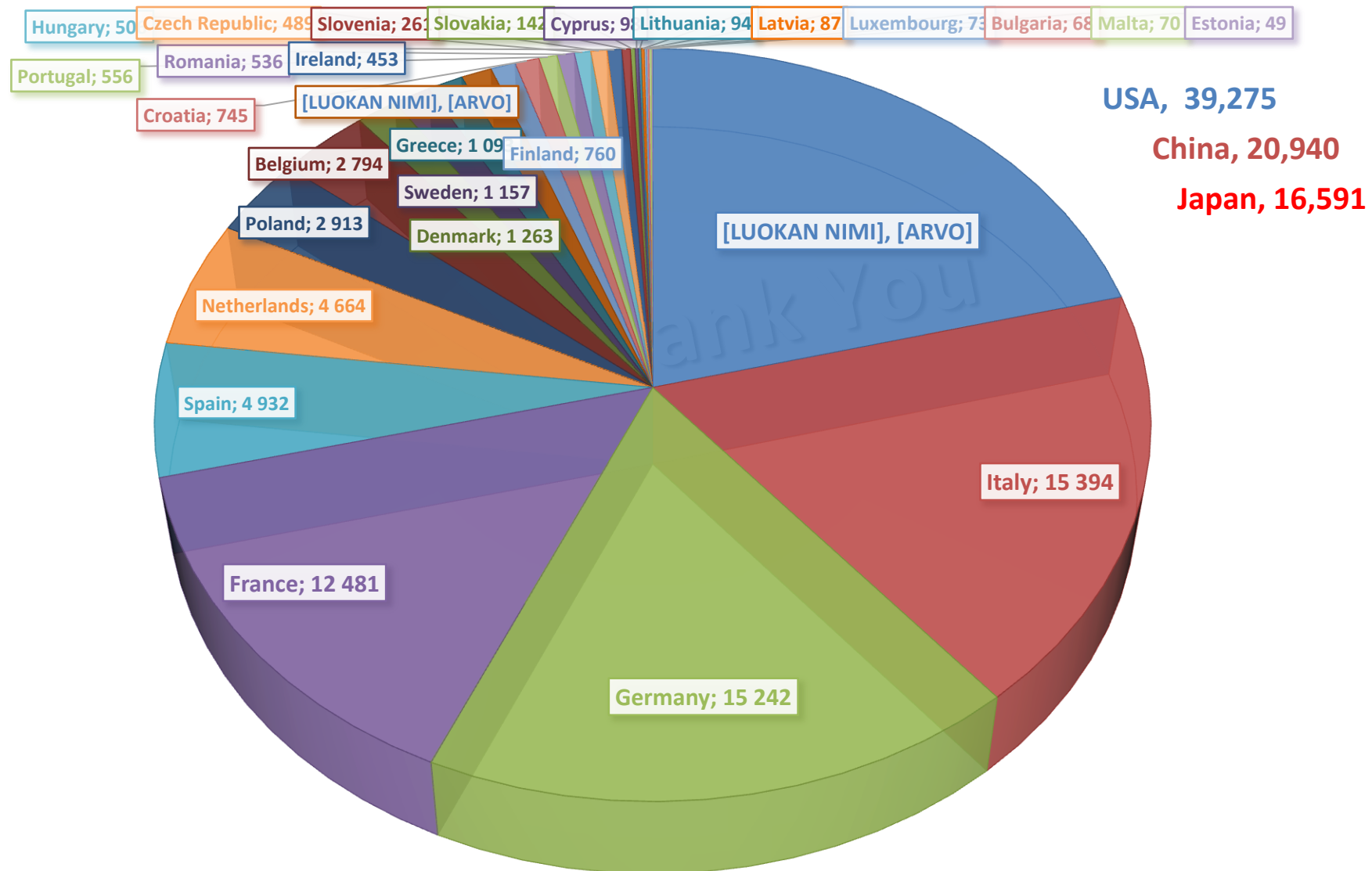
**In 2018 between 0.5 – 1 million asbestos exposed workers,
depending on criteria, practically the whole population is exposed**

Job specific module (JSM)s developed for assessment of
occupational exposure to asbestos for the the **Australian
Mesothelioma Registry**

