6. References

Abdel Hameed, A.A., Khoder, M.I. & Farag, S.A. (2000) Organic dust and gaseous contaminants at wood working shops. *J. environ. Monit*., **2**, 73–76

ACGIH® Worldwide (2003) *Documentation of the TLVs® and BEIs® with Other Worldwide Occupational Exposure Values — 2003 CD-ROM*, Cincinnati, OH, American Conference of Government Industrial Hygienists

Acheson, E.D., Barnes, H.R., Gardner, M.J., Osmond, C., Pannett, B. & Taylor, C.P. (1984a) Formaldehyde in the British chemical industry: An occupational cohort study. *Lancet*, **i**, 611–616

Acheson, E.D., Barnes, H.R., Gardner, M.J., Osmond, C., Pannett, B. & Taylor, C.P. (1984b) Formaldehyde process workers and lung cancer. *Lancet,* **i,** 1066–1067

Adams, D.O., Hamilton, T.A., Lauer, L.D. & Dean, J.H. (1987) The effect of formaldehyde exposure upon the mononuclear phagocyte system of mice. *Toxicol. appl. Pharmacol.*, **88**, 165–174

Åhman, M., Alexandersson, R., Ekholm, U., Bergström, B., Dahlqvist, M. & Ulfvarsson, U. (1991) Impeded lung function in moulders and coremakers handling furan resin sand. *Int. Arch. occup. environ. Health*, **63**, 175–180

Akbar-Khanzadeh, F. & Mlynek, J.S. (1997) Changes in respiratory function after one and three hours of exposure to formaldehyde in non-smoking subjects. *Occup. environ. Med*., **54**, 296–300

Akbar-Khanzadeh, F., Vaquerano, M.U., Akbar-Khanzadeh, M. & Bisesi, M.S. (1994) Formaldehyde exposure, acute pulmonary response, and exposure control options in a gross anatomy laboratory. *Am. J. ind. Med*., **26**, 61–75

Albert, R.E., Sellakumar, A.R., Laskin, S., Kuschner, M., Nelson, N. & Snyder, C.A. (1982) Gaseous formaldehyde and hydrogen chloride induction of nasal cancer in the rat. *J. natl Cancer Inst.*, **68**, 597–603

Alderson, T. (1967) Induction of genetically recombinant chromosomes in the absence of induced mutation. *Nature*, **215**, 1281–1283

Alexandersson, R. & Hedenstierna, G. (1988) Respiratory hazards associated with exposure to formaldehyde and solvents in acid-curing paints. *Arch. environ. Health*, **43**, 222–227

Altshuller, A.P. (1993) Production of aldehydes as primary emissions and from secondary atmospheric reactions of alkenes and alkanes during the night and early morning hours. *Atmos. Environ.*, **27**, 21–32

Alves Pereira, E., Carrilho, E. & Tavares, M.F.M. (2002) Laser-induced fluorescence and UV detection of derivatized aldehydes in air samples using capillary electrophoresis. *J. Chromatogr.*, **A979**, 409–416

Andersen, S.K., Jensen, O.M. & Oliva, D. (1982) [Exposure to formaldehyde and lung cancer in Danish physicians.] *Ugeskr. Laeg.*, **144**, 1571–1573 (in Danish)

Anderson, L.G., Lanning, J.A., Barrell, R., Miyagishima, J., Jones, R.H. & Wolfe, P. (1996) Sources and sinks of formaldehyde and acetaldehyde: An analysis of Denver's ambient concentration data. *Atmos. Environ*., **30**, 2113–2123

Andersson, M., Agurell, E., Vaghef, H., Bolcsfoldi, G. & Hellman, B. (2003) Extended-term cultures of human T-lymphocytes and the comet assay: A useful combination when testing for genotoxicity in vitro? *Mutat. Res.*, **540**, 43–55

Andjelkovich, D.A., Mathew, R.M., Richardson, R.B. & Levine, R.J. (1990) Mortality of iron foundry workers. I. Overall findings. *J. occup. Med.*, **32**, 529–540

Andjelkovich, D.A., Shy, C.M., Brown, M.H., Janszen, D.B., Levine, R.J. & Richardson, R.B. (1994) Mortality of iron foundry workers. III. Lung cancer case–control study. *J. occup. Med*., **36**, 1301–1309

Andjelkovich, D.A., Janszen, D.B., Brown, M.H., Richardson, R.B. & Miller, F.J. (1995) Mortality of iron foundry workers: IV. Analysis of a subcohort exposed to formaldehyde. *J. occup. environ. Med*., **37**, 826–837

de Andrade, J.B., Andrade, M.V. & Pinheiro, H.L.C. (1998) Atmospheric levels of formaldehyde and acetaldehyde and their relationship with the vehicular fleet composition in Salvador, Bahia, Brazil. *J. Braz. chem. Soc*., **9**, 219–223

Andreini, B.P., Baroni, R., Galimberti, E. & Sesana, G. (2000) Aldehydes in the atmospheric environment: Evaluation of human exposure in the north-west area of Milan. *Microchem. J*., **67**, 11–19

AOAC (Association of Official Analytical Chemists) (2003) *Official Methods of Analysis of AOAC International*, 17th Ed., Rev. 2, Gaithersburg, MD [CD-ROM]

Appelman, L.M., Woutersen, R.A., Zwart, A., Falke, H.E. & Feron, V.J. (1988) One-year inhalation toxicity study of formaldehyde in male rats with a damaged or undamaged nasal mucosa. *J. appl. Toxicol.*, **8**, 85–90

Arbejdstilsynet [Danish Working Environment Authority] (2002) *Limit Values for Substances and Material*, Copenhagen, WEA-Guide

Armstrong, R.W., Imrey, P.B., Lye, M.S., Armstrong, M.J., Yu, M.C. & Sani, S. (2000) Nasopharyngeal carcinoma in Malaysian Chinese: Occupational exposures to particles, formaldehyde and heat. *Int. J. Epidemiol*., **29**, 991–998

ASTM International (1990) *Standard Test Method for Determining Formaldehyde Levels from Wood Products Under Defined Test Conditions Using a Large Chamber* (Method E1333-90), Philadelphia, American Society for Testing and Materials

ASTM International (2000) *Standard Test Method for Determining Formaldehyde Levels from Wood Products using a Desiccator* (ASTM D5582-00), Philadelphia, American Society for Testing and Materials

ASTM International (2002a) *Standard Test Method for Determining Formaldehyde Concentration in Air from Wood Products Using a Small Scale Chamber* (ASTM D6007-02), Philadelphia, American Society for Testing and Materials

ASTM International (2002b) *Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber* (ASTM E1333-96, Reapproved 2002), Philadelphia, American Society for Testing and Materials

ATSDR (Agency for Toxic Substances and Disease Registry) (1999) *Toxicological Profile for Formaldehyde*, Atlanta, GA, US Department of Health and Human Services, Public Health Service [http://atsdr.cdc.gov/toxprofiles/tp111.html]

Atzori, L., Dore, M. & Congiu, L. (1989) Aspects of allyl alcohol toxicity. *Drug Metabol. Drug. Interactions*, **7**, 295–319

Atzori, L., Dypbukt, J.M., Hybbinette, S.S., Moldéus, P. & Grafström, R.C. (1994) Modifications of cellular thiols during growth and squamous differentiation of cultured human bronchial epithelial cells. *Exp. Cell Res.*, **211**, 115–120

Auerbach, C. & Moser, H. (1953) Analysis of the mutagenic action of formaldehyde on food. II. The mutagenic potentialities of the treatment. *Zeitschr. indukt. Abstamm. Verebungs.*, **85**, 547–563

Auerbach, C., Moutschen-Dahmen, M. & Moutschen, J. (1977) Genetic and cytogenetical effects of formaldehyde and related compounds. *Mutat. Res.*, **39**, 317–361

Axelsson, G., Lütz, C. & Rylander, R. (1984) Exposure to solvents and outcome of pregnancy in university laboratory employees. *Br. J. ind. Med.*, **41**, 305–312

Azuma, M., Endo, Y., Miyazaki, T., Hikita, Y., Ikeda, H., Moriya, Y., Hara, I. & Araki, S. (2003) Efficacy of a detector tube method in formaldehyde measurement. *Ind. Health*, **41**, 306-312

Baez, A.P., Belmont, R. & Padilla, H. (1995) Measurements of formaldehyde and acetaldehyde in the atmosphere of Mexico City. *Environ. Pollut*., **89**, 163–167

Báez, A., Padilla, H., García, R., Torres, M.C., Rosas, I. & Belmont, R. (2003) Carbonyl levels in indoor and outdoor air in Mexico City and Xalapa, Mexico. *Sci. total Environ*., **302**, 211–226

Ballarin, C., Sarto, F., Giacomelli, L., Bartolucci, G.B. & Clonfero, E. (1992) Micronucleated cells in nasal mucosa of formaldehyde-exposed workers. *Mutat. Res.*, **280**, 1–7

Ballenger, J.J. (1984) Some effects of formaldehyde on the upper respiratory tract. *Laryngoscope*, **94**, 1411–1413

Barber, R.D. & Donohue, T.J. (1998) Pathways for transcriptional activation of a glutathione-dependent formaldehyde dehydrogenase gene. *J. mol. Biol*., **280**, 775–784

Basler, A., van der Hude, W. & Scheutwinkel-Reich, M. (1985) Formaldehyde-induced sister chromatid exchanges in vitro and the influence of the exogenous metabolizing systems S9 mix and primary hepatocytes. *Arch. Toxicol.*, **58**, 10–13

Batalha, J.R.F., Guimarães, E.T., Lobo, D.J.A., Lichtenfels, A.J.F.C, Deur, T., Carvalho, H.A., Alves, E.S., Domingos, M., Rodrigues, G.S. & Saldiva, P.H.N. (1999) Exploring the clastogenic effects of air pollutants in São Paulo (Brazil) using the *Tradescantia* micronuclei assay. *Mutat. Res.*, **426**, 229–232

Baumann, K. & Angerer, J. (1979) Occupational chronic exposure to organic solvents. VI. Formic acid concentration in blood and urine as an indicator of methanol exposure. *Int. Arch. occup. environ. Health*, **42**, 241–249

Belanger, P.L. & Kilburn, K.H. (1981) *California Society for Histotechnology, Los Angeles, CA, Health Hazard Evaluation Report* (NIOSH Report No. HETA 81-422-1387), Cincinnati, OH, US Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health

Bender, J. (2002) The use of noncancer endpoints as a basis for establishing a reference concentration for formaldehyde. *Regul. Toxicol. Pharmacol*., **35**, 23–31

Berke, J.H. (1987) Cytologic examination of the nasal mucosa in formaldehyde-exposed workers. *J. occup. Med.*, **29**, 681–684

Bernardini, P., Carelli, G., Rimatori, V. & Contegiacomo, P. (1983) Health hazard for hospital workers from exposure to formaldehyde. *Med. Lav.*, **74**, 106–110

Berrino, F., Richiardi, L., Boffetta, P., Estève, J., Belletti, I., Raymond, L., Troschel, L., Pisani, P., Zubiri, L., Ascunce, N., Gubéran, E., Tuyns, A., Terracini, B., Merletti, F. & the Milan JEM Working Group (2003) Occupation and larynx and hypopharynx cancer: A job–exposure matrix approach in an international case–control study in France, Italy, Spain and Switzerland. *Cancer Causes Control*, **14**, 213–223

Bertazzi, P.A., Pesatori, A.C., Radice, L., Zocchetti, C. & Vai, T. (1986) Exposure to formaldehyde and cancer mortality in a cohort of workers producing resins. *Scand. J. Work Environ. Health*, **12**, 461–468

Bertazzi, P.A., Pesatori, A.C., Guercilena, S., Consonni, D. & Zocchetti, C. (1989) [Cancer risk among workers producing formaldehyde-based resins: Extension of follow-up.] *Med. Lav.*, **80**, 111–122 (in Italian)

Biagini, R.E., Moorman, W.J., Knecht, E.A., Clark, J.C. & Bernstein, I.L. (1989) Acute airway narrowing in monkeys from challenge with 2.5 ppm formaldehyde generated from formalin. *Arch. environ. Health*, **44**, 12–17

Binding, N. & Witting, U. (1990) Exposure to formaldehyde and glutardialdehyde in operating theatres. *Int. Arch. occup. environ. Health*, **62**, 233–238

Bizzari, S.N. (2000) *CEH Marketing Research Report: Formaldehyde*, Palo Alto, CA, SRI International

Blade, L.M. (1983) Occupational exposure to formaldehyde — Recent NIOSH involvement. In: Clary, J.J., Gibson, J.E. & Waritz, R.S., eds, *Formaldehyde — Toxicology, Epidemiology, Mechanisms*, New York, Marcel Dekker, pp. 1–23

Blair, A. & Stewart, P.A. (1989) Comments on the reanalysis of the National Cancer Institute study of workers exposed to formaldehyde. *J. occup. Med*., **31**, 881

Blair, A. & Stewart, P.A. (1990) Correlation between different measures of occupational exposure to formaldehyde. *Am. J. Epidemiol.*, **131**, 510–516

Blair, A., Stewart, P.A., O'Berg, M., Gaffey, W., Walrath, J., Ward, J., Bales, R., Kaplan, S. & Cubit, D. (1986) Mortality among industrial workers exposed to formaldehyde. *J. natl Cancer Inst.*, **76**, 1071–1084

Blair, A., Stewart, P.A., Hoover, R.N., Fraumeni, J.F., Jr, Walrath, J., O'Berg, M. & Gaffey, W. (1987) Cancers of the nasopharynx and oropharynx and formaldehyde exposure (Letter to the Editor). *J. natl Cancer Inst.*, **78**, 191–193

Blair, A., Stewart, P.A. & Hoover, R.N. (1990a) Mortality from lung cancer among workers employed in formaldehyde industries. *Am. J. ind. Med.*, **17**, 683–699

Blair, A., Saracci, R., Stewart, P.A., Hayes, R.B. & Shy, C. (1990b) Epidemiologic evidence on the relationship between formaldehyde exposure and cancer. *Scand. J. Work Environ. Health*, **16**, 381–393

Blair, A., Zheng, T., Linos, A., Stewart, P.A., Zhang, Y.W. & Cantor, K.P. (2000) Occupation and leukemia: A population-based case–control study in Iowa and Minnesota. *Am. J. ind. Med*., **40**, 3–14

Blasiak, J., Trzeciak, A., Malecka-Panas, E., Drzewoski, J. & Wojewódzka, M. (2000) *In vitro* genotoxicity of ethanol and acetaldehyde in human lymphocytes and the gastrointestinal tract mucosa cells. *Toxicol. in Vitro*, **14**, 287–295

Boj, J.R., Marco, I., Cortès, O. & Canalda, C. (2003) The acute nephrotoxicity of systemically administered formaldehyde in rats. *Eur. J. paediat. Dent*., **4**, 16–20

Bolm-Audorff, U., Vogel, C. & Woitowitz, H. (1990) Occupation and smoking as risk factors of nasal and nasopharyngeal cancer. In: Sakurai, H., ed., *Occupational Epidemiology*, New York, Elsevier Science, pp. 71–74

Bolstad-Johnson, D.M., Burgess, J.L., Crutchfield, C.D., Storment, S., Gerkin, R. & Wilson, J.R. (2000) Characterization of firefighter exposures during fire overhaul. *Am. ind. Hyg. Assoc. J.*, **61**, 636–641

Bolt, H.M. (1987) Experimental toxicology of formaldehyde. *Cancer Res. clin. Oncol.*, **113**, 305–309

Bolt, H.M. (2003) Genotoxicity — Threshold or not? Introduction of cases of industrial chemicals. *Toxicol. Lett.*, **140–141**, 43–51

Bond, G.G., Flores, G.H., Shellenberger, R.J., Cartmill, J.B., Fishbeck, W.A. & Cook, R.R. (1986) Nested case–control study of lung cancer among chemical workers. *Am. J. Epidemiol*., **124**, 53–66

Boysen, M., Zadig, E., Digernes, V., Abeler, V. & Reith, A. (1990) Nasal mucosa in workers exposed to formaldehyde: A pilot study. *Br. J. ind. Med.*, **47**, 116–121

Brandt-Rauf, P.W., Fallon, L.F., Jr, Tarantini, T., Idema, C. & Andrews, L. (1988) Health hazards of fire fighters: Exposure assessment. *Br. J. ind. Med*., **45**, 606–612

