United States
CONSUMER PRODUCT SAFETY COMMISSION
Washington, D.C. 20207

MEMORANDUM

DATE: June 19, 1998

TO: Michael Babich/EHHS

Through: Sadye E. Dunn, Secretary

FROM: Martha Kosh
Records and Reference Assistant

SUBJECT: Flame Retardant Chemicals That May Be Suitable for Use in Upholstered Furniture, FR Vol. 63, No. 71, pp. 18183, April 14, 1998

ATTACHED ARE COMMENTS ON THE CF98-1

COMMENT	DATE	SIGNED BY	AFFILIATION
CF98-1-1	4/13/98	Dr. W. Baitinger, Ph.D, Vice President	Westex, Incorporated 2845 W. 48th Place Chicago, IL 60632
CF98-1-2	4/16/98	George Alleyne Director **Michael Babich has copy of the publication**	Pan American Health Organization 525 23rd St. NW Washington, DC 20037
CF98-1-3	4/20/98	Jerry Rice, Ph.D Chief, Unit of Carcinogen Identification and Evaluation **Michael Babich has copy of the publication**	World Health Organization International Agency For Research on Cancer 150 Cours Albert Thomas 69372 Lyon Cedex 08 FRANCE
CF98-1-4	4/28/98	Jere Glover, Chief Counsel & Shawne McGibbon Assistant Chief Counsel for Advocacy	U.S. Small Business Administration Mail Code: 3113 409 Third St, SW Washington, DC 20416

Flame Retardant Chemicals That May Be Suitable for Use in Upholstered Furniture, FR Vol. 63, No. 71, pp. 18183, April 14, 1998

CF98-1-5	4/??/98	Dr. Ulrich Girrbach M.S., Ph.D	Trevira Frankfurt, Germany
CF98-1-6	4/20/98	Marcia Hardy, D.V.M., Ph.D. Senior Toxicology Advisor (on behalf of the Fire Retardant Chemicals Assn.)	Albermarle Corporation Health and Environment Deparatment, Toxicology Regulatory and Environmental Affairs 451 Florida Street Baton Rouge, LA 70801
CF98-1-7	4/28/98	Phil Stricklen, Ph.D., Research Associate	Amoco Fabrics & Fibers Co Technology Center 260 The Bluffs Austell, GA 30168
CF98-1-8	5/01/98	Phillip Wakelyn, Ph.D., Senior Scientist, Environmental Health and Safety and Patty Adair, Mgr. Standards & Workplace/ Consumer Regulations	National Cotton Council of America 1521 New Hampshire Ave, NW, Washington, DC 20036
CF98-1-9	5/28/98	Tony Wolf President	Wolf Corporation Mattresses & Fiber Products P.O. Box 11306 Ft. Wayne, IN 46857
CF98-1-10	6/2/98	Richard Henrich Principal Toxicologist	Akzo Nobel Chemicals Inc. (formerly Stauffer Chemicals) 5 Livingstone Ave. Dobbs Ferry, NY 10522
CF98-1-11 **rec'd 6/19/98**	6/16/98	Thomas Brace President	National Association of State Fire Marshals 1319 F St., NW, Suite 301 Washington, DC 20004

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CF98-1-12 6/18/98	Paul Schulte, Ph.D Director, Education and Information Division	Department of Health and Human Services National Institute for Occupational Safety and Health Robert A. Taft Lab. 4676 Columbia Parkway Cincinnati, OH 45226

CF98-1-1

WESTEX INC.

BY WESTERN PIECE DYERS AND FINISHERS SINCE 1919

SPECIALTY AND FLAME RESISTANT FABRICS

2845 W. 48TH PLACE
CHICAGO, ILLINOIS 60632
PHONE (773) 523-7000
FAX (773) 523-0965

FLAME RETARDANT CHEMICALS

Dr. William F. Baitinger Ph.D.
Vice President
Westex, Inc.
2845 W. 48th Place
Chicago, IL 60632

I represent Westex inc. a major producer and supplier of flame resistant fabrics for protective clothing. Westex has been in the business of specialty textile fabrics for more than 75 years. We are located in Chicago, Illinois. An associated company is Z-Tex which supplies fabrics to the furniture industry. Fabrics sold by both Westex and Z-Tex are finished with functional finishes by Western Piece Dyers and Finishers the third associated company.

For the purpose of this written response I wish to comment specifically on Section I, FR chemicals as applies to the request for information. Westex Inc. produces and sells fabrics that are utilized for protective clothing for industries that have a hazard risk of fire, thermal or electrical arc exposure. For a short period of time we produced cotton flannel fabrics that met the children's sleepwear standard. The major portion of our business is cotton apparel fabrics treated with the phosphonium salt precondensate/ammonia cure process to the extent of several million yards of fabric produced annually. Our facility is equipped to treat such products in a fashion that meets all applicable OSHA requirements for the workplace and EPA requirements for the environment. By working closely with our customers that make protective apparel we are in a position to monitor the health and safety effects of such finishes for wearing apparel. We can categorically state that these products produce no unusual health risk to wearers under a wide variety of conditions. The flame resistant cotton products we produce are self-extinguishing fabrics when exposed to flame, electrical arc and molten metal ignition sources of significant energy. The finishes are fully wash durable. These points are all made in response to Section I.B. in the Federal Register notice.

The following statements can be made to the questions raised in I.A.

#1. The suitability of FR finishes for upholstered furniture fabrics and barriers would have to be determined based on experimental results of exposure to flames and other ignition sources that may apply. We know

WESTEX INC.

for example that such finishes meet vertical flammability tests but we do not know how their fabrics would respond in composite with other materials and to other ignition sources, e.g., cigarettes.

#2 The number of products available may be commercially, practically and functionally limited. Without more specific information on the standard tests that may apply we cannot comment on what possibilities exist.

#3. The finish we are most familiar with is applied by padding from aqueous solution to fabric followed by ammonia cure and oxidation. Other finishes may be heat cured. Back coating type of finishes would be applied by typical coating processes and heat cured.

#4. Various chemical systems are available to treat cotton, cellulosic and synthetic fibers. Different chemical systems perform in different fashion on various fibers.

In summary I have provided comment on those items that we know today but caution that significant work is necessary to fully explore the efficacy of improvised safety for upholstered furniture. If additional information is required we are available to assist.

CF98-1-2

PAN AMERICAN HEALTH ORGANIZATION
Pan American Sanitary Bureau, Regional Office of the
WORLD HEALTH ORGANIZATION

525 TWENTY-THIRD STREET, N.W., WASHINGTON, D.C. 20037-2895, U.S.A.

NEW
TEL (202) 974-3000
FAX (202) 974-3663

In Reply Refer To: HEP-HEQ/05/51/1

16 April 1998

Michael A. Babich, Ph.D.
Chemist
Directorate for Epidemiology and Health Sciences
U.S. Consumer Product Safety Commission
Washington, D.C. 20207

Dear Dr. Babich:

I acknowledge the receipt of your letter dated 31 March 1998. I would like to thank you for the invitation to participate at the *"Public hearing on the possible toxicity of new Flame Retardants chemicals to consumers"*, to be held in Washington, D.C. on 5-6 May 1998.

I regret to inform you that, due to previous commitments, I am unable to participate in the meeting. As a contribution for the meeting, I am sending you a copy of the "Environmental Health Criteria number 192 (Flame Retardants: A general Introduction," produced by the International Program on Chemical Safety). This publication expresses the opinion of the Pan American Health Organization on Flame Retardants. I hope you find it useful for the meeting.

Sincerely,

for George A. O. Alleyne
Director

Enc.

CF98-1

IPCS

INTERNATIONAL PROGRAMME ON CHEMICAL SAFETY

UNEP

WORLD HEALTH ORGANIZATION

CF98-1-3

CENTRE INTERNATIONAL DE RECHERCHE SUR LE CANCER
INTERNATIONAL AGENCY FOR RESEARCH ON CANCER

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In reply please refer to :
Prière de rappeler la référence : CI/75/2-48

20 April 1998

Dear Ms Hammond,

In response to the invitation extended by Dr Michael Babich, of the Directorate for Epidemiology and Health Sciences, to the Director of the International Agency for Research on Cancer (IARC), I should like to contribute the following comments to the forthcoming CPSC hearing on May 5-6, 1998. That hearing concerns a proposed performance standard that would require upholstered furniture to resist ignition by small open flames, and thereby extend the use of flame retardant chemicals in consumer products.

The documentation provided by CPSC staff of the loss of life and property from fires in residential dwellings started by small open flames is certainly compelling. However, the history of the use of fire retardant chemicals in consumer products includes some mistakes, which the CPSC clearly is making a concerted effort to avoid in the future. The issue of toxicity of flame retardants, including carcinogenicity, was recognized in the past only after the carcinogenic chemical, tris(2,3-dibromopropyl)phosphate (TRIS), had been widely used to treat children's clothing. The CPSC banned its use for that purpose in 1977. The *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans* evaluated the evidence for carcinogenicity of TRIS in Volume 20 (pp. 575-588, 1979, and again in Supplement 7 to the *Monographs*, pp. 369-370, 1987). That chemical is now classified by IARC in *Group 2A--probably carcinogenic to humans.*

The effort that is now underway by the CPSC to identify known toxic properties of chemicals that might be used more widely in the future to reduce flammability of consumer products is to be applauded and encouraged. We emphasize the importance of pursuing this issue in the case of substances for which carcinogenicity and other toxicity data are not now available. The CPSC memorandum dated 1 October 1997, from Dr L.C. Mishra to Mr Dale Ray and entitled, "Toxicity of Flame Retardant Chemicals (FRs) used in Upholstery Fabrics and the Toxicity of the Smoke from FR-treated Fabrics," is a good start, but makes to claim to cite all relevant publications, and makes no recommenda-tions regarding the need to generate information on substances for which little or no published scientific literature now exists. This memorandum cites the *IARC Monographs* evaluation of only one flame retardant chemical, antimony trioxide, which is classified by IARC in *Group 2B--possibly carcinogenic to humans.*

Ms Rocky Hammond
Office of the Secretary
U.S. Consumer Product Safety Commission
Washington, DC 20207
USA

There are three other flame retardant chemicals on the CPSC list that have been evaluated also by the *IARC Monographs*, all of them now classified in *Group 3--cannot be evaluated as to carcinogenicity to humans*. decabromodiphenyl oxide (Vol. 48, pp. 73ff, 1990), tris(2-chloroethyl)phosphate (Vol. 48, pp. 109ff, 1990), and melamine (as a constituent of plastics, not as a flame retardant)(Vol. 39, pp.333ff, 1986, and Supplement 7, p. 65, 1987). The entire Volume 48, entitled "Some Flame Retardants and Textile Chemicals, and Exposures in the Textile Manufacturing Industry," may be of use to the CPSC; a copy of this volume is enclosed.

The remaining chemicals on the CPSC list, and by far the majority, have not been evaluated by IARC as to carcinogenic hazard to humans. These include, e.g., boric acid, hexabromocyclododecane, urea, phenol isopropylated phosphate, ammonium bromide, proban, pyrovatex, ammonium polyphosphate, ammonium sulfamate, triphenyl phosphate, and some others. We would urge that adequate toxicity and carcinogenicity testing data be required for evaluation of the safety of any chemical that is proposed for use as a flame retardant in upholstered furniture or in other consumer products.

Yours sincerely

Jerry M. Rice

Jerry M. Rice, Ph.D.
Chief,
Unit of Carcinogen Identification
and Evaluation

CF98-1-3

WORLD HEALTH ORGANIZATION

INTERNATIONAL AGENCY FOR RESEARCH ON CANCER

IARC MONOGRAPHS

ON THE

EVALUATION OF CARCINOGENIC RISKS TO HUMANS

Some Flame Retardants and Textile Chemicals, and Exposures in the Textile Manufacturing Industry

VOLUME 48

IARC, Lyon, France

1990

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This report contains the collective views of an international group of experts and does not necessarily represent the decisions or the stated policy of the United Nations Environment Programme, the International Labour Organisation, or the World Health Organization.

Environmental Health Criteria 192

FLAME RETARDANTS: A GENERAL INTRODUCTION

First draft prepared by Dr G.J. van Esch, Bilthoven, Netherlands

Published under the joint sponsorship of the United Nations Environment Programme, the International Labour Organisation, and the World Health Organization, and produced within the framework of the Inter-Organization Programme for the Sound Management of Chemicals.

World Health Organization
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The volume, page and year are given. References to corrigenda are given in parentheses.

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1-Amino-2-methylanthraquinone	*27*, 199 (1982); *Suppl.* 7, 57 (1987)
2-Amino-3-methylimidazo[4,5-*f*]quinoline (*see* IQ)	
2-Amino-6-methyldipyrido[1,2-*a*:3′,2′-*d*]-imidazole (*see* Glu-P-1)	
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Anthophyllite (*see* Asbestos)
Anthracene — *32*, 105 (1983); *Suppl.* 7, 57 (1987)
Anthranilic acid — *16*, 265 (1978); *Suppl.* 7, 57 (1987)
Antimony trioxide — *47*, 291 (1989)
Antimony trisulfide — *47*, 291 (1989)
ANTU (*see* 1-Naphthylthiourea)

Apholate — *9*, 31 (1975); *Suppl.* 7, 57 (1987)
Aramite® — *5*, 39 (1974); *Suppl.* 7, 57 (1987)
Areca nut (*see* Betel quid)
Arsanilic acid (*see* Arsenic and arsenic compounds)
Arsenic and arsenic compounds — *1*, 41 (1972); *2*, 48 (1973); *23*, 39 (1980); *Suppl.* 7, 100 (1987)

Arsenic pentoxide (*see* Arsenic and arsenic compounds)
Arsenic sulphide (*see* Arsenic and arsenic compounds)
Arsenic trioxide (*see* Arsenic and arsenic compounds)
Arsine (*see* Arsenic and arsenic compounds)
Asbestos — *2*, 17 (1973) (*corr.* *42*, 252); *14* (1977) (*corr.* *42*, 256); Suppl. 7, 106 (1987) (*corr.* *45*, 283)
Attapulgite — *42*, 159 (1987); *Suppl.* 7, 117 (1987)
Auramine (technical-grade) — *1*, 69 (1972) (*corr.* *42*, 251); *Suppl.* 7, 118 (1987)

Auramine, manufacture of (*see also* Auramine, technical-grade) — *Suppl.* 7, 118 (1987)
Aurothioglucose — *13*, 39 (1977); *Suppl.* 7, 57 (1987)
5-Azacytidine — *26*, 37 (1981); *Suppl.* 7, 57 (1987)
Azaserine — *10*, 73 (1976) (*corr.* *42*, 255); *Suppl.* 7, 57 (1987)