JSM name	Reported jobs for which this JSM may be applicable
Asbestos mining/milling	Jobs in asbestos mining, milling and primary processing jobs
Asbestos removalists	Specialised asbestos removalist jobs
Automotive component manufacture	Automotive component manufacturing jobs, automotive assemblers and related jobs
Cement factory workers	Cement and cement products manufacturing workers
Furnace industries	Jobs closely associated with furnaces and related fixed plant, including foundry, smelter, glassworks, brickworks, ceramic manufacture and power generation jobs with likely furnace related tasks
Insulators	Specialist insulation jobs, including insulators of buildings, ships, trains, boilers, etc.
Land transport	Drivers, mechanics & other vehicle repairers of land vehicles, military or civilian, passenger or freight
Textile worker	Textile and floor-covering manufacturing jobs
Tip worker	Tip/landfill or waste transfer jobs, including waste truck drivers and tip site workers
Trades	All trades not elsewhere classified, including metal, building, electrical, plumbing & mechanical trades and related workers, such as trades assistants, general maintenance workers, etc.
Water transport	Shipbuilders, ship repairers, seamen and waterside workers – military or civilian
Asbestos users not elsewhere classified	Jobs involving possible asbestos end-use not elsewhere classified, including laundry workers/drycleaners, bakers, industrial/factory cleaners, miscellaneous labourers and manufacturing workers



Asbestos Cancer Deaths at Work, GBD 2016, **EU28** Total: 85,914 (+ asbestosis deaths ca. 950)



Costs of asbestos-related disorders_{@work} in EU28

NEW 2018 Data

Disability adjusted Life Years, DALY's, for cancer and asbestosis caused by asbestos from <http://vizhub.healthdata.org/gbd-compare/>

1,443,544 years based on 87,955 deaths in EU28 in GBD estimate of 2017, includes mesothelioma, lung cancer, larynx and ovary cancers, and chronic respiratory diseases (asbestosis)

TOTAL DALY : 1,443,554 years

Employment: 227,000,000 employed persons, or person-years if no loss

Lost DALY's of the total potential maximum years without any DALYs:

$$1.443\ 540 / 227.0 = 0.636\%$$

The GDP of EU28 was 18,750,052 million (* 10⁶ USD*)

of which 0.636 % makes

119.235 * 10⁹ USD, or 107.77 * 10⁹ EUR or 97.5 * 10⁹ GBP

Compare: Virtual Statistical Life for cancer death EU= 4 million euros: 352 * 10⁹ EUR

All Occupational Cancer Costs:

ILO, FI, SG, EU-OSHA, ICOH

132.2 * 10⁹ USD

IHME-GBD2017

140.4 * 10⁹ USD

Exposed number of workers

Occupational exposure to carcinogens in the European Union

15

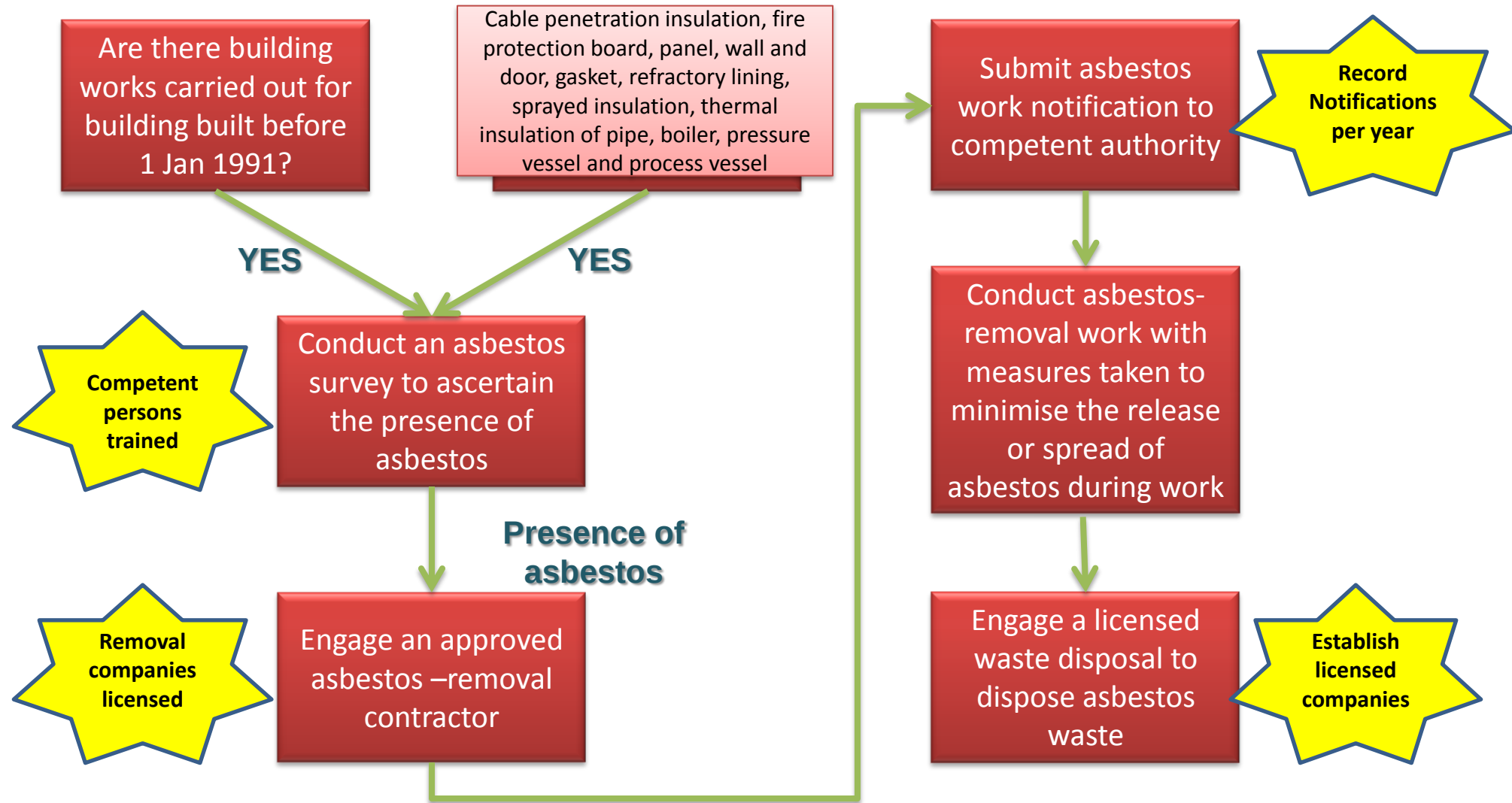
Table 4 The most common carcinogen exposures (in thousands) by country in 1990–3

