

Risks from Naturally Occurring Carcinogens and Human Activities:

There is a multitude of potential causes for cancer. Professor Bruce Ames (Biochemistry, University of California at Berkeley) has written extensively on this subject and estimates that 70% of all cancers are preventable, i.e., due to “external” sources. About 30% of these external sources are due to tobacco, and most of the rest are due to naturally occurring chemicals.

Ames states that

“aging appears to be due, in good part, to mutagenic oxidants produced as by-products of normal metabolism ... The degenerative diseases of aging, such as cancer, cardiovascular disease, cataracts, and brain dysfunction, are increasingly found to have, in good part, an oxidative origin ... The three main causes of cancer are smoking, dietary imbalances (inadequate intake of fruits and vegetables, excessive fat and alcohol) and chronic infections ... Past occupational exposures might cause about 2% of current human cancer ... industrial or synthetic chemical pollution causes less than 1% ... The assumption that residues of synthetic industrial chemicals are significant contributors to cancer rates and that we can lower cancer rates by eliminating them is wrong ... Half of all chemicals tested (animal cancer tests), whether synthetic or natural, are carcinogenic to rodents. A plausible explanation for the high frequency of positive results is that testing at the MTD (maximum tolerated dose) frequently can cause chronic cell killing and consequent cell division due to cell replacement, a risk factor for cancer that can be limited to high doses. ... The vast bulk of chemicals ingested by humans are natural. ... The amount of rodent carcinogens consumed as pesticide residues in a year is less than the known amount of rodent carcinogens in a cup of coffee. This does not mean that coffee is dangerous, but that animal cancer tests and worst-case risk assessment build in enormous safety factors and should not be considered true risks. One reason we can eat the tremendous variety of natural chemicals that are rodent carcinogens is that animals and humans are extremely well protected by many general-defense enzymes, most of which are inducible (i.e., whenever a defense enzyme is in use, more of it is made) ... Concern with minuscule exposures to synthetic substances, such as pesticides, while ignoring the natural world, harms health by diverting resources from programs that could be effective in protecting the health of the public.”

Ames also observes that

“since carcinogens differ enormously in potency, a comparison of possible hazards from various carcinogens ingested by humans must take this into account. The measure of potency that we have developed, the TD_{50} , is the daily dose rate (in milligrams per kilogram) to halve the percent of tumor-free animals by the end of a standard lifetime. ... To calculate our index of possible hazard we express each human exposure (daily lifetime dose in milligrams per kilogram) as a percentage of the rodent TD_{50} dose (in

*milligrams per kilogram) for each carcinogen. We call this percentage **HERP** [Human Exposure / Rodent Potency dose]. The TD_{50} values are taken from our ongoing Carcinogenic Potency Database (currently 3500 experiments on 975 chemicals)"*

An upper-bound total cancer risk of 1×10^{-5} is frequently used as a trigger in regulatory risk assessments. Tables 1 to 4 compare a cancer risk of 1×10^{-5} to the carcinogenic potential associated with several different average human daily consumptions of naturally-occurring carcinogens in the diet, to the carcinogenic potential associated with several different average human daily activities or consumptions of "man-made" carcinogens, and to the lifetime risk of death resulting from accidents, activities, hobbies, and habits of the U.S. population.

Tables 1 and 2 the upper-bound total cancer risk of 1×10^{-5} to the carcinogenic potential associated with several different average human daily consumptions of naturally-occurring carcinogens in the diet (Table 1) or several different average human daily activities or consumptions of "man-made" carcinogens. For example, from Table 1, the average daily consumption of wine has approximately 2,200 times the risk of 1×10^{-5} ; the average daily consumption of coffee has approximately 550 times the risk of 1×10^{-5} ; and the average daily consumption of lettuce has approximately 210 times the risk of 1×10^{-5} . For example, from Table 2, taking one sleeping pill (containing 60 mg phenobarbital) per day has approximately 64,000 times the risk of 1×10^{-5} ; breathing 2.2 mg of formaldehyde in mobile home air has approximately 8,000 times the risk of 1×10^{-5} ; and breathing 598 micrograms of formaldehyde in conventional home air has approximately 2,200 times the risk of 1×10^{-5} .