Azathioprine — *26*, 47 (1981); *Suppl.* 7, 119 (1987)
Aziridine — *9*, 37 (1975); *Suppl.* 7, 58 (1987)
2-(1-Aziridinyl)ethanol — *9*, 47 (1975); *Suppl.* 7, 58 (1987)
Aziridyl benzoquinone — *9*, 51 (1975); *Suppl.* 7, 58 (1987)
Azobenzene — *8*, 75 (1975); *Suppl.* 7, 58 (1987)

B

Barium chromate (*see* Chromium and chromium compounds)
Basic chromic sulphate (*see* Chromium and chromium compounds)
BCNU (*see* Bischloroethyl nitrosourea)
Benz[*a*]acridine — *32*, 123 (1983); *Suppl.* 7, 58 (1987)
Benz[*c*]acridine — *3*, 241 (1973); *32*, 129 (1983); *Suppl.* 7, 58 (1987)

Benzal chloride (*see also* α-Chlorinated toluenes) — *29*, 65 (1982); *Suppl.* 7, 148 (1987)
Benz[*a*]anthracene — *3*, 45 (1973); *32*, 135 (1983); *Suppl.* 7, 58 (1987)

Benzene — *7*, 203 (1974) (*corr.* *42*, 254); *29*, 93, 391 (1982); *Suppl.* *7*, 120 (1987)

Benzidine — *1*, 80 (1972); *29*, 149, 391 (1982); *Suppl.* *7*, 123 (1987)

Benzidine-based dyes — *Suppl.* *7*, 125 (1987)

Benzo[*b*]fluoranthene — *3*, 69 (1973); *32*, 147 (1983); *Suppl.* *7*, 58 (1987)

Benzo[*j*]fluoranthene — *3*, 82 (1973); *32*, 155 (1983); *Suppl.* *7*, 58 (1987)

Benzo[*k*]fluoranthene — *32*, 163 (1983); *Suppl.* *7*, 58 (1987)

Benzo[*ghi*]fluoranthene — *32*, 171 (1983); *Suppl.* *7*, 58 (1987)

Benzo[*a*]fluorene — *32*, 177 (1983); *Suppl.* *7*, 58 (1987)

Benzo[*b*]fluorene — *32*, 183 (1983); *Suppl.* *7*, 58 (1987)

Benzo[*c*]fluorene — *32*, 189 (1983); *Suppl.* *7*, 58 (1987)

Benzo[*ghi*]perylene — *32*, 195 (1983); *Suppl.* *7*, 58 (1987)

Benzo[*c*]phenanthrene — *32*, 205 (1983); *Suppl.* *7*, 58 (1987)

Benzo[*a*]pyrene — *3*, 91 (1973); *32*, 211 (1983); *Suppl.* *7*, 58 (1987)

Benzo[*e*]pyrene — *3*, 137 (1973); *32*, 225 (1983); *Suppl.* *7*, 58 (1987)

para-Benzoquinone dioxime — *29*, 185 (1982); *Suppl.* *7*, 58 (1987)

Benzotrichloride (*see also* α-Chlorinated toluenes) — *29*, 73 (1982); *Suppl.* *7*, 148 (1987)

Benzoyl chloride — *29*, 83 (1982) (*corr.* *42*, 261); *Suppl.* *7*, 126 (1987)

Benzoyl peroxide — *36*, 267 (1985); *Suppl.* *7*, 58 (1987)

Benzyl acetate — *40*, 109 (1986); *Suppl.* *7*, 58 (1987)

Benzyl chloride (*see also* α-Chlorinated toluenes) — *11*, 217 (1976) (*corr.* *42*, 256); *29*, 49 (1982); *Suppl.* *7*, 148 (1987)

Benzyl violet 4B — *16*, 153 (1978); *Suppl.* *7*, 58 (1987)

Bertrandite (*see* Beryllium and beryllium compounds)

Beryllium and beryllium compounds — *1*, 17 (1972); *23*, 143 (1980) (*corr.* *42*, 260); *Suppl.* *7*, 127 (1987)

Beryllium acetate (*see* Beryllium and beryllium compounds)

Beryllium acetate, basic (*see* Beryllium and beryllium compounds)

Beryllium-aluminium alloy (*see* Beryllium and beryllium compounds)

Beryllium carbonate (*see* Beryllium and beryllium compounds)

Beryllium chloride (*see* Beryllium and beryllium compounds)

Beryllium-copper alloy (*see* Beryllium and beryllium compounds)

Beryllium-copper-cobalt alloy (*see* Beryllium and beryllium compounds)

Beryllium fluoride (*see* Beryllium and beryllium compounds)

Beryllium hydroxide (*see* Beryllium and beryllium compounds)

Beryllium-nickel alloy (*see* Beryllium and beryllium compounds)

Beryllium oxide (*see* Beryllium and beryllium compounds)

Beryllium phosphate (*see* Beryllium and beryllium compounds)

Beryllium silicate (*see* Beryllium and beryllium compounds)
Beryllium sulphate (*see* Beryllium and beryllium compounds)
Beryl ore (*see* Beryllium and beryllium compounds) — *37*, 141 (1985); *Suppl.* 7, 128 (1987)
Betel quid
Betel-quid chewing (*see* Betel quid)
BHA (*see* Butylated hydroxyanisole) — 9, 55 (1975); *Suppl.* 7, 58 (1987)
BHT (*see* Butylated hydroxytoluene) — 9, 117 (1975); *Suppl.* 7, 58 (1987)
Bis(1-aziridinyl)morpholinophosphine sulphide — 4, 219 (1974) (*corr.* 42, 253); *Suppl.* 7, 130 (1987)
Bis(2-chloroethyl)ether — 26, 79 (1981); *Suppl.* 7, 150 (1987)
N,N-Bis(2-chloroethyl)-2-naphthylamine — 15, 31 (1977); *Suppl.* 7, 58 (1987)
Bischloroethyl nitrosourea (*see also* Chloroethyl nitrosoureas) — 15, 37 (1977); *Suppl.* 7, 58 (1987)
1,2-Bis(chloromethoxy)ethane — 4, 231 (1974) (*corr.* 42, 253); *Suppl.* 7, 131 (1987)
1,4-Bis(chloromethoxymethyl)benzene — 41, 149 (1986); *Suppl.* 7, 59 (1987)
Bis(chloromethyl)ether — 47, 231 (1989)
Bis(2-chloro-1-methylethyl)ether — 35, 39 (1985); *Suppl.* 7, 133 (1987)
Bis(2,3-epoxycyclopentyl)ether — 26, 97 (1981); *Suppl.* 7, 134 (1987)
Bitumens — 16, 163 (1978); *Suppl.* 7, 59 (1987)
Bleomycins — 25, 249 (1981); *Suppl.* 7, 232 (1987)
Blue VRS — 40, 47 (1986); *Suppl.* 7, 135 (1987)
Boot and shoe manufacture and repair — 16, 171 (1978) (*corr.* 42, 257); *Suppl.* 7, 59 (1987)
Bracken fern — 39, 155 (1986) (*corr.* 42, 264); *Suppl.* 7, 136 (1987)
Brilliant Blue FCF — 4, 247 (1974); *Suppl.* 7, 137 (1987)
1,3-Butadiene — 39, 67 (1986); *Suppl.* 7, 59 (1987)
1,4-Butanediol dimethanesulphonate — 40, 123 (1986); *Suppl.* 7, 59 (1987)
n-Butyl acrylate — 40, 161 (1986); *Suppl.* 7, 59 (1987)
Butylated hydroxyanisole — 29, 193 (1982) (*corr.* 42, 261); *Suppl.* 7, 59 (1987)
Butylated hydroxytoluene — 11, 225 (1976); *Suppl.* 7, 59 (1987)
Butyl benzyl phthalate — 11, 231 (1976); *Suppl.* 7, 59 (1987)
β-Butyrolactone
γ-Butyrolactone

C

Cabinet-making (*see* Furniture and cabinet-making)
Cadmium acetate (*see* Cadmium and cadmium compounds)
Cadmium and cadmium compounds — 2, 74 (1973); *11*, 39 (1976) (*corr.* 42, 255); *Suppl.* 7, 139 (1987)
Cadmium chloride (*see* Cadmium and cadmium compounds)
Cadmium oxide (*see* Cadmium and cadmium compounds)

Cadmium sulphate (*see* Cadmium and cadmium compounds)	
Cadmium sulphide (*see* Cadmium and cadmium compounds)	
Calcium arsenate (*see* Arsenic and arsenic compounds)	
Calcium chromate (*see* Chromium and chromium compounds)	
Calcium cyclamate (*see* Cyclamates)	
Calcium saccharin (*see* Saccharin)	
Cantharidin	*10*, 79 (1976); *Suppl. 7*, 59 (1987)
Caprolactam	*19*, 115 (1979) (*corr. 42*, 258); *39*, 247 (1986) (*corr. 42*, 264); *Suppl. 7*, 390 (1987)
Captan	*30*, 295 (1983); *Suppl. 7*, 59 (1987)
Carbaryl	*12*, 37 (1976); *Suppl. 7*, 59 (1987)
Carbazole	*32*, 239 (1983); *Suppl. 7*, 59 (1987)
3-Carbethoxypsoralen	*40*, 317 (1986); *Suppl. 7*, 59 (1987)
Carbon blacks	*3*, 22 (1973); *33*, 35 (1984); *Suppl. 7*, 142 (1987)
Carbon tetrachloride	*1*, 53 (1972); *20*, 371 (1979); *Suppl. 7*, 143 (1987)
Carmoisine	*8*, 83 (1975); *Suppl. 7*, 59 (1987)
Carpentry and joinery	*25*, 139 (1981); *Suppl. 7*, 378 (1987)
Carrageenan	*10*, 181 (1976) (*corr. 42*, 255); *31*, 79 (1983); *Suppl. 7*, 59 (1987)
Catechol	*15*, 155 (1977); *Suppl. 7*, 59 (1987)
CCNU (*see* 1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea)	
Ceramic fibres (*see* Man-made mineral fibres)	
Chemotherapy, combined, including alkylating agents (*see* MOPP and other combined chemotherapy including alkylating agents)	
Chlorambucil	*9*, 125 (1975); *26*, 115 (1981); *Suppl. 7*, 144 (1987)
Chloramphenicol	*10*, 85 (1976); *Suppl. 7*, 145 (1987)
Chlorendic acid	*48*, 45 (1990)
Chlordane (*see also* Chlordane/Heptachlor)	*20*, 45 (1979) (*corr. 42*, 258)
Chlordane/Heptachlor	*Suppl. 7*, 146 (1987)
Chlordecone	*20*, 67 (1979); *Suppl. 7*, 59 (1987)
Chlordimeform	*30*, 61 (1983); *Suppl. 7*, 59 (1987)
Chlorinated dibenzodioxins (other than TCDD)	*15*, 41 (1977); *Suppl. 7*, 59 (1987)
Chlorinated paraffins	*48*, 55 (1990)
α-Chlorinated toluenes	*Suppl. 7*, 148 (1987)
Chlormadinone acetate (*see also* Progestins; Combined oral contraceptives)	*6*, 149 (1974); *21*, 365 (1979)
Chlornaphazine (*see N,N*-Bis(2-chloroethyl)-2-naphthylamine)	
Chlorobenzilate	*5*, 75 (1974); *30*, 73 (1983); *Suppl. 7*, 60 (1987)
Chlorodifluoromethane	*41*, 237 (1986); *Suppl. 7*, 149 (1987)

1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (*see also* Chloroethyl nitrosoureas) — *26*, 137 (1981) (*corr.* *42*, 260); *Suppl.* *7*, 150 (1987)
1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (*see also* Chloroethyl nitrosoureas) — *Suppl.* *7*, 150 (1987)
Chloroethyl nitrosoureas — *Suppl.* *7*, 150 (1987)
Chlorofluoromethane — *41*, 229 (1986); *Suppl.* *7*, 60 (1987)
Chloroform — *1*, 61 (1972); *20*, 401 (1979); *Suppl.* *7*, 152 (1987)

Chloromethyl methyl ether (technical-grade) (*see also* Bis(chloromethyl)ether) — *4*, 239 (1974)
(4-Chloro-2-methylphenoxy)acetic acid (*see* MCPA)
Chlorophenols — *Suppl.* *7*, 154 (1987)
Chlorophenols (occupational exposures to) — *41*, 319 (1986)
Chlorophenoxy herbicides — *Suppl.* *7*, 156 (1987)
Chlorophenoxy herbicides (occupational exposures to) — *41*, 357 (1986)
4-Chloro-*ortho*-phenylenediamine — *27*, 81 (1982); *Suppl.* *7*, 60 (1987)
4-Chloro-*meta*-phenylenediamine — *27*, 82 (1982); *Suppl.* *7*, 60 (1987)
Chloroprene — *19*, 131 (1979); *Suppl.* *7*, 160 (1987)
Chloropropham — *12*, 55 (1976); *Suppl.* *7*, 60 (1987)
Chloroquine — *13*, 47 (1977); *Suppl.* *7*, 60 (1987)
Chlorothalonil — *30*, 319 (1983); *Suppl.* *7*, 60 (1987)
para-Chloro-*ortho*-toluidine and its strong acid salts (*see also* Chlordimeform) — *16*, 277 (1978); *30*, 65 (1983); *Suppl.* *7*, 60 (1987); *48*, 123 (1990)
Chlorotrianisene (*see also* Nonsteroidal oestrogens) — *21*, 139 (1979)
2-Chloro-1,1,1-trifluoroethane — *41*, 253 (1986); *Suppl.* *7*, 60 (1987)
Cholesterol — *10*, 99 (1976); *31*, 95 (1983); *Suppl.* *7*, 161 (1987)

Chromic acetate (*see* Chromium and chromium compounds)
Chromic chloride (*see* Chromium and chromium compounds)
Chromic oxide (*see* Chromium and chromium compounds)
Chromic phosphate (*see* Chromium and chromium compounds)
Chromite ore (*see* Chromium and chromium compounds)
Chromium and chromium compounds — *2*, 100 (1973); *23*, 205 (1980); *Suppl.* *7*, 165 (1987)

Chromium carbonyl (*see* Chromium and chromium compounds)
Chromium potassium sulphate (*see* Chromium and chromium compounds)
Chromium sulphate (*see* Chromium and chromium compounds)
Chromium trioxide (*see* Chromium and chromium compounds)
Chrysene — *3*, 159 (1973); *32*, 247 (1983); *Suppl.* *7*, 60 (1987)

Chrysoidine — *8*, 91 (1975); *Suppl.* *7*, 169 (1987)
Chrysotile (*see* Asbestos)
CI Disperse Yellow 3 — *8*, 97 (1975); *Suppl.* *7*, 60 (1987)