Agent	A	B	D	DK	E	F	FIN	GB	GR	I	IRL	L	NL	P	S
Solar radiation	240	200	2400	180	1100	1500	180	1300	460	560	110	14	290	370	240
Tobacco smoke, environmental	180	190	2000	100	670	1200	110	1300	170	770	58	11	350	210	210
Silica, crystalline	100	74	1000	59	400	110	83	590	87	280	29	7	170	83	86
Diesel exhaust	79	67	720	71	270	410	39	470	79	550	21	4	110	73	81
Radon	72	86	820	0	280	520	49	560	66	38	24	4	0	92	99
Wood dust	82	55	680	51	400	180	65	430	51	320	18	4	95	86	84
Lead and its compounds	37	30	460	23	100	140	13	250	24	290	9	3	49	33	35
Benzene	49	21	470	49	90	70	14	300	35	190	11	2	43	43	34
Asbestos	15	10	160	9	57	140	7	95	15	680	6	1	14	16	12
Ethylene dibromide	46	17	440	27	81	10	12	280	33	170	10	2	19	40	31
Formaldehyde	17	16	130	90	71	310	11	94	10	180	3	0.6	16	36	11
PAH	19	17	210	13	55	120	6	110	13	350	4	2	26	21	18
Glasswool	23	19	250	14	92	130	12	140	17	150	6	2	34	19	20
Tetrachloroethylene	19	12	210	11	47	140	3	120	14	180	5	1	21	21	16
Chromium (VI) compounds	18	19	260	25	57	70	10	130	10	130	5	1	29	21	21
Sulphuric acid mist	7	10	100	4	20	380	2	42	3	120	2	1	10	5	8
Nickel compounds	12	15	200	11	43	50	8	85	6	79	3	1	19	12	17
Styrene	6	10	110	36	28	50	3	54	4	66	2	0.5	12	7	9
Methylene chloride	2	3	29	23	7	60	1	15	1	130	1	0.2	3	3	2
Trichloroethylene	2	2	33	7	6	110	1	16	1	90	1	0.1	3	2	2
Total, exposures	1100	910	11100	880	4000	6000	650	6600	1100	5600	330	63	1400	1200	1100
Total, exposed workers	790	730	8300	680	3100	4900	510	5000	910	4200	260	48	1100	970	820
Exposed/employed (%)	25	21	24	24	25	23	24	22	27	24	24	25	17	24	20