Tables 3 and 4 compare the upper-bound total cancer risk of 1×10^{-5} to the lifetime risk of death resulting from accidents, activities, hobbies, and habits of the U.S. population. For example, in Table 3, smoking 1 pack per day has approximately 25,000 times the risk of 1×10^{-5} ; working in agriculture has approximately 4,200 times the risk of 1×10^{-5} ; and canoeing has approximately 2,800 times the risk of 1×10^{-5} . For example, in Table 4 based on the National Safety Council, transportation accidents resulting in death have approximately 1,300 times the risk of 1×10^{-5} ; death from assault has approximately 470 times the risk of 1×10^{-5} ; falls resulting in death have approximately 370 times the risk of 1×10^{-5} ; and death from exposure to smoke, fire, and flames has approximately 94 times the risk of 1×10^{-5} .

Table 1. Ratio of the carcinogenic potential of naturally-occurring rodent carcinogens found in consumables typically included in the U.S. population diet and habits to an excess risk of 1×10^{-5}

Source: Ranking Possible Cancer Hazards from Rodent Carcinogens, Using the Human Exposure/Rodent Potency Index (HERP)

<http://potency.berkeley.edu/herp.pdf>

Average Human Daily Consumption in the U.S.	Naturally Occurring Rodent Carcinogen Chemical Found in the Consumables	Ratio: Carcinogenic Potential of the Natural Hazard to an Excess Risk of 1×10^{-5}
/Comfrey-pepsin tablets, 9 daily (no longer recommended)	Comfrey root, 2.7 g	34,098.34
Alcoholic beverages, all types	Ethyl alcohol, 22.8 ml - density=0.7893 g/ml	15,617.17
Beer, 229 g	Ethyl alcohol, 11.7 ml - density=0.7893 g/ml	8,014.07
Comfrey-pepsin tablets, 9 daily (no longer recommended)	Symphytine, 1.8 mg	7,450.46
Wine, 20.8 g	Ethyl alcohol, 3.67 ml - density=0.7893 g/ml	2,166.69
d-Limonene in food	d-Limonene, 15.5 mg	600.68
Coffee, 11.6 g	Caffeic acid, 20.8 mg	553.67
Lovastatin	Lovastatin, 20 mg	307.02
Lettuce, 14.9 g	Caffeic acid, 7.90 mg	210.29
Safrole in spices	Safrole, 1.2 mg	184.93
Orange juice, 138 g	d-Limonene, 4.28 mg	165.87
Comfrey herb tea, 1 cup (1.5 g root) (no longer recommended)	Symphytine, 38 μ g	157.29
Tomato, 88.7 g	Caffeic acid, 5.46 mg	145.34
Furfural in food	Furfural, 3.64 mg	146.08
Coffee, 11.6 g	Catechol, 1.16 mg	108.27
Mushroom (Agaricus bisporus 2.55 g)	Mixture of hydrazines, etc. (whole mushroom)	110.68
Apple, 32.0 g	Caffeic acid, 3.40 mg	90.50
Beer (before 1979), 229 g	Dimethylnitrosamine, 646 ng	53.25
Aflatoxin: daily U.S. avg (1984-89)	Aflatoxin, 18 ng	44.47
Celery, 14 g	Caffeic acid, 1.51 mg	40.19
Cinnamon, 21.9 mg	Coumarin, 65.0 μ g	36.97
Coffee, 11.6 g	Furfural, 783 μ g	31.42

Coffee, 11.6 g	Hydroquinone, 290 µg	27.69
Carrot, 12.1 g	Aniline, 624 µg	25.43
Bread, 79 g	Furfural, 584 µg	23.44
Potato, 54.9 g	Caffeic acid, 867 µg	23.08
Methyl eugenol in food	Methyl eugenol, 46.2 µg	19.64
Coffee, 11.6 g	4-Methylcatechol, 378 µg	12.08
Nutmeg, 17.6 mg	d-Limonene, 299 µg	11.59
Carrot, 12.1 g	Caffeic acid, 374 µg	9.96
Estragole in spices	Estragole, 54.0 µg	8.24
Pear, 3.7 g	Caffeic acid, 270 µg	7.19
Mushroom (Agaricus bisporus 5.34 g)	Glutamyl-p-hydrazinobenzoate, 224 µg	6.39
Plum, 1.7 g	Caffeic acid, 235 µg	6.26
Bacon, 19 g	Diethylnitrosamine, 19 ng	5.65
Bacon, 19 g	Dimethylnitrosamine, 57.0 ng	4.70
Bacon, 19	N-Nitrosopyrrolidine, 324 ng	3.77
Celery, 14 g	8-Methoxypsoralen, 8.56 µg	2.09
Mango, 1.0 g	d-Limonene, 40.0 µg	1.55
Mustard, 18.9 mg	Allyl isothiocyanate, 17.4 µg	1.43
Beer (1994-95), 229 g	Dimethylnitrosamine, 16 ng	1.32
Mushroom (Agaricus bisporus, 5.34 g)	p-Hydrazinobenzoate, 58.6 µg	1.02
Hamburger, pan fried, 85 g	PhIP, 176 ng	0.85
Toast, 79 g	Urethane, 948 ng	0.44
Beer, 229 g	Furfural, 9.50 µg	0.38
Parsnip, 48.8 mg	8-Methoxypsoralen, 1.42 µg	0.35
Parsley, fresh, 257 mg	8-Methoxypsoralen, 928 ng	0.23
Hamburger, pan fried, 85 g	MeIQx, 38.1 ng	0.18
Hamburger, pan fried, 85 g	IQ, 6.38 ng	0.05
Beer, 229 g	Urethane, 102 ng	0.05

