



CENTRE FOR
PUBLIC HEALTH
RESEARCH





CENTRE FOR
PUBLIC HEALTH
RESEARCH

CARCINOGENS IN THE NEW ZEALAND WORKPLACE: AN OVERVIEW

Dr Andrea 't Mannetje

BACKGROUND

- The National Occupational Health and Safety Committee (NOHSAC) estimates that 237-425 people die each year from occupational cancer in New Zealand.
- This represents 3-6% of all cancer deaths in New Zealand.
- Within blue collar workers this may be as high as 25%.
- All of these work-related cancers are preventable in principle.

MANY QUESTIONS REMAIN...

- How many workers are potentially exposed to carcinogens in New Zealand?
- Which industries are the most exposed in New Zealand?
- What carcinogens are the most common in New Zealand work places?
- What interventions would have the biggest impact on reducing the number of occupational cancer cases in New Zealand?

PROJECT: WORKPLACE EXPOSURE TO CARCINOGENS IN NEW ZEALAND

- Based on project “Workplace exposure to carcinogens in New Zealand”
- funded by:
 - Department of Labour (now MBIE)
 - Health Research Council of New Zealand (HRC)

CARCINOGENS IN THE NEW ZEALAND WORKPLACE: AN OVERVIEW

- Prepare list of occupational carcinogens
- For each NZ industry sector review the literature re. cancer risk
- For each NZ industry sector list carcinogens that can be present
- For each NZ industry sector estimate the number exposed

- Determine carcinogens to which high number of NZ workers are exposed
- Determine industries associated with increased cancer risk and with a high number of NZ workers are exposed to carcinogens

<group 1> 1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitros
<group 1> 1,3-Butadiene
<group 1> 1,4-Butanediol dimethanesulfonate (Myleran)
<group 1> 8-Methoxysoralen (Methoxsalen) plus ultraviolet
<group 1> Aflatoxins (naturally occurring mixtures of)
<group 1> Aluminium production
<group 1> Arsenic and arsenic compounds
<group 1> **Asbestos**
<group 1> Azathioprine
<group 1> **Benzene**
<group 1> Benzidine
<group 1> Beryllium and beryllium compounds
<group 1> Boot and shoe manufacture and repair
<group 1> Cadmium and cadmium compounds
<group 1> Chimney sweeping
<group 1> Chlorambucil
<group 1> Chromium VI compounds
<group 1> Ciclosporin (=cyclosporine?)
<group 1> Coal gasification (see PAH)
<group 1> Coal-tar distillation
<group 1> Coal-tar pitches (see PAHs)
<group 1> Coal-tars (see PAHs)
<group 1> Cyclophosphamide
<group 1> Diethylstilboestrol
<group 1> Dyes metabolized to benzidine
<group 1> Epstein-Barr virus
<group 1> Ethylene oxide
<group 1> Etoposide
<group 1> **Formaldehyde**
<group 1> Furniture and cabinet making
<group 1> Helicobacter pylori (infection with)
<group 1> Hepatitis B virus (chronic infection with)
<group 1> Hepatitis C virus (chronic infection with)
<group 1> Involuntary smoking (exposure to second hand
<group 1> Iron and steel founding
<group 1> Melphalan
<group 1> MOPP and other combined chemotherapy includ
<group 1> N,N-Bis(2-chloroethyl)-2-naphthylamine (Chlorna
<group 1> Nickel compounds
<group 1> Oestrogens, nonsteroidal
<group 1> Oestrogens, steroid
<group 1> Ortho-toluidine
<group 1> Painter (occupational exposure as a)
<group 1> Paving and roofing with coal-tar pitch
<group 1> Phenacetin
<group 1> Phenacetin, analgesic mixtures containing (see
<group 1> Phosphorus-32, as phosphate
<group 1> Rubber industry
<group 1> Silica, crystalline
<group 1> Solar radiation