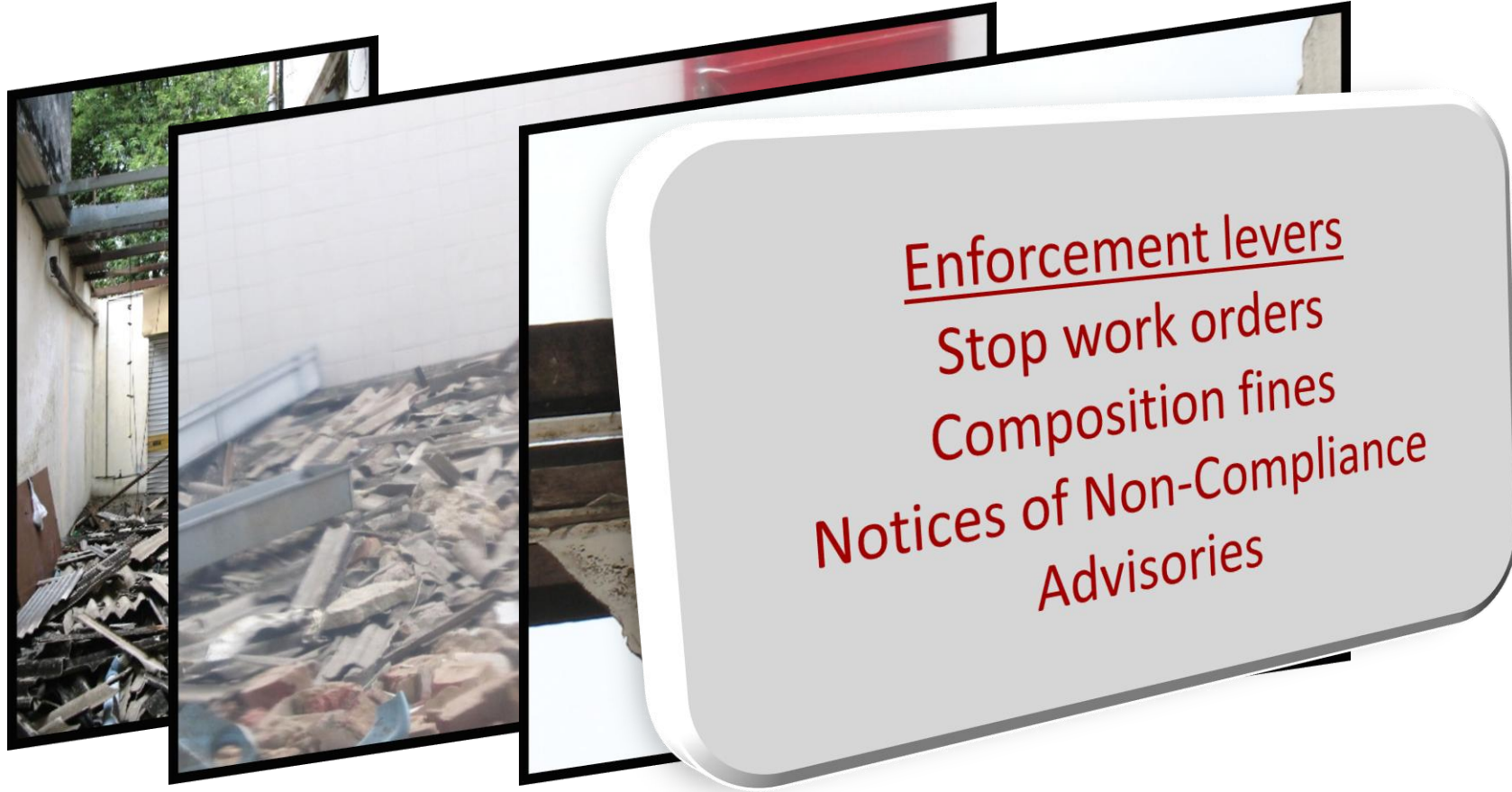
A=Austria; B=Belgium; D=Germany; DK=Denmark; E=Spain; F=France; FIN=Finland; GB=Great Britain; GR=Greece; I=Italy; IRL=Ireland; L=Luxembourg; NL=The Netherlands; P=Portugal; S=Sweden.

GBD 2017 are slightly revised

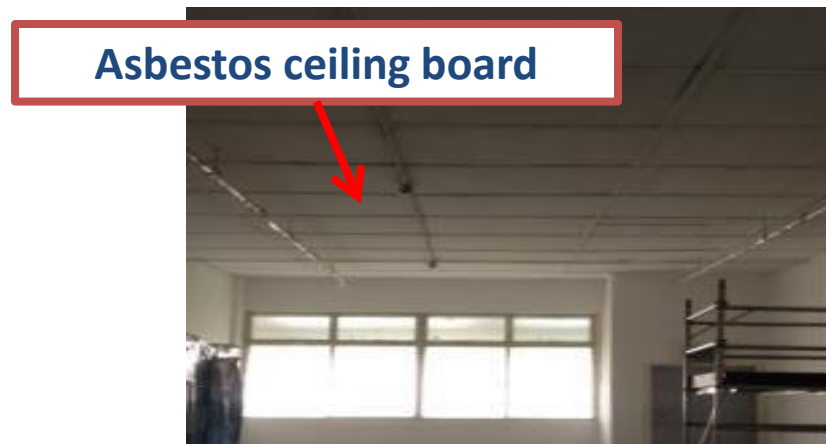
Age Group	Percentage
18-24	28%
25-34	22%
35-44	18%
45-54	15%
55-64	12%
65-74	8%
75-84	5%
85+	2%



Illegal removal of asbestos-containing materials



Common ACMs found in (Buildings)



Technical requirements on asbestos work



Designated
work area



Negative
pressure units



Proper
decontamination
facilities



Industrial
vacuum
cleaner

Measures to minimise the release or spread of asbestos
during work

Recommendations

- Strict regulatory framework and enforcement of work carried out in asbestos contaminated buildings and structures.
- No renovation nor demolition if asbestos exposure is likely, e.g. structures built before 1990. Asbestos survey and removal compulsory before renovation work. Capability of surveyors and authorized companies checked.
- All asbestos containing buildings identified, marked and mapped. New CAREX for EU.