Brickus, L.S.R., Cardoso, J.N. & Aquino Neto, F.R. (1998) Distributions of indoor and outdoor air pollutants in Rio de Janeiro, Brazil: Implications to indoor air quality in bayside offices. *Environ. Sci. Technol*., **32**, 3485–3490

Brinton, L.A., Blot, W.J., Becker, J.A., Winn, D.M., Browder, J.P., Farmer, J.C., Jr & Fraumeni, J.F., Jr (1984) A case–control study of cancers of the nasal cavity and paranasal sinuses. *Am. J. Epidemiol*., **119**, 896–906

Brinton, L.A., Blot, W.J. & Fraumeni, J.F., Jr (1985) Nasal cancer in the textile and clothing industries. *Br. J. ind. Med.*, **42**, 469–474

Broder, I., Corey, P., Cole, P., Lipa, M., Mintz, S. & Nethercott, J.R. (1988a) Comparison of health of occupants and characteristics of houses among control homes and homes insulated with urea formaldehyde foam. I. Methodology. *Environ. Res.*, **45**, 141–155

Broder, I., Corey, P., Cole, P., Lipa, M., Mintz, S. & Nethercott, J.R. (1988b) Comparison of health of occupants and characteristics of houses among control homes and homes insulated with urea formaldehyde foam. II. Initial health and house variables and exposure–response relationships. *Environ. Res.*, **45**, 156–178

Broder, I., Corey, P., Brasher, P., Lipa, M. & Cole, P. (1988c) Comparison of health of occupants and characteristics of houses among control homes and homes insulated with urea formaldehyde foam. III. Health and house variables following remedial work. *Environ. Res.*, **45**, 179–203

Broder, I., Corey, P., Brasher, P., Lipa, M. & Cole, P. (1991) Formaldehyde exposure and health status in households. *Environ. Health Perspect.*, **95**, 101–104

Brownson, R.C., Alavanja, M.C.R. & Chang, J.C. (1993) Occupational risk factors for lung cancer among nonsmoking women: A case–control study in Missouri (United States). *Cancer Causes Control*, **4**, 449–454

Buckley, L.A., Jiang, X.Z., James, R.A., Morgan, K.T. & Barrow, C.S. (1984) Respiratory tract lesions induced by sensory irritants at the RD50 concentration. *Toxicol. appl. Pharmacol.*, **74**, 417–429

Burgaz, S., Cakmak, G., Erdem, O., Yilmaz, M. & Karakaya, A.E. (2001) Micronuclei frequencies in exfoliated nasal mucosa cells from pathology and anatomy laboratory workers exposed to formaldehyde. *Neoplasma*, **48**, 144–147

Burgaz, S., Erdem, O., Çakmak, G., Erdem, N., Karakaya, A. & Karakaya, A.E. (2002) Cytogenetic analysis of buccal cells from shoe-workers and pathology and anatomy laboratory workers exposed to *n*-hexane, toluene, methyl ethyl ketone and formaldehyde. *Biomarkers*, **7**, 151–161

Burge, P.S., Harries, M.G., Lam, W.K., O'Brien, I.M. & Patchett, P. (1985) Occupational asthma due to formaldehyde. *Thorax*, **40**, 255–260

Buss, J., Kuschinsky, K., Kewitz, H. & Koransky, W. (1964) [Enteric resorption of formaldehyde.] *Naunyn-Schmiedeberg's Arch. exp. Pathol. Pharmakol.*, **247**, 380–381 (in German)

California Air Resources Board (2004) *California Ambient Air Quality Data 1990–2002*, Los Angeles, CA, Planning & Technical Support Division

Callas, P.W., Pastides, H. & Hosmer, D.W., Jr (1996) Lung cancer mortality among workers in formaldehyde industries. *J. occup. environ. Med.*, **38**, 747–748

Cantor, K.P., Stewart, P.A., Brinton, L.A. & Dosemeci, M. (1995) Occupational exposures and female breast cancer mortality in the United States. *J. occup. environ. Med.*, **37**, 336–348

CAREX (2003) Available at http://www.ttl.fi/NR/rdonlyres/407B368B-26EF-475D-8F2B-DA0024B853E0/0/5_exposures_by_agent_and_industry.pdf

Carraro, E., Gasparini, S. & Gilli, G. (1999) Identification of a chemical marker of environmental exposure to formaldehyde. *Environ. Res.*, **A80**, 132–137

Casanova, M. & Heck, H.d'A. (1987) Further studies of the metabolic incorporation and covalent binding of inhaled [^{3}H]- and [^{14}C]formaldehyde in Fischer-344 rats: Effects of glutathione depletion. *Toxicol. appl. Pharmacol.*, **89**, 105–121

Casanova, M., Heck, H.d'A., Everitt, J.I., Harrington, W.W., Jr & Popp, J.A. (1988) Formaldehyde concentrations in the blood of rhesus monkeys after inhalation exposure. *Food chem. Toxicol.*, **26**, 715–716

Casanova, M., Deyo, D.F. & Heck, H.d'A. (1989) Covalent binding of inhaled formaldehyde to DNA in the nasal mucosa of Fischer 344 rats: Analysis of formaldehyde and DNA by high-performance liquid chromatography and provisional pharmacokinetic interpretation. *Fundam. appl. Toxicol.*, **12**, 397–417

Casanova, M., Morgan, K.T., Steinhagen, W.H., Everitt, J.I., Popp, J.A. & Heck, H.d'A. (1991) Covalent binding of inhaled formaldehyde to DNA in the respiratory tract of rhesus monkeys: Pharmacokinetics, rat-to-monkey interspecies scaling, and extrapolation to man. *Fundam. appl. Toxicol.*, **17**, 409–428

Casanova, M., Morgan, K.T., Gross, E.A., Moss, O.R. & Heck, H.d'A. (1994) DNA–protein cross-links and cell replication at specific sites in the nose of F344 rats exposed subchronically to formaldehyde. *Fundam. appl. Toxicol.*, **23**, 525–536

Casanova, M., Bell, D.A. & Heck, H.d'A. (1997) Dichloromethane metabolism to formaldehyde and reaction of formaldehyde with nucleic acids in hepatocytes of rodents and humans with and without glutathione S-transferase *T1* and *M1* genes. *Fundam. appl. Toxicol.*, **37**, 168–180

Casanova-Schmitz, M. & Heck, H.d'A. (1983) Effects of formaldehyde exposure on the extractability of DNA from proteins in the rat nasal mucosa. *Toxicol. appl. Pharmacol.*, **70**, 121–132

Casanova-Schmitz, M., David, R.M. & Heck, H.d'A. (1984a) Oxidation of formaldehyde and acetaldehyde by NAD^+-dependent dehydrogenases in rat nasal mucosal homogenates. *Biochem. Pharmacol.*, **33**, 1137–1142

Casanova-Schmitz, M., Starr, T.B. & Heck, H.d'A. (1984b) Differentiation between metabolic incorporation and covalent binding in the labeling of macromolecules in the rat nasal mucosa and bone marrow by inhaled [^{14}C]- and [^{3}H]formaldehyde. *Toxicol. appl. Pharmacol.*, **76**, 26–44

Cassee, F.R. & Feron, V.J. (1994) Biochemical and histopathological changes in nasal epithelium of rats after 3-day intermittent exposure to formaldehyde and ozone alone or in combination. *Toxicol. Lett.*, **72**, 257–268

Cassee, F.R., Arts, J.H.E., Groten, J.P. & Feron, V.J. (1996a) Sensory irritation to mixtures of formaldehyde, acrolein and acetaldehyde in rats. *Arch. Toxicol.*, **70**, 329–337

Cassee, F.R., Groten, J.P. & Feron, V.J. (1996b) Changes in the nasal epithelium of rats exposed by inhalation to mixtures of formaldehyde, acetaldehyde, and acrolein. *Fundam. appl. Toxicol.*, **29**, 208–218

Cecinato, A., Yassaa, N., Di Palo, V. & Possanzini, M. (2002) Observation of volatile and semi-volatile carbonyls in an Algerian urban environment using dinitrophenylhydrazine/silica-HPLC and pentafluorophenylhydrazine/silica-GC-MS. *J. environ. Monit.*, **4**, 223–228

Centers for Disease Control (1986) Occupational exposure to formaldehyde in dialysis units. *J. Am. med. Assoc.*, **256**, 698–703

Chan, W.H., Shuang, S. & Choi, M.M.F. (2001) Determination of airborne formaldehyde by active sampling on 3-methyl-2-benzothiazolinone hydrazone hydrochloride-coated glass fibre filters. *Analyst*, **126**, 720–723

Chanet, R., Izard, C. & Moustacchi, E. (1975) Genetic effects of formaldehyde in yeast. I. Influence of the growth stages on killing and recombination. *Mutat. Res.*, **33**, 179–186

Chang, J.C.F. & Barrow, C.S. (1984) Sensory irritation tolerance and cross-tolerance in F-344 rats exposed to chlorine or formaldehyde gas. *Toxicol. appl. Pharmacol.*, **76**, 319–327

Chang, J.-Y. & Lin, J.-M. (1998) Aliphatic aldehydes and allethrin in mosquito-coil smoke. *Chemosphere*, **36**, 617–624

Chang, J.C.F., Steinhagen, W.H. & Barrow, C.S. (1981) Effect of single or repeated formaldehyde exposure on minute volume of B6C3F1 mice and F-344 rats. *Toxicol. appl. Pharmacol.*, **61**, 451–459

Chang, J.C.F., Gross, E.A., Swenberg, J.A. & Barrow, C.S. (1983) Nasal cavity deposition, histopathology and cell proliferation after single or repeated formaldehyde exposures in B6C3F1 mice and F-344 rats. *Toxicol. appl. Pharmacol.*, **68**, 161–176

Chang, H.L., Kuo, M.L. & Lin J.M. (1997) Mutagenic activity of incense smoke in comparison to formaldehyde and acetaldehyde in *Salmonella typhimurium* TA102. *Bull. environ. Contam. Toxicol.*, **58**, 394–401

Chemical Information Services (2004) *Directory of World Chemical Producers*, Dallas, TX [www.chemicalinfo.com]

Chiazze, L., Jr, Watkins, D.K., Fryar, C. & Kozono, J. (1993) A case–control study of malignant and non-malignant respiratory disease among employees of a fiberglass manufacturing facility. II. Exposure assessment. *Br. J. ind. Med*., **50**, 717–725

Chiazze, L., Watkins, D.K. & Fryar, C. (1997) Historical cohort mortality study of a continuous filament fiberglass manufacturing plant. I. White men. *J. occup. environ. Med*., **39**, 432–441

Christensen, C.S., Skov, H., Nielsen, T. & Lohse, C. (2000) Temporal variation of carbonyl compound concentrations at a semi-rural site in Denmark. *Atmos. Environ*., **34**, 287–296

Chung, K.Y.K., Cuthbert, R.J., Revell, G.S., Wassel, S.G. & Summers, N. (2000) A study on dust emission, particle size distribution and formaldehyde concentration during machining of medium density fibreboard. *Ann. occup. Hyg*., **44**, 455–466

Clarisse, B., Laurent, A.M., Seta, N., Le Moullec, Y., El Hasnaoui, A. & Momas, I. (2003) Indoor aldehydes: Measurement of contamination levels and identification of their determinants in Paris dwellings. *Environ. Res*., **92**, 245–253

Coggon, D., Pannett, B. & Acheson, E.D. (1984) Use of job–exposure matrix in an occupational analysis of lung and bladder cancers on the basis of death certificates. *J. natl Cancer Inst*., **72**, 61–65

Coggon, D., Harris, E.C., Poole, J. & Palmer, K.T. (2003) Extended follow-up of a cohort of British chemical workers exposed to formaldehyde. *J. natl Cancer Inst*., **95**, 1608–1615

Cohen Hubal, E.A., Schlosser, P.M., Conolly, R.B. & Kimbell, J.S. (1997) Comparison of inhaled formaldehyde dosimetry predictions with DNA–protein cross-link measurements in the rat nasal passages. *Toxicol. appl. Pharmacol*., **143**, 47–55

Coldiron, V.R., Ward, J.B., Jr, Trieff, N.M., Janssen, E., Jr & Smith, J.H. (1983) Occupational exposure to formaldehyde in a medical center autopsy service. *J. occup. Med*., **25**, 544–548

Collins, J.J. & Lineker, G.A. (2004) A review and meta-analysis of formaldehyde exposure and leukemia. *Regul. Toxicol. Pharmacol*., **40**, 81–91

Collins, J.J., Acquavella, J.F. & Esmen, N.A. (1997) An updated meta-analysis of formaldehyde exposure and upper respiratory tract cancers. *J. occup. environ. Med.*, **39**, 639–651

Collins, J.J., Esmen, N.A. & Hall, T.A. (2001a) A review and meta-analysis of formaldehyde exposure and pancreatic cancer. *Am. J. ind. Med*., **39**, 336–345

Collins, J.J., Ness, R., Tyl, R.W., Krivanek, N., Esmen, N.A. & Hall, T.A. (2001b) A review of adverse pregnancy outcomes and formaldehyde exposure in human and animal studies. *Regul. Toxicol. Pharmacol*., **34**, 17–34

Comba, P., Barbieri, P.G., Battista, G., Belli, S., Ponterio, F., Zanetti, D. & Axelson, O. (1992a) Cancer of the nose and paranasal sinuses in the metal industry: A case–control study. *Br. J. ind. Med.*, **49**, 193–196

Comba, P., Battista, G., Belli, S., de Capua, B., Merler, E., Orsi, D., Rodella, S., Vindigni, C. & Axelson, O. (1992b) A case–control study of cancer of the nose and paranasal sinuses and occupational exposures. *Am. J. ind. Med.*, **22**, 511–520

Composite Panel Association (1999) *American National Standard — Particleboard* (ANSI A208.1-1999), Gaithersburg, MD

Composite Panel Association (2002) *American National Standard — Medium Density Fiberboard (MDF) for Interior Applications* (ANSI A208.2-2002), Gaithersburg, MD

Conaway, C.C., Whysner, J., Verna, L.K. & Williams, G.M. (1996) Formaldehyde mechanistic data and risk assessment: Endogenous protection from DNA adduct formation. *Pharmacol. Ther*., **71**, 29–55

Connor, T.H., Barrie, M.D., Theiss, J.C., Matney, T.S. & Ward, J.B., Jr (1983) Mutagenicity of formalin in the Ames assay. *Mutat. Res.*, **119**, 145–149

Connor, T.H., Ward, J.B., Jr & Legator, M.S. (1985) Absence of mutagenicity in the urine of autopsy service workers exposed to formaldehyde: Factors influencing mutagenicity testing of urine. *Arch. occup. environ. Health*, **56**, 225–237

Conolly, R.B. (2002) The use of biologically based modeling in risk assessment. *Toxicology*, **181–182**, 275–279

Conolly, R.B. & Lutz, W.K. (2004) Nonmonotonic dose–response relationships: Mechanistic basis, kinetic modeling, and implications for risk assessment. *Toxicol. Sci.*, **77**, 151–157

Conolly, R.B., Lilly, P.D. & Kimbell, J.S. (2000) Simulation modeling of the tissue disposition of formaldehyde to predict nasal DNA–protein cross-links in Fischer 344 rats, rhesus monkeys and humans. *Environ. Health Perspect*., **108** (Suppl. 5), 919–924

Conolly, R.B., Kimbell, J.S., Janszen, D., Schlosser, P.M., Kalisak, D., Preston, J. & Miller, F.J. (2003) Biologically motivated computational modeling of formaldehyde carcinogenicity in the F344 rat. *Toxicol. Sci*., **75**, 432–447

Corrêa, S.M., Martins, E.M. & Arbilla, G. (2003) Formaldehyde and acetaldehyde in a high traffic street of Rio de Janeiro, Brazil. *Atmos. Environ*., **37**, 23–29

Cosma, G.N., Wilhite, A.S. & Marchok, A.C. (1988) The detection of DNA–protein cross-links in rat tracheal implants exposed *in vivo* to benzo[*a*]pyrene and formaldehyde. *Cancer Lett.*, **42**, 13–21

Cosmetic Ingredient Review Expert Panel (1984) Final report on the safety assessment of formaldehyde. *J. Am. Coll. Toxicol.*, **3**, 157–184

Costa, M., Zhitkovich, A., Harris, M., Paustenbach, D. & Gargas, M. (1997) DNA–protein cross-links produced by various chemicals in cultured human lymphoma cells. *J. Toxicol. environ. Health*, **50**, 433–449

Craft, T.R., Bermudez, E. & Skopek, T.R. (1987) Formaldehyde mutagenesis and formation of DNA–protein crosslinks in human lymphoblasts *in vitro*. *Mutat. Res.*, **176**, 147–155