Table 2. Ratio of the carcinogenic potential of rodent carcinogens found in activities in the U.S. population to an excess risk of 1×10^{-5}

Source: Ranking Possible Cancer Hazards from Rodent Carcinogens, Using the Human Exposure/Rodent Potency Index (HERP)
<http://potency.berkeley.edu/herp.pdf>

Average Human Daily Activity or Consumption in the U.S.	Rodent Carcinogen Chemical Resulting from Activity or Consumption	Ratio: Carcinogenic Potential of the Natural Hazard to an Excess Risk of 1×10^{-5}
EDB: production workers (high exposure) (before 1977)	Ethylene dibromide, 150 mg	780,174.01
Clofibrate	Clofibrate, 2 g	93,559.33
Phenobarbital, 1 sleeping pill	Phenobarbital, 60 mg	64,274.50
Gemfibrozil	Gemfibrozil, 1.2 g	38,408.57
Styrene-butadiene rubber industry workers (1978-86)	1,3-Butadiene, 66.0 mg	37,538.16
Tetrachloroethylene: dry cleaners with dry-to-dry units (1980-90)	Tetrachloroethylene, 433 mg	33,893.02
Formaldehyde: production workers (1979)	Formaldehyde, 6.1 mg	22,020.62
Acrylonitrile: production workers (1960-1986)	Acrylonitrile, 28.4 mg	13,285.42
Trichloroethylene: vapor degreasing (before 1977)	Trichloroethylene, 1.02 g	12,071.67
Mobile home air (14 hours/day)	Formaldehyde, 2.2 mg	7,941.86
Methylene chloride: workers, industry average (1940s-80s)	Methylene chloride, 471 mg	5,143.11
Dehydroepiandrosterone (DHEA)	DHEA supplement, 25 mg	2,902.26
Conventional home air (14 hours/day)	Formaldehyde, 598 μ g	2,158.74
Fluvastatin	Fluvastatin, 20 mg	1,264.92
BHA: daily U.S. avg (1975)	BHA, 4.6 mg	60.01
d-Limonene	Food additive, 1.01 mg	39.14
Saccharin: daily U.S. avg (1977)	Saccharin, 7 mg	25.86
Conventional home air (14 hour/day)	Benzene, 155 μ g	15.81
Ethylene thiourea: daily U.S. avg (1990)	Ethylene thiourea, 9.51 μ g	9.52
BHA: daily U.S. avg (1987)	BHA, 700 μ g	9.13
DDT: daily U.S. avg (before 1972 ban)	DDT, 13.8 μ g	8.52
Toxaphene: daily U.S. avg (before 1982 ban)	Toxaphene, 6.43 μ g	6.77
[UDMH: daily U.S. avg (1988)]	[UDMH, 2.82 μ g (from Alar)]	5.63