Recommendations, continued

- Dutch Expert Committee on Occupational Safety (DECOS) has proposed that the occupational exposure limits (OELs) for asbestos be reduced from 10,000 fibres/m³ (all types) to 420 fibres/m³ for amphibole asbestos, 1,300 fibres/m³ for mixed asbestos fibres, and 2,000 fibres/m³ for chrysotile asbestos.
- New exposure limit value for work setting proposed by ICOH: 1,000 fibres/m³
- *Existing measurements: Geneva park area 900 fibres/m³ , Germany wheat field: 200 fibres/m³*

Dutch Expert Committee on Occupational Safety (DECOS) has proposed that the occupational exposure limits (OELs) for asbestos

Proposed new *MTR* and *VR* values and the existing values for asbestos by type. The values are for lifetime exposure from the general environment, expressed in fibres/m³ as measured using TEM (Transmission Electron Microscopy). The proposed values are for the two health effects (mesothelioma and lung cancer) combined. The existing *MTR* and *VR* values are for mesothelioma only.

	Proposed new <i>MTR</i> and <i>VR</i> values ¹⁾			Existing <i>MTR</i> and <i>VR</i> values	
	Chrysotile in fibres per m ³	Mixed exposure to chrysotile and up to 20% amphibole in fibres per m ³	100% amphibole in fibres per m ³	Chrysotile in fibres per m ³	Amphibole in fibres per m ³
<i>MTR</i>	2,800	1,300	300	100,000	10,000
<i>VR</i>	28	13	3	1,000	100

1)

The State Secretary for Housing, Spatial Planning and Environmental Management at that time accordingly asked the Council to calculate the asbestos concentrations consistent with the risk levels defined in the context of Dutch environmental policy: the maximum permissible risk level (*maximaal toelaatbaar risiconiveau*, *MTR*) and the negligible risk level (*verwaarloosbaar risiconiveau*, *VR*). The State Secretary for Social Affairs and Employment additionally asked the Health Council to consider whether new occupational exposure limits for asbestos were necessary and, if so, to specify the concentrations corresponding to the risk levels defined by the government.

Concluding remarks

- Asbestos remains a very real problem
- Exposure to even low levels can cause fatal disease
- The current risks are mainly to those involved in the maintenance, renovation and repair of buildings
- Great care and effort must be taken to identify the presence of asbestos and minimise (to zero) any exposures
- Recommendations needs implementation