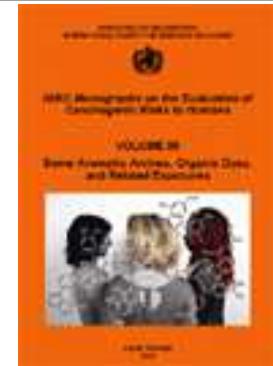
<group 1> Soots (see PAHs)
<group 1> Strong-inorganic-acid mists containing sulfuric
<group 1> Thiotepa
<group 1> Treosulfan
<group 1> Vinyl chloride
<group 1> **Wood dust**
<group 1> X and gamma-radiation
<group 2A> 1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (C
<group 2A> 1,2,3-Trichloropropane
<group 2A> 1,2-dimethylhydrazine
<group 2A> 4-chloro-ortho-toluidine
<group 2A> Acrylamide
<group 2A> Adriamycin
<group 2A> Alpha-chlorinated toluenes (benzal chloride,
<group 2A> Androgenic (anabolic) steroids
<group 2A> Art glass, glass containers and pressed ware (br
<group 2A> Azacitidine
<group 2A> Bischloroethyl nitrosourea (BCNU)
<group 2A> Captafol
<group 2A> Chloramphenicol
<group 2A> Chlorozotocin
<group 2A> Cisplatin
<group 2A> Cobalt metal with tungsten carbide
<group 2A> Creosotes (see PAHs)
<group 2A> Diesel engine exhaust
<group 2A> Diethyl sulfate
<group 2A> Dimethyl sulfate
<group 2A> Dimethylcarbamoyl chloride
<group 2A> Epichlorohydrin
<group 2A> Ethyl carbamate (urethane)
<group 2A> Ethylene dibromide
<group 2A> Glycidol
<group 2A> Hairdresser and barber (occupational exposure
<group 2A> High-temperature frying, emission from
<group 2A> Lead compounds, inorganic
<group 2A> Nitrogen mustard
<group 2A> N-Nitrosodiethylamine
<group 2A> N-Nitrosodimethylamine
<group 2A> Non-arsenical insecticides (occup. exp. in spra
<group 2A> Petroleum refining (occupational exposures in)
<group 2A> Polychlorinated biphenyls (PCB)
<group 2A> Procabarazine hydrochloride
<group 2A> **Shiftwork that involves circadian disruption**
<group 2A> Styrene-7,8-oxide
<group 2A> Sunlamps and sunbeds (use of)
<group 2A> Tetrachloroethylene
<group 2A> Trichloroethylene
<group 2A> Ultraviolet radiation, artificial
<group 2A> Vinyl bromide
<group 2A> Vinyl fluoride

<group 2B> 1,1-dimethylhydrazine
<group 2B> 1,4-dioxane
<group 2B> 2-Methylaziridine (Propyleneimine)
<group 2B> 3,3'-Dimethoxybenzidine (ortho-dianisidine)
<group 2B> 3,3'-Dimethylbenzidine (o-tolidine)
<group 2B> 3,3'-Dichlorobenzidine
<group 2B> 4,4-methylene dianiline
<group 2B> Acetaldehyde
<group 2B> Acrylonitrile
<group 2B> Antimony trioxide
<group 2B> Bitumens
<group 2B> Carbon black
<group 2B> Carbon tetrachloride
<group 2B> Carpentry and joinery
<group 2B> Catechol
<group 2B> Ceramic fibers
<group 2B> Chlordane
<group 2B> Chlordecone (Kepone)
<group 2B> Chloroform
<group 2B> Chlorophenoxy herbicides
<group 2B> Chlorothalonil
<group 2B> Cobalt and its compounds
<group 2B> Diesel fuel, marine
<group 2B> Dry cleaning (occupational exposures in)
<group 2B> Engine exhaust, gasoline
<group 2B> Ethylbenzene
<group 2B> Firefighter (occupational exposure as a)
<group 2B> Fuel oils, residual (heavy)
<group 2B> Gasoline
<group 2B> Gasoline engine exhaust
<group 2B> Heptachlor
<group 2B> Hexachloroethane
<group 2B> Hydrazine
<group 2B> Magnetic fields, extremely low frequency
<group 2B> Methylene chloride (dichloromethane)
<group 2B> Mirex
<group 2B> Nitrobenzene
<group 2B> Nitromethane
<group 2B> Ochratoxin B
<group 2B> Ortho-anisidine
<group 2B> Para-dichlorobenzene
<group 2B> Printing processes (occupational exposures in)
<group 2B> Propylene oxide
<group 2B> Styrene
<group 2B> Tetranitromethane
<group 2B> Textile manufacturing industry (work in)
<group 2B> Toxaphene (polychlorinated camphenes)
<group 2B> Vinyl acetate
<group 2B> Welding fumes