Crosby, R.M., Richardson, K.K., Craft, T.R., Benforado, K.B., Liber, H.L. & Skopek, T.R. (1988) Molecular analysis of formaldehyde-induced mutations in human lymphoblasts and *E. coli*. *Environ. mol. Mutag.*, **12**, 155–166

Dahl, A.R. & Hadley, W.M. (1991) Nasal cavity enzymes involved in xenobiotic metabolism: Effects on the toxicity of inhalants. *Crit. Rev. Toxicol*., **21**, 345–372

Dalbey, W.E. (1982) Formaldehyde and tumors in hamster respiratory tract. *Toxicology*, **24**, 9–14

Dallas, C.E., Badeaux, P., Theiss, J.C. & Fairchild, E.J. (1989) The influence of inhaled formaldehyde on rat lung cytochrome P450. *Environ. Res.*, **49**, 50–59

Dallas, C.E., Scott, M.J., Ward, J.B., Jr & Theiss, J.C. (1992) Cytogenetic analysis of pulmonary lavage and bone marrow cells of rats after repeated formaldehyde inhalation. *J. appl. Toxicol.*, **12**, 199–203

Day, J.H., Lees, R.E.M., Clark, R.H. & Pattee, P.L. (1984) Respiratory response to formaldehyde and off-gas of urea formaldehyde foam insulation. *Can. med. Assoc. J.*, **131**, 1061–1065

Dean, J.H., Lauer, L.D., House, R.V., Murray, M.J., Stillman, W.S., Irons, R.D., Steinhagen, W.H., Phelps, M.C. & Adams, D.O. (1984) Studies of immune function and host resistance in B6C3F1 mice exposed to formaldehyde. *Toxicol. appl. Pharmacol.*, **72**, 519–529

Delfino, R.J., Gong, H., Jr, Linn, W.S., Pellizzari, E.D. & Hu, Y. (2003) Asthma symptoms in Hispanic children and daily ambient exposures to toxic and criteria air pollutants. *Environ. Health Perspect*., **111**, 647–656

Dell, L. & Teta, M.J. (1995) Mortality among workers at a plastics manufacturing and research and development facility: 1946–1988. *Am. J. ind. Med.*, **28**, 373–384

Deltour, L., Foglio, M.H. & Duester, G. (1999) Metabolic deficiencies in alcohol dehydrogenase *Adh1*, *Adh3*, and *Adh4* null mutant mice. Overlapping roles of *Adh1* and *Adh4* in ethanol clearance and metabolism of retinol to retinoic acid. *J. biol. Chem*., **274**, 16796–16801

Demerec, M., Bertani, G. & Flint, J. (1951) A survey of chemicals for mutagenic action on E. coli. *Am. Naturalist*, **85**, 119–136

Demkowicz-Dobrzanski, K. & Castonguay, A. (1992) Modulation by glutathione of DNA strand breaks induced by 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone and its aldehyde metabolites in rat hepatocytes. *Carcinogenesis*, **13**, 1447–1454

Department of Housing and Urban Development (2003) Manufactured home construction and safety standards. *US Code fed. Regul.*, **Title 24**, Part 3280.308, pp. 133–134

Deutsche Forschungsgemeinschaft (1993) Aldehydes (formaldehyde, acetaldehyde, propionaldehyde, butyraldehyde, glutaraldehyde). In: Henschler, D. & Kettrup, A., eds, *Analyses of Hazardous Substances in Air*, Vol. 2, Weinheim, VCH, Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area, pp. 15–28

Deutsche Forschungsgemeinschaft (2003) *List of MAK and BAT Values 2003 — Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area* (Report No. 39), Weinheim, Wiley-VCH Verlag GmbH, pp. 64, 132, 157–169

Deutsche Norm (1992) *Wood-based Panels Products. Determination of Formaldehyde Content. Extraction Method (Known as Perforator Method)* (DIN EN 120:1992), Berlin, German Norm Institute

Deutsche Norm (1994) *Wood-based Panel Products. Determination of Formaldehyde Release by the Gas Analysis Method* (DIN EN 717-2:1994), Berlin, German Norm Institute

Deutsche Norm (1996) *Wood-based Panel Products. Determination of Formaldehyde Release by the Flask Method* (DIN EN 717-3:1996), Berlin, German Norm Institute

Diaz, M., Achkor, H., Titarenko, E. & Martinez, M.C. (2003) The gene encoding glutathione-dependent formaldehyde dehydrogenase/GSNO reductase is responsive to wounding, jasmonic acid and salicylic acid. *FEBS Lett*., **543**, 136–139

Dicker, E. & Cederbaum, A.I. (1986) Inhibition of the low-K_m mitochondrial aldehyde dehydrogenase by diethyl maleate and phorone *in vivo* and *in vitro*. Implications for formaldehyde metabolism. *Biochem. J*., **240**, 821–827

Dickey, F.H., Cleland, G.H. & Lotz, C. (1949) The role of organic peroxides in the induction of mutations. *Proc. natl Acad. Sci. USA*, **35**, 581–586

Dillon, D., Combes, R. & Zeiger, E. (1998) The effectiveness of *Salmonella* strains TA100, TA102 and TA104 for detecting mutagenicity of some aldehydes and peroxides. *Mutagenesis*, **13**, 19–26

Dingle P., Tapsell, P. & Hu, S. (2000) Reducing formaldehyde exposure in office environments using plants. *Bull. environ. Contam. Toxicol*., **64**, 302–308

Dinsdale, D., Riley, R.A. & Verschoyle, R.D. (1993) Pulmonary cytochrome P450 in rats exposed to formaldehyde vapor. *Environ. Res.*, **62**, 19–27

Doi, S., Suzuki, S., Morishita, M., Yamada, M., Kanda, Y., Torii, S. & Sakamoto, T. (2003) The prevalence of IgE sensitization in asthmatic children. *Allergy*, **58**, 668–671

Doolittle, D.J., Furlong, J.W. & Butterworth, B.E. (1985) Assessment of chemically induced DNA repair in primary cultures of human bronchial epithelial cells. *Toxicol. appl. Pharmacol.*, **79**, 28–38

Douglas, M.P. & Rogers, S.O. (1998) DNA damage caused by common cytological fixatives. *Mutat. Res.*, **401**, 77–88

Draeger Safety (undated) *Draeger-Tubes® and Accuro® Pump*, Pittsburgh, PA

Dresp, J. & Bauchinger, M. (1988) Direct analysis of the clastogenic effect of formaldehyde in unstimulated human lymphocytes by means of the premature chromosome condensation technique. *Mutat. Res.*, **204**, 349–352

Duester, G., Farrés, J., Felder, M.R., Holmes, R.S., Höög, J.-O., Parés, X., Plapp, B.V., Yin, S.-J. & Jörnvall, H. (1999) Recommended nomenclature for the vertebrate alcohol dehydrogenase gene family. *Biochem. Pharmacol*., **58**, 389–395

Dufresne, A., Infante-Rivard, C., Malo, J.L. & Gautrin, D. (2002) Exposure to formaldehyde among animal health students. *Am. ind. Hyg. Assoc. J*., **63**, 647–650

Dumas, S., Parent, M.-E., Siemiatycki, J. & Brisson, J. (2000) Rectal cancer and occupational risk factors: A hypothesis-generating, exposure-based case–control study. *Int. J. Cancer*, **87**, 874–879

Echt, A. & Burr, G.A. (1997) Exposure to formaldehyde during garment manufacturing. *Appl. occup. environ. Hyg*., **12**, 451–455

Edling, C., Järvholm, B., Andersson, L. & Axelson, O. (1987a) Mortality and cancer incidence among workers in an abrasive manufacturing industry. *Br. J. ind. Med.*, **44**, 57–59

Edling, C., Hellquist, H. & Ödkvist, L. (1987b) Occupational formaldehyde exposure and the nasal mucosa. *Rhinology*, **25**, 181–187

Edling, C., Hellquist, H. & Ödkvist, L. (1988) Occupational exposure to formaldehyde and histopathological changes in the nasal mucosa. *Br. J. ind. Med.*, **45**, 761–765

Eells, J.T., McMartin, K.E., Black, K., Virayotha, V., Tisdell, R.H. & Tephly, T.R. (1981) Formaldehyde poisoning. Rapid metabolism to formic acid. *J. am. Med. Assoc.*, **246**, 1237–1238

Eitzer, B.D., Iannucci-Berger, W.A., Mark, G. & Zito, C. (1997) Fate of toxic compounds during composting. *Bull. environ. Contam. Toxicol.*, **58**, 953–960

Elci, O.C., Akpinar-Elci, M., Blair, A. & Dosemeci, M. (2003) Risk of laryngeal cancer by occupational chemical exposure in Turkey. *J. occup. environ. Med*., **45**, 1100–1106

Elias, I. (1987) [Evaluation of methods for disinfection of operating theatres in hospitals according to the concentration of formaldehyde in the air.] *Zbl. Arbeitsmed.*, **37**, 389–397 (in German)

Elliott, L.J., Stayner, L.T., Blade, L.M., Halperin, W. & Keenlyside, R. (1987) *Formaldehyde Exposure Characterization in Garment Manufacturing Plants: A Composite Summary of Three In-depth Industrial Hygiene Surveys*, Cincinnati, OH, US Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health

Enterline, P.E., Marsh, G.M., Henderson, V. & Callahan, C. (1987) Mortality update of a cohort of US man-made mineral fibre workers. *Ann. occup. Hyg.*, **31**, 625–656

Environment Canada (1997) *Results of the CEPA Section 16 Notice to Industry Respecting the Second Priority Substances List and Di(2-ethylhexyl) Phthalate*, Hull, Quebec, Use Patterns Section, Commercial Chemicals Evaluation Branch

Environment Canada (1999) *Canadian Environmental Protection Act — Priority Substances List — Supporting Document for the Environmental Assessment of Formaldehyde*, Hull, Quebec, Commercial Chemicals Evaluation Branch

Environment Canada/Health Canada (2001) *Canadian Environmental Protection Act, 1999. Priority Substances List Assessment Report: Formaldehyde*, Ottawa, Ontario

Environmental Protection Agency (1976) *Investigation of Selected Potential Environmental Contaminants: Formaldehyde* (Report No. EPA-560/2-76-009; PB 256 839), Washington DC, Office of Toxic Substances

Environmental Protection Agency (1988) *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air* (Report No. EPA-600/4-89-017; US NTIS PB90-116989), Research Triangle Park, NC, Office of Research and Development, pp. TO5-1–TO5-22

Environmental Protection Agency (1999a) *Method 318 — Extractive FTIR method for the Measurement of Emissions from the Mineral Wool and Wool Fiberglass Industries*, Washington DC

Environmental Protection Agency (1999b) *Test Method 320 — Measurement of Vapor Phase Organic and Inorganic Emissions by Extractive Fourier Transform Infrared (FTIR) Spectroscopy*, Washington DC

Environmental Protection Agency (1999c) *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air* (Report No. EPA-625/R-96-010b), 2nd Ed., Cincinnati, OH, Office of Research and Development, pp. TO11A-1–TO11A-56

Epstein, S.S. & Shafner, H. (1968) Chemical mutagens in the human environment. *Nature*, **219**, 385–387

Epstein, S.S., Arnold, E., Andrea, J., Bass, W. & Bishop, Y. (1972) Detection of chemical mutagens by the dominant lethal assay in the mouse. *Toxicol. appl. Pharmacol.*, **23**, 288–325

Erdei, E., Bobvos, J., Brózik, M., Páldy, A., Farkas, I., Vaskövi, E. & Rudnai, P. (2003) Indoor air pollutants and immune biomarkers among Hungarian asthmatic children. *Arch. environ. Health*, **58**, 337–347

Ericson, A., Källén, B., Zetterström, R., Eriksson, M. & Westerholm, P. (1984) Delivery outcome of women working in laboratories during pregnancy. *Arch. environ. Health*, **39**, 5–10

Estonius, M., Svensson, S. & Höög, J.-O. (1996) Alcohol dehydrogenase in human tissues: localisation of transcripts coding for five classes of the enzyme. *FEBS Lett*., **397**, 338–342

European Commission (1989) *Formaldehyde Emission from Wood Based Materials: Guideline for the Determination of Steady State Concentrations in Test Chambers* (EUR 12196 EN; Report No. 2), Luxembourg, European Concerted Action: Indoor Air Quality and Its Impact on Man (COST Project 613)

European Commission (1990) Proposal for a Council Directive on the approximation of the laws of the Member States relating to cosmetic products (90/C322/06). *Off. J. Eur. Commun.*, **C322**, 29–77

European Union (1989) *Council Directive 89/106/EEC of 21 December 1988 on the Approximation of the Laws, Regulations and Administrative Provisions of the Member States Relating to Construction Products, Annex on Legislation on the Release of Dangerous Substances* (89/106/EEC) [Available at: http://europa.eu.int/comm/enterprise/construction/internal/dangsub/dangcount.htm; accessed 01/03/2004]

Fantuzzi, G., Aggazzotti, G., Righi, E., Cavazzuti, L., Predieri, G. & Franceschelli, A. (1996) Indoor air quality in the university libraries of Modena (Italy). *Sci. total Environ*., **193**, 49–56

Fayerweather, W.E., Pell, S. & Bender, J.R. (1983) Case–control study of cancer deaths in DuPont workers with potential exposure to formaldehyde. In: Clary, J.C., Gibson, J.E. & Waritz, R.S., eds, *Formaldehyde. Toxicology, Epidemiology, and Mechanisms*, New York, Marcel Dekker, pp. 47–121

Feinman, S.E. (1988) Formaldehyde genotoxicity and teratogenicity. In: Feinman, S.E., ed., *Formaldehyde. Sensitivity and Toxicity*, Boca Raton, FL, CRC Press, pp. 167–178

Fenech, M., Holland, N., Chang, W.P., Zeiger, E. & Bonassi, S. (1999) The Human Micronucleus Project — An international collaborative study on the use of the micronucleus technique for measuring DNA damage in humans. *Mutat. Res.*, **428**, 271–283

Feng, Y., Wen, S., Wang, X., Sheng, G., He, Q., Tang, J. & Fu, J. (2004) Indoor and outdoor carbonyl compounds in the hotel ballrooms in Guangzhou, China. *Atmos. Environ*., **38**, 103–112

Feron, V.J., Bruyntjes, J.P., Woutersen, R.A., Immel, H.R. & Appelman, L.M. (1988) Nasal tumours in rats after short-term exposure to a cytotoxic concentration of formaldehyde. *Cancer Lett.*, **39**, 101–111

Feron, V.J., Til, H.P. & Woutersen, R.A. (1990) Letter to the Editor. *Toxicol. ind. Health*, **6**, 637–639

Feron, V.J., Til, H.P., de Vrijer, F., Woutersen, R.A., Cassee, F.R. & van Bladeren, P.J. (1991) Aldehydes: Occurrence, carcinogenic potential, mechanism of action and risk assessment. *Mutat. Res*., **259**, 363–385

Ferrari, C.P., Kaluzny, P., Roche, A., Jacob, V. & Foster, P. (1998) Aromatic hydrocarbons and aldehydes in the atmosphere of Grenoble, France. *Chemosphere*, **37**, 1587–1601

Finnish Institute of Occupational Health (1994) *Measurements of Formaldehyde, Industrial Hygiene Data Base*, Helsinki

Fló-Neyret, C., Lorenzi-Filho, G., Macchione, M., Garcia, M.L.B. & Saldiva, P.H.N. (2001) Effects of formaldehyde on the frog's mucociliary epithelium as a surrogate to evaluate air pollution effects on the respiratory epithelium. *Braz. J. med. biol. Res*., **34**, 639–643

Fontignie-Houbrechts, N. (1981) Genetic effects of formaldehyde in the mouse. *Mutat. Res.*, **88**, 109–114

Food & Drug Administration (2003) Food and drugs. *US Code fed. Regul.*, **Title 21**, Parts 173.340, 175.105, 176.170, 176.180, 176.200, 176.210, 177.2800, 178.3120, 529.1030, 573.460 [www.fda.gov]

Fornace, A.J., Jr, Lechner, J.F., Grafström, R.C. & Harris, C.C. (1982) DNA repair in human bronchial epithelial cells. *Carcinogenesis*, **3**, 1373–1377

Fransman, W., McLean, D., Douwes, J., Demers, P.A., Leung, V. & Pearce, N. (2003) Respiratory symptoms and occupational exposures in New Zealand plywood mill workers. *Ann. occup. Hyg.*, **47**, 287–295