Underestimates are common

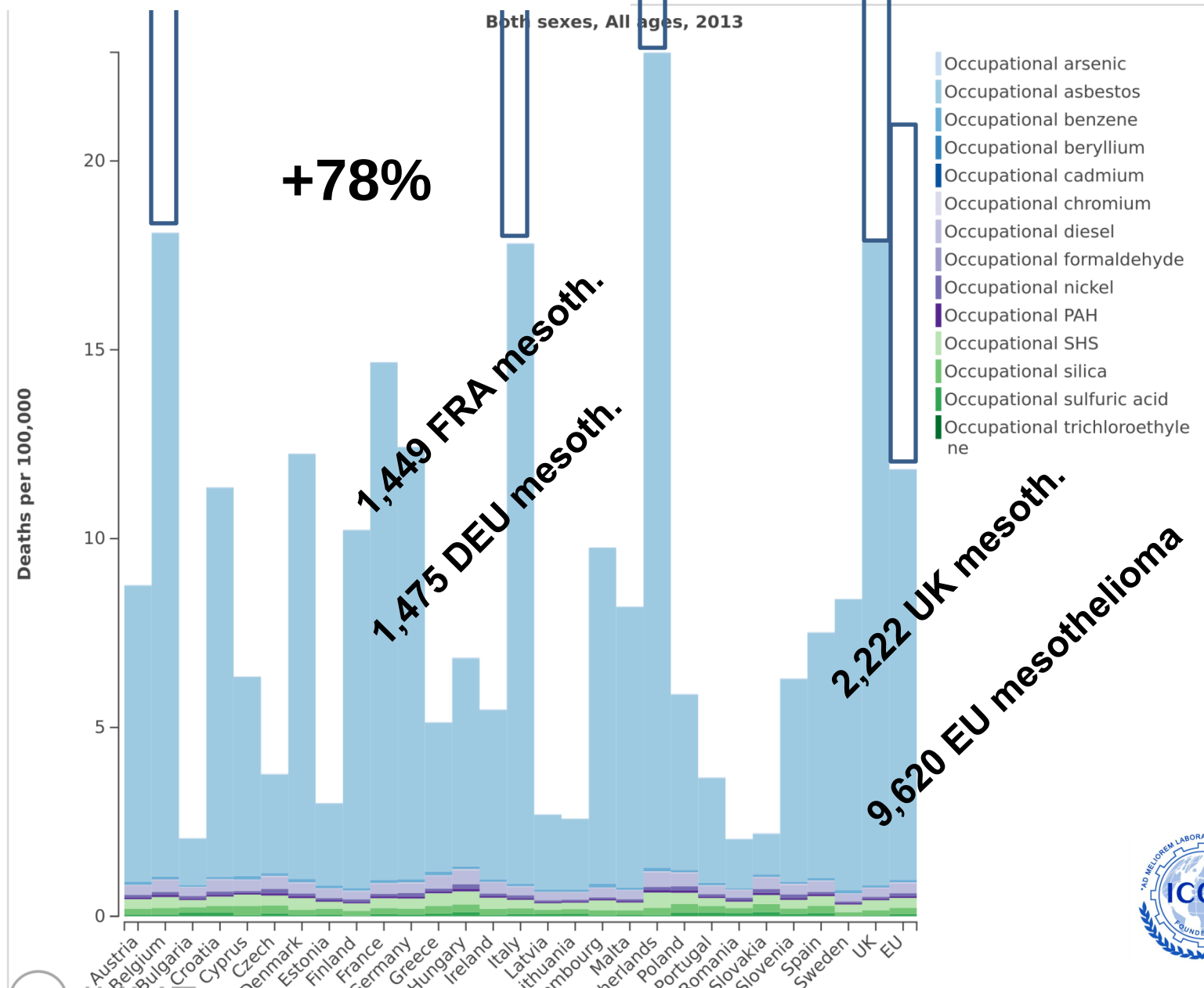


Table 3. Comparison of Global burden of Mesothelioma Deaths (by Odgerel et al / GBD 2016)								GBD2016	
Rank	Country/Region	Asbestos use	Extrapolation method Continent	Employment	Estimated mesothelioma deaths**			Rank	Mesothelioma deaths
					Asbestos-adjusted/ Reported*	Continents-adjusted	Employment-adjusted***		
					A	B	C		D
1	China	H	Asia	M	10,459	6,456	9,594	3	2,747
2	India	H	Asia	M	5,940	3,732	5,411	4	2,405
3	United States	of	America	H	2,611			1	3,282
4	United Kingdom	H	Europe	H	2,405			2	2,864
5	Italy	H	Europe	H	1,423			6	1,727
6	Germany	H	Europe	H	1,413			5	1,765
7	Japan	H	Asia	H	1,357			8	1,506
8	Russian Federation	H	Europe	H	1,292	1,645	1,241	11	691
9	Brazil	H	America	H	1,183	779	1,143	9	778
10	France	H	Europe	H	972			7	1,573
11	Australia	H	Oceania	M	609			10	776
12	Indonesia	M	Asia	L	548	700	184	16	440
13	Thailand	H	Asia	L	539	330	83	22	255
14	Netherlands	H	Europe	M	493			13	647
15	Canada	H	America	M	436			12	663
16	Spain	H	Europe	H	412			15	515
17	Nigeria	H	Africa	L	410	472	73	43	79
18	Turkey	H	Asia	H	363			14	539
19	Iran (Islamic R. of)	H	Asia	H	361	221	350	17	399
20	Pakistan	M	Asia	M	337	431	646	25	212
.....									
	Total				38,388	36,258	37,455		30,201

Common ACMs found in (Buildings)

Corrugated asbestos sheets



Roof



Wall Cladding

Common ACMs found (Plants /vessels)