LIST OF OCCUPATIONAL CARCINOGENS

82 Group 1: carcinogenic to humans

e.g.: asbestos; benzene; silica; wood dust



56 Group 2A: probably carcinogenic to humans

e.g.: inorganic lead; shiftwork; trichloroethylene

118 Group 2B: possibly carcinogenic to humans

e.g.: carbon tertrachloride; DDT; Mirex; carbon black

The 82 Group 1 occupational carcinogens by exposure category

- 17 Industrial chemicals** (e.g. benzene, ethylene oxide, formaldehyde)
- 6 Metals** (e.g. arsenic, beryllium, cadmium, chromium VI)
- 5 Fibres and dust** (e.g. asbestos, silica, wood dust)
- 4 Radiation** (e.g. solar radiation, X and gamma-radiation)
- 17 Pharmacological** (e.g. cyclospirin, chlorambucil, thiotepa)
- 5 Hormones** (e.g. oestrogens, diethylstilboestrol)
- 10 Microbial agents** (e.g. EBV, HPV, HepB, HepC, HIV)
- 3 Combustion products** (e.g. PAHs, ETS, soots)
- 16 Exposure circumstances** (e.g. aluminium production, chimney sweeping, occupational exposure as painter, rubber industry, shoe manucture&repair, furniture and cabinet making)

LIST OF OCCUPATIONAL CARCINOGENS

Not static! Accumulating evidence

- changes in classification
(e.g. diesel engine exhaust: from 2A to 1 in 2012)
- additions
(e.g. shift work, 2A in 2010)



ANZSIC 3-digit industry subdivision	men	women	total	men	women	total
A01 Agriculture	69,162	38,904	108,066	G52 Personal & Household Good Retailing	39,807	66,804 106,596
A02 Services to Agriculture; Hunting and Trapping	12,726	6,180	18,909	G53 Motor Vehicle Retailing and Services	39,243	11,250 50,490
A03 Forestry and Logging	6,744	1,227	7,974	H57 Accommodation, Cafes & Restaurants	34,686	59,904 94,590
A04 Commercial Fishing	2,238	627	2,862	I61 Road Transport	27,261	6,174 33,432
B11 Coal Mining	708	66	771	I62 Rail Transport	1,563	291 1,857
B12 Oil and Gas Extraction	240	54	297	I63 Water Transport	1,341	810 2,151
B13 Metal Ore Mining	384	54	438	I64 Air and Space Transport	5,502	3,441 8,949
B14 Other Mining	1,497	222	1,719	I65 Other Transport	1,146	276 1,419
B15 Services to Mining	807	120	927	I66 Services to Transport	12,357	9,924 22,272
C21 Food, Beverage and Tobacco	35,436	19,350	54,789	I67 Storage	3,588	1584 5,172
C22 Textile, Clothing, Footwear and Leather Manuf.	7119	10647	17763	J71 Communication Services	13,119	11,220 24,333
C23 Wood and Paper Product Manufacturing	19,101	3,876	22,980	K73 Finance	15,957	22,449 38,415
C24 Printing, Publishing and Recorded Media	12,111	10,131	22,242	K74 Insurance	3,993	5,046 9,039
C25 Petroleum, Coal, Chemical & Assoc. Product Manuf.	12,609	5,361	17,955	K75 Services to Finance and Insurance	8,367	8,316 16,686
C26 Non-Metallic Mineral Product Manufacturing	5,607	1,239	6,822	L77 Property Services	27,537	24,801 52,329
C27 Metal Product Manufacturing	22,503	4,254	26,745	L78 Business Services	105,156	96,255 201,414
C28 Machinery and Equipment Manufacturing	34,359	8,301	42,654	M81 Government Administration	23,217	34,044 57,267
C29 Other Manufacturing	10,314	3,882	14,193	M82 Defence	7,380	2,454 9,834
D36 Electricity and Gas Supply	3,075	1,326	4,401	N84 Education	38,028	101,097 139,134
D37 Water Supply, Sewerage and Drainage Services	1,191	504	1,695	O86 Health Services	21,246	85,047 106,305
E41 General Construction	57,399	7,509	64,908	O87 Community Services	7,203	47,634 54,834
E42 Construction Trade Services	70,797	11,832	82,644	P91 Motion Picture, Radio & TV Services	6,105	5,043 11,151
F45 Basic Material Wholesaling	20,379	8,190	28,566	P92 Libraries, Museums and the Arts	7,056	8,748 15,801
F46 Machinery and Motor Vehicle Wholesaling	26,295	9,279	35,577	P93 Sport and Recreation	12,060	12660 24,717
F47 Personal and Household Good Wholesaling	23,088	20,424	43,530	Q95 Personal Services	13,050	21,252 34,299
G51 Food Retailing	33,252	47,772	81,024	Q96 Other Services	23,007	18,729 41,739
				Q97 Private Households Employing Staff	9	24 33