Friedfeld, S., Fraser, M., Lancaster, D., Leleux, D., Rehle, D. & Tittel, F. (2000) Field intercomparison of a novel optical sensor for formaldehyde quantification. *Geophys. Res. Lett.*, **27**, 2093–2096

Friedman, G.D. & Ury, H.K. (1983) Screening for possible drug carcinogenicity: Second report of findings. *J. natl Cancer Inst.,* **71**, 1165–1175

Fritschi, L. & Siemiatycki, J. (1996) Lymphoma, myeloma and occupation: Results of a case–control study. *Int. J. Cancer*, **67**, 498–503

Gaffney, J.S., Marley, N.A., Martin, R.S., Dixon, R.W., Reyes, L.G. & Popp, C.J. (1997) Potential air quality effects of using ethanol–gasoline fuel blends: A field study in Albuquerque, New Mexico. *Environ. Sci. Technol.*, **31**, 3053–3061

Gallagher, R.P., Threlfall, W.J., Band, P.R., Spinelli, J.J. & Coldman, A.J. (1986) *Occupational Mortality in British Columbia 1950–1978*, Ottawa, Statistics Canada, Health and Welfare Canada

Gallagher, R.P., Threlfall, W.J., Band, P.R. & Spinelli, J.J. (1989) *Occupational Mortality in British Columbia 1950–1984*, Vancouver, Canadian Cancer Association of British Columbia

Gammage, R.B. & Gupta, K.C. (1984) Formaldehyde. In: Walsh, P.J., Dudney, C.S. & Copenhaver, E.D., eds, *Indoor Air Quality*, Boca Raton, FL, CRC Press, pp. 109–142

Gammage, R.G. & Travis, C.C. (1989) Formaldehyde exposure and risk in mobile homes. In: Paustenbach, D.J., ed., *The Risk Assessment of Environmental and Human Health Hazards: A Textbook of Case Studies*, New York, John Wiley & Sons, pp. 601–611

García-Alonso, S. & Pérez-Pastor, R.M. (1998) Use of C_{18} and silica-gel coated Sep-Pak cartridges for the determination of carbonyls in air by liquid chromatography. *Anal. chim. Acta*, **367**, 93–99

Gardner, M.J., Pannett, B., Winter, P.D. & Cruddas, A.M. (1993) A cohort study of workers exposed to formaldehyde in the British chemical industry: An update. *Br. J. ind. Med*., **50**, 827–834

Garrett, M.H., Hooper, M.A. & Hooper, B.M. (1997) Formaldehyde in Australian homes; levels and sources. *Clean Air*, **31**, 28–32

Garrett, M.H., Hooper, M.A., Hooper, B.M., Rayment, P.R. & Abramson, M.J. (1999) Increased risk of allergy in children due to formaldehyde exposure in homes. *Allergy*, **54**, 330–337

Gaylor, D.W., Lutz, W.K. & Conolly, R.B. (2004) Statistical analysis of nonmonotonic dose–response relationships: Research design and analysis of nasal cell proliferation in rats exposed to formaldehyde. *Toxicol. Sci.*, **77**, 158–164

Georghiou, P.E., Winsor, L., Sliwinski, J.F. & Shirtliffe, C.J. (1993) Method 11. Determination of formaldehyde in indoor air by a liquid sorbent technique. In: Seifert, B., van de Wiel, H., Dodet, B. & O'Neill, I.K., eds, *Environmental Carcinogens: Methods of Analysis and Exposure Measurement. Vol. 12*: *Indoor Air Contaminants* (IARC Scientific Publications No. 109), Lyon, IARC, pp. 245–249

Georgieva, A.V., Kimbell, J.S. & Schlosser, P.M. (2003) A distributed-parameter model for formaldehyde uptake and disposition in the rat nasal lining. *Inhal. Toxicol*., **15**, 1435–1463

Gerberich, H.R. & Seaman, G.C. (2004) Formaldehyde. In: Kroschwitz, J.I. & Howe-Grant, M., eds, *Kirk–Othmer Encyclopedia of Chemical Technology*, 5th Ed., Vol. 11, New York, John Wiley & Sons, pp. 929–951

Gérin, M., Siemiatycki, J., Nadon, L., Dewar, R. & Krewski, D. (1989) Cancer risks due to occupational exposure to formaldehyde: Results of a multi-site case–control study in Montreal. *Int. J. Cancer*, **44**, 53–58

Gibson, J.E. (1984) Coordinated toxicology: An example study with formaldehyde. *Concepts Toxicol.*, **1**, 276–282

Gocke, E., King, M.-T., Eckhardt, K. & Wild, D. (1981) Mutagenicity of cosmetics ingredients licensed by the European Communities. *Mutat. Res.*, **90**, 91–109

Gofmekler, V.A. (1968) [Embryotropic action of benzol and formaldehyde on experimental introduction by the respiratory route.] *Gig. Sanit.*, **33**, 327–332 (in Russian)

Gofmekler, V.A. & Bonashevskaya, T.I. (1969) [Experimental studies of teratogenic properties of formaldehyde, based on pathological investigations.] *Hyg. Sanit.*, **34**, 266–268 (in Russian)

Gofmekler, V.A., Pushkina, N.N. & Klevtsova. G.N. (1968) [Some biochemical aspects of the embryotropic effect of benzene and formaldehyde.] *Hyg. Sanit.*, **33**, 112–116 (in Russian)

Goldmacher, V.S. & Thilly, W.G. (1983) Formaldehyde is mutagenic for cultured human cells. *Mutat. Res.*, **116**, 417–422

Goldoft, M., Weiss, N., Vaughan, T. & Lee, J. (1993) Nasal melanoma. *Br. J. ind. Med.*, **50**, 767–768

Goldstein, H.B. (1973) Textiles and the chemical industry: A marriage. *J. am. Assoc. Text. Chem. Color.*, **5**, 209–214

Goldstein, B.D. (1990) Is exposure to benzene a cause of human multiple myeloma? *Ann. N.Y. Acad. Sci.*, **609**, 225–234

Gosselin, N.H., Brunet, R.C. & Carrier, G. (2003) Comparative occupational exposures to formaldehyde released from inhaled wood product dusts versus that in vapor form. *Appl. occup. environ. Hyg.*, **18**, 384–393

Gotoh, Y., Sumimoto, H. & Minakami, S. (1990) Formation of 20-oxoleukotriene B_4 by an alcohol dehydrogenase isolated from human neutrophils. *Biochim. biophys. Acta*, **1043**, 52–56

Gottschling, L.M., Beaulieu, H.J. & Melvin, W.W. (1984) Monitoring of formic acid in urine of humans exposed to low levels of formaldehyde. *Am. ind. Hyg. Assoc. J.*, **45**, 19–23

Grafström, R.C (1990) In vitro studies of aldehyde effects related to human respiratory carcinogenesis. *Mutat. Res.*, **238**, 175–184

Grafström, R.C., Fornace, A., Jr & Harris, C.C. (1984) Repair of DNA damage caused by formaldehyde in human cells. *Cancer Res.*, **44**, 4323–4327

Grafström, R.C., Curren, R.D., Yang, L.L. & Harris, C.C. (1985) Genotoxicity of formaldehyde in cultured human bronchial fibroblasts. *Science*, **228**, 89–91

Grafström, R.C., Willey, J.C., Sundqvist, K. & Harris, C.C. (1986) Pathobiological effects of tobacco smoke-related aldehydes in cultured human bronchial epithelial cells. In: Hoffmann, D. & Harris, C.C., eds, *Mechanisms in Tobacco Carcinogenesis* (Banbury Report 23), Cold Spring Harbor, NY, CSH Press, pp. 273–285

Grafström, R.C., Hsu, I.-C. & Harris, C.C. (1993) Mutagenicity of formaldehyde in Chinese hamster lung fibroblasts: Synergy with ionizing radiation and *N*-nitroso-*N*-methylurea. *Chem.-biol. Interactions*, **86**, 41–49

Grafström, R.C., Jernelöv, M.I., Dypbukt, J.M., Sundqvist, K., Atzori, L. & Zheng, X. (1996) Aldehyde toxicity and thiol redox state in cell cultures from human aerodigestive tract. In: Mohr, U., Adler, K.B., Dungworth, D.I., Harris, C.C., Plopper, C.G. & Saracci, R., eds, *Correlations Between In Vitro and In Vivo Investigations in Inhalation Toxicology*, Washington DC, ILSI Press, pp. 319–336

Granby, K., Christensen, C.S. & Lohse, C. (1997) Urban and semi-rural observations of carboxylic acids and carbonyls. *Atmos. Environ.*, **31**, 1403–1415

Graves, R.J., Callander, R.D. & Green, T. (1994) The role of formaldehyde and *S*-chloromethylglutathione in the bacterial mutagenicity of methylene chloride. *Mutat. Res.*, **320**, 235–243

Graves, R.J., Trueman, P., Jones, S. & Green, T. (1996) DNA sequence analysis of methylene chloride-induced HPRT mutations in Chinese hamster ovary cells: Comparison with the mutation spectrum obtained for 1,2-dibromoethane and formaldehyde. *Mutagenesis*, **11**, 229–233

Green, D.J., Sauder, L.R., Kulle, T.J. & Bascom, R. (1987) Acute response to 3.0 ppm formaldehyde in exercising healthy nonsmokers and asthmatics. *Am. Rev. respir. Dis.*, **135**, 1261–1266

Groah, W.J., Bradfield, J., Gramp, G., Rudzinski, R. & Heroux, G. (1991) Comparative response of reconstituted wood products to European and North American test methods for determining formaldehyde emissions. *Environ. Sci. Technol.*, **25**, 117–122

Grosjean, E., Williams, E.L., II & Grosjean, D. (1993) Ambient levels of formaldehyde and acetaldehyde in Atlanta, Georgia. *J. Air Waste Manage. Assoc*., **43**, 469–474

Grosjean, E., Grosjean, D., Fraser, M.P. & Cass, G.R. (1996) Air quality model evaluation data for organics. 2. C_1-C_{14} carbonyls in Los Angeles air. *Environ. Sci. Technol*., **30**, 2687–2703

Grosjean, D., Grosjean, E. & Moreira, L.F.R. (2002) Speciated ambient carbonyls in Rio de Janeiro, Brazil. *Environ. Sci. Technol*., **36**, 1389–1395

Gustavsson, P., Jakobsson, R., Johansson, H., Lewin, F., Norell, S. & Rutkvist, L.-E. (1998) Occupational exposures and squamous cell carcinoma of the oral cavity, pharynx, larynx, and oesophagus: A case–control study in Sweden. *Occup. environ. Med*., **55**, 393–400

Gylseth, B. & Digernes, V. (1992) The European development of regulations and standards for formaldehyde in air and in wood composite boards. In: *Proceedings of the Pacific Rim Biobased Composites Symposium, 9–13 November 1992*, *Rotorua, New Zealand*, Rotorua, Forest Products Research Institute, pp. 199–206

Hagberg, M., Kolmodin-Hedman, B., Lindahl, R., Nilsson, C.-A. & Nordström, Å. (1985) Irritative complaints, carboxyhemoglobin increase and minor ventilatory function changes due to exposure to chain-saw exhaust. *Eur. J. respir. Dis*., **66**, 240–247

Hagen, J.A., Nafstad, P., Skrondal, A., Bjørkly, S. & Magnus, P. (2000) Associations between outdoor air pollutants and hospitalization for respiratory diseases. *Epidemiology*, **11**, 136–140

Hall, A., Harrington, J.M. & Aw, T.-C. (1991) Mortality study of British pathologists. *Am. J. ind. Med.*, **20**, 83–89

Hamaguchi, F. & Tsutsui, T. (2000) Assessment of genotoxicity of dental antiseptics: Ability of phenol, guaiacol, *p*-phenolsulfonic acid, sodium hypochlorite, *p*-chlorophenol, *m*-cresol or formaldehyde to induce unscheduled DNA synthesis in cultured Syrian hamster embryo cells. *Jpn J. Pharmacol.*, **83**, 273–276

Hansch, C., Leo, A. & Hoekman (1995) *Exploring QSAR — Hydrophobic, Electronic, and Steric Constants*, Washington DC, American Chemical Society

Hansen, J. & Olsen, J.H. (1995) Formaldehyde and cancer morbidity among male employees in Denmark. *Cancer Causes Control*, **6**, 354–360

Hansen, J. & Olsen, J.H. (1996) [Occupational exposure to formaldehyde and risk for cancer.] *Ugeskr. Laeger.*, **158**, 4191–4194 (in Danish)

Hardell, L., Johansson, B. & Axelson, O. (1982) Epidemiological study of nasal and nasopharyngeal cancer and their relation to phenoxy acid or chlorophenol exposure. *Am. J. ind. Med.*, **3**, 247–257

Harrington, J.M. & Oakes, D. (1984) Mortality study of British pathologists 1974–80. *Br. J. ind. Med.,* **41**, 188–191

Harrington, J.M. & Shannon, H.S. (1975) Mortality study of pathologists and medical laboratory technicians. *Br. med. J.*, **i**, 329–332

Harving, H., Korsgaard, J., Pedersen, O.F., Mølhave, L. & Dahl, R. (1990) Pulmonary function and bronchial reactivity in asthmatics during low-level formaldehyde exposure. *Lung*, **168**, 15–21

Haszpra, L. Szilágyi, I., Demeter, A., Turányi, T. & Bérces, T. (1991) Non-methane hydrocarbon and aldehyde measurements in Budapest, Hungary. *Atmos. Environ*., **25**, 2103–2110

Hauptmann, M., Lubin, J.H., Stewart, P.A., Hayes, R.B. & Blair, A. (2003) Mortality from lymphohematopoietic malignancies among workers in formaldehyde industries. *J. natl Cancer Inst.*, **95**, 1615–1623

Hauptmann, M., Lubin, J.H., Stewart, P.A., Hayes, R.B. & Blair, A. (2004) Mortality from solid cancers among workers in formaldehyde industries. *Am. J. Epidemiol.*, **159**, 1117–1130

Haworth, S., Lawlor, T., Mortelmans, K., Speck, W. & Zeiger, E. (1983) Salmonella mutagenicity test results for 250 chemicals. *Environ. Mutag.*, **Suppl. 1**, 3–142

Hayasaka, Y., Yayasaka, S. & Nagaki, Y. (2001) Ocular changes after intravitreal injection of methanol, formaldehyde, or formate in rabbits. *Pharmacol. Toxicol*., **89**, 74–78

Hayes, R.B., Raatgever, J.W., de Bruyn, A. & Gerin, M. (1986a) Cancer of the nasal cavity and paranasal sinuses, and formaldehyde exposure. *Int. J. Cancer*, **37**, 487–492

Hayes, R.B., Gérin, M., Raatgever, J.W. & de Bruyn, A. (1986b) Wood-related occupations, wood dust exposure, and sinonasal cancer. *Am. J. Epidemiol.*, **124**, 569–577

Hayes, R.B., Blair, A., Stewart, P.A., Herrick, R.F. & Mahar, H. (1990) Mortality of US embalmers and funeral directors. *Am. J. ind. Med.*, **18**, 641–652

Hayes, R.B., Klein, S., Suruda, A., Schulte, P., Boeniger, M., Stewart, P., Livingston, G.K. & Oesch, F. (1997) O^6-Alkylguanine DNA alkyltansferase activity in student embalmers. *Am. J. ind. Med.*, **31**, 361–365

He, J.-L., Jin, L.-F. & Jin, H.-Y. (1998) Detection of cytogenetic effects in peripheral lymphocytes of students exposed to formaldehyde with cytokinesis-blocked micronucleus assay. *Biomed. environ. Sci.*, **11**, 87–92

Health & Safety Executive (2002) *Occupational Exposure Limits 2002* (EH40/2002), Norwich, Her Majesty' Stationery Office

Health Canada (2000) *Draft Supporting Documentation for PSL2 Assessments. Human Exposure Assessment for Formaldehyde*, Ottawa, Ontario, Priority Substances Section, Health Protection Branch

Heck, H.d'A. & Casanova, M. (1987) Isotope effects and their implications for the covalent binding of inhaled [^{3}H]- and [^{14}C]formaldehyde in the rat nasal mucosa. *Toxicol. appl. Pharmacol.*, **89**, 122–134

Heck, H.d'A. & Casanova, M. (1995) Nasal dosimetry of formaldehyde: Modelling site specificity and the effects of pre-exposure. In: Miller, F.J., ed., *Nasal Toxicity and Dosimetry of Inhaled Xenobiotics: Implications for Human Health*, Washington DC, Taylor Francis, pp. 159–175