Cinnamyl anthranilate	*16*, 287 (1978); *31*, 133 (1983); *Suppl. 7*, 60 (1987)
Cisplatin	*26*, 151 (1981); *Suppl. 7*, 170 (1987)
Citrinin	*40*, 67 (1986); *Suppl. 7*, 60 (1987)
Citrus Red No. 2	*8*, 101 (1975) (*corr. 42*, 254); *Suppl. 7*, 60 (1987)
Clofibrate	*24*, 39 (1980); *Suppl. 7*, 171 (1987)
Clomiphene citrate	*21*, 551 (1979); *Suppl. 7*, 172 (1987)
Coal gasification	*34*, 65 (1984); *Suppl. 7*, 173 (1987)
Coal-tar pitches (*see also* Coal-tars)	*Suppl. 7*, 174 (1987)
Coal-tars	*35*, 83 (1985); *Suppl. 7*, 175 (1987)
Cobalt-chromium alloy (*see* Chromium and chromium compounds)	
Coke production	*34*, 101 (1984); *Suppl. 7*, 176 (1987)
Combined oral contraceptives (*see also* Oestrogens, progestins and combinations)	*Suppl. 7*, 297 (1987)
Conjugated oestrogens (*see also* Steroidal oestrogens)	*21*, 147 (1979)
Contraceptives, oral (*see* Combined oral contraceptives; Sequential oral contraceptives)	
Copper 8-hydroxyquinoline	*15*, 103 (1977); *Suppl. 7*, 61 (1987)
Coronene	*32*, 263 (1983); *Suppl. 7*, 61 (1987)
Coumarin	*10*, 113 (1976); *Suppl. 7*, 61 (1987)
Creosotes (*see also* Coal-tars)	*Suppl. 7*, 177 (1987)
meta-Cresidine	*27*, 91 (1982); *Suppl. 7*, 61 (1987)
para-Cresidine	*27*, 92 (1982); *Suppl. 7*, 61 (1987)
Crocidolite (*see* Asbestos)	
Crude oil	*45*, 119 (1989)
Crystalline silica (*see also* Silica)	*Suppl. 7*, 341 (1987)
Cycasin	*1*, 157 (1972) (*corr. 42*, 251); *10*, 121 (1976); *Suppl. 7*, 61 (1987)
Cyclamates	*22*, 55 (1980); *Suppl. 7*, 178 (1987)
Cyclamic acid (*see* Cyclamates)	
Cyclochlorotine	*10*, 139 (1976); *Suppl. 7*, 61 (1987)
Cyclohexanone	*47*, 157 (1989)
Cyclohexylamine (*see* Cyclamates)	
Cyclopenta[*cd*]pyrene	*32*, 269 (1983); *Suppl. 7*, 61 (1987)
Cyclopropane (*see* Anaesthetics, volatile)	
Cyclophosphamide	*9*, 135 (1975); *26*, 165 (1981); *Suppl. 7*, 182 (1987)

D

2,4-D (*see also* Chlorophenoxy herbicides; Chlorophenoxy herbicides, occupational exposures to)	*15*, 111 (1977)
Dacarbazine	*26*, 203 (1981); *Suppl. 7*, 184 (1987)

D & C Red No. 9	*8*, 107 (1975); *Suppl.* 7, 61 (1987)
Dapsone	*24*, 59 (1980); *Suppl.* 7, 185 (1987)
Daunomycin	*10*, 145 (1976); *Suppl.* 7, 61 (1987)
DDD (*see* DDT)	
DDE (*see* DDT)	
DDT	*5*, 83 (1974) (*corr.* *42*, 253); *Suppl.* 7, 186 (1987)
Decabromodiphenyl oxide	*48*, 73 (1990)
Diacetylaminoazotoluene	*8*, 113 (1975); *Suppl.* 7, 61 (1987)
N,N'-Diacetylbenzidine	*16*, 293 (1978); *Suppl.* 7, 61 (1987)
Diallate	*12*, 69 (1976); *30*, 235 (1983); *Suppl.* 7, 61 (1987)
2,4-Diaminoanisole	*16*, 51 (1978); *27*, 103 (1982); *Suppl.* 7, 61 (1987)
4,4'-Diaminodiphenyl ether	*16*, 301 (1978); *29*, 203 (1982); *Suppl.* 7, 61 (1987)
1,2-Diamino-4-nitrobenzene	*16*, 63 (1978); *Suppl.* 7, 61 (1987)
1,4-Diamino-2-nitrobenzene	*16*, 73 (1978); *Suppl.* 7, 61 (1987)
2,6-Diamino-3-(phenylazo)pyridine (*see* Phenazopyridine hydrochloride)	
2,4-Diaminotoluene (*see also* Toluene diisocyanates)	*16*, 83 (1978); *Suppl.* 7, 61 (1987)
2,5-Diaminotoluene (*see also* Toluene diisocyanates)	*16*, 97 (1978); *Suppl.* 7, 61 (1987)
ortho-Dianisidine (*see* 3,3'-Dimethoxybenzidine)	
Diazepam	*13*, 57 (1977); *Suppl.* 7, 189 (1987)
Diazomethane	*7*, 223 (1974); *Suppl.* 7, 61 (1987)
Dibenz[*a,h*]acridine	*3*, 247 (1973); *32*, 277 (1983); *Suppl.* 7, 61 (1987)
Dibenz[*a,j*]acridine	*3*, 254 (1973); *32*, 283 (1983); *Suppl.* 7, 61 (1987)
Dibenz[*a,c*]anthracene	*32*, 289 (1983) (*corr.* *42*, 262); *Suppl.* 7, 61 (1987)
Dibenz[*a,h*]anthracene	*3*, 178 (1973) (*corr.* *43*, 261); *32*, 299 (1983); *Suppl.* 7, 61 (1987)
Dibenz[*a,j*]anthracene	*32*, 309 (1983); *Suppl.* 7, 61 (1987)
7*H*-Dibenzo[*c,g*]carbazole	*3*, 260 (1973); *32*, 315 (1983); *Suppl.* 7, 61 (1987)
Dibenzodioxins, chlorinated (other than TCDD) (*see* Chlorinated dibenzodioxins (other than TCDD))	
Dibenzo[*a,e*]fluoranthene	*32*, 321 (1983); *Suppl.* 7, 61 (1987)
Dibenzo[*h,rst*]pentaphene	*3*, 197 (1973); *Suppl.* 7, 62 (1987)
Dibenzo[*a,e*]pyrene	*3*, 201 (1973); *32*, 327 (1983); *Suppl.* 7, 62 (1987)
Dibenzo[*a,h*]pyrene	*3*, 207 (1973); *32*, 331 (1983); *Suppl.* 7, 62 (1987)

Dibenzo[*a,i*]pyrene	*3*, 215 (1973); *32*, 337 (1983); *Suppl.* 7, 62 (1987)
Dibenzo[*a,l*]pyrene	*3*, 224 (1973); *32*, 343 (1983); *Suppl.* 7, 62 (1987)
1,2-Dibromo-3-chloropropane	*15*, 139 (1977); *20*, 83 (1979); *Suppl.* 7, 191 (1987)
Dichloroacetylene	*39*, 369 (1986); *Suppl.* 7, 62 (1987)
ortho-Dichlorobenzene	*7*, 231 (1974); *29*, 213 (1982); *Suppl.* 7, 192 (1987)
para-Dichlorobenzene	*7*, 231 (1974); *29*, 215 (1982); *Suppl.* 7, 192 (1987)
3,3′-Dichlorobenzidine	*4*, 49 (1974); *29*, 239 (1982); *Suppl.* 7, 193 (1987)
trans-1,4-Dichlorobutene	*15*, 149 (1977); *Suppl.* 7, 62 (1987)
3,3′-Dichloro-4,4′-diaminodiphenyl ether	*16*, 309 (1978); *Suppl.* 7, 62 (1987)
1,2-Dichloroethane	*20*, 429 (1979); *Suppl.* 7, 62 (1987)
Dichloromethane	*20*, 449 (1979); *41*, 43 (1986); *Suppl.* 7, 194 (1987)
2,4-Dichlorophenol (*see* Chlorophenols; Chlorophenols, occupational exposures to)	
(2,4-Dichlorophenoxy)acetic acid (*see* 2,4-D)	
2,6-Dichloro-*para*-phenylenediamine	*39*, 325 (1986); *Suppl.* 7, 62 (1987)
1,2-Dichloropropane	*41*, 131 (1986); *Suppl.* 7, 62 (1987)
1,3-Dichloropropene (technical-grade)	*41*, 113 (1986); *Suppl.* 7, 195 (1987)
Dichlorvos	*20*, 97 (1979); *Suppl.* 7, 62 (1987)
Dicofol	*30*, 87 (1983); *Suppl.* 7, 62 (1987)
Dicyclohexylamine (*see* Cyclamates)	
Dieldrin	*5*, 125 (1974); *Suppl.* 7, 196 (1987)
Dienoestrol (*see also* Nonsteroidal oestrogens)	*21*, 161 (1979)
Diepoxybutane	*11*, 115 (1976) (*corr.* *42*, 255); *Suppl.* 7, 62 (1987)
Diesel and gasoline engine exhausts	*46*, 41 (1989)
Diesel fuels	*45*, 219 (1989) (*corr.* *47*, 505)
Diethyl ether (*see* Anaesthetics, volatile)	
Di(2-ethylhexyl)adipate	*29*, 257 (1982); *Suppl.* 7, 62 (1987)
Di(2-ethylhexyl)phthalate	*29*, 269 (1982) (*corr.* *42*, 261); *Suppl.* 7, 62 (1987)
1,2-Diethylhydrazine	*4*, 153 (1974); *Suppl.* 7, 62 (1987)
Diethylstilboestrol	*6*, 55 (1974); *21*, 173 (1979) (*corr.* *42*, 259); *Suppl.* 7, 273 (1987)
Diethylstilboestrol dipropionate (*see* Diethylstilboestrol)	
Diethyl sulphate	*4*, 277 (1974); *Suppl.* 7, 198 (1987)
Diglycidyl resorcinol ether	*11*, 125 (1976); *36*, 181 (1985); *Suppl.* 7, 62 (1987)

Dihydrosafrole	*1*, 170 (1972); *10*, 233 (1976); *Suppl.* 7, 62 (1987)
Dihydroxybenzenes (*see* Catechol; Hydroquinone; Resorcinol)	
Dihydroxymethylfuratrizine	*24*, 77 (1980); *Suppl.* 7, 62 (1987)
Dimethisterone (*see also* Progestins: Sequential oral contraceptives)	*6*, 167 (1974); *21*, 377 (1979)
Dimethoxane	*15*, 177 (1977); *Suppl.* 7, 62 (1987)
3,3′-Dimethoxybenzidine	*4*, 41 (1974); *Suppl.* 7, 198 (1987)
3,3′-Dimethoxybenzidine-4,4′-diisocyanate	*39*, 279 (1986); *Suppl.* 7, 62 (1987)
para-Dimethylaminoazobenzene	*8*, 125 (1975); *Suppl.* 7, 62 (1987)
para-Dimethylaminoazobenzenediazo sodium sulphonate	*8*, 147 (1975); *Suppl.* 7, 62 (1987)
trans-2-[(Dimethylamino)methylimino]-5-[2-(5-nitro-2-furyl)-vinyl]-1,3,4-oxadiazole	*7*, 147 (1974) (*corr.* *42*, 253); *Suppl.* 7, 62 (1987)
4,4′-Dimethylangelicin plus ultraviolet radiation (*see also* Angelicin and some synthetic derivatives)	*Suppl.* 7, 57 (1987)
4,5′-Dimethylangelicin plus ultraviolet radiation (*see also* Angelicin and some synthetic derivatives)	*Suppl.* 7, 57 (1987)
Dimethylarsinic acid (*see* Arsenic and arsenic compounds)	
3,3′-Dimethylbenzidine	*1*, 87 (1972); *Suppl.* 7, 62 (1987)
Dimethylcarbamoyl chloride	*12*, 77 (1976); *Suppl.* 7, 199 (1987)
Dimethylformamide	*47*, 171 (1989)
1,1-Dimethylhydrazine	*4*, 137 (1974); *Suppl.* 7, 62 (1987)
1,2-Dimethylhydrazine	*4*, 145 (1974) (*corr.* *42*, 253); *Suppl.* 7, 62 (1987)
Dimethyl hydrogen phosphite	*48*, 85 (1990)
1,4-Dimethylphenanthrene	*32*, 349 (1983); *Suppl.* 7, 62 (1987)
Dimethyl sulphate	*4*, 271 (1974); *Suppl.* 7, 200 (1987)
3,7-Dinitrofluoranthene	*46*, 189 (1989)
3,9-Dinitrofluoranthene	*46*, 195 (1989)
1,3-Dinitropyrene	*46*, 201 (1989)
1,6-Dinitropyrene	*46*, 215 (1989)
1,8-Dinitropyrene	*33*, 171 (1984); *Suppl.* 7, 63 (1987); *46*, 231 (1989)
Dinitrosopentamethylenetetramine	*11*, 241 (1976); *Suppl.* 7, 63 (1987)
1,4-Dioxane	*11*, 247 (1976); *Suppl.* 7, 201 (1987)
2,4′-Diphenylidiamine	*16*, 313 (1978); *Suppl.* 7, 63 (1987)
Direct Black 38 (*see also* Benzidine-based dyes)	*29*, 295 (1982) (*corr.* *42*, 261)
Direct Blue 6 (*see also* Benzidine-based dyes)	*29*, 311 (1982)
Direct Brown 95 (*see also* Benzidine-based dyes)	*29*, 321 (1982)
Disperse Blue 1	*48*, 139 (1990)
Disperse Yellow 3	*48*, 149 (1990)
Disulfiram	*12*, 85 (1976); *Suppl.* 7, 63 (1987)
Dithranol	*13*, 75 (1977); *Suppl.* 7, 63 (1987)
Divinyl ether (*see* Anaesthetics, volatile)	

Dulcin — *12*, 97 (1976); *Suppl. 7*, 63 (1987)