ANZSIC 3-digit industry subdivision	men	women	total					
A01 Agriculture	69,162	38,904	108,066	G52	Personal & Household Good Retailing	39,807	66,804	106,596
A02 Services to Agriculture; Hunting and Trapping	12,726	6,180	18,909	G53	Motor Vehicle Retailing and Services	39,243	11,250	50,490
A03 Forestry and Logging	6,744	1,227	7,974	H57	Accommodation, Cafes & Restaurants	34,686	59,904	94,590
A04 Commercial Fishing	2,238	627	2,862	I61	Road Transport	27,261	6,174	33,432
B11 Coal Mining	708	66	771	I62	Rail Transport	1,563	291	1,857
B12 Oil and Gas Extraction	240	54	297	I63	Water Transport	1,341	810	2,151
B13 Metal Ore Mining	384	54	438	I64	Air and Space Transport	5,502	3,441	8,949
B14 Other Mining	1,497	222	1,719	I65	Other Transport	1,146	276	1,419
B15 Services to Mining	807	120	927	I66	Services to Transport	12,357	9,924	22,272
C21 Food, Beverage and Tobacco	35,436	19,350	54,789	I67	Storage	3,588	1584	5,172
C22 Textile, Clothing, Footwear and Leather Manuf.	7119	10647	17763	J71	Communication Services	13,119	11,220	24,333
C23 Wood and Paper Product Manufacturing	19,101	3,876	22,980	K73	Finance	15,957	22,449	38,415
C24 Printing, Publishing and Recorded Media	12,111	10,131	22,242	K74	Insurance	3,993	5,046	9,039
C25 Petroleum, Coal, Chemical & Assoc. Product Manuf.	12,609	5,361	17,955	K75	Services to Finance and Insurance	8,367	8,316	16,686
C26 Non-Metallic Mineral Product Manufacturing	5,607	1,239	6,822	L77	Property Services	27,537	24,801	52,329
C27 Metal Product Manufacturing	22,503	4,254	26,745	L78	Business Services	105,156	96,255	201,414
C28 Machinery and Equipment Manufacturing	34,359	8,301	42,654	M81	Government Administration	23,217	34,044	57,267
C29 Other Manufacturing	10,314	3,882	14,193	M82	Defence	7,380	2,454	9,834
D36 Electricity and Gas Supply	3,075	1,326	4,401	N84	Education	38,028	101,097	139,134
D37 Water Supply, Sewerage and Drainage Services	1,191	504	1,695	O86	Health Services	21,246	85,047	106,305
E41 General Construction	57,399	7,509	64,908	O87	Community Services	7,203	47,634	54,834
E42 Construction Trade Services	70,797	11,832	82,644	P91	Motion Picture, Radio & TV Services	6,105	5,043	11,151
F45 Basic Material Wholesaling	20,379	8,190	28,566	P92	Libraries, Museums and the Arts	7,056	8,748	15,801
F46 Machinery and Motor Vehicle Wholesaling	26,295	9,279	35,577	P93	Sport and Recreation	12,060	12660	24,717
F47 Personal and Household Good Wholesaling	23,088	20,424	43,530	Q95	Personal Services	13,050	21,252	34,299
G51 Food Retailing	33,252	47,772	81,024	Q96	Other Services	23,007	18,729	41,739
				Q97	Private Households Employing Staff	9	24	33