Heck, H.d'A. & Casanova, M. (1999) Pharmacodynamics of formaldehyde: Applications of a model for the arrest of DNA replication by DNA–protein cross-links. *Toxicol. appl. Pharmacol*., **160**, 86–100

Heck, H.d'A. & Casanova, M. (2004) The implausibility of leukemia induction by formaldehyde: A critical review of the biological evidence on distant-site toxicity. *Regul. Toxicol. Pharmacol.*, **40**, 92–106

Heck, H.d'A., White, E.L. & Casanova-Schmitz, M. (1982) Determination of formaldehyde in biological tissues by gas chromatography/mass spectrometry. *Biomed. mass Spectrom.*, **9**, 347–353

Heck, H.d'A., Chin, T.Y. & Schmitz, M.C. (1983) Distribution of [^{14}C]formaldehyde in rats after inhalation exposure. In: Gibson, J.E., ed., *Formaldehyde Toxicity*, Washington DC, Hemisphere, pp. 26–37

Heck, H.d'A., Casanova-Schmitz, M., Dodd, P.B., Schachter, E.N., Witek, T.J. & Tosun, T. (1985) Formaldehyde (CH_2O) concentrations in the blood of humans and Fischer-344 rats exposed to CH_2O under controlled conditions. *Am. ind. Hyg. Assoc. J*., **46**, 1–3

Heck, H.d'A., Casanova, M., Lam, C.-W. & Swenberg, J.A. (1986) The formation of DNA–protein cross-links by aldehydes present in tobacco smoke. In: Hoffmann, D. & Harris, C.C., eds,

Mechanisms in Tobacco Carcinogenesis (Banbury Report 23), Cold Spring Harbor, NY, CSH Press, pp. 215–230

Heck, H.d'A., Casanova, M., Steinhagen, W.H., Everitt, J.I., Morgan, K.T. & Popp, J.A. (1989) Formaldehyde toxicity: DNA–protein cross-linking studies in rats and nonhuman primates. In: Feron, V.J. & Bosland, M.C., eds, *Nasal Carcinogenesis in Rodents: Relevance to Human Risk*, Wageningen, Pudoc, pp. 159–164

Hedberg, J.J., Strömberg, P. & Höög, J.-O. (1998) An attempt to transform class characteristics within the alcohol dehydrogenase family. *FEBS Lett*., **436**, 67–70

Hedberg, J.J., Höög, J.-O., Nilsson, J.A., Zheng, X., Elfwing, A. & Grafström, R.C. (2000) Expression of alcohol dehydrogenase 3 in tissue and cultured cells from human oral mucosa. *Am. J. Pathol*., **157**, 1745–1755

Hedberg, J.J., Backlund, M., Strömberg, P., Lönn, S., Dahl, M.-L., Ingelman-Sundberg, M. & Höög, J.-O. (2001) Functional polymorphism in the alcohol dehydrogenase 3 (*ADH3*) promoter. *Pharmacogenetics*, **11**, 815–824

Hedberg, J.J., Höög, J.-O. & Grafström R.C. (2002) Assessment of formaldehyde metabolizing enzymes in human oral mucosa and cultured oral keratinocytes indicate high capacity for detoxification of formaldehyde. In: Heinrich, U. & Mohr, U., eds, *Crucial Issues in Inhalation Research — Mechanistic, Clinical and Epidemiologic* (INIS Monographs), Stuttgart, Fraunhofer IRB Verlag, pp. 103–115

Hedberg, J.J., Griffiths, W.J., Nilsson, S.J.F. & Höög, J.-O. (2003) Reduction of *S*-nitrosoglutathione by human alcohol dehydrogenase 3 is an irreversible reaction as analysed by electrospray mass spectrometry. *Eur. J. Biochem*., **270**, 1249–1256

Heikkilä, P., Priha, E. & Savela, A. (1991) [Formaldehyde (Exposures at Work No. 14)], Helsinki, Finnish Institute of Occupational Health and Finnish Work Environment Fund (in Finnish)

Hemminki, K., Mutanen, P., Saloniemi, I., Niemi, M.-L. & Vainio, H. (1982) Spontaneous abortions in hospital staff engaged in sterilising instruments with chemical agents. *Br. med. J.*, **285**, 1461–1463

Hemminki, K., Kyyrönen, P. & Lindbohm, M.-L. (1985) Spontaneous abortions and malformations in the offspring of nurses exposed to anaesthetic gases, cytostatic drugs, and other potential hazards in hospitals, based on registered information of outcome. *J. Epidemiol. Community Health*, **39**, 141–147

Hemminki, K., Partanen, R., Koskinen, H., Smith, S., Carney, W. & Brandt-Rauf, P.W. (1996) The molecular epidemiology of oncogens. Serum p53 protein in patients with asbestosis. *Chest*, **109**, 22S–26S

Hendrick, D.J. & Lane, D.J. (1975) Formalin asthma in hospital staff. *Br. med. J*., **i**, 607–608

Hendrick, D.J. & Lane, D.J. (1977) Occupational formalin asthma. *Br. J. ind. Med*., **34**, 11–18

Hendrick, D.J., Rando, R.J., Lane, D.J. & Morris, M.J. (1982) Formaldehyde asthma: Challenge exposure levels and fate after five years. *J. occup. Med*., **24**, 893–897

Herbert, F.A., Hessel, P.A., Melenka, L.S., Yoshida, K. & Nakaza, M. (1995) Pulmonary effects of simultaneous exposures to MDI formaldehyde and wood dust on workers in an oriented strand board plant. *J. occup. environ. Med*., **37**, 461–465

Hernberg, S., Westerholm, P., Schultz-Larsen, K., Degerth, R., Kuosma, E., Englund, A., Engzell, U., Sand Hansen, H. & Mutanen, P. (1983a) Nasal and sinonasal cancer. Connection with occupational exposures in Denmark, Finland and Sweden. *Scand. J. Work Environ. Health*, **9**, 315–326

Hernberg, S., Collan, Y., Degerth, R., Englund, A., Engzell, U., Kuosma, E., Mutanen, P., Nordlinder, H., Sand Hansen, H., Schultz-Larsen, K., Søgaard, H. & Westerholm, P. (1983b) Nasal cancer and occupational exposures. Preliminary report of a joint Nordic case–referent study. *Scand. J. Work Environ. Health*, **9**, 208–213

Hester, S.D., Benavides, G.B., Yoon, L., Morgan, K.T., Zou, F., Barry, W. & Wolf, D.C. (2003) Formaldehyde-induced gene expression in F344 rat nasal respiratory epithelium. *Toxicology*, **187**, 13–24

Hildesheim, A., West, S., DeVeyra, E., De Guzman, M.F., Jurado, A., Jones, C., Imai, J. & Hinuma, Y. (1992) Herbal medicine use, Epstein–Barr virus, and risk of nasopharyngeal carcinoma. *Cancer Res.*, **52**, 3048–3051

Hildesheim, A., Dosemeci, M., Chan, C.-C., Chen, C.-J., Cheng, Y.-J., Hsu, M.-M., Chen, I.-H., Mittl, B.F., Sun, B., Levine, P.H., Chen, J.-Y., Brinton, L.A. & Yang, C.-S. (2001) Occupational exposure to wood, formaldehyde, and solvents and risk of nasopharyngeal carcinoma. *Cancer Epidemiol. Biomarkers Prev*., **10**, 1145–1153

Hilton, J., Dearman, R.J., Basketter, D.A., Scholes, E.W. & Kimber, I. (1996) Experimental assessment of the sensitizing properties of formaldehyde. *Food chem. Toxicol*., **34**, 571–578

Ho, K.F., Lee, S.C., Louie, P.K.K. & Zou, S.C. (2002) Seasonal variation of carbonyl compound concentrations in urban area of Hong Kong. *Atmos. Environ*., **36**, 1259–1265

Hodgson, A.T., Wooley, J.D. & Daisey, J.M. (1993) Emissions of volatile organic compounds from new carpets measured in a large-scale environmental chamber. *J. Air Waste Manage. Assoc.*, **43**, 316–324

Hodgson, A.T., Rudd, A.F., Beal, D. & Chandra, S. (2000) Volatile organic compound concentrations and emission rates in new manufactured and site-built houses. *Indoor Air*, **10**, 178–192

Hodgson, A.T., Beal, D. & McIlvane, J.E.R. (2002) Sources of formaldehyde, other aldehydes and terpenes in a new manufactured house. *Indoor Air*, **12**, 235–242

Holly, E.A., Aston, D.A., Ahn, D.K. & Smith, A.H. (1996) Intraocular melanoma linked to occupations and chemical exposures. *Epidemiology*, **7**, 55–61

Holmquist, B. & Vallee, B.L. (1991) Human liver class III alcohol and glutathione dependent formaldehyde dehydrogenase are the same enzyme. *Biochem. biophys. Res. Commun*., **178**, 1371–1377

Holmström, M., Wilhelmsson, B., Hellquist, H. & Rosén, G. (1989a) Histological changes in the nasal mucosa in persons occupationally exposed to formaldehyde alone and in combination with wood dust. *Acta otolaryngol.*, **107**, 120–129

Holmström, M., Wilhelmsson, B. & Hellquist, H. (1989b) Histological changes in the nasal mucosa in rats after long-term exposure to formaldehyde and wood dust. *Acta otolaryngol.*, **108**, 274–283

Holmström, M., Rynnel-Dagöö, B. & Wilhelmsson, B. (1989c) Antibody production in rats after long-term exposure to formaldehyde. *Toxicol. appl. Pharmacol.*, **100**, 328–333

Höög, J.-O., Hedberg, J.J., Strömberg, P. & Svensson, S. (2001) Mammalian alcohol dehydrogenase — Functional and structural implications. *J. biomed. Sci*., **8**, 71–76

Höög, J.-O., Strömberg, P., Hedberg, J.J. & Griffiths, W.J. (2003) The mammalian alcohol dehydrogenases interact in several metabolic pathways. *Chem.-biol. Interactions*, **143–144**, 175–181

Horton, A.W., Tye, R. & Stemmer, K.L. (1963) Experimental carcinogenesis of the lung. Inhalation of gaseous formaldehyde or an aerosol of coal tar by C3H mice. *J. natl Cancer Inst.*, **30**, 31–43

IARC (1979) *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*, Vol. 19, *Some Monomers, Plastics and Synthetic Elastomers, and Acrolein*, Lyon, pp. 314–340

IARC (1982) *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*, Vol. 29, *Some Industrial Chemicals and Dyestuffs*, Lyon, pp. 345–389

IARC (1983) *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*, Vol. 32, *Polynuclear Aromatic Compounds, Part 1, Chemical, Environmental and Experimental Data*, Lyon

IARC (1984) *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*, Vol. 34, *Polynuclear Aromatic Compounds, Part 3, Industrial Exposures in Aluminium Production, Coal Gasification, Coke Production, and Iron and Steel Founding*, Lyon

IARC (1986) *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*, Vol. 39, *Some Chemicals Used in Plastics and Elastomers*, Lyon, pp. 287–323

IARC (1987a) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Suppl. 7, *Overall Evaluations of Carcinogenicity: An Updating of* IARC Monographs *Volumes 1–42*, Lyon, pp. 211–216

IARC (1987b) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Suppl. 7, *Overall Evaluations of Carcinogenicity: An Updating of* IARC Monographs *Volumes 1–42*, Lyon, pp. 131–134

IARC (1987c) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Suppl. 7, *Overall Evaluations of Carcinogenicity: An Updating of* IARC Monographs *Volumes 1–42*, Lyon, pp. 152–154

IARC (1987d) *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*, Vol. 42, *Silica and Some Silicates*, Lyon, pp. 39–143

IARC (1987e) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Suppl. 7, *Overall Evaluations of Carcinogenicity: An Updating of* IARC Monographs *Volumes 1–42*, Lyon, pp. 106–116

IARC (1989a) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Vol. 47, *Some Organic Solvents, Resin Monomers and Related Compounds, Pigments and Occupational Exposures in Paint Manufacture and Painting*, Lyon, pp. 125–156

IARC (1989b) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Vol. 47, *Some Organic Solvents, Resin Monomers and Related Compounds, Pigments and Occupational Exposures in Paint Manufacture and Painting*, Lyon, pp. 79–123

IARC (1989c) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Vol. 47, *Some Organic Solvents, Resin Monomers and Related Compounds, Pigments and Occupational Exposures in Paint Manufacture and Painting*, Lyon, pp. 263–287

IARC (1990a) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Vol. 48, *Some Flame Retardants and Textile Chemicals, and Exposures in the Textile Manufacturing Industry,* Lyon, pp. 181–212

IARC (1990b) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Vol. 48, *Some Flame Retardants and Textile Chemicals, and Exposures in the Textile Manufacturing Industry,* Lyon, pp. 215–280

IARC (1994a) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Vol. 60, *Some Industrial Chemicals*, pp. 445–474

IARC (1994b) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Vol. 60, *Some Industrial Chemicals*, pp. 73–159

IARC (1995) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Vol. 62, *Wood Dust and Formaldehyde*, Lyon, pp. 217–362

IARC (1999) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Vol. 71, *Re-evaluation of Some Organic Chemicals, Hydrazine and Hydrogen Peroxide*, Lyon

IARC (2002) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Vol. 81, *Man-made Vitreous Fibres*, Lyon

IARC (2004) *IARC Monographs on the Evaluation of Carcinogenic Risks to Humans*, Vol. 83, *Tobacco Smoke and Involuntary Smoking*, Lyon

Inoue, K., Nishimukai, H. & Yamasawa, K. (1979) Purification and partial characterization of aldehyde dehydrogenase from human erythrocytes. *Biochim. biophys. Acta*, **569**, 117–123

INRS (Institut national de Recherche et de Sécurité) (2005) [Threshold Limit Values for Occupational Exposure to Chemicals in France] (Notes documentaires 2098), Paris, Hygiène et Sécurité du Travail (in French)

International Labour Office (2001) *Safety in the Use of Synthetic Vitreous Fibre Insulation Wool (Glass Wool, Rockwool, Slag Wool)*, Geneva, International Labour Organization, p. 20

Interscan Corporation (undated) *Portable Analyzer (4000 Series) with Digital Display — Formaldehyde*, Chatsworth, CA

Ishidate, M., Jr, Sofuni, T. & Yoshikawa, K. (1981) Chromosomal aberration tests *in vitro* as a primary screening tool for environmental mutagens and/or carcinogens. *Gann Monogr. Cancer Res.*, **27**, 95–108

Iversen, O.H. (1986) Formaldehyde and skin carcinogenesis. *Environ. int.*, **12**, 541–544

Jaeger, R.J. & Gearhart, J.M. (1982) Respiratory and metabolic response of rats and mice to formalin vapor. *Toxicology*, **25**, 299–309

James, J.T. (1997) Carcinogens in spacecraft air. *Radiat. Res*., **148**, S11–S16

Jankovic, J., Jones, W., Burkhart, J. & Noonan, G. (1991) Environmental study of firefighters. *Ann. occup. Hyg*., **35**, 581–602

Jann, O. (1991) Present state and developments in formaldehyde regulations and testing methods in Germany. In: *Proceedings of the 25th International Particleboard/Composite Materials Symposium*, Pullman, WA, Washington State University

Japanese Standards Association (2001) *Japanese Industrial Standard: Building Boards. Determination of Formaldehdye Emission — Dessicator Method* (JIS A-1460:2001), Tokyo

Jeffcoat, A.R., Chasalow, F., Feldman, D.B. & Marr, H. (1983) Disposition of [^{14}C]formaldehyde after topical exposure to rats, guinea pigs, and monkeys. In: Gibson, J.E., ed., *Formaldehyde Toxicity*, Washington DC, Hemisphere, pp. 38–50

Jensen, O.M. & Andersen, S.K. (1982) Lung cancer risk from formaldehyde. *Lancet*, **i**, 913

Jensen, N.J. & Cohr, K.-H. (1983) Testing of formaldehyde in the mammalian spot test by inhalation (Abstract No. 73). *Mutat. Res.*, **113**, 266

Jensen, K.A., Kirk, I., Kølmark, G. & Westergaard, M. (1951) Chemically induced mutations in Neurospora. *Cold Spring Harbor Symp. quant. Biol.*, **16**, 245–261

Jensen, D.E., Belka, G.K. & Du Bois, G.C. (1998) *S*-Nitrosoglutathione is a substrate for rat alcohol dehydrogenase class III isoenzyme. *Biochem. J*., **331**, 659–668