E

Endrin — *5*, 157 (1974); *Suppl. 7*, 63 (1987)
Enflurane (*see* Anaesthetics, volatile)
Eosin — *15*, 183 (1977); *Suppl. 7*, 63 (1987)
Epichlorohydrin — *11*, 131 (1976) (*corr. 42*, 256); *Suppl. 7*, 202 (1987)
1,2-Epoxybutane — *47*, 217 (1989)
1-Epoxyethyl-3,4-epoxycyclohexane — *11*, 141 (1976); *Suppl. 7*, 63 (1987)
3,4-Epoxy-6-methylcyclohexylmethyl-3,4-epoxy-6-methylcyclohexane carboxylate — *11*, 147 (1976); *Suppl. 7*, 63 (1987)
cis-9,10-Epoxystearic acid — *11*, 153 (1976); *Suppl. 7*, 63 (1987)
Erionite — *42*, 225 (1987); *Suppl. 7*, 203 (1987)
Ethinyloestradiol (*see also* Steroidal oestrogens) — *6*, 77 (1974); *21*, 233 (1979)
Ethionamide — *13*, 83 (1977); *Suppl. 7*, 63 (1987)
Ethyl acrylate — *19*, 57 (1979); *39*, 81 (1986); *Suppl. 7*, 63 (1987)
Ethylene — *19*, 157 (1979); *Suppl. 7*, 63 (1987)
Ethylene dibromide — *15*, 195 (1977); *Suppl. 7*, 204 (1987)
Ethylene oxide — *11*, 157 (1976); *36*, 189 (1985) (*corr. 42*, 263); *Suppl. 7*, 205 (1987)
Ethylene sulphide — *11*, 257 (1976); *Suppl. 7*, 63 (1987)
Ethylene thiourea — *7*, 45 (1974); *Suppl. 7*, 207 (1987)
Ethyl methanesulphonate — *7*, 245 (1974); *Suppl. 7*, 63 (1987)
N-Ethyl-*N*-nitrosourea — *1*, 135 (1972); *17*, 191 (1978); *Suppl. 7*, 63 (1987)
Ethyl selenac (*see also* Selenium and selenium compounds) — *12*, 107 (1976); *Suppl. 7*, 63 (1987)
Ethyl tellurac — *12*, 115 (1976); *Suppl. 7*, 63 (1987)
Ethynodiol diacetate (*see also* Progestins; Combined oral contraceptives) — *6*, 173 (1974); *21*, 387 (1979)
Eugenol — *36*, 75 (1985); *Suppl. 7*, 63 (1987)
Evans blue — *8*, 151 (1975); *Suppl. 7*, 63 (1987)

F

Fast Green FCF — *16*, 187 (1978); *Suppl. 7*, 63 (1987)
Ferbam — *12*, 121 (1976) (*corr. 42*, 256); *Suppl. 7*, 63 (1987)
Ferric oxide — *1*, 29 (1972); *Suppl. 7*, 216 (1987)
Ferrochromium (*see* Chromium and chromium compounds)
Fluometuron — *30*, 245 (1983); *Suppl. 7*, 63 (1987)
Fluoranthene — *32*, 355 (1983); *Suppl. 7*, 63 (1987)

	32, 365 (1983); *Suppl.* 7, 63 (1987)
Fluorene	27, 237 (1982); *Suppl.* 7, 208 (1987)
Fluorides (inorganic, used in drinking-water)	26, 217 (1981); *Suppl.* 7, 210 (1987)
5-Fluorouracil	
Fluorspar (*see* Fluorides)	
Fluosilicic acid (*see* Fluorides)	
Fluroxene (*see* Anaesthetics, volatile)	
Formaldehyde	29, 345 (1982); *Suppl.* 7, 211 (1987)
2-(2-Formylhydrazino)-4-(5-nitro-2-furyl)thiazole	7, 151 (1974) (*corr.* 42, 253); *Suppl.* 7, 63 (1987)
	45, 239 (1989) (*corr.* 47, 505)
Fuel oils (heating oils)	31, 141 (1983); *Suppl.* 7, 63 (1987)
Furazolidone	25, 99 (1981); *Suppl.* 7, 280 (1987)
Furniture and cabinet-making	
2-(2-Furyl)-3-(5-nitro-2-furyl)acrylamide (*see* AF-2)	
Fusarenon-X	11, 169 (1976); 31, 153 (1983); *Suppl.* 7, 64 (1987)

G

Gasoline	45, 159 (1989) (*corr.* 47, 505)
Gasoline engine exhaust (*see* Diesel and gasoline engine exhausts)	
Glass fibres (*see* Man-made mineral fibres)	
Glasswool (*see* Man-made mineral fibres)	
Glass filaments (*see* Man-made mineral fibres)	
Glu-P-1	40, 223 (1986); *Suppl.* 7, 64 (1987)
Glu-P-2	40, 235 (1986); *Suppl.* 7, 64 (1987)
L-Glutamic acid, 5-[2-(4-hydroxymethyl)phenylhydrazide] (*see* Agaratine)	11, 175 (1976); *Suppl.* 7, 64 (1987)
Glycidaldehyde	47, 237 (1989)
Some glycidyl ethers	11, 183 (1976); *Suppl.* 7, 64 (1987)
Glycidyl oleate	11, 187 (1976); *Suppl.* 7, 64 (1987)
Glycidyl stearate	10, 153 (1976); *Suppl.* 7, 391 (1987)
Griseofulvin	16, 199 (1978); *Suppl.* 7, 64 (1987)
Guinea Green B	31, 163 (1983); *Suppl.* 7, 391 (1987)
Gyromitrin	

H

Haematite	1, 29 (1972); *Suppl.* 7, 216 (1987)
Haematite and ferric oxide	*Suppl.* 7, 216 (1987)
Haematite mining, underground, with exposure to radon	1, 29 (1972); *Suppl.* 7, 216 (1987)
Hair dyes, epidemiology of	16, 29 (1978); 27, 307 (1982)
Halothane (*see* Anaesthetics, volatile)	
α-HCH (*see* Hexachlorocyclohexanes)	
β-HCH (*see* Hexachlorocyclohexanes)	

γ-HCH (*see* Hexachlorocyclohexanes)
Heating oils (*see* Fuel oils)
Heptachlor (*see also* Chlordane/Heptachlor) *5*, 173 (1974); *20*, 129 (1979)
Hexachlorobenzene *20*, 155 (1979); *Suppl. 7*, 219 (1987)
Hexachlorobutadiene *20*, 179 (1979); *Suppl. 7*, 64 (1987)
Hexachlorocyclohexanes *5*, 47 (1974); *20*, 195 (1979) (*corr. 42*, 258); *Suppl. 7*, 220 (1987)

Hexachlorocyclohexane, technical-grade (*see* Hexachlorocyclohexanes)
Hexachloroethane *20*, 467 (1979); *Suppl. 7*, 64 (1987)
Hexachlorophene *20*, 241 (1979); *Suppl. 7*, 64 (1987)
Hexamethylphosphoramide *15*, 211 (1977); *Suppl. 7*, 64 (1987)
Hexoestrol (*see* Nonsteroidal oestrogens)
Hycanthone mesylate *13*, 91 (1977); *Suppl. 7*, 64 (1987)
Hydralazine *24*, 85 (1980); *Suppl. 7*, 222 (1987)
Hydrazine *4*, 127 (1974); *Suppl. 7*, 223 (1987)
Hydrogen peroxide *36*, 285 (1985); *Suppl. 7*, 64 (1987)
Hydroquinone *15*, 155 (1977); *Suppl. 7*, 64 (1987)
4-Hydroxyazobenzene *8*, 157 (1975); *Suppl. 7*, 64 (1987)
17α-Hydroxyprogesterone caproate (*see also* Progestins) *21*, 399 (1979) (*corr. 42*, 259)
8-Hydroxyquinoline *13*, 101 (1977); *Suppl. 7*, 64 (1987)
8-Hydroxysenkirkine *10*, 265 (1976); *Suppl. 7*, 64 (1987)

I

Indeno[1,2,3-*cd*]pyrene *3*, 229 (1973); *32*, 373 (1983); *Suppl. 7*, 64 (1987)

IQ *40*, 261 (1986); *Suppl. 7*, 64 (1987)
Iron and steel founding *34*, 133 (1984); *Suppl. 7*, 224 (1987)
Iron-dextran complex *2*, 161 (1973); *Suppl. 7*, 226 (1987)
Iron-dextrin complex *2*, 161 (1973) (*corr. 42*, 252); *Suppl. 7*, 64 (1987)

Iron oxide (*see* Ferric oxide)
Iron oxide, saccharated (*see* Saccharated iron oxide)
Iron sorbitol-citric acid complex *2*, 161 (1973); *Suppl. 7*, 64 (1987)
Isatidine *10*, 269 (1976); *Suppl. 7*, 65 (1987)
Isoflurane (*see* Anaesthetics, volatile)
Isoniazid (*see* Isonicotinic acid hydrazide)
Isonicotinic acid hydrazide *4*, 159 (1974); *Suppl. 7*, 227 (1987)
Isophosphamide *26*, 237 (1981); *Suppl. 7*, 65 (1987)
Isopropyl alcohol *15*, 223 (1977); *Suppl. 7*, 229 (1987)
Isopropyl alcohol manufacture (strong-acid process) (*see also* Isopropyl alcohol) *Suppl. 7*, 229 (1987)
Isopropyl oils *15*, 223 (1977); *Suppl. 7*, 229 (1987)
Isosafrole *1*, 169 (1972); *10*, 232 (1976); *Suppl. 7*, 65 (1987)

J

Jacobine — *10*, 275 (1976); *Suppl.* 7, 65 (1987)
Jet fuel — *45*, 203 (1989)
Joinery (*see* Carpentry and joinery)

K

Kaempferol — 31, 171 (1983); *Suppl.* 7, 65 (1987)
Kepone (*see* Chlordecone)

L

Lasiocarpine — *10*, 281 (1976); *Suppl.* 7, 65 (1987)
Lauroyl peroxide — *36*, 315 (1985); Suppl. 7, 65 (1987)
Lead acetate (*see* Lead and lead compounds)
Lead and lead compounds — *1*, 40 (1972) (*corr.* *42*, 251); 2, 52, 150 (1973); *12*, 131 (1976); 23, 40, 208, 209, 325 (1980); *Suppl.* 7, 230 (1987)
Lead arsenate (*see* Arsenic and arsenic compounds)
Lead carbonate (*see* Lead and lead compounds)
Lead chloride (*see* Lead and lead compounds)
Lead chromate (*see* Chromium and chromium compounds)
Lead chromate oxide (*see* Chromium and chromium compounds)
Lead naphthenate (*see* Lead and lead compounds)
Lead nitrate (*see* Lead and lead compounds)
Lead oxide (*see* Lead and lead compounds)
Lead phosphate (*see* Lead and lead compounds)
Lead subacetate (*see* Lead and lead compounds)
Lead tetroxide (*see* Lead and lead compounds)
Leather goods manufacture — 25, 279 (1981); *Suppl.* 7, 235 (1987)
Leather industries — 25, 199 (1981); *Suppl.* 7, 232 (1987)
Leather tanning and processing — 25, 201 (1981); *Suppl.* 7, 236 (1987)
Ledate (*see also* Lead and lead compounds) — *12*, 131 (1976)
Light Green SF — *16*, 209 (1978); *Suppl.* 7, 65 (1987)
Lindane (*see* Hexachlorocyclohexanes)
The lumber and sawmill industries (including logging) — 25, 49 (1981); *Suppl.* 7, 383 (1987)
Luteoskyrin — *10*, 163 (1976); *Suppl.* 7, 65 (1987)
Lynoestrenol (*see also* Progestins; Combined oral contraceptives) — *21*, 407 (1979)

M

Magenta — *4*, 57 (1974) (*corr.* *42*, 252); *Suppl.* 7, 238 (1987)

Magenta, manufacture of (*see also* Magenta)	*Suppl. 7*, 238 (1987)
Malathion	*30*, 103 (1983); *Suppl. 7*, 65 (1987)
Maleic hydrazide	*4*, 173 (1974) (*corr. 42*, 253); *Suppl. 7*, 65 (1987)
Malonaldehyde	*36*, 163 (1985); *Suppl. 7*, 65 (1987)
Maneb	*12*, 137 (1976); *Suppl. 7*, 65 (1987)
Man-made mineral fibres	*43*, 39 (1988)
Mannomustine	*9*, 157 (1975); *Suppl. 7*, 65 (1987)
MCPA (*see also* Chlorophenoxy herbicides; Chlorophenoxy herbicides, occupational exposures to)	*30*, 255 (1983)
MeA-α-C	*40*, 253 (1986); *Suppl. 7*, 65 (1987)
Medphalan	*9*, 168 (1975); *Suppl. 7*, 65 (1987)
Medroxyprogesterone acetate	*6*, 157 (1974); *21*, 417 (1979) (*corr. 42*, 259); *Suppl. 7*, 289 (1987)
Megestrol acetate (*see* also Progestins; Combined oral contraceptives)	
MeIQ	*40*, 275 (1986); *Suppl. 7*, 65 (1987)
MeIQx	*40*, 283 (1986); *Suppl. 7*, 65 (1987)
Melamine	*39*, 333 (1986); *Suppl. 7*, 65 (1987)
Melphalan	*9*, 167 (1975); *Suppl. 7*, 239 (1987)
6-Mercaptopurine	*26*, 249 (1981); *Suppl. 7*, 240 (1987)
Merphalan	*9*, 169 (1975); *Suppl. 7*, 65 (1987)
Mestranol (*see also* Steroidal oestrogens)	*6*, 87 (1974); *21*, 257 (1979) (*corr. 42*, 259)
Methanearsonic acid, disodium salt (*see* Arsenic and arsenic compounds)	
Methanearsonic acid, monosodium salt (*see* Arsenic and arsenic compounds	
Methotrexate	*26*, 267 (1981); *Suppl. 7*, 241 (1987)
Methoxsalen (*see* 8-Methoxypsoralen)	
Methoxychlor	*5*, 193 (1974); *20*, 259 (1979); *Suppl. 7*, 66 (1987)
Methoxyflurane (*see* Anaesthetics, volatile)	
5-Methoxypsoralen	*40*, 327 (1986); *Suppl. 7*, 242 (1987)
8-Methoxypsoralen (*see also* 8-Methoxypsoralen plus ultraviolet radiation)	*24*, 101 (1980)
8-Methoxypsoralen plus ultraviolet radiation	*Suppl. 7*, 243 (1987)
Methyl acrylate	*19*, 52 (1979); *39*, 99 (1986); *Suppl. 7*, 66 (1987)
5-Methylangelicin plus ultraviolet radiation (*see also* Angelicin and some synthetic derivatives)	*Suppl. 7*, 57 (1987)
2-Methylaziridine	*9*, 61 (1975); *Suppl. 7*, 66 (1987)
Methylazoxymethanol acetate	*1*, 164 (1972); *10*, 131 (1976); *Suppl. 7*, 66 (1987)

Methyl bromide — *41*, 187 (1986) (*corr.* *45*, 283); *Suppl.* *7*, 245 (1987)

Methyl carbamate — *12*, 151 (1976); *Suppl.* *7*, 66 (1987)

Methyl-CCNU [*see* 1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea] — *41*, 161 (1986); *Suppl.* *7*, 246 (1987)

Methyl chloride — *32*, 379 (1983); *Suppl.* *7*, 66 (1987)

1-, 2-, 3-, 4-, 5- and 6-Methylchrysenes — *1*, 141 (1972); *Suppl.* *7*, 66 (1987)

