

RESULTS AND CONCLUSIONS

The separate evaluations of animal and human evidence are presented in Table 3.

The Working Group concluded that the following 18 chemicals, groups of chemicals, and industrial processes are *carcinogenic for humans* (Group 1):

4-Aminobiphenyl	Diethylstilboestrol
Arsenic and certain arsenic compounds	Underground haematite mining <sup>1</sup>
Asbestos	Manufacture of isopropyl alcohol by the strong acid process <sup>1</sup>
Manufacture of auramine <sup>1</sup>	Melphalan
Benzene	Mustard gas
Benzidine	2-Naphthylamine
N,N-bis(2-chloroethyl)-2-naphthylamine (chlornaphazine)	Nickel refining <sup>1</sup>
Bis(chloromethyl)ether and technical grade chloromethyl methyl ether	Soots, tars and mineral oils <sup>1</sup>
Chromium and certain chromium compounds <sup>1</sup>	Vinyl chloride

The following 18 chemicals and groups of chemicals are *probably carcinogenic for humans* (Group 2)

Group A (six chemicals)

Aflatoxins	Cyclophosphamide
Cadmium and certain cadmium compounds <sup>1</sup>	Nickel and certain nickel compounds <sup>1</sup>
Chlorambucil	Tris(1-aziridinyl)phosphine sulphide (thiotepa)

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<sup>1</sup> The specific compound(s) which may be responsible for a carcinogenic effect in humans cannot be specified precisely.

Group B (12 chemicals)

Acrylonitrile	Dimethylsulphate
Amitrole (aminotriazole)	Ethylene oxide
Auramine	Iron dextran
Beryllium and certain beryllium compounds <sup>1</sup>	Oxymetholone
Carbon tetrachloride	Phenacetin
Dimethylcarbamoyl chloride	Polychlorinated biphenyls

The following 18 chemicals and groups of chemicals *could not be classified as to their carcinogenicity for humans* (Group 3):

Chloramphenicol	Isopropyl oils
Chlordane/heptachlor	Lead and certain lead compounds <sup>1</sup>
Chloroprene	Phenobarbitone
Dichlorodiphenyltrichloroethane (DDT)	N-Phenyl-2-naphthylamine
Dieldrin	Phenytoin
Epichlorohydrin	Reserpine
Haematite	Styrene
Hexachlorocyclohexane (technical grade HCH/lindane)	Trichloroethylene
Isoniazid	Tris(aziridinyl)- <i>para</i> -benzoquinone (triaziquone)

*Mining and manufacturing processes*

For some of the chemicals, part or all of the evidence indicating a carcinogenic effect for humans comes from an increased incidence of cancer in individuals involved in the mining or manufacture of these chemicals. There is *sufficient evidence* that the manufacture of auramine, the underground mining of haematite, the manufacture of isopropyl alcohol by the strong acid process, and the refining of nickel are carcinogenic to humans, at least in the situations in which they have been studied. Because these occupations include exposure to other factors in addition to the chemical under consideration, the responsible

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<sup>1</sup> The specific compound(s) which may be responsible for a carcinogenic effect in humans cannot be specified precisely.

carcinogen(s) cannot be specified precisely; therefore, the results cannot be generalized to all situations involving these processes. Nonetheless, these processes should be assumed to carry a carcinogenic risk to humans unless proven otherwise.

Table 3. Classification of the degree of evidence of carcinogenicity for humans of chemicals or industrial processes from *IARC Monographs Volumes 1-20*

Chemical or process	Degree of evidence <sup>a</sup>		Evaluation <sup>b</sup> of carcinogenic risk to humans
	In humans	In experimental animals	
1. Acrylonitrile	limited	sufficient	2B
2. Aflatoxins	limited	sufficient	2A
3. 4-Aminobiphenyl	sufficient	sufficient	1
4. Amitrole (aminotriazole)	inadequate	sufficient	2B
5. Arsenic and certain arsenic compounds	sufficient	inadequate	1
6. Asbestos	sufficient	sufficient	1
7. Auramine <sup>d</sup>	limited	limited	2B
8. Manufacture of auramine	sufficient	not applicable <sup>e</sup>	1
9. Benzene	sufficient	inadequate	1
10. Benzidine	sufficient	sufficient	1
11. Beryllium and certain beryllium compounds <sup>e</sup>	limited	sufficient	2B
12. <i>N,N</i> -Bis (2-chloroethyl)-2-naphthylamine (chlornaphazine)	sufficient	limited	1
13. Bis(chloromethyl)ether and technical grade chloromethyl methyl ether	sufficient	sufficient	1
14. Cadmium and certain cadmium compounds <sup>e</sup>	limited	sufficient	2A
15. Carbon tetrachloride	inadequate	sufficient	2B
16. Chlorambucil	limited	sufficient	2A
17. Chloramphenicol	inadequate	no data	3