Tap water, 1 liter (1987-92)	Chloroform, 51 µg	4.47
DDE: daily U.S. avg (before 1972 ban)	DDE, 6.91 µg	4.37
TCDD: daily U.S. avg (1994)	TCDD, 12.0 pg	4.04
Methyl eugenol	Food additive, 7.7 µg	3.27
EDB: Daily U.S. avg (before 1984 ban)	EDB, 420 ng	2.18
Tap water, 1 liter (1987-92)	Bromodichloromethane, 13 µg	2.15
Furfural	Food additive, 36.4 µg	1.46
Carbaryl: daily U.S. avg (1990)	Carbaryl, 2.6 µg	1.46
Estragole	Food additive, 5.79 µg	0.88
Allyl isothiocyanate	Food additive, 10.5 µg	0.86
Toxaphene: daily U.S. avg (1990)	Toxaphene, 595 ng	0.63
PCBs: daily U.S. avg (1984-86)	PCBs, 98 ng	0.45
DDE/DDT: daily U.S. avg (1990)	DDE, 659 ng	0.42
Dicofol: daily U.S. avg (1990)	Dicofol, 544 ng	0.13
Hexachlorobenzene: daily U.S. avg (1990)	Hexachlorobenzene, 14 ng	0.03
Lindane: daily U.S. avg (1990)	Lindane, 32 ng	0.01
PCNB: daily U.S. avg (1990)	PCNB (Quintozene), 19.2 ng	0.002
Chlorobenzilate: daily U.S. avg (1989)	Chlorobenzilate, 6.4 ng	0.001
Captan: daily U.S. avg (1990)	Captan, 115 ng	0.0004
Folpet: daily U.S. avg (1990)	Folpet, 12.8 ng	0.0001
Chlorothalonil: daily U.S. avg (1990)	Chlorothalonil, <6.4 ng	0.0001

Table 3. Ratio of the lifetime risk of death resulting from activities, hobbies, and habits typical for the U.S. population to the trigger excess lifetime risk of 1×10^{-5}

Sources:

Wilson, Richard (1990). Communicating risks by comparisons. Talk at a symposium at Singapore; November 12 1990,

Wilson, R. and E.A.C. Crouch (1987). Risk Assessment and Comparisons: An Introduction. Science, vol. 236, 1987, pp. 267-236,

Wilson, Richard (1981). The Risks of Pesticides: Their Assessment and Comparison with Benefits. Symposia IX, International Congress of Plant Protection, Washington, D.C., August 5-11, 1979, Vol. I (1981)

Activity, Hobby, or Habit	Lifetime Risk of Death	Ratio: Lifetime Risk of Death from the Activity to the Trigger Lifetime Risk of 1×10^{-5}
Coal mining: black lung disease (1969)	5.60×10^{-1}	56,000.00
Sunbathing, mt. Climbing (skin cancer risk/curable)	3.50×10^{-1}	35,000.00
Cigarette smoking 1 pack/ day	2.52×10^{-1}	25,200.00
Tobacco: Smoker, all effects (including heart disease)	2.10×10^{-1}	21,000.00
All cancers	1.96×10^{-1}	19,600.00
Motorcycle racing	1.26×10^{-1}	12,600.00
Horse racing	9.10×10^{-2}	9,100.00
Coal mining: accident (average 1970-74)	9.10×10^{-2}	9,100.00
Railroad worker (1974) (all accidents excluding grade crossing)	9.10×10^{-2}	9,100.00
Car racing	8.40×10^{-2}	8,400.00
Tobacco: Smoker, cancer only	8.40×10^{-2}	8,400.00
Rock climbing (USA)	7.00×10^{-2}	7,000.00
Fire fighters (1971-72 average)	5.60×10^{-2}	5,600.00
Mountaineering	4.20×10^{-2}	4,200.00
Mining & Quarrying (accident only)	4.20×10^{-2}	4,200.00
Agriculture: total	4.20×10^{-2}	4,200.00
Trade	4.20×10^{-2}	4,200.00
Canoeing	2.80×10^{-2}	2,800.00
Transportation & Utilities	2.31×10^{-2}	2,310.00
Airline pilot	2.10×10^{-2}	2,100.00