N-Methyl-*N*,4-dinitrosoaniline — *4*, 65 (1974) (*corr.* *42*, 252); *Suppl.* *7*, 246 (1987)

4,4′-Methylene bis(2-chloroaniline) — *27*, 119 (1982); *Suppl.* *7*, 66 (1987)

4,4′-Methylene bis(*N*,*N*-dimethyl)benzenamine — *4*, 73 (1974); *Suppl.* *7*, 248 (1987)

4,4′-Methylene bis(2-methylaniline) — *4*, 79 (1974) (*corr.* *42*, 252); *39*, 347 (1986); *Suppl.* *7*, 66 (1987)

4,4′-Methylenedianiline — *19*, 314 (1979); *Suppl.* *7*, 66 (1987)

4,4′-Methylenediphenyl diisocyanate — *32*, 399 (1983); *Suppl.* *7*, 66 (1987)

2-Methylfluoranthene — *32*, 399 (1983); *Suppl.* *7*, 66 (1987)

3-Methylfluoranthene — *15*, 245 (1977); *41*, 213 (1986); *Suppl.* *7*, 66 (1987)

Methyl iodide — *19*, 187 (1979); *Suppl.* *7*, 66 (1987)

Methyl methacrylate — *7*, 253 (1974); *Suppl.* *7*, 66 (1987)

Methyl methanesulphonate — *27*, 205 (1982); *Suppl.* *7*, 66 (1987)

2-Methyl-1-nitroanthraquinone — *4*, 183 (1974); *Suppl.* *7*, 248 (1987)

N-Methyl-*N*′-nitro-*N*-nitrosoguanidine

3-Methylnitrosaminopropionaldehyde (*see* 3-(*N*-Nitrosomethylamino)propionaldehyde)

3-Methylnitrosaminopropionitrile (*see* 3-(*N*-Nitrosomethylamino)propionitrile)

4-(Methylnitrosamino)-4-(3-pyridyl)-1-butanal (*see* 4-(*N*-Nitrosomethylamino)-4-(3-pyridyl)-1-butanal)

4-(Methylnitrosamino)-1-(3-pyridyl)-1-butanone (*see* 4-(*N*-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone)

N-Methyl-*N*-nitrosourea — *1*, 125 (1972); *17*, 227 (1978); *Suppl.* *7*, 66 (1987)

N-Methyl-*N*-nitrosourethane — *4*, 211 (1974); *Suppl.* *7*, 66 (1987)

Methyl parathion — *30*, 131 (1983); *Suppl.* *7*, 392 (1987)

1-Methylphenanthrene — *32*, 405 (1983); *Suppl.* *7*, 66 (1987)

7-Methylpyrido[3,4-*c*]psoralen — *40*, 349 (1986); *Suppl.* *7*, 71 (1987)

Methyl red — *8*, 161 (1975); *Suppl.* *7*, 66 (1987)

Methyl selenac (*see also* Selenium and selenium compounds) — *12*, 161 (1976); *Suppl.* *7*, 66 (1987)

Methylthiouracil — *7*, 53 (1974); *Suppl.* *7*, 66 (1987)

Metronidazole — *13*, 113 (1977); *Suppl.* *7*, 250 (1987)

Mineral oils — *3*, 30 (1973); *33*, 87 (1984) (*corr.* *42*, 262); *Suppl.* *7*, 252 (1987)

Mirex	*5*, 203 (1974); *20*, 283 (1979) (*corr.* *42*, 258); *Suppl.* *7*, 66 (1987)
Mitomycin C	*10*, 171 (1976); *Suppl.* *7*, 67 (1987)
MNNG (*see* *N*-Methyl-*N'*-nitro-*N*-nitrosoguanidine)	
MOCA (*see* 4,4'-Methylene bis(2-chloroaniline))	
Modacrylic fibres	*19*, 86 (1979); *Suppl.* *7*, 67 (1987)
Monocrotaline	*10*, 291 (1976); *Suppl.* *7*, 67 (1987)
Monuron	*12*, 167 (1976); *Suppl.* *7*, 67 (1987)
MOPP and other combined chemotherapy including alkylating agents	*Suppl.* *7*, 254 (1987)
Morpholine	*47*, 199 (1989)
5-(Morpholinomethyl)-3-[(5-nitrofurfurylidene)amino]-2-oxazolidinone	*7*, 161 (1974); *Suppl.* *7*, 67 (1987)
Mustard gas	*9*, 181 (1975) (*corr.* *42*, 254); *Suppl.* *7*, 259 (1987)
Myleran (*see* 1,4-Butanediol dimethanesulphonate)	

N

Nafenopin	*24*, 125 (1980); *Suppl.* *7*, 67 (1987)
1,5-Naphthalenediamine	*27*, 127 (1982); *Suppl.* *7*, 67 (1987)
1,5-Naphthalene diisocyanate	*19*, 311 (1979); *Suppl.* *7*, 67 (1987)
1-Naphthylamine	*4*, 87 (1974) (*corr.* *42*, 253); *Suppl.* *7*, 260 (1987)
2-Naphthylamine	*4*, 97 (1974); *Suppl.* *7*, 261 (1987)
1-Naphthylthiourea	*30*, 347 (1983); *Suppl.* *7*, 263 (1987)
Nickel acetate (*see* Nickel and nickel compounds)	
Nickel ammonium sulphate (*see* Nickel and nickel compounds)	
Nickel and nickel compounds	*2*, 126 (1973) (*corr.* *42*, 252); *11*, 75 (1976); *Suppl.* *7*, 264 (1987) (*corr.* *45*, 283)
Nickel carbonate (*see* Nickel and nickel compounds)	
Nickel carbonyl (*see* Nickel and nickel compounds)	
Nickel chloride (*see* Nickel and nickel compounds)	
Nickel-gallium alloy (*see* Nickel and nickel compounds)	
Nickel hydroxide (*see* Nickel and nickel compounds)	
Nickelocene (*see* Nickel and nickel compounds)	
Nickel oxide (*see* Nickel and nickel compounds)	
Nickel subsulphide (*see* Nickel and nickel compounds)	
Nickel sulphate (*see* Nickel and nickel compounds)	
Niridazole	*13*, 123 (1977); *Suppl.* *7*, 67 (1987)
Nithiazide	*31*, 179 (1983); *Suppl.* *7*, 67 (1987)
Nitrilotriacetic acid and its salts	*48*, 181 (1990)
5-Nitroacenaphthene	*16*, 319 (1978); *Suppl.* *7*, 67 (1987)
5-Nitro-*ortho*-anisidine	*27*, 133 (1982); *Suppl.* *7*, 67 (1987)

9-Nitroanthracene	*33*, 179 (1984); *Suppl.* 7, 67 (1987)
7-Nitrobenz[*a*]anthracene	*46*, 247 (1989)
6-Nitrobenzo[*a*]pyrene	*33*, 187 (1984); *Suppl.* 7, 67 (1987); *46*, 255 (1989)
4-Nitrobiphenyl	*4*, 113 (1974); *Suppl.* 7, 67 (1987)
6-Nitrochrysene	*33*, 195 (1984); *Suppl.* 7, 67 (1987); *46*, 267 (1989)
Nitrofen (technical-grade)	*30*, 271 (1983); *Suppl.* 7, 67 (1987)
3-Nitrofluoranthene	*33*, 201 (1984); *Suppl.* 7, 67 (1987)
2-Nitrofluorene	*46*, 277 (1989)
5-Nitro-2-furaldehyde semicarbazone	*7*, 171 (1974); *Suppl.* 7, 67 (1987)
1-[(5-Nitrofurfurylidene)amino]-2-imidazolidinone	*7*, 181 (1974); *Suppl.* 7, 67 (1987)
N-[4-(5-Nitro-2-furyl)-2-thiazolyl]acetamide	*1*, 181 (1972); *7*, 185 (1974); *Suppl.* 7, 67 (1987)
Nitrogen mustard	*9*, 193 (1975); *Suppl.* 7, 269 (1987)
Nitrogen mustard *N*-oxide	*9*, 209 (1975); *Suppl.* 7, 67 (1987)
1-Nitronaphthalene	*46*, 291 (1989)
2-Nitronaphthalene	*46*, 303 (1989)
3-Nitroperylene	*46*, 313 (1989)
2-Nitropropane	*29*, 331 (1982); *Suppl.* 7, 67 (1987)
1-Nitropyrene	*33*, 209 (1984); *Suppl.* 7, 67 (1987); *46*, 321 (1989)
2-Nitropyrene	*46*, 359 (1989)
4-Nitropyrene	*46*, 367 (1989)
N-Nitrosatable drugs	*24*, 297 (1980) (*corr.* *42*, 260)
N-Nitrosatable pesticides	*30*, 359 (1983)
N'-Nitrosoanabasine	*37*, 225 (1985); *Suppl.* 7, 67 (1987)
N'-Nitrosoanatabine	*37*, 233 (1985); *Suppl.* 7, 67 (1987)
N-Nitrosodi-*n*-butylamine	*4*, 197 (1974); *17*, 51 (1978); *Suppl.* 7, 67 (1987)
N-Nitrosodiethanolamine	*17*, 77 (1978); *Suppl.* 7, 67 (1987)
N-Nitrosodiethylamine	*1*, 107 (1972) (*corr.* *42*, 251); *17*, 83 (1978) (*corr.* *42*, 257); *Suppl.* 7, 67 (1987)
N-Nitrosodimethylamine	*1*, 95 (1972); *17*, 125 (1978) (*corr.* *42*, 257); *Suppl.* 7, 67 (1987)
N-Nitrosodiphenylamine	*27*, 213 (1982); *Suppl.* 7, 67 (1987)
para-Nitrosodiphenylamine	*27*, 227 (1982) (*corr.* *42*, 261); *Suppl.* 7, 68 (1987)
N-Nitrosodi-*n*-propylamine	*17*, 177 (1978); *Suppl.* 7, 68 (1987)
N-Nitroso-*N*-ethylurea (*see* *N*-Ethyl-*N*-nitrosourea)	
N-Nitrosofolic acid	*17*, 217 (1978); *Suppl.* 7, 68 (1987)
N-Nitrosoguvacine	*37*, 263 (1985); *Suppl.* 7, 68 (1987)
N-Nitrosoguvacoline	*37*, 263 (1985); *Suppl.* 7, 68 (1987)
N-Nitrosohydroxyproline	*17*, 304 (1978); *Suppl.* 7, 68 (1987)

3-(*N*-Nitrosomethylamino)propionaldehyde — *37*, 263 (1985); *Suppl.* *7*, 68 (1987)
3-(*N*-Nitrosomethylamino)propionitrile — *37*, 263 (1985); *Suppl.* *7*, 68 (1987)
4-(*N*-Nitrosomethylamino)-4-(3-pyridyl)-1-butanal — *37*, 205 (1985); *Suppl.* *7*, 68 (1987)
4-(*N*-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone — *37*, 209 (1985); *Suppl.* *7*, 68 (1987)
N-Nitrosomethylethylamine — *17*, 221 (1978); *Suppl.* *7*, 68 (1987)
N-Nitroso-*N*-methylurea (*see* *N*-Methyl-*N*-nitrosourea)
N-Nitroso-*N*-methylurethane (*see* *N*-Methyl-*N*-methylurethane)
N-Nitrosomethylvinylamine — *17*, 257 (1978); *Suppl.* *7*, 68 (1987)
N-Nitrosomorpholine — *17*, 263 (1978); *Suppl.* *7*, 68 (1987)
N'-Nitrosonornicotine — *17*, 281 (1978); *37*, 241 (1985); *Suppl.* *7*, 68 (1987)
N-Nitrosopiperidine — *17*, 287 (1978); *Suppl.* *7*, 68 (1987)
N-Nitrosoproline — *17*, 303 (1978); *Suppl.* *7*, 68 (1987)
N-Nitrosopyrrolidine — *17*, 313 (1978); *Suppl.* *7*, 68 (1987)
N-Nitrososarcosine — *17*, 327 (1978); *Suppl.* *7*, 68 (1987)
Nitrosoureas, chloroethyl (*see* Chloroethyl nitrosoureas)
5-Nitro-*ortho*-toluidine — *48*, 169 (1990)
Nitrous oxide (*see* Anaesthetics, volatile)
Nitrovin — *31*, 185 (1983); *Suppl.* *7*, 68 (1987)
NNA (*see* 4-(*N*-Nitrosomethylamino)-4-(3-pyridyl)-1-butanal)
NNK (*see* 4-(*N*-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone)
Nonsteroidal oestrogens (*see also* Oestrogens, progestins and combinations) — *Suppl.* *7*, 272 (1987)
Norethisterone (*see also* Progestins; Combined oral contraceptives) — *6*, 179 (1974); *21*, 461 (1979)
Norethynodrel (*see also* Progestins; Combined oral contraceptives — *6*, 191 (1974); *21*, 461 (1979) (*corr.* *42*, 259)
Norgestrel (*see also* Progestins, Combined oral contraceptives) — *6*, 201 (1974); *21*, 479 (1979)
Nylon 6 — *19*, 120 (1979); *Suppl.* *7*, 68 (1987)

O

Ochratoxin A — *10*, 191 (1976); *31*, 191 (1983) (*corr.* *42*, 262); *Suppl.* *7*, 271 (1987)
Oestradiol-17β (*see also* Steroidal oestrogens) — *6*, 99 (1974); *21*, 279 (1979)
Oestradiol 3-benzoate (*see* Oestradiol-17β)
Oestradiol dipropionate (*see* Oestradiol-17β)
Oestradiol mustard — *9*, 217 (1975)
Oestradiol-17β-valerate (*see* Oestradiol-17β)
Oestriol (*see also* Steroidal oestrogens) — *6*, 117 (1974); *21*, 327 (1979)
Oestrogen-progestin combinations (*see* Oestrogens, progestins and combinations)
Oestrogen-progestin replacement therapy (*see also* Oestrogens, progestins and combinations) — *Suppl.* *7*, 308 (1987)

Oestrogen replacement therapy (*see also* Oestrogens, progestins and combinations) *Suppl.* 7, 280 (1987)
Oestrogens (*see* Oestrogens, progestins and combinations)
Oestrogens, conjugated (*see* Conjugated oestrogens)
Oestrogens, nonsteroidal (*see* Nonsteroidal oestrogens)
Oestrogens, progestins and combinations *6* (1974); *21* (1979); *Suppl.* 7, 272 (1987)

Oestrogens, steroidal (*see* Steroidal oestrogens)
Oestrone (*see also* Steroidal oestrogens) *6*, 123 (1974); *21*, 343 (1979) (*corr.* *42*, 259)