ANZSIC 3-digit industry subdivision		men	women	total
A01 Agriculture	25	69,162	38,904	108,066
A02 Services to Agriculture; Hunting and Trapping	25	12,726	6,180	18,909
A03 Forestry and Logging	8	6,744	1,227	7,974
A04 Commercial Fishing	10	2,238	627	2,862
B11 Coal Mining	8	708	66	771
B12 Oil and Gas Extraction	9	240	54	297
B13 Metal Ore Mining	12	384	54	438
B14 Other Mining	5	1,497	222	1,719
B15 Services to Mining	10	807	120	927
C21 Food, Beverage and Tobacco	19	35,436	19,350	54,789
C22 Textile, Clothing, Footwear and Leather Manuf.	25	7119	10647	17763
C23 Wood and Paper Product Manufacturing	22	19,101	3,876	22,980
C24 Printing, Publishing and Recorded Media	25	12,111	10,131	22,242
C25 Petroleum, Coal, Chemical & Assoc. Product Manuf.	59	12,609	5,361	17,955
C26 Non-Metallic Mineral Product Manufacturing	19	5,607	1,239	6,822
C27 Metal Product Manufacturing	25	22,503	4,254	26,745
C28 Machinery and Equipment Manufacturing	29	34,359	8,301	42,654
C29 Other Manufacturing	15	10,314	3,882	14,193
D36 Electricity and Gas Supply	9	3,075	1,326	4,401
D37 Water Supply, Sewerage and Drainage Services	3	1,191	504	1,695
E41 General Construction	16	57,399	7,509	64,908
E42 Construction Trade Services	16	70,797	11,832	82,644
F45 Basic Material Wholesaling	2	20,379	8,190	28,566
F46 Machinery and Motor Vehicle Wholesaling	12	26,295	9,279	35,577
F47 Personal and Household Good Wholesaling	2	23,088	20,424	43,530
G51 Food Retailing	8	33,252	47,772	81,024

G52 Personal & Household Good Retailing	12	39,807	66,804	106,596
G53 Motor Vehicle Retailing and Services	13	39,243	11,250	50,490
H57 Accommodation, Cafes & Restaurants	5	34,686	59,904	94,590
I61 Road Transport	9	27,261	6,174	33,432
I62 Rail Transport	8	1,563	291	1,857
I63 Water Transport	10	1,341	810	2,151
I64 Air and Space Transport	10	5,502	3,441	8,949
I65 Other Transport	17	1,146	276	1,419
I66 Services to Transport	10	12,357	9,924	22,272
I67 Storage	11	3,588	1584	5,172
J71 Communication Services	5	13,119	11,220	24,333
K73 Finance	0	15,957	22,449	38,415
K74 Insurance	0	3,993	5,046	9,039
K75 Services to Finance and Insurance	0	8,367	8,316	16,686
L77 Property Services	4	27,537	24,801	52,329
L78 Business Services	3	105,156	96,255	201,414
M81 Government Administration	2	23,217	34,044	57,267
M82 Defence	4	7,380	2,454	9,834
N84 Education	2	38,028	101,097	139,134
O86 Health Services	39	21,246	85,047	106,305
O87 Community Services	4	7,203	47,634	54,834
P91 Motion Picture, Radio & TV Services	4	6,105	5,043	11,151
P92 Libraries, Museums and the Arts	17	7,056	8,748	15,801
P93 Sport and Recreation	5	12,060	12660	24,717
Q95 Personal Services	18	13,050	21,252	34,299
Q96 Other Services	14	23,007	18,729	41,739
Q97 Private Households Employing Staff	0	9	24	33