Steel worker (accident only) (1969-71)	1.96×10^{-2}	1,960.00
Motor vehicle accident	1.68×10^{-2}	1,680.00
Police killed in line of duty	1.54×10^{-2}	1,540.00
Motor vehicle, total	1.54×10^{-2}	1,540.00
Air Pollution, Eastern US	1.40×10^{-2}	1,400.00
Power boating	1.19×10^{-2}	1,190.00
Alcohol, liver cirrhosis (1974)	1.12×10^{-2}	1,120.00
Air pollution, sulfates	1.05×10^{-2}	1,050.00
Police killed in line of duty by felons only	9.10×10^{-3}	910.00
Agriculture: tractor driver (1 driver/tractor)	9.10×10^{-3}	910.00
Home accidents	7.70×10^{-3}	770.00
Government	7.70×10^{-3}	770.00
Truck driver (1 driver/truck)	7.00×10^{-3}	700.00
Jet flying consultant & professor	7.00×10^{-3}	700.00
Service	6.30×10^{-3}	630.00
Manufacturing	5.60×10^{-3}	560.00
Falls	5.39×10^{-3}	539.00
Frequent flying professor	3.50×10^{-3}	350.00
Living 1 year downstream from dam	3.50×10^{-3}	350.00
Cosmic ray risk: Airline pilot 50 hr /mo. @ 35,000 ft	3.50×10^{-3}	350.00
Food & Drinks: Alcohol - average over smokers and nonsmokers	3.50×10^{-3}	350.00
Motor vehicle accident pedestrian only	2.94×10^{-3}	294.00
Football	2.80×10^{-3}	280.00
Motor vehicle, pedestrian	2.80×10^{-3}	280.00
Alcohol, liver cirrhosis (moderate drinker)	2.80×10^{-3}	280.00
Food & Drinks: Four tablespoons peanut butter/day (aflatoxin)	2.80×10^{-3}	280.00
Skiing	2.10×10^{-3}	210.00
Air pollution, benzo-a-pyrene (cancer risk)	2.10×10^{-3}	210.00
Sea-level background radiation excluding radon	1.40×10^{-3}	140.00
Alcohol, light drinker	1.40×10^{-3}	140.00
Boxing (amateur)	1.40×10^{-3}	140.00
Food & Drinks: Alcohol - light drinker (1 berr/day)	1.40×10^{-3}	140.00
Other: Taking contraceptive pills regularly	1.40×10^{-3}	140.00
Cosmic ray risk: Frequent airline passenger	1.05×10^{-3}	105.00

Other radiation risk: Natural background at sea level	1.05×10^{-3}	105.00
Inhalation and ingestion of objects	9.80×10^{-4}	98.00
Home accidents (1975)	8.40×10^{-4}	84.00
Fishing (drowning)	7.00×10^{-4}	70.00
Drowning (all recreational causes)	7.00×10^{-4}	70.00
Bicycling (1 person/bicycle)	7.00×10^{-4}	70.00
Cosmic ray risk: Living in Denver compare to N.Y.	7.00×10^{-4}	70.00
Cosmic ray risk: One summer (4 mo) camping at 15,000 ft	7.00×10^{-4}	70.00
Other radiation risk: Average US diagnostic medical x-rays	7.00×10^{-4}	70.00
Food & Drinks: One diet soda/day (saccharin)	7.00×10^{-4}	70.00
Food & Drinks: One pint milk/day (aflatoxin)	7.00×10^{-4}	70.00
Tobacco: Person in room with smoker	7.00×10^{-4}	70.00
4 tablespoons peanut butter/day	5.60×10^{-4}	56.00
Accidental poisoning: gases and vapors	4.90×10^{-4}	49.00
Accidental poisoning: solids and liquids	4.20×10^{-4}	42.00
Electrocution	3.71×10^{-4}	37.10
Other radiation risk: Increase in risk from living in a brick bldg (with radioactive bricks) compared to wood	3.50×10^{-4}	35.00
Air travel, one transcontinental trip per year	2.10×10^{-4}	21.00
Vaccination for small pox, per occasion	2.10×10^{-4}	21.00
Food & Drinks: Average US saccharin consumption	1.40×10^{-4}	14.00
Food & Drinks: Miami or New Orleans drinking water	8.40×10^{-5}	8.40
Drinking water (EPA limit of chloroform)	4.20×10^{-5}	4.20
Tornados	3.50×10^{-5}	3.50
Cosmic ray risk: One transcontinental flight/year	3.50×10^{-5}	3.50
Hurricanes	2.80×10^{-5}	2.80
Lightning	2.80×10^{-5}	2.80
Food & Drinks: 1/2 lb. Charcoal broiled steak once a week (cancer risk only; heart attack, etc. additional)	2.80×10^{-5}	2.80
Other: Backpack spray applicators of 2-4-5 T	3.50×10^{-6}	0.35
Backpack spray applicators of 2-4-5 T	3.50×10^{-6}	0.35
Drinking water with EPA limit of TCE	1.40×10^{-7}	0.01