Oestrone benzoate (*see* Oestrone) *8*, 165 (1975); *Suppl.* 7, 69 (1987)
Oil Orange SS
Oral contraceptives, combined (*see* Combined oral contraceptives)
Oral contraceptives, investigational (*see* Combined oral contraceptives)
Oral contraceptives, sequential (*see* Sequential oral contraceptives) *8*, 173 (1975); *Suppl.* 7, 69 (1987)
Orange I *8*, 181 (1975); *Suppl.* 7, 69 (1987)
Orange G *Suppl.* 7, 230 (1987)
Organolead compounds (*see also* Lead and lead compounds) *13*, 58 (1977); *Suppl.* 7, 69 (1987)
Oxazepam *13*, 131 (1977)
Oxymetholone (*see also* Androgenic (anabolic) steroids) *13*, 185 (1977); *Suppl.* 7, 69 (1987)
Oxyphenbutazone

P

Paint manufacture and painting (occupational exposures in) *47*, 329 (1989)
Panfuran S (*see also* Dihydroxymethylfuratrizine) *24*, 77 (1980); *Suppl.* 7, 69 (1987)
Paper manufacture (*see* Pulp and paper manufacture)
Parasorbic acid *10*, 199 (1976) (*corr.* *42*, 255); *Suppl.* 7, 69 (1987)
Parathion *30*, 153 (1983); *Suppl.* 7, 69 (1987)
Patulin *10*, 205 (1976); *40*, 83 (1986); *Suppl.* 7, 69 (1987)
Penicillic acid *10*, 211 (1976); *Suppl.* 7, 69 (1987)
Pentachloroethane *41*, 99 (1986); *Suppl.* 7, 69 (1987)
Pentachloronitrobenzene (*see* Quintozene)
Pentachlorophenol (*see also* Chlorophenols; Chlorophenols, occupational exposures to) *20*, 303 (1979)
Perylene *32*, 411 (1983); *Suppl.* 7, 69 (1987)
Petasitenine *31*, 207 (1983); *Suppl.* 7, 69 (1987)
Petasites japonicus (*see* Pyrrolizidine alkaloids)
Petroleum refining (occupational exposures in) *45*, 39 (1989)
Some petroleum solvents *47*, 43 (1989)
Phenacetin *3*, 141 (1973); *24*, 135 (1980); *Suppl.* 7, 310 (1987)

Phenanthrene	*32*, 419 (1983); *Suppl. 7*, 69 (1987)
Phenazopyridine hydrochloride	*8*, 117 (1975); *24*, 163 (1980) (*corr.* *42*, 260); *Suppl. 7*, 312 (1987)
Phenelzine sulphate	*24*, 175 (1980); *Suppl. 7*, 312 (1987)
Phenicarbazide	*12*, 177 (1976); *Suppl. 7*, 70 (1987)
Phenobarbital	*13*, 157 (1977); *Suppl. 7*, 313 (1987)
Phenol	*47*, 263 (1989)
Phenoxyacetic acid herbicides (*see* Chlorophenoxy herbicides)	
Phenoxybenzamine hydrochloride	*9*, 223 (1975); *24*, 185 (1980); *Suppl. 7*, 70 (1987)
Phenylbutazone	*13*, 183 (1977); *Suppl. 7*, 316 (1987)
meta-Phenylenediamine	*16*, 111 (1978); *Suppl. 7*, 70 (1987)
para-Phenylenediamine	*16*, 125 (1978); *Suppl. 7*, 70 (1987)
N-Phenyl-2-naphthylamine	*16*, 325 (1978) (*corr.* *42*, 257); *Suppl. 7*, 318 (1987)
ortho-Phenylphenol	*30*, 329 (1983); *Suppl. 7*, 70 (1987)
Phenytoin	*13*, 201 (1977); *Suppl. 7*, 319 (1987)
Piperazine oestrone sulphate (*see* Conjugated oestrogens)	
Piperonyl butoxide	*30*, 183 (1983); *Suppl. 7*, 70 (1987)
Pitches, coal-tar (*see* Coal-tar pitches)	
Polyacrylic acid	*19*, 62 (1979); *Suppl. 7*, 70 (1987)
Polybrominated biphenyls	*18*, 107 (1978); *41*, 261 (1986); *Suppl. 7*, 321 (1987)
Polychlorinated biphenyls	*7*, 261 (1974); *18*, 43 (1978) (*corr.* *42*, 258); *Suppl. 7*, 322 (1987)
Polychlorinated camphenes (*see* Toxaphene)	
Polychloroprene	*19*, 141 (1979); *Suppl. 7*, 70 (1987)
Polyethylene	*19*, 164 (1979); *Suppl. 7*, 70 (1987)
Polymethylene polyphenyl isocyanate	*19*, 314 (1979); *Suppl. 7*, 70 (1987)
Polymethyl methacrylate	*19*, 195 (1979); *Suppl. 7*, 70 (1987)
Polyoestradiol phosphate (*see* Oestradiol-17β)	
Polypropylene	*19*, 218 (1979); *Suppl. 7*, 70 (1987)
Polystyrene	*19*, 245 (1979); *Suppl. 7*, 70 (1987)
Polytetrafluoroethylene	*19*, 288 (1979); *Suppl. 7*, 70 (1987)
Polyurethane foams	*19*, 320 (1979); *Suppl. 7*, 70 (1987)
Polyvinyl acetate	*19*, 346 (1979); *Suppl. 7*, 70 (1987)
Polyvinyl alcohol	*19*, 351 (1979); *Suppl. 7*, 70 (1987)
Polyvinyl chloride	*7*, 306 (1974); *19*, 402 (1979); *Suppl. 7*, 70 (1987)
Polyvinyl pyrrolidone	*19*, 463 (1979); *Suppl. 7*, 70 (1987)
Ponceau MX	*8*, 189 (1975); *Suppl. 7*, 70 (1987)
Ponceau 3R	*8*, 199 (1975); *Suppl. 7*, 70 (1987)
Ponceau SX	*8*, 207 (1975); *Suppl. 7*, 70 (1987)
Potassium arsenate (*see* Arsenic and arsenic compounds)	

Potassium arsenite (*see* Arsenic and arsenic compounds)
Potassium bis(2-hydroxyethyl)dithiocarbamate — *12*, 183 (1976); *Suppl.* 7, 70 (1987)
Potassium bromate — *40*, 207 (1986); *Suppl.* 7, 70 (1987)
Potassium chromate (*see* Chromium and chromium compounds)
Potassium dichromate (*see* Chromium and chromium compounds)
Prednisone — *26*, 293 (1981); *Suppl.* 7, 326 (1987)
Procarbazine hydrochloride — *26*, 311 (1981); *Suppl.* 7, 327 (1987)
Proflavine salts — *24*, 195 (1980); *Suppl.* 7, 70 (1987)
Progesterone (*see also* Progestins; Combined oral contraceptives) — *6*, 135 (1974); *21*, 491 (1979) (*corr.* *42*, 259)
Progestins (*see also* Oestrogens, progestins and combinations) — *Suppl.* 7, 289 (1987)
Pronetalol hydrochloride — *13*, 227 (1977) (*corr.* *42*, 256); *Suppl.* 7, 70 (1987)
1,3-Propane sultone — *4*, 253 (1974) (*corr.* *42*, 253); *Suppl.* 7, 70 (1987)
Propham — *12*, 189 (1976); *Suppl.* 7, 70 (1987)
β-Propiolactone — *4*, 259 (1974) (*corr.* *42*, 253); *Suppl.* 7, 70 (1987)
n-Propyl carbamate — *12*, 201 (1976); *Suppl.* 7, 70 (1987)
Propylene — *19*, 213 (1979); *Suppl.* 7, 71 (1987)
Propylene oxide — *11*, 191 (1976); *36*, 227 (1985) (*corr.* *42*, 263); *Suppl.* 7, 328 (1987)
Propylthiouracil — *7*, 67 (1974); *Suppl.* 7, 329 (1987)
Ptaquiloside (*see also* Bracken fern) — *40*, 55 (1986); *Suppl.* 7, 71 (1987)
Pulp and paper manufacture — *25*, 157 (1981); *Suppl.* 7, 385 (1987)
Pyrene — *32*, 431 (1983); *Suppl.* 7, 71 (1987)
Pyrido[3,4-*c*]psoralen — *40*, 349 (1986); *Suppl.* 7, 71 (1987)
Pyrimethamine — *13*, 233 (1977); *Suppl.* 7, 71 (1987)
Pyrrolizidine alkaloids (*see also* Hydroxysenkirkine; Isatidine; Jacobine; Lasiocarpine; Monocrotaline; Retrorsine; Riddelliine; Seneciphylline; Senkirkine)

Q

Quercetin (*see also* Bracken fern) — *31*, 213 (1983); *Suppl.* 7, 71 (1987)
para-Quinone — *15*, 255 (1977); *Suppl.* 7, 71 (1987)
Quintozene — *5*, 211 (1974); *Suppl.* 7, 71 (1987)

R

Radon — *43*, 173 (1988) (*corr.* *45*, 283)
Reserpine — *10*, 217 (1976); *24*, 211 (1980) (*corr.* *42*, 260); *Suppl.* 7, 330 (1987)
Resorcinol — *15*, 155 (1977); *Suppl.* 7, 71 (1987)

Retrorsine	*10*, 303 (1976); *Suppl. 7*, 71 (1987)
Rhodamine B	*16*, 221 (1978); *Suppl. 7*, 71 (1987)
Rhodamine 6G	*16*, 233 (1978); *Suppl. 7*, 71 (1987)
Riddelliine	*10*, 313 (1976); *Suppl. 7*, 71 (1987)
Rifampicin	*24*, 243 (1980); *Suppl. 7*, 71 (1987)
Rockwool (*see* Man-made mineral fibres)	
The rubber industry	*28* (1982) (*corr. 42*, 261); *Suppl. 7*, 332 (1987)
Rugulosin	*40*, 99 (1986); *Suppl. 7*, 71 (1987)

S

Saccharated iron oxide	*2*, 161 (1973); *Suppl. 7*, 71 (1987)
Saccharin	*22*, 111 (1980) (*corr. 42*, 259); *Suppl. 7*, 334 (1987)
Safrole	*1*, 169 (1972); *10*, 231 (1976); *Suppl. 7*, 71 (1987)
The sawmill industry (including logging) (*see* The lumber and sawmill industry (including logging))	
Scarlet Red	*8*, 217 (1975); *Suppl. 7*, 71 (1987)
Selenium and selenium compounds	*9*, 245 (1975) (*corr. 42*, 255); *Suppl. 7*, 71 (1987)
Selenium dioxide (*see* Selenium and selenium compounds)	
Selenium oxide (*see* Selenium and selenium compounds)	
Semicarbazide hydrochloride	*12*, 209 (1976) (*corr. 42*, 256); *Suppl. 7*, 71 (1987)
Senecio jacobaea L. (*see* Pyrrolizidine alkaloids)	
Senecio longilobus (*see* Pyrrolizidine alkaloids)	
Seneciphylline	*10*, 319, 335 (1976); *Suppl. 7*, 71 (1987)
Senkirkine	*10*, 327 (1976); *31*, 231 (1983); *Suppl. 7*, 71 (1987)
Sepiolite	*42*, 175 (1987); *Suppl. 7*, 71 (1987)
Sequential oral contraceptives (*see also* Oestrogens, progestins and combinations)	*Suppl. 7*, 296 (1987)
Shale-oils	*35*, 161 (1985); *Suppl. 7*, 339 (1987)
Shikimic acid (*see also* Bracken fern)	*40*, 55 (1986); *Suppl. 7*, 71 (1987)
Shoe manufacture and repair (*see* Boot and shoe manufacture and repair)	
Silica (*see also* Amorphous silica; Crystalline silica)	*42*, 39 (1987)
Slagwool (*see* Man-made mineral fibres)	
Sodium arsenate (*see* Arsenic and arsenic compounds)	
Sodium arsenite (*see* Arsenic and arsenic compounds)	
Sodium cacodylate (*see* Arsenic and arsenic compounds)	
Sodium chromate (*see* Chromium and chromium compounds)	

Sodium cyclamate (*see* Cyclamates)
Sodium dichromate (*see* Chromium and chromium compounds)
Sodium diethyldithiocarbamate — *12*, 217 (1976); *Suppl.* 7, 71 (1987)
Sodium equilin sulphate (*see* Conjugated oestrogens)
Sodium fluoride (*see* Fluorides)
Sodium monofluorophosphate (*see* Fluorides)
Sodium oestrone sulphate (*see* Conjugated oestrogens)
Sodium *ortho*-phenylphenate (*see also ortho*-Phenylphenol) — *30*, 329 (1983); *Suppl.* 7, 392 (1987)
Sodium saccharin (*see* Saccharin)
Sodium selenate (*see* Selenium and selenium compounds)
Sodium selenite (*see* Selenium and selenium compounds)
Sodium silicofluoride (*see* Fluorides)
Soots — *3*, 22 (1973); *35*, 219 (1985); *Suppl.* 7, 343 (1987)

Spironolactone — *24*, 259 (1980); *Suppl.* 7, 344 (1987)
Stannous fluoride (*see* Fluorides)
Steel founding (*see* Iron and steel founding)
Sterigmatocystin — *1*, 175 (1972); *10*, 245 (1976); *Suppl.* 7, 72 (1987)

Steroidal oestrogens (*see also* Oestrogens, progestins and combinations) — *Suppl.* 7, 280 (1987)
Streptozotocin — *4*, 221 (1974); *17*, 337 (1978); *Suppl.* 7, 72 (1987)

Strobane® (*see* Terpene polychlorinates)
Strontium chromate (*see* Chromium and chromium compounds)
Styrene — *19*, 231 (1979) (*corr.* 42, 258); *Suppl.* 7, 345 (1987)

Styrene–acrylonitrile copolymers — *19*, 97 (1979); *Suppl.* 7, 72 (1987)
Styrene–butadiene copolymers — *19*, 252 (1979); *Suppl.* 7, 72 (1987)
Styrene oxide — *11*, 201 (1976); *19*, 275 (1979); *36*, 245 (1985); *Suppl.* 7, 72 (1987)

Succinic anhydride — *15*, 265 (1977); *Suppl.* 7, 72 (1987)
Sudan I — *8*, 225 (1975); *Suppl.* 7, 72 (1987)
Sudan II — *8*, 233 (1975); *Suppl.* 7, 72 (1987)
Sudan III — *8*, 241 (1975); *Suppl.* 7, 72 (1987)
Sudan Brown RR — *8*, 249 (1975); *Suppl.* 7, 72 (1987)
Sudan Red 7B — *8*, 253 (1975); *Suppl.* 7, 72 (1987)
Sulfafurazole — *24*, 275 (1980); *Suppl.* 7, 347 (1987)
Sulfallate — *30*, 283 (1983); *Suppl.* 7, 72 (1987)
Sulfamethoxazole — *24*, 285 (1980); *Suppl.* 7, 348 (1987)
Sulphisoxazole (*see* Sulfafurazole)
Sulphur mustard (*see* Mustard gas)
Sunset Yellow FCF — *8*, 257 (1975); *Suppl.* 7, 72 (1987)
Symphytine — *31*, 239 (1983); *Suppl.* 7, 72 (1987)