Johannsen, F.R., Levinskas, G.J. & Tegeris, A.S. (1986) Effects of formaldehyde in the rat and dog following oral exposure. *Toxicol. Lett.*, **30**, 1–6

John, E.M., Savitz, D.A. & Shy, C.M. (1994) Spontaneous abortions among cosmetologists. *Epidemiology*, **5**, 147–155

Johnsen, R.C. & Baillie, D.L. (1988) Formaldehyde mutagenesis of the eT1 balanced region in *Caenorhabditis elegans*: Dose–response curve and the analysis of mutation events. *Mutat. Res.*, **201**, 137–147

Jones, D.P., Thor, H., Andersson, B. & Orrenius, S. (1978) Detoxification reactions in isolated hepatocytes. Role of glutathione peroxidase, catalase, and formaldehyde dehydrogenase in reactions relating to *N*-demethylation by the cytochrome P-450 system. *J. biol. Chem*., **253**, 6031–6037

Jörnvall, H. & Höög, J.-O. (1995) Nomenclature of alcohol dehydrogenases. *Alcohol Alcohol*., **30**, 153–161

Jörnvall, H., Höög, J.-O., Persson, B. & Parés, X. (2000) Pharmacogenetics of the alcohol dehydrogenase system. *Pharmacology*, **61**, 184–191

Jurvelin, J., Vartiainen, M., Jantunen, M. & Pasanen, P. (2001) Personal exposure levels and microenvironmental concentrations of formaldehyde and acetaldehyde in the Helsinki metropolitan area, Finland. *J. Air Waste Manage. Assoc*., **51**, 17–24

Jurvelin, J.A., Edwards, R.D., Vartiainen, M., Pasanen, P. & Jantunen, M.J. (2003) Residential indoor, outdoor, and workplace concentrations of carbonyl compounds: Relationships with personal exposure concentrations and correlation with sources. *J. Air Waste Manage. Assoc*., **53**, 560–573

Kalabokas, P., Carlier, P., Fresnet, P., Mouvier, G. & Toupance, G. (1988) Field studies of aldehyde chemistry in the Paris area. *Atmos. Environ*., **22**, 147–155

Kalász, H. (2003) Biological role of formaldehyde, and cycles related to methylation, demethylation, and formaldehyde production. *Mini Rev. med. Chem*., **3**, 175–192

Kamata, E., Nakadate, M., Uchida, O., Ogawa, Y., Suzuki, S., Kaneko, T., Saito, M. & Kurokawa, Y. (1997) Results of a 28-month chronic inhalation toxicity study of formaldehyde in male Fisher-344 rats. *J. toxicol. Sci.*, **22**, 239–254

Kaplan, W.D. (1948) Formaldehyde as a mutagen in *Drosophila*. *Science*, **108**, 43

Karlberg, A.-T., Skare, L., Lindberg, I. & Nyhammar, E. (1998) A method for quantification of formaldehyde in the presence of formaldehyde donors in skin-care products. *Contact Derm*., **38**, 20–28

Katakura, Y., Kishi, R., Ikeda, T. & Miyake, H. (1990) [Distributions of [^{14}C]-formaldehyde and their metabolites in pregnant mice.] *Sangyo Igaku*, **32**, 42–43 (in Japanese)

Katakura, Y., Okui, T., Kishi, R., Ikeda, T. & Miyake, H. (1991) [Distribution of ^{14}C-formaldehyde in pregnant mice: A study by liquid scintillation counter and binding to DNA.] *Sangyo Igaku*, **33**, 264–265 (in Japanese)

Katakura, Y., Kishi, R., Okui, T., Ikeda, T. & Miyake, H. (1993) Distribution of radioactivity from ^{14}C-formaldehyde in pregnant mice and their fetuses. *Br. J. ind. Med.*, **50**, 176–182

Kato, S., Burke, P.J., Koch, T.H. & Bierbaum, V.M. (2001) Formaldehyde in human cancer cells: Detection by preconcentration-chemical ionization mass spectrometry. *Anal. Chem.*, **73**, 2992–2997

Kauppinen, T. (1986) Occupational exposure to chemical agents in the plywood industry. *Ann. occup. Hyg.*, **30**, 19–29

Kauppinen, T. & Niemelä, R. (1985) Occupational exposure to chemical agents in the particleboard industry. *Scand. J. Work Environ. Health*, **11**, 357–363

Kauppinen, T. & Partanen, T. (1988) Use of plant- and period-specific job–exposure matrices in studies on occupational cancer. *Scand. J. Work Environ. Health*, **14**, 161–167

Kauppinen, T., Toikkanen, J., Pedersen, D., Young, R., Ahrens, W., Boffetta, P., Hansen, J., Kromhout, H., Maqueda Blasco J., Mirabelli, D., de la Orden-Rivera, V., Pannett, B., Plato, N., Savela, A., Vincent, R. & Kogevinas, M. (2000) Occupational exposure to carcinogens in the European Union. *Occup. environ. Med*., **57**, 10–18

Keil, C.B., Akbar-Khanzadeh, F. & Konecny, K.A. (2001) Characterizing formaldehyde emission rates in a gross anatomy laboratory. *Appl. occup. environ. Hyg*., **16**, 967–972

Kelly, T.J., Smith, D.L. & Satola, J. (1999) Emission rates of formaldehyde from materials and consumer products found in California homes. *Environ. Sci. Technol.*, **33**, 81–88

Kennedy, E.R., Gagnon, Y.T., Teass, A.W. & Seitz, T. (1992) Development and evaluation of a method to estimate potential formaldehyde dose from inhalable dust/fibers. *Appl. occup. environ. Hyg*., **7**, 231–240

Kepler, G.M., Richardson, R.B., Morgan, K.T. & Kimbell, J.S. (1998) Computer simulation of inspiratory nasal airflow and inhaled gas uptake in a rhesus monkey. *Toxicol. appl. Pharmacol*., **150**, 1–11

Kerfoot, E.J. & Mooney, T.F., Jr (1975) Formaldehyde and paraformaldehyde study in funeral homes. *Am. ind. Hyg. Assoc. J.*, **36**, 533–537

Kernan, G.J., Ji, B.-T., Dosemeci, M., Silverman, D.T., Balbus, J. & Zahm, S.H. (1999) Occupational risk factors for pancreatic cancer: A case–control study based on death certificates from 24 US states. *Am. J. ind. Med*., **36**, 260–270

Kerns, W.D., Pavkov, K.L., Donofrio, D.J., Gralla, E.J. & Swenberg, J.A. (1983a) Carcinogenicity of formaldehyde in rats and mice after long-term inhalation exposure. *Cancer Res.*, **43**, 4382–4392

Kerns, W.D., Donofrio, D.J. & Pavkov, K.L. (1983b) The chronic effects of formaldehyde inhalation in rats and mice: A preliminary report. In: Gibson, J.E., ed., *Formaldehyde Toxicity*, Washington DC, Hemisphere, pp. 111–131

Khan, A.H. (1967) The induction of crossing over in the absence of mutation. *Sind Univ. Sci. Res. J.*, **3**, 103–106

Khoder, M.I., Shakour, A.A., Farag, S.A. & Abdel Hameed, A.A. (2000) Indoor and outdoor formaldehyde concentrations in homes in residential areas in Greater Cairo. *J. environ. Monit*., **2**, 123–126

Khwaja, H.A. (1995) Atmospheric concentrations of carboxylic acids and related compounds at a semiurban site. *Atmos. Environ*., **29**, 127–139

Kiec-Swierczynska, M., Krecisz, B., Krysiak, B., Kuchowicz, E. & Rydzynski, K. (1998) Occupational allergy to aldehydes in health care workers. Clinical observations. Experiments. *Int. J. occup. Med. environ. Health*, **11**, 349–358

Kilburn, K.H. & Moro, A. (1985) Reproductive and maternal effects of formaldehyde (HCHO) in rats (Abstract). *Fed. Proc.*, **44**, 535

Kilburn, K.H., Seidman, B.C. & Warshaw, R. (1985) Neurobehavioral and respiratory symptoms of formaldehyde and xylene exposure in histology technicians. *Arch. environ Health*, **40**, 229–233

Kim, H., Kim, Y.-D. & Cho, S.-H. (1999) Formaldehyde exposure levels and serum antibodies to formaldehyde–human serum albumin of Korean medical students. *Arch. environ. Health*, **54**, 115–118

Kim, C.-W., Song, J.-S., Ahn, Y.-S., Park, S.-H., Park, J.-W., Noh, J.-H. & Hong, C.-S. (2001) Occupational asthma due to formaldehyde. *Yonsei med. J.*, **42**, 440–445

Kim, W.J., Terada, N., Nomura, T., Takahashi, R., Lee, S.D., Park, J.H. & Konno, A. (2002) Effect of formaldehyde on the expression of adhesion molecules in nasal microvascular endothelial cells: The role of formaldehyde in the pathogenesis of sick building syndrome. *Clin. exp. Allergy*, **32**, 287–295

Kimbell, J.S. & Subramaniam, R.P. (2001) Use of computational fluid dynamics models for dosimetry of inhaled gases in the nasal passages. *Inhal. Toxicol*., **13**, 325–334

Kimbell, J.S., Gross, E.A., Richardson, R.B., Conolly, R.B. & Morgan, K.T. (1997) Correlation of regional formaldehyde flux predictions with the distribution of formaldehyde-induced squamous metaplasia in F344 rat nasal passages. *Mutat. Res*., **380**, 143–154

Kimbell, J.S., Overton, J.H., Subramaniam, R.P., Schlosser, P.M., Morgan, K.T., Conolly, R.B. & Miller, F.J. (2001a) Dosimetry modeling of inhaled formaldehyde: Binning nasal flux predictions for quantitative risk assessment. *Toxicol. Sci*., **64**, 111–121

Kimbell, J.S., Subramaniam, R.P., Gross, E.A., Schlosser, P.M. & Morgan, K.T. (2001b) Dosimetry modeling of inhaled formaldehyde: Comparisons of local flux predictions in the rat, monkey, and human nasal passages. *Toxicol. Sci*., **64**, 100–110

Kimbell, J.S., Schlosser, P.M., Conolly, R.B. & Miller, F.J. (2002) Dosimetry modelling of inhaled formaldehyde. *CIIT Activities*, **22**, 1–8

Kinney, P.L., Chillrud, S.N., Ramstrom, S., Ross, J. & Spengler, J.D. (2002) Exposures to multiple air toxics in New York City. *Environ. Health Perspect*., **110** (Suppl. 4), 539–546

Kirchstetter, T.W., Singer, B.C., Harley, R.A., Kendall, G.R. & Chan, W. (1996) Impact of oxygenated gasoline use on California light-duty vehicle emissions. *Environ. Sci. Technol.*, **30**, 661–670

Kitaeva, L.V., Kitaev, E.M. & Pimenova, M.N. (1990) [The cytopathic and cytogenetic effects of chronic inhalation of formaldehyde on germ and marrow cells of the female rat.] *Tsitologiia*, **32**, 1212–1216 (in Russian)

Kitaeva, L.V., Mikheeva, E.A., Shelomova, L.F. & Shvartsman, P.Y. (1996) [Genotoxic effect of formaldehyde in somatic human cells in vivo.] *Genetika*, **32**, 1298–1290 (in Russian)

Kligerman, A.D., Phelps, M.C. & Erexson, G.L. (1984) Cytogenetic analysis of lymphocytes from rats following formaldehyde inhalation. *Toxicol. Lett.*, **21**, 241–246

Koeck, M., Pichler-Semmelrock, F.P. & Schlacher, R. (1997) Formaldehyde — Study of indoor air pollution in Austria. *Centr. Eur. J. public Health*, **5**, 127–130

Koivusalo, M., Baumann, M. & Uotila, L. (1989) Evidence for the identity of glutathione-dependent formaldehyde dehydrogenase and class III alcohol dehydrogenase. *FEBS Lett*., **257**, 105–109

Kölmark, G. & Westergaard, M. (1953) Further studies on chemically induced reversions at the adenine locus of *Neurospora*. *Hereditas*, **39**, 209–224

Köppel, C., Baudisch, H., Schneider, V. & Ibe, K. (1990) Suicidal ingestion of formalin with fatal complications. *Intensive Care Med.*, **16**, 212–214

Korczynski, R.E. (1994) Formaldehyde exposure in the funeral industry. *Appl. occup. environ. Hyg.*, **9**, 575–579

Korczynski, R.E. (1996) Effectiveness of downdraft ventilation in morgues. *Appl. occup. environ. Hyg*., **11**, 5–8

Korhonen, K., Liukkonen,T., Ahrens, W., Astrakianakis, G., Boffetta, P., Burdorf, A., Heederik, D., Kauppinen, T., Kogevinas, M., Osvoll, P., Rix, B.A., Saalo, A., Sunyer, J., Szadkowska-

Stanczyk, I., Teschke, K., Westberg, H. & Widerkiewicz, K. (2004) Occupational exposure to chemical agents in the paper industry. *Int. Arch. occup. environ. Health*, **77**, 451–460

Korky, J.K., Schwarz, S.R. & Lustigman, B.K. (1987) Formaldehyde concentrations in biology department teaching facilities. *Bull. environ. Contam. Toxicol.*, **38**, 907–910

Krakowiak, A., Górski, P., Pazdrak, K. & Ruta, U. (1998) Airway response to formaldehyde inhalation in asthmatic subjects with suspected respiratory formaldehyde sensitization. *Am. J. ind. Med.*, **33**, 274–281

Kreiger, R.A. & Garry, V.F. (1983) Formaldehyde-induced cytotoxicity and sister-chromatid exchanges in human lymphocyte cultures. *Mutat. Res.*, **120**, 51–55

Kriebel, D., Sama, S.R. & Cocanour, B. (1993) Reversible pulmonary responses to formaldehyde. A study of clinical anatomy students. *Am. Rev. respir. Dis.*, **148**, 1509–1515

Krieger, P., De Blay, F., Pauli, G. & Kopferschmitt, M.-C. (1998) [Asthma and domestic chemical pollutants (except for tobacco).] *Rev. Mal. respir.*, **15**, 11–24 (in French)

Kulle, T.J. (1993) Acute odor and irritation response in healthy nonsmokers with formaldehyde exposure. *Inhal. Toxicol.*, **5**, 323–332

Kulle, T.J., Sauder, L.R., Hebel, J.R., Green, D.J. & Chatham, M.D. (1987) Formaldehyde dose–response in healthy nonsmokers. *J. Air Pollut. Control Assoc.*, **37**, 919–924

Kuykendall, J.R. & Bogdanffy, M.S. (1992) Efficiency of DNA–histone crosslinking induced by saturated and unsaturated aldehydes *in vitro*. *Mutat. Res.*, **283**, 131–136

Laforest, L., Luce, D., Goldberg, P., Bégin, D., Gérin, M., Demers, P.A., Brugère, J. & Leclerc, A. (2000) Laryngeal and hypopharyngeal cancers and occupational exposure to formaldehyde and various dusts: A case–control study in France. *Occup. environ. Med.*, **57**, 767–773

Lam, C.-W., Casanova, M. & Heck, H.d'A. (1985) Depletion of nasal mucosal glutathione by acrolein and enhancement of formaldehyde-induced DNA–protein cross-linking by simultaneous exposure to acrolein. *Arch. Toxicol.*, **58**, 67–71

Lamont Moore, L. & Ogrodnik, E.C. (1986) Occupational exposure to formaldehyde in mortuaries. *J. environ. Health*, **49**, 32–35

Lancaster, D.G., Fried, A., Wert, B., Henry, B. & Tittel, F.K. (2000) Difference-frequency-based tunable absorption spectrometer for detection of atmospheric formaldehyde. *Appl. Optics*, **39**, 4436–4443

Leclerc, A., Martinez Cortes, M., Gérin, M., Luce, D. & Brugère, J. (1994) Sinonasal cancer and wood dust exposure: Results from a case–control study. *Am. J. Epidemiol.*, **140**, 340–349

Le Curieux, F., Marzin, D. & Erb, F. (1993) Comparison of three short-term assays: Results on seven chemicals. Potential contribution to the control of water genotoxicity. *Mutat. Res.*, **319**, 223–236

Lee, S. & Radtke, T. (1998) Exposure to formaldehyde among fish hatchery workers. *Appl. occup. environ. Hyg.*, **13**, 3–6

Lee, H.K., Alarie, Y. & Karol, M.H. (1984) Induction of formaldehyde sensitivity in guinea pigs. *Toxicol. appl. Pharmacol.*, **75**, 147–155

Lehmann, W.F. & Roffael, E. (1992) International guidelines and regulations for formaldehyde emissions. In: *Proceedings of the 26th Washington State University International Particleboard/Composite Materials Symposium*, Pullman, WA, Washington State University, pp. 124–150