Table 4. Ratio of the lifetime risk of death resulting from accidents, activities, hobbies, and habits of the U.S. population to the trigger excess lifetime risk of 1×10^{-5}

Source: Source: National Safety Council
<http://www.nsc.org/lrs/statinfo/odds.htm>

Activity	Lifetime Risk of Death	Ratio: Lifetime Risk of Death from the Activity to the Trigger Lifetime Risk of 1×10^{-5}
Transport Accidents, V01-V99, Y85	1.30×10^{-2}	1,298.70
Pedestrian, V01-V09	1.64×10^{-3}	163.93
Pedalcyclist, V10-V19	2.07×10^{-4}	20.67
Motorcycle rider, V20-V29	7.72×10^{-4}	77.22
Occupant of three-wheeled motor vehicle, V30-V39	6.42×10^{-6}	0.64
Car occupant, V40-V49	4.13×10^{-3}	413.22
Occupant of pick-up truck or van, V50-V59	9.13×10^{-4}	91.32
Occupant of heavy transport vehicle, V60-V69	1.03×10^{-4}	10.31
Bus occupant, V70-V79	5.59×10^{-6}	0.56
Animal rider or occupant of animal-drawn vehicle, V80	2.71×10^{-5}	2.71
Occupant of railway train or railway vehicle, V81	8.38×10^{-6}	0.84
Occupant of streetcar, V82	2.79×10^{-7}	0.03
Other and unspecified land transport accidents, V83-V89	4.72×10^{-3}	471.70
<i>Occupant of special industrial vehicle, V83</i>	4.19×10^{-6}	0.42
<i>Occupant of special agricultural vehicle, V84</i>	7.63×10^{-5}	7.63
<i>Occupant of special construction vehicle, V85</i>	1.03×10^{-5}	1.03
<i>Occupant of all-terrain or other off-road motor vehicle, V86</i>	2.00×10^{-4}	20.03
<i>Other and unspecified person, V87-V89</i>	4.42×10^{-3}	442.48
Water transport accidents, V90-V94	1.76×10^{-4}	17.60
<i>Drowning, V90, V92</i>	1.30×10^{-4}	13.02
<i>Other and unspecified injuries, V91, V93-V94</i>	4.58×10^{-5}	4.58
Air and space transport accidents, V95-V97	2.17×10^{-4}	21.70
Other and unspecified transport accidents and sequelae, V98-V99, Y85	1.39×10^{-4}	13.85
<i>Other specified transport accidents, V98</i>	5.59×10^{-7}	0.06
<i>Unspecified transport accident, V99</i>	1.12×10^{-6}	0.11

Nontransport Unintentional (Accidental) Injuries, W00-X59, Y86	1.43×10^{-2}	1,428.57
Falls, W00-W19	3.72×10^{-3}	371.75
<i>Fall on same level from slipping, tripping, and stumbling, W01</i>	1.58×10^{-4}	15.78
<i>Other fall on same level, W00, W02-W03, W18</i>	5.27×10^{-4}	52.66
<i>Fall involving bed, chair, other furniture, W06-W08</i>	1.82×10^{-4}	18.16
<i>Fall on and from stairs and steps, W10</i>	3.65×10^{-4}	36.51
<i>Fall on and from ladder or scaffolding, W11-W12</i>	1.15×10^{-4}	11.51
<i>Fall from out of or through building or structure, W13</i>	1.41×10^{-4}	14.13
<i>Other fall from one level to another, W09, W14-W17</i>	1.92×10^{-4}	19.19
<i>Other and unspecified fall, W04-W05, W19</i>	2.04×10^{-3}	204.08
Exposure to inanimate mechanical forces, W20-W49	7.73×10^{-4}	77.34
<i>Struck by or striking against object, W20-W22</i>	2.45×10^{-4}	24.50
<i>Caught between objects, W23</i>	2.35×10^{-5}	2.35
<i>Contact with machinery, W24, W30-W31</i>	1.89×10^{-4}	18.88
<i>Contact with sharp objects, W25-W29</i>	2.23×10^{-5}	2.23
<i>Firearms discharge, W32-W34</i>	2.17×10^{-4}	21.68
<i>Explosion and rupture of pressurized devices, W35-W38</i>	8.38×10^{-6}	0.84
<i>Fireworks discharge, W39</i>	1.40×10^{-6}	0.14
<i>Explosion of other materials, W40</i>	4.66×10^{-5}	4.66
<i>Foreign body entering through skin or natural orifice, W44-W45</i>	1.01×10^{-5}	1.01
<i>Other and unspecified inanimate mechanical forces, W41-W43, W49</i>	1.03×10^{-5}	1.03
Exposure to animate mechanical forces, W50-W64	5.70×10^{-5}	5.70
<i>Struck by or against another person, W50-W52</i>	1.70×10^{-5}	1.70
<i>Bitten or struck by dog, W54</i>	7.26×10^{-6}	0.73
<i>Bitten or struck by other mammals, W53, W55</i>	1.82×10^{-5}	1.82
<i>Bitten or stung by nonvenomous insect and other arthropods, W57</i>	2.51×10^{-6}	0.25
<i>Bitten or crushed by other reptiles, W59</i>	8.66×10^{-6}	0.87
<i>Other & unspecified animate mechanical forces, W56, W58, W60, W64</i>	3.35×10^{-6}	0.34
Accidental drowning and submersion, W65-W74	9.73×10^{-4}	97.28
<i>Drowning and submersion while in or falling into bath-tub, W65-W66</i>	9.52×10^{-5}	9.52
<i>Drowning & submersion while in or falling into swimming-pool, W67-W68</i>	1.58×10^{-4}	15.84
<i>Drowning and submersion while in or falling into natural water, W69-W70</i>	3.17×10^{-4}	31.71
<i>Other and unspecified drowning and submersion, W73-W74</i>	4.02×10^{-4}	40.19
Other accidental threats to breathing, W75-W84	1.58×10^{-3}	157.73
<i>Accidental suffocation and strangulation in bed, W75</i>	9.13×10^{-5}	9.13

