HSE's DISEASE REDUCTION PROGRAMME - CANCER PROJECT

Profiling of Occupational Carcinogens

1. Potency rankings (at 19 May 2006)

The following lists provide a summary of the emerging view on the potency of those carcinogens within scope of the Cancer Project.

(a). Carcinogens flagged as highly potent:

- Arsenic and compounds (arsenic acid and its salts, arsenic pentoxide, arsenic trioxide, diarsine trioxide and gallium arsenide)
- Benzene
- Beryllium and compounds (including beryllium metal and beryllium oxide)
- Bis chloromethyl ether [BCME]
- Butadiene
- Cadmium and compounds (especially fluoride, chloride & sulphate)
- Chlorodimethyl ether
- N,N-Diacetylbenzidine
- 1,4-Dichlorobut-2-ene
- 3,3'-Dimethylbenzidine and its salts
- Dimethylcarbamoyl chloride
- 1,2-Dimethyl hydrazine
- Dimethylnitrosamine
- Dimethylsulphamoyl chloride
- 2,4-Dinitrotoluene
- 2,6-Dinitrotoluene
- 1,2-Diphenyl hydrazine
- Epichlorohydrin
- Ethylene dibromide
- Ethyleneimine
- Glycidol
- Hydrazine (including salts of hydrazine)
- Hexachlorobenzene
- Hexamethylphosphoric triamide
- Indium phosphide
- 2-Methylaziridine
- 4,4’-Methylene-di-o-toluidine
- 1-Methyl-3-nitro-1-nitroso-guanidine
- Nitrosodipropylamine
- 1,3-Propane sultone
- 3-Propanolide [beta propiolactone]
- Thioacetamide
- 2,3,4-Trichloro-1-butene
- 1,2,3-Trichloropropane

(b). Carcinogens not flagged as highly potent

- Acrylamide
- Acrylonitrile
- Acrylamidomethoxyacetate (containing \( \geq 0.1\% \) acrylamide)
- Methylacrylamidoglycolate (containing \( \geq 0.1\% \) acrylamide))
- 5-Allyl-1,3-benzodioxole [safrole]
- 4-Aminoazobenzene
- o-Aminoazotoluene [4-o-tolylazo-o-toluidine]
- 3-Amino-9-ethylcarbazole
- 4-Amino-3-fluorophenol
- o-Anisidine
- Azobenzene
- 3,3’-Dichlorobenzidine (including salts of 3,3’- Dichlorobenzidine)
- Benzyl chloride [\( \alpha \)-chlorotoluene]
- 4-Chloroaniline
- 4-Chloro-o-toluidine
- C.I. Basic Violet 3 with \( \geq 0.1\% \) of Michler's ketone
- p-Cresidine [6-Methoxy-\( \alpha \)-toluidine]
- 2,4-Diaminoanisole [4-methoxy-\( \alpha \)-phenylenediamine] and its sulphate
- o-Dianisidine (Salts of o-dianisidine o-dianisidine-based azodyes)
- Diazomethane
- 1,2,3,4 Diepoxybutane
- Diesel engine exhaust emission
- Diethyl sulphate
- Dimethyl sulphate
- 3,5-Dinitrotoluene
- 3,4-Dinitrotoluene
- 2,5-Dinitrotoluene
- 2,3-Dinitrotoluene
- 1,2-Epoxypropane [propylene oxide]
- 2,3-Epoxypropyltrimethylammonium chloride [EPTAC]
- Ethylene dichloride
- Ethylene oxide
- Ferrous foundry particulate
- Formaldehyde
- Hydrazine-tri-nitromethane
- Isobutyl nitrite
- Isoprene
- Leather dust in boot and shoe manufacture, arising during preparation and finishing
- MbOCA and salts
- 4,4’-Methylenedianiline (MDA)
- 4-Methyl-m-phenylenediamine and its sulphate salt (2,4-toluenediamine) [diaminotoluene]
- Michler’s ketone
- Nickel and compounds (inc. soluble and insoluble salts)
- 5-Nitroacenaphthene
- 2-Nitroanisole
- 4-Nitrobiphenyl [4-nitrodiphenyl]
- 2-Nitropropane
- 2,2’-(Nitrosoimino) bisethanol [N-nitrosodiethanolamine]
- 2-Nitrotoluene
- Oxiranemethanol, 4-methylbenzene-sulfonate, (S)-
- 4,4’-Oxydianiline and its salts
- Phenyl glycidyl ether
- Phenyl hydrazine
- Potassium bromate
- Refractory ceramic fibres
- Rubber fume/rubber process dust
- Styrene oxide
- Sulphuric acid mist
- 1,4,5,8-Tetraamino-anthraquinone [CI Disperse Blue 1]
- N,N,N’,N’-Tetramethyl-4,4’-methyleneedianiline
- 4,4’-Thiodianiline and its salts
- o-Toluidine
- Trichloroethylene
- 2,4,5-Trimethylaniline
- Urethane
- Used engine oil
- Vinyl bromide [bromoethylene]
- Vinyl chloride [chloroethylene]
- Vinyl fluoride
- Wood dust

(c). Carcinogens for which potency has not been evaluated:

Work to assess the potency of some of these carcinogens is ongoing; for some, it may be decided that a potency assessment is not be required.

- Auramine and its manufacture
- Butane [1], isobutene [2], (containing ≥ 0.1% butadiene) [liquid petroleum gas]
- Calcining, sintering or smelting of nickel copper matte or acid leaching or electrofining of roasted matte
- Chromyl chloride
- Chromium VI compounds (excluding chromium trioxide)
- Chromium trioxide
- 3,3'-Diaminobenzidine
- 1,3-Dichloro-2-propanol
- 1,2-Dibromo-3-chloropropane
- Dioxins (incl. polychlorodibenzodioxins and polychlorodibenzofurans)
- Gallium arsenide
- Hydrazobenzene
- Magenta manufacture
- Petroleum substances (incl. lubrication oils, low boiling point naphtha, petroleum gas, refinery gas, used engine oils etc.)
- Phenolphthalein
- Polycyclic aromatic hydrocarbons, including:
  - Coal soot
  - Coal tar [and coal tar products]
  - Pitch
  - Coal tar fumes
  - Chrysene
- Quinoline
(d). Carcinogens that do not appear in UK industry; no potency evaluation made:

- 4-Aminobiphenyl
- 2-Napthylamine
- Benzidine and salts
- Benzidine based azodyes
- Erionite
- Hydrazine bis (3-carboxy-4-hydroxybenzene sulphonate)
- Methyl-2-methoxyaniline
- 4-Methyl-m-hexylenediamine
- Methyl-ONN-azoxymethyl acetate
- Mustard gas

2. Potency Factors

The following list shows those factors that have been considered as indications of “High Potency”.

(a). Factors used frequently:

- \( T_{25} \leq 1 \) mg/kg/day (figures taken mostly from existing datasets)
- \( TD_{50} \leq 10 \) mg/kg/day (figures taken directly from the Gold database)
- Direct genotoxic or alkylating agent
- Tumours induced following relatively short exposure periods

(b). Other factors used, often in combinations with factors listed above:

- Tumours induced following relatively low doses (no \( T_{25} \) or \( TD_{50} \) available)
- Multi-site carcinogen
- High incidence of tumours
- Considered potent by other experts, panels or regulatory systems
- Site of contact carcinogen
- Single-exposure carcinogen