NZ-CAREX prioritizing intervention: industries

	Low number exposed	Medium number exposed	High number exposed
Not associated with increased cancer risk/ not studied	Storage Communication services Property services Government administration Community services Motion picture/radio/tv services Sport and recreation	Machinery & motor vehicle wholesaling	Personal and household good retailing
Occasionally associated with increased cancer risk	Commercial fishing Food, beverage Electricity & gas supply Defence Libraries, museums, arts	Food retailing Motor vehicle retailing Accommodation, cafes & restaurant education	Printing & publishing Petroleum & chemical
Repeatedly associated with increased cancer risk	Forestry and logging Mining and extraction	Textile, clothing, footwear Transport Business services (Includes painting, carpentry, chimney sweeping Personal services (Includes hairdressers)	Agriculture Construction Health services Machinery & equipment mfg Metal product mfg Wood & paper product mfg

Increasing priority ↓

Increasing priority →

NZ-CAREX prioritizing intervention: exposures

	Low prevalence of exposure	Medium prevalence of exposure	High prevalence of exposure
2B (possibly carcinogenic to humans)	<i>Examples:</i> Acrylonitrile Marine diesel fuel Occup exp in drycleaning Occup exp in printing processes	<i>Examples:</i> Bitumens Chlordane Chlorophenoxy herbicides ELF EMF	<i>Examples:</i> Chlorinated solvents (Carbon tetrachloride; methylene chloride) Carpentry and Joinery Gasoline engine exhaust Styrene Welding fumes
2A (probably carcinogenic to humans)	<i>Examples:</i> PCBs	<i>Examples:</i> Ethylene bromide Hairdresser & barber	<i>Examples:</i> Diesel engine exhaust Shiftwork Chlorinated solvents (1,2,3-trichloropropane; tetrachloroethylene; trichloroethylene) High temperature frying (emissions from) Inorganic lead compounds Non-arsenical insecticides
1 (carcinogenic to humans)	<i>Examples:</i> Beryllium acrylamide	<i>Examples:</i> Arsenic nickel Ethylene oxide X and gamma radiation	Asbestos Benzene Chromium VI compounds Formaldehyde Involuntary smoking Painter – occup exp as Silica Solar radiation Wood dust

Increasing priority ↓

conclusions

- There are more than **50** known (group 1) human carcinogens commonly present in New Zealand workplaces.
- The most common of these are: **Asbestos; Benzene; Chromium VI compounds; Formaldehyde; Involuntary smoking; occupational exposures as a Painter; Silica; Solar radiation; Wood dust.**
- There are more than an additional **100** possible or probable human carcinogens present in New Zealand workplaces.
- The industries for which an increased cancer risk has been observed repeatedly in epidemiological studies and have the highest number of potentially exposed workers include: **Agriculture; Construction; Health services; Machinery & equipment manufacturing (mfg); Metal product mfg; Wood & paper product mfg.**

observations

- Occupational exposure to carcinogens is common
- For almost all industries there is a potential for exposure to carcinogens

observations

- Most common workplace carcinogens are not ‘simply’ industrial chemicals



CARCINOGENS IN THE NEW ZEALAND WORKPLACE:
AN OVERVIEW

cphr

CENTRE FOR
PUBLIC HEALTH
RESEARCH

MASSEY
UNIVERSITY
TE WHARE WĀHINE
UNIVERSITY OF NEW ZEALAND

OCCUPATIONAL CARCINOGENS: IMPROVING AWARENESS...

1. Awareness what workplace agents are carcinogenic
2. Awareness of presence in the workplace
3. Awareness of how to effectively control exposure

OCCUPATIONAL CARCINOGENS: HEALTH IMPACT

By reducing exposure to workplace carcinogens, a significant health benefit can be achieved

- through the prevention of a large number of occupational cancer deaths
- and through reducing risks for many other work-related diseases also associated with these common workplace exposures.