Table 3 - continued

Chemical or process	Degree of evidence <sup>a</sup>		Evaluation <sup>b</sup> of carcinogenic risk to humans
	In humans	In experimental animals	
18. Chlordane and heptachlor	inadequate	limited	3
19. Chloroprene	inadequate	inadequate	3
20. Chromium and certain chromium compounds <sup>c</sup>	sufficient	sufficient	1
21. Cyclophosphamide	limited	sufficient	2A
22. Dichlorodiphenyltrichloroethane (DDT)	inadequate	limited	3
23. Dieldrin	inadequate	limited	3
24. Diethylstilboestrol	sufficient	sufficient	1
25. Dimethylcarbamoyl chloride	inadequate	sufficient	2B
26. Dimethyl sulphate	inadequate	sufficient	2B
27. Epichlorohydrin	inadequate	limited	3
28. Ethylene oxide	limited	inadequate	2B
29. Haematite <sup>d</sup>	inadequate	negative	3
30. Underground haematite mining	sufficient	not applicable <sup>e</sup>	1
31. Hexachlorocyclohexane (technical HCH.& lindane)	inadequate	limited	3
32. Iron dextran	inadequate	sufficient	2B
33. Isoniazid	inadequate	limited	3
34. Isopropyl oils <sup>e,d</sup>	inadequate	inadequate	3

Table 3 - continued

Chemical or process	Degree of evidence <sup>a</sup>		Evaluation <sup>b</sup> of carcinogenic risk to humans
	In humans	In experimental animals	
35. Manufacture of isopropyl alcohol (strong acid process)	sufficient	not applicable <sup>e</sup>	1
36. Lead and certain lead compounds <sup>c</sup>	inadequate	sufficient (for some soluble salts)	3
37. Melphalan	sufficient	sufficient	1
38. Mustard gas	sufficient	limited	1
39. 2-Naphthylamine	sufficient	sufficient	1
40. Nickel and certain nickel compounds <sup>e, d</sup>	limited	sufficient	2A
41. Nickel refining	sufficient	not applicable <sup>e</sup>	1
42. Oxymetholone	limited	no data	2B
43. Phenacetin	limited	limited	2B
44. Phenobarbitone	limited	limited	3
45. <i>N</i> -Phenyl-2-naphthylamine	inadequate	inadequate	3
46. Phenytoin	limited	limited	3
47. Polychlorinated biphenyls	inadequate	sufficient	2B
48. Reserpine	inadequate	inadequate	3
49. Soots, tars and mineral oils <sup>e</sup>	sufficient	sufficient	1
50. Styrene	inadequate	limited	3
51. Trichloroethylene	inadequate	limited	3
52. Tris(aziridinyl) <i>para</i> -benzoquinone (triaziquone)	inadequate	limited	3

Table 3 - continued

Chemical or process	Degree of evidence <sup>a</sup>		Evaluation <sup>b</sup> of carcinogenic risk to humans
	In humans	In experimental animals	
53. Tris(1-aziridiny)phosphine sulphide (thiotepa)	limited	sufficient	2A
54. Vinyl chloride	sufficient	sufficient	1

<sup>a</sup> For an explanation of the categories of *Degree of Evidence*, see Methods.

<sup>b</sup> For an explanation of the categories of *carcinogenic risk to humans*, see Methods.

<sup>c</sup> The specific compounds which may be responsible for a carcinogenic effect cannot be specified precisely.

<sup>d</sup> Please refer to section on industrial processes, and to the evaluations in the appendix.

<sup>e</sup> It is difficult to expose experimental animals to the same conditions to which workers are exposed, therefore no animal data are available.