T

2,4,5-T (*see also* Chlorophenoxy herbicides; Chlorophenoxy herbicides, occupational exposures to) — *15*, 273 (1977)
Talc — *42*, 185 (1987); *Suppl. 7*, 349 (1987)
Tannic acid — *10*, 253 (1976) (*corr. 42*, 255); *Suppl. 7*, 72 (1987)
Tannins (*see also* Tannic acid) — *10*, 254 (1976); *Suppl. 7*, 72 (1987)
TCDD (*see* 2,3,7,8-Tetrachlorodibenzo-*para*-dioxin)
TDE (*see* DDT)
Terpene polychlorinates — *5*, 219 (1974); *Suppl. 7*, 72 (1987)
Testosterone (*see also* Androgenic (anabolic) steroids) — *6*, 209 (1974); *21*, 519 (1979)
Testosterone oenanthate (*see* Testosterone)
Testosterone propionate (*see* Testosterone)
2,2′,5,5′-Tetrachlorobenzidine — *27*, 141 (1982); *Suppl. 7*, 72 (1987)
2,3,7,8-Tetrachlorodibenzo-*para*-dioxin — *15*, 41 (1977); *Suppl. 7*, 350 (1987)
1,1,1,2-Tetrachloroethane — *41*, 87 (1986); *Suppl. 7*, 72 (1987)
1,1,2,2-Tetrachloroethane — *20*, 477 (1979); *Suppl. 7*, 354 (1987)
Tetrachloroethylene — *20*, 491 (1979); *Suppl. 7*, 355 (1987)
2,3,4,6-Tetrachlorophenol (*see* Chlorophenols; Chlorophenols, occupational exposures to)
Tetrachlorvinphos — *30*, 197 (1983); *Suppl. 7*, 72 (1987)
Tetraethyllead (*see* Lead and lead compounds)
Tetrafluoroethylene — *19*, 285 (1979); *Suppl. 7*, 72 (1987)
Tetrakis(hydroxymethyl) phosphonium salts — *48*, 95 (1990)
Tetramethyllead (*see* Lead and lead compounds)
Textile manufacturing industry, exposures in — *48*, 215 (1990)
Thioacetamide — *7*, 77 (1974); *Suppl. 7*, 72 (1987)
4,4′-Thiodianiline — *16*, 343 (1978); *27*, 147 (1982); *Suppl. 7*, 72 (1987)
Thiotepa (*see* Tris(1-aziridinyl)phosphine sulphide)
Thiouracil — *7*, 85 (1974); *Suppl. 7*, 72 (1987)
Thiourea — *7*, 95 (1974); *Suppl. 7*, 72 (1987)
Thiram — *12*, 225 (1976); *Suppl. 7*, 72 (1987)
Titanium dioxide — *47*, 307 (1989)
Tobacco habits other than smoking (*see* Tobacco products, smokeless)
Tobacco products, smokeless — *37* (1985) (*corr. 42*, 263); *Suppl. 7*, 357 (1987)
Tobacco smoke — *38* (1986) (*corr. 42*, 263); *Suppl. 7*, 357 (1987)
Tobacco smoking (*see* Tobacco smoke)
ortho-Tolidine (*see* 3,3′-Dimethylbenzidine)
2,4-Toluene diisocyanate (*see also* Toluene diisocyanates) — *19*, 303 (1979); *39*, 287 (1986)
2,6-Toluene diisocyanate (*see also* Toluene diisocyanates) — *19*, 303 (1979); *39*, 289 (1986)

Toluene	*47*, 79 (1989)
Toluene diisocyanates	*39*, 287 (1986) (*corr.* *42*, 264); *Suppl.* 7, 72 (1987)
Toluenes, α-chlorinated (*see* α-Chlorinated toluenes)	
ortho-Toluenesulphonamide (*see* Saccharin)	
ortho-Toluidine	*16*, 349 (1978); *27*, 155 (1982); *Suppl.* 7, 362 (1987)
Toxaphene	*20*, 327 (1979); *Suppl.* 7, 72 (1987)
Tremolite (*see* Asbestos)	
Treosulphan	*26*, 341 (1981); *Suppl.* 7, 363 (1987)
Triaziquone (*see* Tris(aziridinyl)-*para*-benzoquinone)	
Trichlorfon	*30*, 207 (1983); *Suppl.* 7, 73 (1987)
1,1,1-Trichloroethane	*20*, 515 (1979); *Suppl.* 7, 73 (1987)
1,1,2-Trichloroethane	*20*, 533 (1979); *Suppl.* 7, 73 (1987)
Trichloroethylene	*11*, 263 (1976); *20*, 545 (1979); *Suppl.* 7, 364 (1987)
2,4,5-Trichlorophenol (*see also* Chlorophenols; Chlorophenols occupational exposures to)	*20*, 349 (1979)
2,4,6-Trichlorophenol (*see also* Chlorophenols; Chlorophenols, occupational exposures to)	*20*, 349 (1979)
(2,4,5-Trichlorophenoxy)acetic acid (*see* 2,4,5-T)	
Trichlorotriethylamine hydrochloride	*9*, 229 (1975); *Suppl.* 7, 73 (1987)
T_2-Trichothecene	*31*, 265 (1983); *Suppl.* 7, 73 (1987)
Triethylene glycol diglycidyl ether	*11*, 209 (1976); *Suppl.* 7, 73 (1987)
4,4′,6-Trimethylangelicin plus ultraviolet radiation (*see also* Angelicin and some synthetic derivatives)	*Suppl.* 7, 57 (1987)
2,4,5-Trimethylaniline	*27*, 177 (1982); *Suppl.* 7, 73 (1987)
2,4,6-Trimethylaniline	*27*, 178 (1982); *Suppl.* 7, 73 (1987)
4,5′,8-Trimethylpsoralen	*40*, 357 (1986); *Suppl.* 7, 366 (1987)
Triphenylene	*32*, 447 (1983); *Suppl.* 7, 73 (1987)
Tris(aziridinyl)-*para*-benzoquinone	*9*, 67 (1975); *Suppl.* 7, 367 (1987)
Tris(1-aziridinyl)phosphine oxide	*9*, 75 (1975); *Suppl.* 7, 73 (1987)
Tris(1-aziridinyl)phosphine sulphide	*9*, 85 (1975); *Suppl.* 7, 368 (1987)
2,4,6-Tris(1-aziridinyl)-*s*-triazine	*9*, 95 (1975); *Suppl.* 7, 73 (1987)
Tris(2-chloroethyl) phosphate	*48*, 109 (1990)
1,2,3-Tris(chloromethoxy)propane	*15*, 301 (1977); *Suppl.* 7, 73 (1987)
Tris(2,3-dibromopropyl)phosphate	*20*, 575 (1979); *Suppl.* 7, 369 (1987)
Tris(2-methyl-1-aziridinyl)phosphine oxide	*9*, 107 (1975); *Suppl.* 7, 73 (1987)
Trp-P-1	*31*, 247 (1983); *Suppl.* 7, 73 (1987)
Trp-P-2	*31*, 255 (1983); *Suppl.* 7, 73 (1987)
Trypan blue	*8*, 267 (1975); *Suppl.* 7, 73 (1987)
Tussilago farfara L. (*see* Pyrrolizidine alkaloids)	

U

Ultraviolet radiation — *40*, 379 (1986)
Underground haematite mining with exposure to radon — *1*, 29 (1972); *Suppl. 7*, 216 (1987)
Uracil mustard — *9*, 235 (1975); *Suppl. 7*, 370 (1987)
Urethane — *7*, 111 (1974); *Suppl. 7*, 73 (1987)

V

Vat Yellow 4 — *48*, 161 (1990)
Vinblastine sulphate — *26*, 349 (1981) (*corr. 42*, 261); *Suppl. 7*, 371 (1987)
Vincristine sulphate — *26*, 365 (1981); *Suppl. 7*, 372 (1987)
Vinyl acetate — *19*, 341 (1979); *39*, 113 (1986); *Suppl. 7*, 73 (1987)
Vinyl bromide — *19*, 367 (1979); *39*, 133 (1986); *Suppl. 7*, 73 (1987)
Vinyl chloride — *7*, 291 (1974); *19*, 377 (1979) (*corr. 42*, 258); *Suppl. 7*, 373 (1987)
Vinyl chloride–vinyl acetate copolymers — *7*, 311 (1976); *19*, 412 (1979) (*corr. 42*, 258); *Suppl. 7*, 73 (1987)
4-Vinylcyclohexene — *11*, 277 (1976); *39*, 181 (1986); *Suppl. 7*, 73 (1987)
Vinyl fluoride — *39*, 147 (1986); *Suppl. 7*, 73 (1987)
Vinylidene chloride — *19*, 439 (1979); *39*, 195 (1986); *Suppl. 7*, 376 (1987)
Vinylidene chloride–vinyl chloride copolymers — *19*, 448 (1979) (*corr. 42*, 258); *Suppl. 7*, 73 (1987)
Vinylidene fluoride — *39*, 227 (1986); *Suppl. 7*, 73 (1987)
N-Vinyl-2-pyrrolidone — *19*, 461 (1979); *Suppl. 7*, 73 (1987)

W

Wollastonite — *42*, 145 (1987); *Suppl. 7*, 377 (1987)
Wood industries — *25* (1981); *Suppl. 7*, 378 (1987)

X

Xylene — *47*, 125 (1989)
2,4-Xylidine — *16*, 367 (1978); *Suppl. 7*, 74 (1987)
2,5-Xylidine — *16*, 377 (1978); *Suppl. 7*, 74 (1987)

Y

Yellow AB — *8*, 279 (1975); *Suppl. 7*, 74 (1987)

Yellow OB 3, 287 (1975); *Suppl.* 7, 74 (1987)

Z

Zearalenone 31, 279 (1983); *Suppl.* 7, 74 (1987)
Zectran 12, 237 (1976); *Suppl.* 7, 74 (1987)
Zinc beryllium silicate (*see* Beryllium and beryllium compounds)
Zinc chromate (*see* Chromium and chromium compounds)
Zinc chromate hydroxide (*see* Chromium and chromium compounds)
Zinc potassium chromate (*see* Chromium and chromium compounds)
Zinc yellow (*see* Chromium and chromium compounds)
Zineb 12, 245 (1976); *Suppl.* 7, 74 (1987)
Ziram 12, 259 (1976); *Suppl.* 7, 74 (1987)

CF98-1-4

U.S. SMALL BUSINESS ADMINISTRATION
WASHINGTON, D.C. 20416

OFFICE OF CHIEF COUNSEL FOR ADVOCACY

APR 28 1998

Honorable Sadye E. Dunn
Office of the Secretary
Consumer Product Safety Commission
Washington, DC 20207

Re: Flame Retardant Chemicals for Upholstered Furniture; 63 Fed. Reg. 13,017 (March 17, 1998)

Dear Secretary Dunn:

On March 17, 1998, the Consumer Product Safety Commission (CPSC) issued a request for comments concerning the toxicity, exposure, bioavailability, and environmental effects of flame retardant chemicals that may be suitable for use in residential upholstered furniture. CPSC intends to evaluate the comments in order to determine whether to propose a standard to address hazards associated with small open flame ignitions of upholstered furniture.

The Office of the Chief Counsel for Advocacy of the U.S. Small Business Administration was created in 1976 to represent the views and interests of small business in federal policy making activities.[1] The Chief Counsel participates in rulemakings when he deems it necessary to ensure proper representation of small business interests. In addition to these responsibilities, the Chief Counsel monitors compliance with the Regulatory Flexibility Act (RFA), and works with federal agencies to ensure that their rulemakings demonstrate an analysis of the impact that their decisions will have on small entities.

The Chief Counsel has reviewed the information contained in CPSC's March 17, 1998 request for comments, as well as the statement issued by Commissioner Mary Sheila Gall that explains her vote to withdraw the advance notice of proposed rulemaking on small open flame-ignited upholstered furniture.[2] Accordingly, the Office of Advocacy wishes to express serious concerns about the likely burden placed on upholstery related businesses (which are predominantly small in size) if CPSC were to impose a mandatory small flame standard for upholstered furniture.

The possible health risks to consumers and employees, and the economic burden on the industry, when compared with the benefits that can realistically be achieved, seem out of proportion. A careful analysis by CPSC of the economic impact (in conjunction with an

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[1] Regulatory Flexibility Act, 5 U.S.C. § 601, as amended by the Small Business Regulatory Enforcement Fairness Act, Pub. L. No. 104-121, 110 Stat. 866 (1996).

[2] Press Release from Mary Sheila Gall, CPSC Commissioner; Statement of the Honorable Mary Sheila Gall on Options for Upholstered Furniture Flammability Project (March 2, 1998).

analysis of alternative approaches) may address this problem adequately, but based on the information presented thus far, the problems seem insurmountable. Therefore, if CPSC intends to move forward with proposing a mandatory small flame rule for upholstery, then certain minimum requirements must be met.

First, CPSC must demonstrate the need for the regulation. This may sound obvious, but CPSC has not provided sufficient data to convince this office, or Commissioner Gall, that a small flame standard would reduce accidental fires. Second, CPSC must consider relevant cost data and determine the impact on all affected small businesses. Third, CPSC must consider and analyze less burdensome alternatives that would accomplish the Commission's safety objectives. Granted, CPSC is only soliciting information for a future rulemaking at this stage in the process, but the basis for an adequate and thoughtful rulemaking begins at this stage.

Why Regulate? CPSC says that small open flame ignitions of upholstered furniture account for an estimated 3,100 fires, resulting in an estimated 100 deaths, 460 injuries, and $50 million in property damage per year in the U.S.[3] However, CPSC's data does not distinguish between fires that were deliberately set, fires that were set by individuals with a history of setting fires, fires set by unsupervised children playing with matches, fires cause by very lengthy exposure to fallen candles, versus fires that are purely accidental in nature with short term exposure. Without an explanation of the data, there is no way to know whether or to what extent the problem can be cured by the proposed regulation. If the majority of the fires are set deliberately, or by other means which are not purely accidental, then no regulation is going to help reduce the problem. Acting without all the relevant facts or data means the industry will be confronted by costly regulations that serve no legitimate public policy objective. Agencies should identify the problem, identify who or what is contributing to the problem, and identify the conduct that needs to be changed. If all of these issues cannot be addressed with relative specificity, then DO NOT REGULATE.