Pipe lagging



Gasket



Pipe insulation



Cable Penetration

“Not-so-common” ACMs



**Rubbish
chute
insulation
lining**



**Ventilation
panels**





Designated work area

Industrial vacuum cleaner



Decontamination facilities

Sampling and analysis

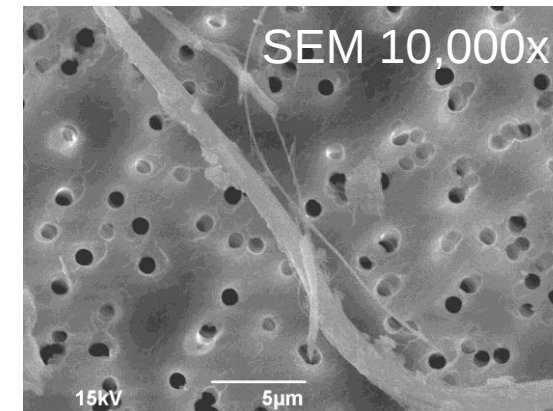
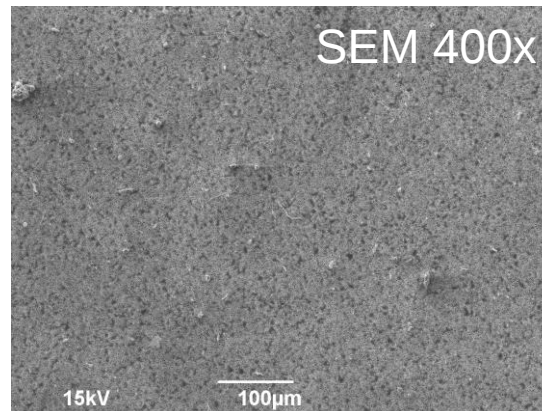
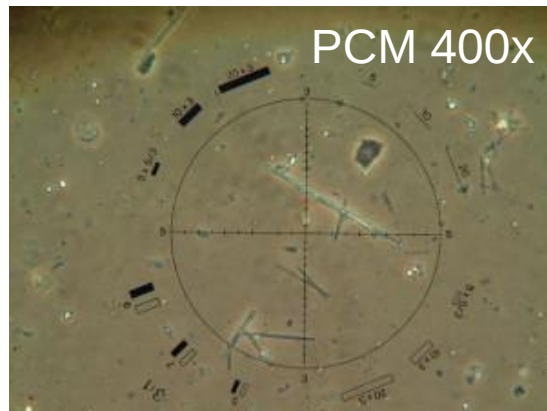


- Analysis by fibre counting
- WHO Counting rules reflect the hazard
- Fibres are harmful because...
 - they are *thin* ($d < 3\mu\text{m}$)
 - they are *long* ($l > 5\mu\text{m}$) and
 - because of *their shape* ($l/d > 3$)
- and because they *persist in the lung*

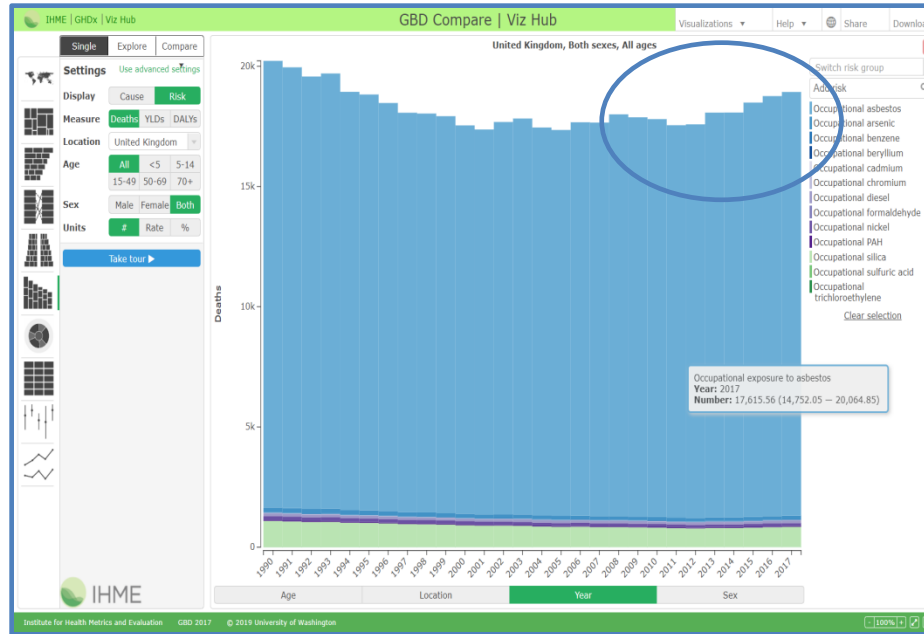
Analysis methods

Method	Determines airborne concentration	Identifies type	Min resolution
Polarized light microscope	No	Yes	~ 1 to 2 μm
Phase contrast microscope	Yes	No	~ 0.25 μm
Scanning electron microscope*	Yes	Yes	~ 0.03 μm
Transmission electron microscope*	Yes	Yes	~ 0.001 μm
X-ray diffraction	No	Yes	n/a