<i>Other accidental hanging and strangulation, W76</i>	9.30×10^{-5}	9.30
<i>Threat to breathing due to cave-in, falling earth & other substances, W77</i>	1.79×10^{-5}	1.79
<i>Inhalation of gastric contents, W78</i>	1.07×10^{-4}	10.67
<i>Inhalation & ingestion of food causing obstruction of respiratory tract, W79</i>	2.08×10^{-4}	20.78
<i>Inhalation & ingestion other objects causing obstruction of resp tract, W80</i>	8.90×10^{-4}	89.05
<i>Confined to or trapped in a low-oxygen environment, W81</i>	4.19×10^{-6}	0.42
<i>Other and unspecified threats to breathing, W83-W84</i>	1.66×10^{-4}	16.65
Exposure to electric current, radiation, temperature, & pressure, W85-W99	1.17×10^{-4}	11.70
<i>Electric transmission lines, W85</i>	2.77×10^{-5}	2.77
<i>Other and unspecified electric current, W86-W87</i>	8.27×10^{-5}	8.27
<i>Radiation, W88-W91</i>		
<i>Excessive heat or cold of man-made origin, W92-W93</i>	3.35×10^{-6}	0.34
<i>High and low air pressure and changes in air pressure, W94</i>	3.35×10^{-6}	0.34
<i>Other and unspecified man-made environmental factors, W99</i>		
Exposure to smoke, fire and flames, X00-X09	9.43×10^{-4}	94.34
<i>Uncontrolled fire in building or structure, X00</i>	7.75×10^{-4}	77.52
<i>Uncontrolled fire not in building or structure, X01</i>	1.90×10^{-5}	1.90
<i>Controlled fire in building or structure, X02</i>	1.40×10^{-5}	1.40
<i>Controlled fire not in building or structure, X03</i>	8.10×10^{-6}	0.81
<i>Ignition of highly flammable material, X04</i>	1.82×10^{-5}	1.82
<i>Ignition or melting of nightwear, X05</i>	2.51×10^{-6}	0.25
<i>Ignition or melting of other clothing and apparel, X06</i>	3.24×10^{-5}	3.24
<i>Other and unspecified smoke fire and flames, X08-X09</i>	7.37×10^{-5}	7.37
Contact with heat and hot substances, X10-X19	3.07×10^{-5}	3.07
<i>Contact with hot tap-water, X11</i>	1.54×10^{-5}	1.54
<i>Other and unspecified heat and hot substances, X10, X12-X19</i>	1.54×10^{-5}	1.54
Contact with venomous animals and plants, X20-X29	2.23×10^{-5}	2.23
<i>Contact with venomous snakes and lizards, X20</i>	3.35×10^{-6}	0.34
<i>Contact with venomous spiders, X21</i>	1.40×10^{-6}	0.14
<i>Contact with hornets, wasps and bees, X23</i>	1.51×10^{-5}	1.51
<i>Contact with other & unspecified venomous animal / plant, X22, X24-X29</i>	2.51×10^{-6}	0.25
Exposure to forces of nature, X30-X39	3.42×10^{-4}	34.16
<i>Exposure to excessive natural heat, X30</i>	8.41×10^{-5}	8.41
<i>Exposure to excessive natural cold, X31</i>	2.07×10^{-4}	20.73
<i>Lightning, X33</i>	1.40×10^{-5}	1.40