Leifer, Z., Hyman, J. & Rosenkranz, H.S. (1981) Determination of genotoxic activity using DNA polymerase-deficient and -proficient *E. coli*. In: Stich, H.F. & San, R.H.C., eds, *Short-term Tests for Chemical Carcinogenesis*, New York, Springer, pp. 127–139

Lemus, R., Abdelghani, A.A., Akers, T.G. & Horner, W.E. (1998) Potential health risks from exposure to indoor formaldehyde. *Rev. environ. Health*, **13**, 91–98

Lévesque, B., Allaire, S., Gauvin, D., Koutrakis, P., Gingras, S., Rhainds, M., Prud'Homme, H. & Duchesne, J.-F. (2001) Wood-burning appliances and indoor air quality. *Sci. total Environ*., **281**, 47–62

Levine, R.J., Andjelkovich, D.A., & Shaw, L.K. (1984) The mortality of Ontario undertakers and a review of formaldehyde-related mortality studies. *J. occup. Med.*, **26**, 740–746

Levy, S., Nocentini, S. & Billardon, C. (1983) Induction of cytogenetic effects in human fibroblast cultures after exposure to formaldehyde or X-rays. *Mutat. Res.*, **119**, 309–317

Lewis, B. (1998) Formaldehyde in dentistry: A review for the millennium. *J. clin. pediatr. Dent*., **22**, 167–177

Lewis, K.J., Ward, M.K. & Kerr, D.N.S. (1981) Residual formaldehyde in dialyzers: Quantity, location, and the effect of different methods of rinsing. *Artif. Organs*, **5**, 269–277

Liber, H.L., Benforado, K., Crosby, R.M., Simpson, D. & Skopek, T.R. (1989) Formaldehyde-induced and spontaneous alterations in human *hprt* DNA sequence and mRNA expression. *Mutat. Res.*, **226**, 31–37

Lide, D.R., ed. (2003) *CRC Handbook of Chemistry and Physics*, 84th Ed., Boca Raton, FL, CRC Press, p. 3-288

Liebling, T., Rosenman, K.D., Pastides, H., Griffith, R.G., & Lemeshow, S. (1984) Cancer mortality among workers exposed to formaldehyde. *Am. J. ind. Med.,* **5,** 423–428

Lindbohm, M.-L., Hemminki, K., Bonhomme, M.G., Anttila, A., Rantala, K., Heikkilä, P. & Rosenberg, M.J. (1991) Effects of paternal occupational exposure on spontaneous abortions. *Am. J. public Health*, **81**, 1029–1033

Lindstrom, A.B., Proffitt, D. & Fortune, C.R. (1995) Effects of modified residential construction on indoor air quality. *Indoor Air*, **5**, 258–269

Linos, A., Blair, A., Cantor, K.P., Burmeister, L., VanLier, S., Gibson, R.W., Schuman, L. & Everett, G. (1990) Leukemia and non-Hodgkin's lymphoma among embalmers and funeral directors (Letter to the Editor). *J. natl Cancer Inst*., **82**, 66

Liteplo, R.G. & Meek, M.E. (2003) Inhaled formaldehyde: Exposure estimation, hazard characterization, and exposure–response analysis. *J. Toxicol. environ. Health*, **B6**, 85–114

Liu, L., Hausladen, A., Zeng, M., Que, L., Heitman, J. & Stamler, J.S. (2001) A metabolic enzyme for *S*-nitrosothiol conserved from bacteria to humans. *Nature*, **410**, 490–494

Lodén, M. (1986) The *in vitro* permeability of human skin to benzene, ethylene glycol, formaldehyde, and n-hexane. *Acta pharmacol. toxicol.*, **58**, 382–389

Logue, J.N., Barrick, M.K. & Jessup, G.L., Jr (1986) Mortality of radiologists and pathologists in the radiation registry of physicians. *J. occup. Med.*, **28**, 91–99

Lovschall, H., Eiskjaer, M. & Arenholt-Bindslev, D. (2002) Formaldehyde cytotoxicity in three human cell types assessed in three different assays. *Toxicol. in Vitro*, **16**, 63–69

Luce, D., Leclerc, A., Morcet, J.F., Casal-Lareo, A., Gérin, M., Brugère, J., Haguenoer, J.M. & Goldberg, M. (1992) Occupational risk factors for sinonasal cancer: A case–control study in France. *Am. J. ind. Med.*, **21**, 163–175

Luce, D., Gérin, M., Leclerc, A., Morcet, J.-F., Brugère, J. & Goldberg, M. (1993) Sinonasal cancer and occupational exposure to formaldehyde and other substances. *Int. J. Cancer*, **53**, 224–231

Luce, D., Leclerc, A., Bégin, D., Demers, P.A., Gérin, M., Orlowski, E., Kogevinas, M., Belli, S., Bugel, I., Bolm-Audorff, U., Brinton, L.A., Comba, P., Hardell, L., Hayes, R.B., Magnani, C., Merler, E., Preston-Martin, S., Vaughan, T.L., Zheng, W. & Boffetta, P. (2002) Sinonasal cancer and occupational exposures: A pooled analysis of 12 case–control studies. *Cancer Causes Control*, **13**, 147–157

Luker, M.A. & Van Houten, R.W. (1990) Control of formaldehyde in a garment sewing plant. *Am. ind. Hyg. Assoc. J.*, **51**, 541–544

Luo, J.-C., Zehab, R., Anttila, S., Ridanpaa, M., Husgafvel-Pursiainen, K., Vainio, H., Carney, W., DeVivo, I., Milling, C. & Brandt-Rauf, P.W. (1994) Detection of serum p53 protein in lung cancer patients. *J. occup. Med.*, **36**, 155–160

Luo, W., Li, H., Zhang, Y. & Ang, C.Y.W. (2001) Determination of formaldehyde in blood plasma by high-performance liquid chromatography with fluorescence detection. *J. Chromatogr.*, **B753**, 253–257

Ma, T.-H. & Harris, M.M. (1988) Review of the genotoxicity of formaldehyde. *Mutat. Res.*, **196**, 37–59

Mackerer, C.R., Angelosanto, F.A., Blackburn, G.R. & Schreiner, C.A. (1996) Identification of formaldehyde as the metabolite responsible for the mutagenicity of methyl *tertiary*-butyl ether in the activiated mouse lymphoma assay. *Proc. Soc. exp. Biol. Med.*, **212**, 338–341

Magaña-Schwencke, N. & Ekert, B. (1978) Biochemical analysis of damage induced in yeast by formaldehyde. II. Induction of cross-links between DNA and protein. *Mutat. Res.*, **51**, 11–19

Magaña-Schwencke, N. & Moustacchi, E. (1980) Biochemical analysis of damage induced in yeast by formaldehyde. III. Repair of induced cross-links between DNA and proteins in the wild-type and in excision-deficient strains. *Mutat. Res.*, **70**, 29–35

Magaña-Schwencke, N., Ekert, B. & Moustacchi, E. (1978) Biochemical analysis of damage induced in yeast by formaldehyde. I. Induction of single-strand breaks in DNA and their repair. *Mutat. Res.*, **50**, 181–193

Magnani, C., Comba, P., Ferraris, F., Ivaldi, C., Meneghin, M. & Terracini, B. (1993) A case–control study of carcinomas of the nose and paranasal sinuses in the woolen textile manufacturing industry. *Arch. environ. Health*, **48**, 94–97

Maibach, H. (1983) Formaldehyde: Effects on animal and human skin. In: Gibson, J.E., ed., *Formaldehyde Toxicity*, Washington DC, Hemisphere, pp. 166–174

Maier, K.L., Wippermann, U., Leuschel, L., Josten, M., Pflugmacher, S., Schröder, P., Sandermann, H., Jr, Takenaka, S., Ziesenis, A. & Heyder, J. (1999) Xenobiotic-metabolizing enzymes in the canine respiratory tract. *Inhal. Toxicol.*, **11**, 19–35

Maître, A., Soulat, J.-M., Masclet, P., Stoklov, M., Marquès, M. & de Gaudemaris, R. (2002) Exposure to carcinogenic air pollutants among policemen working close to traffic in an urban area. *Scand. J. Work Environ. Health*, **28**, 402–410

Mäkinen, M., Kalliokoski, P. & Kangas, J. (1999) Assessment of total exposure to phenol–formaldehyde resin glue in plywood manufacturing. *Int. Arch. occup. environ. Health*, **72**, 309–314

Malaka, T. & Kodama, A.M. (1990) Respiratory health of plywood workers occupationally exposed to formaldehyde. *Arch. environ. Health*, **45**, 288–294

Malek, F.A., Möritz, K.-U. & Fanghänel, J. (2003) A study on the effect of inhalative formaldehyde exposure on water labyrinth test performance in rats. *Ann. Anat.*, **185**, 277–285

Malker, H.R. & Weiner, J. (1984) [Cancer–Environment Registry: Examples of the Use of Register Epidemiology in Studies of the Work Environment] (Arbete och Hälsa 1984;9), Stockholm, Arbetarskyddsverket (in Swedish)

Malorny, G., Rietbrock, N. & Schneider, M. (1965) [Oxidation of formaldehyde to formic acid in blood, a contribution to the metabolism of formaldehyde.] *Naunyn–Schmiedeberg's Arch. exp. Pathol. Pharmakol.*, **250**, 419–436 (in German)

't Mannetje, A., Kogevinas, M., Luce, D., Demers, P.A., Bégin, D., Bolm-Audorff, U., Comba, P., Gérin, M., Hardell, L., Hayes, R.B., Leclerc, A., Magnani, C., Merler, E., Tobías, A. & Boffetta, P. (1999) Sinonasal cancer, occupation, and tobacco smoking in European women and men. *Am. J. ind. Med*., **36**, 101–107

Marnett, L.J., Hurd, H.K., Hollstein, M.C., Levin, D.E., Esterbauer, H. & Ames, B.N. (1985) Naturally occurring carbonyl compounds are mutagens in Salmonella tester strain TA104. *Mutat. Res.*, **148**, 25–34

Maronpot, R.A., Miller, R.A., Clarke, W.J., Westerberg, R.B., Decker, J.R. & Moss, O.R. (1986) Toxicity of formaldehyde vapor in B6C3F1 mice exposed for 13 weeks. *Toxicology*, **41**, 253–266

Maroziene, L. & Grazuleviciene, R. (2002) Maternal exposure to low-level air pollution and pregnancy outcomes: A population-based study. *Environ. Health*, **1**, 6–12

Marsh, G.M. (1982) Proportional mortality patterns among chemical plant workers exposed to formaldehyde. *Br. J. ind. Med.*, **39**, 313–322

Marsh, G.M. (1983) Proportional mortality among chemical workers exposed to formaldehyde. In: Gibson, J.E., ed., *Formaldehyde Toxicity*, Washington DC, Hemisphere, pp. 237–255

Marsh, G.M. & Youk, A.O. (2004) Reevaluation of mortality risks from leukemia in the formaldehyde cohort study of the National Cancer Institute. *Regul. Toxicol. Pharmacol.*, **40**, 113–124

Marsh, G.M., Stone, R.A. & Henderson, V.L. (1992a) A reanalysis of the National Cancer Institute study on lung cancer mortality among industrial workers exposed to formaldehyde. *J. occup. Med.*, **34**, 42–44

Marsh, G.M., Stone, R.A. & Henderson, V.L. (1992b) Lung cancer mortality among industrial workers exposed to formaldehyde: A Poisson regression analysis of the National Cancer Institute study. *Am. ind. Hyg. Assoc. J.*, **53**, 681–691

Marsh, G.M., Stone, R.A., Esmen, N.A. & Henderson, V.L. (1994) Mortality patterns among chemical plant workers exposed to formaldehyde and other substances (Brief communication). *J. natl Cancer Inst.*, **86**, 384–386

Marsh, G.M., Stone, R.A., Esmen, N.A., Henderson, V.L. & Lee, K.Y. (1996) Mortality among chemical workers in a factory where formaldehyde was used. *Occup. environ. Med.*, **53**, 613–627

Marsh, G.M., Youk, A.O., Stone, R.A., Buchanich, J.M., Gula, M.J., Smith, T.J. & Quinn, M.M. (2001) Historical cohort study of US man-made vitreous fiber production workers: I. 1992 fiberglass cohort follow-up: Initial findings. *J. occup. environ. Med.*, **43**, 741–756

Marsh, G.M., Youk, A.O., Buchanich, J.M., Cassidy, L.D., Lucas, L.J., Esmen, N.A. & Gathuru, I.M. (2002) Pharyngeal cancer mortality among chemical plant workers exposed to formaldehyde. *Toxicol. ind. Health*, **18**, 257–268

Martin, W.J. (1990) A teratology study of inhaled formaldehyde in rat. *Reprod. Toxicol.*, **4**, 237–239

Mašek, V. (1972) [Aldehydes in the air of workplaces in coal coking and pitch coking plants.] *Staub-Reinhalt Luft*, **32**, 335–336 (in German)

Mashford, P.M. & Jones, A.R. (1982) Formaldehyde metabolism by the rat: A re-appraisal. *Xenobiotica*, **12**, 119–124

Matanoski, G.M. (1991) *Risk of Pathologists Exposed to Formaldehyde* (NTIS/PB91-173682), Springfield, VA, National Technical Information Service

Materna, B.L., Jones, J.R., Sutton, P.M., Rothman, N. & Harrison, R.J. (1992) Occupational exposures in California wildland fire fighting. *Am. ind. Hyg. Assoc. J.*, **53**, 69–76

Matheson Tri-Gas® (2004) *Detector Tube Listing for Matheson-Kitagawa Toxic Gas Detector System* (Technical Bulletin 102-1, Issue 3), Irving, TX

Mathew, L., Tai, W.R. & Lo, J.-G. (2001) Measurements of sulfur dioxide and formaldehyde in Taipei using a differential optical absorption spetrometer. *J. Air Waste Manage. Assoc.*, **51**, 94–101

Mathison, B.H., Harman, A.E. & Bogdanffy, M.S. (1997) DNA damage in the nasal passageway: A literature review. *Mutat. Res.*, **380**, 77–96

Maurice, F., Rivory, J.-P., Larsson, P.H., Johansson, S.G.O. & Bousquet, J. (1986) Anaphylactic shock caused by formaldehyde in a patient undergoing long-term hemodialysis. *J. Allergy clin. Immunol.*, **77**, 594–597

Mautz, W.J. (2003) Exercising animal models in inhalation toxicology: Interactions with ozone and formaldehyde. *Environ. Res.*, **92**, 14–26

McClellan, R.O. (1995) Risk assessment and biological mechanisms: Lessons learned, future opportunities. *Toxicology*, **102**, 239–258

McGuire, M.T., Casserly, D.M. & Greff, R.M. (1992) Formaldehyde concentrations in fabric stores. *Appl. occup. environ. Hyg.*, **7**, 112–119

McMillan, A., Whittemore, A.S., Silvers, A. & DiCiccio, Y. (1994) Use of biological markers in risk assessment. *Risk Anal.*, **14**, 807–813

Meister, A. & Anderson, M.E. (1983) Glutathione. *Annu. Rev. Biochem.*, **52**, 711–760

Merk, O. & Speit, G. (1998) Significance of formaldehyde-induced DNA–protein crosslinks for mutagenesis. *Environ. mol. Mutag.*, **32**, 260–268

Merk, O. & Speit, G. (1999) Detection of crosslinks with the comet assay in relationship to genotoxicity and cytotoxicity. *Environ. mol. Mutag.*, **33**, 167–172

Merler, E., Baldasseroni, A., Laria, R., Faravelli, P., Agostini, R., Pisa, R. & Berrino, F. (1986) On the causal association between exposure to leather dust and nasal cancer: Further evidence from a case–control study. *Br. J. ind. Med.*, **43**, 91–95

Merletti, F., Boffetta, P., Ferro, G., Pisani, P. & Terracini, B. (1991) Occupation and cancer of the oral cavity or oropharynx in Turin, Italy. *Scand. J. Work Environ. Health*, **17**, 248–254

Mery, S., Gross, E.A., Joyner, D.R., Godo, M. & Morgan, K.T. (1994) Nasal diagrams: A tool for recording the distribution of nasal lesions in rats and mice. *Toxicol. Pathol.*, **22**, 353–372

Migliore, L., Ventura, L., Barale, R., Loprieno, N., Castellino, S. & Pulci, R. (1989) Micronuclei and nuclear anomalies induced in the gastro-intestinal epithelium of rats treated with formaldehyde. *Mutagenesis*, **4**, 327–334