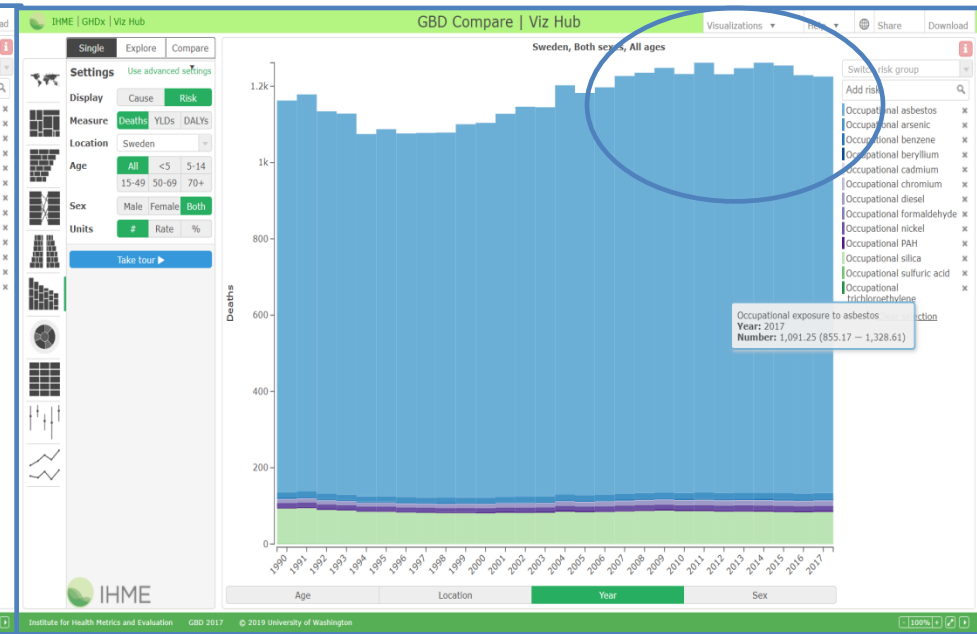
* With energy dispersive x-ray system



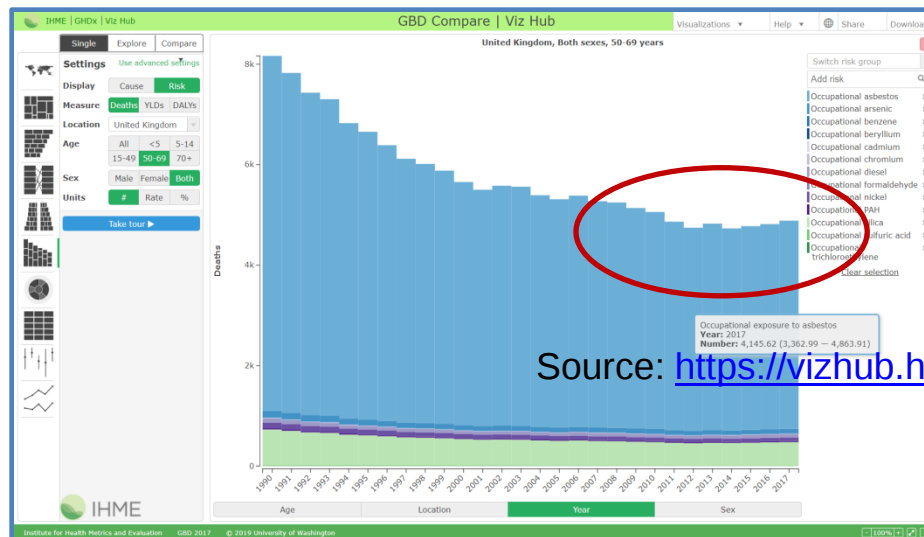
Trends in **all** asbestos deaths in **U.K.** 1990 -2017



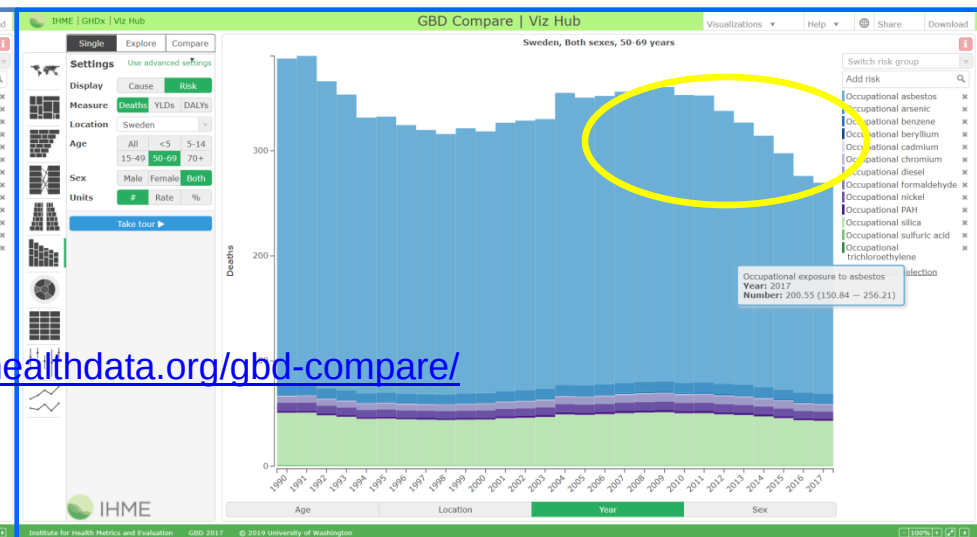
Trends in **all** asbestos deaths in **Sweden** 1990 -2017



Trends in asbestos deaths of **50-69 years old** in **U.K.** 1990 -2017



Trends in asbestos deaths of **50-69 years old** in **Sweden** 1990 -2017



Source: <https://vizhub.healthdata.org/gbd-compare/>