<i>Earthquake and other earth movements, X34-X36</i>	9.78×10^{-6}	0.98
<i>Cataclysmic storm, X37</i>	1.37×10^{-5}	1.37
<i>Flood, X38</i>	1.40×10^{-6}	0.14
<i>Exposure to other and unspecified forces of nature, X32, X39</i>	1.15×10^{-5}	1.15
Accidental poisoning by and exposure to noxious substances, X40-X49	3.56×10^{-3}	355.87
<i>Nonopioid analgesics, antipyretics, and antirheumatics, X40</i>	4.92×10^{-5}	4.92
<i>Antiepileptic, sedative-hypnotic, antiparkinsonism, and psychotropic drugs n.e.c., X41</i>	1.97×10^{-4}	19.67
<i>Narcotics and psychodysleptics [hallucinogens] n.e.c., X42</i>	1.72×10^{-3}	171.53
<i>Other and unspecified drugs, medicaments, and biologicals, X43-X44</i>	1.31×10^{-3}	131.06
<i>Alcohol, X45</i>	8.44×10^{-5}	8.44
<i>Gases and vapours, X46-X47</i>	1.76×10^{-4}	17.62
<i>Other and unspecified chemicals and noxious substances, X48-X49</i>	3.13×10^{-5}	3.13
Overexertion, travel and privation, X50-X57	5.17×10^{-5}	5.17
Accidental exposure to other & unspecified factors and sequelae, X58-X59, Y86	2.11×10^{-3}	211.42
Intentional self-harm, X60-X84, Y87.0	8.20×10^{-3}	819.67
Intentional self-poisoning, X60-X69	1.36×10^{-3}	135.69
Intentional self-harm by hanging, strangulation, and suffocation, X70	1.59×10^{-3}	158.98
Intentional self-harm by firearm, X72-X74	4.63×10^{-3}	462.96
Other and unspecified means and sequelae, X71, X75-X84, Y87.0	6.19×10^{-4}	61.92
Assault, X85-Y09, Y87.1	4.67×10^{-3}	467.29
Assault by firearm, X93-X95	3.02×10^{-3}	302.11
Assault by sharp object, X99	5.04×10^{-4}	50.43
Other and unspecified means and sequelae, X85-X92, X96-X98, Y00-Y09, Y87.1	1.16×10^{-3}	116.14
Event of undetermined intent, Y10-Y34, Y87.2, Y89.9	1.07×10^{-3}	106.72
Poisoning, Y10-Y19	7.14×10^{-4}	71.43
Hanging, strangulation, and suffocation, Y20	2.90×10^{-5}	2.90
Drowning and submersion, Y21	6.45×10^{-5}	6.45
Firearm discharge, Y22-Y24	6.42×10^{-5}	6.42
Exposure to smoke, fire, and flames, Y26	2.12×10^{-5}	2.12
Falling, jumping, or pushed from a high place, Y30	1.54×10^{-5}	1.54
Other and unspecified means and sequelae, Y25, Y27-Y29, Y31-Y34, Y87.2, Y89.9	1.58×10^{-4}	15.81
Legal intervention, Y35, Y89.0	1.00×10^{-4}	10.03
Legal intervention involving firearm discharge, Y35.0	7.54×10^{-5}	7.54

Legal execution, Y35.5	2.23×10^{-5}	2.23
Other and unspecified means and sequelae, Y35.1-Y35.4, Y35.6-Y35.7, Y89.0	2.51×10^{-6}	0.25
Operations of war and sequelae, Y36, Y89.1	4.47×10^{-6}	0.45
Complications of medical and surgical care and sequelae, Y40-Y84, Y88.0-Y88.3	8.55×10^{-4}	85.47