





CARCINOGENS IN THE NEW ZEALAND WORKPLACE: *AN OVERVIEW*

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

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

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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	Increasing priority ↓
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



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.