Costs/Small Business Impact. Costs should be identified and fully explained. Costs may include new equipment for treating fabrics, lower profits caused by increased prices for more expensive treated fabrics, costs associated with additional environmental regulations and controls, costs associated with additional worker/employee protections or controls resulting from chemical exposure, and costs associated with maintaining flammability resistance over time (age, wear and tear may reduce flammability resistance). Other indirect, but significant costs may include increased litigation due to health-related problems associated with adverse chemical reactions. It is interesting to note that CPSC specifically requested comments on about 42 issues regarding toxicity, flame retardant chemicals, exposure and bioavailability, occupational issues and environmental issues; yet only two deal with the costs and impact on the industry.[4]

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[3] 63 Fed. Reg. at 13,017.

[4] CPSC requests comments on the "cost of complying with additional regulations and implementing additional controls to protect workers, resulting from the use of FR chemicals in upholstered furniture, especially for small companies", and on the "cost of complying with additional environmental regulations

The costs will be borne by various small businesses, including textile manufacturers (cotton, synthetics, silk and wool—presuming that leather will not be included) and furniture finishers/manufacturers/refinishers. In the manufacturing sector, the Small Business Administration's (SBA) definition of a small business is generally employee-based. A small furniture manufacturer is one with 500 or fewer employees. A small cotton manufacturer is one with 1000 or fewer employees, and a small synthetic fabric/silk manufacturer is one with 500 or fewer employees. The retail industry may also be affected, but the focus of these comments shall be on manufacturing.

Using 1993 data supplied by the U.S. Bureau of the Census, SBA has derived statistics about furniture and upholstery manufacturers and other industries. Furniture manufacturers, for instance, may fall into the category of Wood Household Furniture (Standard Industrial Classification (SIC) code 2512), Metal Household Furniture (SIC code 2514), and Mattresses, Foundations, and Convertible Beds (SIC code 2515). Fabrics may fall into Broadwoven Fabric Mills for Cotton (SIC code 2211) and Broadwoven Fabric Mills for Manmade Fiber and Silk (SIC code 2221). Nearly 96% of the firms in the upholstered wood household furniture have fewer than 500 employees and are considered small by SBA; 93% of upholstered metal furniture; 87.5% of cotton mills (this percentage is for 500 employees although a small cotton mill is one with 1000 employees); 79% of manmade fiber/silk. It is perfectly clear that a substantial number, if not the vast majority, of the industry is small and will be affected by the suggested proposed rule.[5]

Regulatory Alternatives. The RFA requires agencies to prepare an initial regulatory flexibility analysis (IRFA) unless the agency determines and certifies that there will be no significant economic impact on a substantial number of small entities. The Office of Advocacy opines that CPSC will not be able to certify the rule and, therefore, should prepare an IRFA. One of the most important elements of an IRFA is giving consideration to flexible regulatory alternatives that reduce the burden on small businesses while still allowing the agency to accomplish its regulatory and public policy objectives. Alternatives in the instance case might include: issuing voluntary guidance for small flame resistance instead of a proposed rule,[6] requiring prominent warning labels on residential furniture about the risks of flammability, allow a number of different chemicals to be used when treating fabrics (rather than one specific chemical), exempt certain types of businesses like reupholsterers or antique furniture restorers, avoid process controls and requirements, support the development of consumer-applied sprays to increase small flame resistance, etc. All, some, or none of these alternatives may be feasible. The only way for CPSC to know is to analyze all significant alternatives.

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and implementing additional environmental controls, resulting from the introduction of FR chemicals into upholstered furniture, especially for small companies." 63 Fed. Reg. at 13,019.

[5] More data is available by contacting the Office of Economic Research at the Office of Advocacy, 202-205-6530, or by checking our website under small business statistics, www.sba.gov/ADVO.

[6] A 1997 study by CPSC found that 92% of individual cigarettes placed on upholstered furniture did not produce ignition. These results were based on the successful implementation of a voluntary industry program.

The RFA is not intended to be a burden on agencies, but a tool to help agencies formulate rational, less costly rules. Please consider these comments as you continue to develop this rule. In the meantime, do not hesitate to contact the Office of Advocacy if we can assist you further on this or future rulemakings, 202-205-6945.

Sincerely,

Jere W. Glover
Chief Counsel

Shawne Carter McGibbon
Asst. Chief Counsel for Advocacy

CF98-1-5

TESTIMONY

OF

DR. ULRICH GIRRBACH, M.S., PH.D.

MAY 5-6, 1998

BEFORE THE U.S. CONSUMER PRODUCT SAFETY COMMISSION

PUBLIC HEARING ON FLAME RETARDANT CHEMICALS THAT MAY BE SUITABLE FOR USE IN UPHOLSTERED FURNITURE

REGULATION OF THE BURNING BEHAVIOR OF UPHOLSTERED FURNITURE FOR PRIVATE DWELLINGS IN EUROPE AND GERMANY

GOOD MORNING. MY NAME IS ULRICH GIRRBACH, AND I APPRECIATE THE OPPORTUNITY TO SPEAK TO THE COMMISSION TODAY. I HAVE TRAVELLED FROM FRANKFURT FOR THIS HEARING BECAUSE OF THE IMPORTANCE OF THE ISSUES YOU HAVE UNDER CONSIDERATION. I HAVE SOME EXPERIENCE REGARDING THE COMBUSTION OF TEXTILES AND UPHOLSTERED FURNITURE, AND I HOPE THAT THIS TESTIMONY WILL BE HELPFUL TO THE COMMISSIONERS AND THEIR STAFF.

TO BRIEFLY REVIEW MY BACKGROUND IN THIS FIELD, I HOLD AN MS IN CHEMICAL ENGINEERING, AND A PH.D. IN CHEMISTRY. I PRESENTLY WORK FOR TREVIRA, A MAJOR PRODUCER OF SYNTHETIC TEXTILES. I SERVE ON A NUMBER OF EUROPEAN AND INTERNATIONAL STANDARDS COMMITTEES DEALING WITH THE FIRE SAFETY OF TEXTILES AND UPHOLSTERED FURNITURE. THESE INCLUDE COMMITTEES OF THE EUROPEAN STANDARDIZATION INSTITUTE (CEN) THE INTERNATIONAL STANDARDIZATION INSTITUTE (ISO), THE GERMAN INSTITUTE OF STANDARDS (DIN) AND THE EUROPEAN FURNITURE ACTION COUNCIL (EUFAC).

MY ACTIVE INVOLVEMENT IN THESE ORGANIZATIONS HAS PLACED ME VERY MUCH AT THE CENTER OF THE EUROPEAN DEBATE OVER WHETHER UPHOLSTERY TEXTILES SHOULD BE MODIFIED TO ACHIEVE GREATER FLAME RESISTANCE, SPECIFICALLY THE DESIRABILITY OF FLAME RETARDANT CHEMICAL TREATMENTS. IT IS MY

HOPE THAT THE NEAR DECADE OF CONSIDERATION, DEBATE AND DECISIONMAKING BY BODIES OF SPECIALIZED EXPERTISE ON THE CONTINENT WILL HELP INFORM YOUR WORK HERE IN THE UNITED STATES.

CURRENTLY ONLY THE U.K. AND IRELAND (SINCE 1990) REGULATE THE FLAME BEHAVIOR OF UPHOLSTERED FURNITURE USED IN THE HOME. NO OTHER EUROPEAN COUNTRY CURRENTLY HAS COMPARABLE REQUIREMENTS. THE U.K. REGULATIONS REQUIRE INDIVIDUAL COMPONENTS (THE COVER FABRIC AS WELL AS THE FOAM OR OTHER FILLING MATERIAL) TO PASS AN IGNITION TEST. THE COVER FABRICS HAVE TO PASS THE IGNITION TEST WITH CRIB 5 AS THE IGNITION SOURCE (CRIB 5 IS A SMALL WOODEN IGNITION APPARATUS WEIGHING APPROXIMATELY 20 G).

IN 1990, THE EU COMMISSION PROPOSED A HARMONIZATION DIRECTIVE IN ORDER TO ELIMINATE WHAT WAS EFFECTIVELY A TRADE BARRIER CREATED BY THE U.K. LEGISLATION ON THE EUROPEAN FURNITURE MARKET. THERE WAS A GREAT DEAL OF CONTROVERSY OVER THE ECONOMIC, HEALTH AND ENVIRONMENTAL IMPLICATIONS OF MOVING TOWARD THE U.K. APPROACH. IT WAS ESTIMATED THAT, HAD THE DRAFT DIRECTIVE BEEN ENACTED IN THE FORM THAT IT WAS PROPOSED, MORE THAN 80% OF UPHOLSTERED FURNITURE WOULD HAVE DISAPPEARED FROM THE MARKET. THE VAST MAJORITY OF FABRICS AND FILLINGS WOULD HAVE BEEN TREATED OR BACKCOATED WITH CONSIDERABLE AMOUNTS OF FIRE RETARDANTS.

THE PROPOSED INCREASED USE OF FIRE RETARDANT CHEMICALS CREATED GRAVE CONCERN, ESPECIALLY

AMONG CONSUMERS IN GERMANY AND AUSTRIA. THE AVAILABLE INFORMATION ON POSSIBLE LONG TERM EFFECTS OF FR PRODUCTS IN SUCH CLOSE PROXIMITY TO THE HUMAN SKIN WAS CONSIDERED UNSATISFACTORY. THERE WERE ALSO SERIOUS QUESTIONS ABOUT THE DISPOSAL OF FABRIC AND FURNITURE WASTE AND DISCARDED PRODUCTS, PARTICULARLY GIVEN THE BULK, COST AND LONG-TERM LIFE OF THESE PRODUCTS IN THE HOME.

OUR CITIZENS WERE AWARE OF RECALL ACTIONS UNDERTAKEN BECAUSE OF PRIOR CHEMICAL HAZARDS, INCLUDING THE UNFORTUNATE SITUATION CREATED IN THE U.S. BY THE INTRODUCTION OF TRIS INTO CHILDREN'S SLEEPING GARMENTS. IF A SIMILAR THING OCCURRED WITH UPHOLSTERED FURNITURE, WHERE 20 YEARS FROM NOW A CHEMICAL HAZARD WAS DOCUMENTED, IT WOULD NOT BE REALISTIC TO EXPECT THE ENTIRE FURNITURE STOCK TO BE RECALLED OUT OF PEOPLE'S HOUSEHOLDS. THE POOR WOULD BE THE MOST DIFFICULT TO REACH AND LEAST AGREEABLE TO THE EXPENSE OF REFURBISHING THEIR HOME. AS A RESULT, TOXIC HAZARDS WOULD REMAIN MOSTLY WITH THE POOR, WHAT IS SOMETIMES CALLED "ENVIRONMENTAL INJUSTICE."

IN EUROPE, AND PERHAPS ESPECIALLY IN GERMANY, FURNITURE BELONGS TO THE CLASS OF CONSUMER GOODS WHICH ACCOMPANIES ITS OWNER FOR A LONG TIME. IN MANY CASES UPHOLSTERED FURNITURE WILL NOT BE REPLACED WITHIN ONE GENERATION; SOME WILL EVEN BE TRANSFERRED TO THE CHILDREN. WHEN I WENT TO UNIVERSITY AND RENTED MY FIRST FLAT, I GOT A SOFA AND TWO UPHOLSTERED CHAIRS FROM MY

PARENTS WHICH WERE ALREADY 25 YEARS OLD WHEN I RECEIVED THEM. WHEN I PURCHASED MY OWN FURNITURE SOME 10 YEARS LATER, I GAVE MY PARENT'S FURNITURE TO MY SISTER, WHO WAS GROWN UP BY THIS TIME. WHEN SHE WAS ABLE TO BUY HER OWN FURNITURE ANOTHER 10 YEARS LATER, SHE GAVE THE OLD ONES TO CHARITY FOR BOSNIAN REFUGEES.

AN ADDITIONAL QUESTION WHICH PLAYED A MUCH SMALLER ROLE IN THE DEBATE WAS THE CONTROVERSY OVER COT DEATH. IN 1994, ENGLISH RESEARCHER BARRY RICHARDSON THEORIZED A LINK BETWEEN SUDDEN INFANT DEATH SYNDROME AND THE ACTION OF MICROBES ON FLAME RETARDANTS SUCH AS ANTIMONY IN CHILDREN'S MATTRESSES. ALTHOUGH OTHER RESEARCHERS DISCOUNTED VARIOUS ASPECTS OF RICHARDSON'S WORK, SOME DOUBTS REMAINED.

FOR ALL OF THESE REASONS, THE GERMAN CONSUMER COUNCIL WAS NOT CONVINCED THAT THE EXPANDED USE OF FLAME RETARDANT CHEMICALS IN THE LIVING ROOM AND BEDROOMS OF THE CONSUMER WOULD LEAD TO MORE SAFETY IN THE LONG RUN, AND THEREFORE STRONGLY OBJECTED TO THE PROPOSAL.

IN 1994, THE DRAFT DIRECTIVE WAS TAKEN FROM THE LEGISLATIVE PROGRAM IN ORDER TO FURTHER EVALUATE THE SITUATION AND STUDY POSSIBLE LONG-TERM IMPACTS FROM THE EXTENDED USE OF FLAME RETARDANT CHEMICALS. A CONSENSUS OF THE VARIOUS PARTIES CONCERNED HAS ALSO BEEN REQUIRED AS A PRECONDITION FOR FURTHER ACTION BY THE COMMISSION.

IN LIEU OF THE U.K. APPROACH, MANY OF THE SAFETY AUTHORITIES IN EUROPE HAVE ENDORSED THE EUROPEAN UPHOLSTERED FURNITURE ACTION COUNCIL (EUFAC). EUFAC IS A MODIFIED VERSION OF THE UFAC PROGRAM WITH WHICH YOU IN THE UNITED STATES ARE FAMILIAR. THE EUFAC SYSTEM HAS BEEN CHECKED BY MORE THAN 4,000 TEST RESULTS AND IS PROVING A VALUABLE TOOL IN REDUCING IGNITION PROPENSITY.

OTHER SUCCESSFUL MEASURES INCLUDE PUBLIC EDUCATION, SMOKE DETECTORS, SPRINKLERS AND COUNSELING FOR CHILDREN WHO START FIRES. THESE PROGRAMS CAN REACH A MUCH BROADER SCOPE OF PRODUCT CATEGORIES, CAN BE TARGETED TO HIGH RISK AREAS, AND ARE NOT LIMITED BY THE VERY GRADUAL TURNOVER IN THE HOUSEHOLD FURNITURE STOCK. THEY ALSO AVOID THE HEALTH AND ENVIRONMENTAL UNCERTAINTIES AND THE LACK OF PUBLIC ACCEPTANCE ASSOCIATED WITH FR CHEMICAL TREATMENT OF UPHOLSTERED FURNITURE.

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