Miguel, A.H., De Aquino Neto, F.R., Cardoso, J.N., Vasconcellos, P.C., Pereira, A.S. & Marquez, K.S.G. (1995) Characterization of indoor air quality in the cities of São Paulo and Rio de Janeiro, Brazil. *Environ. Sci. Technol.*, **29**, 338–345

Milham, S. (1983) *Occupational Mortality in Washington State 1950–1979* (DHHS (NIOSH) Publication No. 83-116), Cincinatti, OH, National Institute for Occupational Safety and Health

Milton, D.K., Walters, M.D., Hammond, K. & Evans, J.S. (1996) Worker exposure to endotoxin, phenolic compounds, and formaldehyde in a fiberglass insulation manufacturing plant. *Am. ind. Hyg. Assoc. J*., **57**, 889–896

Miretskaya, L.M. & Shvartsman, P.Y. (1982) [Studies of chromosome aberrations in human lymphocytes under the influence of formaldehyde. 1. Formaldehyde treatment of lymphocytes *in vitro*.] *Tsitologiia*, **24**, 1056–1060 (in Russian)

MKS Instruments (2004a) *Application Note: Formaldehyde Emissions Monitoring with MultiGas™ 2030* (App. Note #06/03), Wilmington, MA

MKS Instruments (2004b) *MultiGas™ 2030 On-line Gas Analysis*, Wilmington, MA

Molotkov, A., Fan, X., Deltour, L., Foglio, M.H., Martras, S., Farrés, J., Parés, X. & Duester, G. (2002) Stimulation of retinoic acid production and growth by ubiquitously expressed alcohol dehydrogenase *Adh3*. *Proc. natl Acad. Sci. USA*, **99**, 5337–5342

Monteiro-Riviere, N.A. & Popp, J.A. (1986) Ultrastructural evaluation of acute nasal toxicity in the rat respiratory epithelium in response to formaldehyde gas. *Fundam. appl. Toxicol.*, **6**, 251–262

Montero, L., Vasconcellos, P.C., Souza, S.R., Pires, M.A.F., Sanchez-Ccoyllo, O.R., Andrade, M.F. & Carvalho, L.R.F. (2001) Measurements of atmospheric carboxylic acids and carbonyl compounds in São Paulo City, Brazil. *Environ. Sci. Technol*., **35**, 3071–3081

Monticello, T.M. & Morgan, K.T. (1994) Cell proliferation and formaldehyde-induced respiratory carcinogenesis. *Risk Anal.*, **14**, 313–319

Monticello, T.M. & Morgan, K.T. (1997) Chemically-induced nasal carcinogenesis and epithelial cell proliferation: A brief review. *Mutat. Res.*, **380**, 33–41

Monticello, T.M., Morgan, K.T., Everitt, J.I. & Popp, J.A. (1989) Effects of formaldehyde gas on the respiratory tract of rhesus monkeys. Pathology and cell proliferation. *Am. J. Pathol.*, **134**, 515–527

Monticello, T.M., Miller, F.J. & Morgan, K.T. (1991) Regional increases in rat nasal epithelial cell proliferation following acute and subchronic inhalation of formaldehyde. *Toxicol. appl. Pharmacol.*, **111**, 409–421

Monticello, T.M., Gross, E.A. & Morgan, K.T. (1993) Cell proliferation and nasal carcinogenesis. *Environ. Health Perspect.*, **101** (Suppl. 5), 121–124

Monticello, T.M., Swenberg, J.A., Gross, E.A., Leininger, J.R., Kimbell, J.S., Seilkop, S., Starr, T.B., Gibson, J.E. & Morgan, K.T. (1996) Correlation of regional and nonlinear formaldehyde-induced nasal cancer with proliferating populations of cells. *Cancer Res*., **56**, 1012–1022

Morgan, K.T., Jiang, X.-Z., Starr, T.B. & Kerns, W.D. (1986a) More precise localization of nasal tumors associated with chronic exposure of F-344 rats to formaldehyde gas. *Toxicol. appl. Pharmacol.*, **82**, 264–271

Morgan, K.T., Patterson, D.L. & Gross, E.A. (1986b) Responses of the nasal mucociliary apparatus of F-344 rats to formaldehyde gas. *Toxicol. appl. Pharmacol.*, **82**, 1–13

Morgan, K.T., Gross, E.A. & Patterson, D.L. (1986c) Distribution, progression, and recovery of acute formaldehyde-induced inhibition of nasal mucociliary function in F-344 rats. *Toxicol. appl. Pharmacol.*, **86**, 448–456

Morgan, K.T., Kimbell, J.S., Monticello, T.M., Patra, A.L. & Fleishman, A. (1991) Studies of inspiratory airflow patterns in the nasal passages of the F344 rat and rhesus monkey using nasal molds: Relevance to formaldehyde toxicity. *Toxicol. appl. Pharmacol.*, **110**, 223–240

MSA (1998) *Detector Tubes and Pumps* (Bulletin 08-00-02-MC), Pittsburgh, PA

Mukerjee, N. & Pietruszko, R. (1992) Human mitochondrial aldehyde dehydrogenase substrate specificity: Comparison of esterase with dehydrogenase reaction. *Arch. Biochem. Biophys*., **299**, 23–29

Nakao, H., Umebayashi, C., Nakata, M., Nishizaki, Y., Noda, K., Okano, Y. & Oyama, Y. (2003) Formaldehyde-induced shrinkage of rat thymocytes. *J. pharmacol. Sci.*, **91**, 83–86

Natarajan, A.T., Darroudi, F., Bussman, C.J.M. & van Kesteren-van Leeuwen, A.C. (1983) Evaluation of the mutagenicity of formaldehyde in mammalian cytogenetic assays in vivo and in vitro. *Mutat. Res.*, **122**, 355–360

National Library of Medicine (NLM) (2004) *TRI2001 — Toxics Release Inventory*, Bethesda, MD

Naylor, S., Mason, R.P., Sanders, J.K.M., Williams, D.H. & Moneti, G. (1988) Formaldehyde adducts of glutathione. Structure elucidation by two-dimensional n.m.r. spectroscopy and fast-atom-bombardment tandem mass spectrometry. *Biochem. J*., **249**, 573–579

Neitzert, V. & Seiler, W. (1981) Measurement of formaldehyde in clean air. *Geophys. Res. Lett.*, **8**, 79–82

Neuberger, A. (1981) The metabolism of glycine and serine. In: Neuberger, A. & van Deenen, L.L.M., eds, *Comprehensive Biochemistry*, Vol. 19A, *Amino Acid Metabolism and Sulphur Metabolism*, Amsterdam, Elsevier, pp. 257–303

Nguyen, H.T.-H., Takenaka, N., Bandow, H., Maeda, Y., de Oliva, S.T., Botelho, M.M. & Tavares, T.M. (2001) Atmospheric alcohols and aldehydes concentrations measured in Osaka, Japan and in Sao Paulo, Brazil. *Atmos. Environ*., **35**, 3075–3083

Nielsen, J. (2002) [Introduction to research in frozen fish and fishing.] In: [Proceedings of a Workshop on 'High Quality Frozen Fish', March 7, 2002], Copenhagen (in Danish)

Niemelä, R. & Vainio, H. (1981) Formaldehyde exposure in work and the general environment. Occurrence and possibilities for prevention. *Scand. J. Work Environ. Health*, **7**, 95–100

Nilsson, J.A., Zheng, X., Sundqvist, K., Liu, Y., Atzori, L., Elfwing, Å., Arvidson, K. & Grafström, R.C. (1998) Toxicity of formaldehyde to human oral fibroblasts and epithelial cells: Influences of culture conditions and role of thiol status. *J. dent. Res.*, **77**, 1896–1903

Nilsson, J.A., Hedberg, J.J., Vondracek, M., Staab, C.A., Hansson, A., Höög, J.-O. & Grafström, R.C. (2004) Alcohol dehydrogenase 3 transcription associates with proliferation of human oral keratinocytes. *Cell. mol. Life Sci*., **61**, 610–617

NIOSH (National Institute for Occupational Safety and Health) (1994a) *NIOSH Manual of Analytical Methods (NMAM®)* (DHHS (NIOSH) Publ. No. 94-113), 4th Ed., Cincinnati, OH, pp. 3500-1–3500-5 [http://www.cdc.gov/niosh/nmam/]

NIOSH (National Institute for Occupational Safety and Health) (1994b) *NIOSH Manual of Analytical Methods (NMAM®)* (DHHS (NIOSH) Publ. No. 94-113), 4th Ed., Cincinnati, OH, pp. 2539-1–2539-10 [http://www.cdc.gov/niosh/nmam/]

NIOSH (National Institute for Occupational Safety and Health) (1994c) *NIOSH Manual of Analytical Methods (NMAM®)* (DHHS (NIOSH) Publ. No. 94-113), 4th Ed., Cincinnati, OH, pp. 2541-1–2541-5 [http://www.cdc.gov/niosh/nmam/]

NIOSH (National Institute for Occupational Safety and Health) (1994d) *NIOSH Manual of Analytical Methods (NMAM®)* (DHHS (NIOSH) Publ. No. 94-113), 4th Ed., Cincinnati, OH, pp. 5700-1–5700-5 [http://www.cdc.gov/niosh/nmam/]

NIOSH (National Institute for Occupational Safety and Health) (2003a) *NIOSH Manual of Analytical Methods (NMAM®)* (DHHS (NIOSH) Publ. 2003-154), 4th Ed., Supplement 3, Cincinnati, OH, pp. 2016-1–2016-7 [http://www.cdc.gov/niosh/nmam/]

NIOSH (National Institute for Occupational Safety and Health) (2003b) *NIOSH Manual of Analytical Methods (NMAM®)* (DHHS (NIOSH) Publ. 2003-154), 4th Ed., Supplement 3, Cincinnati, OH, pp. 3800-1–3800-47 [http://www.cdc.gov/niosh/nmam/]

Nishioka, H. (1973) Lethal and mutagenic action of formaldehyde in Hcr+ and Hcr– strains of *Escherichia coli*. *Mutat. Res.*, **17**, 261–265

Nisse, C., Haguenoer, J.M., Grandbastien, B., Preudhomme, C., Fontaine, B., Brillet, J.M., Lejeune, R. & Fenaux, P. (2001) Occupational and environmental risk factors of the myelodysplastic syndromes in the North of France. *Br. J. Haematol*., **112**, 927–935

Norbäck, D., Björnsson, E., Janson, C., Widström, J. & Boman, G. (1995) Asthmatic symptoms and volatile organic compounds, formaldehyde, and carbon dioxide in dwellings. *Occup. environ. Med.*, **52**, 388–395

Norbäck, D., Wålinder, R., Wieslander, G., Smedje, G., Erwall, C. & Venge, P. (2000) Indoor air pollutants in schools: Nasal patency and biomarkers in nasal lavage. *Allergy*, **55**, 163–170

Nordman, H., Keskinen, H. & Tuppurainen, M. (1985) Formaldehyde asthma — Rare or overlooked. *J. Allergy clin. Immunol*., **75**, 91–99

Nousiainen, P. & Lindqvist, J. (1979) [Chemical Hazards in the Textile Industry. Air Contaminants] (Tiedonanto 16), Tampere, Valtion teknillinen tutkimuskeskus (in Finnish)

Obe, G. & Beek, B. (1979) Mutagenic activity of aldehydes. *Drug Alcohol Dependence*, **4**, 91–94

Occupational Safety & Health Administration (1990a) *OSHA Analytical Methods Manual*, 2nd Ed., Part 1, Vol. 2 (Methods 29–54), Salt Lake City, UT, Method 52 [www.osha.gov]

Occupational Safety & Health Administration (1990b) *OSHA Analytical Methods Manual*, 2nd Ed., Part 2, Vol. 2 (Methods ID-160 to ID-210), Salt Lake City, UT, Method ID-205 [www.osha.gov]

O'Connor, P.M. & Fox, B.W. (1987) Comparative studies of DNA cross-linking reactions following methylene dimethanesulphonate and its hydrolytic product, formaldehyde. *Cancer Chemother. Pharmacol.*, **19**, 11–15

Odeigah, P.G.C. (1997) Sperm head abnormalities and dominant lethal effects of formaldehyde in albino rats. *Mutat. Res.*, **389**, 141–148

O'Donovan, M.R. & Mee, C.D. (1993) Formaldehyde is a bacterial mutagen in a range of Salmonella and Escherichia indicator strains. *Mutagenesis*, **8**, 577–581

Oftedal, B., Nafstad, P., Magnus, P., Bjørkly, S. & Skrondal, A. (2003) Traffic related air pollution and acute hospital admission for respiratory diseases in Drammen, Norway 1995–2000. *Eur. J. Epidemiol*., **18**, 671–675

Ohta, T., Watanabe-Akanuma, M., Tokishita, S.-I. & Yamagata, H. (1999) Mutation spectra of chemical mutagens determined by Lac^+ reversion assay with *Escherichia coli* WP3101P–WP3106P tester strains. *Mutat. Res.*, **440**, 59–74

Ohta, T., Watanabe-Akanuma, M. & Yamagata, H. (2000) A comparison of mutation spectra detected by the *Escherichia coli* Lac^+ reversion assay and the *Salmonella typhimurium* His^+ reversion assay. *Mutagenesis*, **15**, 317–323

Ohtsuka, R., Shuto, Y., Fujie, H., Takeda, M., Harada, T. & Itagaki, S.-J. (1997) Response of respiratory epithelium of BN and F344 rats to formaldehyde inhalation. *Exp. Anim*., **46**, 279–286

Ohtsuka, R., Shutoh, Y., Fujie, H., Yamaguchi, S., Takeda, M., Harada, T. & Doi, K. (2003) Rat strain difference in histology and expression of Th1- and Th2-related cytokines in nasal mucosa after short-term formaldehyde inhalation. *Exp. Toxicol. Pathol*., **54**, 287–291

Ojajärvi, I.A., Partanen, T.J., Ahlbom, A., Boffetta, P., Hakulinen, T., Jourenkova, N., Kauppinen, T.P., Kogevinas, M., Porta, M., Vainio, H.U., Weiderpass, E. & Wesseling, C.H. (2000) Occupational exposures and pancreatic cancer: A meta-analysis. *Occup. environ. Med*., **57**, 316–324

Olin, K.L., Cherr, G.N., Rifkin, E. & Keen, C.L. (1996) The effects of some redox-active metals and reactive aldehydes on DNA–protein cross-links in vitro. *Toxicology*, **110**, 1–8

Olsen, J.H. & Asnaes, S. (1986) Formaldehyde and the risk of squamous cell carcinoma of the sinonasal cavities. *Br. J. ind. Med*., **43**, 769–774

Olsen, J.H., Plough Jensen, S., Hink, M., Faurbo, K., Breum, N.O. & Møller Jensen, O. (1984) Occupational formaldehyde exposure and increased nasal cancer risk in man. *Int. J. Cancer*, **34**, 639–644

Ott, M.G., Teta, M.J. & Greenberg, H.L. (1989) Lymphatic and hematopoietic tissue cancer in a chemical manufacturing environment. *Am. J. ind. Med*., **16**, 631–643

Overman, D.O. (1985) Absence of embryotoxic effects of formaldehyde after percutaneous exposure in hamsters. *Toxicol. Lett.*, **24**, 107–110

Overton, J.H., Kimbell, J.S. & Miller, F.J. (2001) Dosimetry modeling of inhaled formaldehyde: The human respiratory tract. *Toxicol. Sci*., **64**, 122–134

Özen, O.A., Songur, A., Sarsilmaz, M., Yaman, M. & Kus, I. (2003) Zinc, copper and iron concentrations in cerebral cortex of male rats exposed to formaldehyde inhalation. *J. trace Elem. Med. Biol*., **17**, 207–209

Panfilova, Z.I., Voronina, E.N., Poslovina, A.S., Goryukhova, N.M. & Salganik, R.I. (1966) Study of the joint action of chemical mutagens and ultra-violet rays upon the appearance of back mutations in *Escherichia coli*. *Sov. Genet.*, **2**, 35–40

Parfett, C.L. (2003) Combined effects of tumor promoters and serum on proliferin mRNA induction: A biomarker sensitive to saccharin, 2,3,7,8-TCDD, and other compounds at minimal concentrations promoting C3H/10T1/2 cell transformation. *J. Toxicol. environ. Health*, **A66**, 1943–1966

Park, J.S. & Ikeda, K. (2003) Database system, AFoDAS/AVODAS, on indoor air organic compounds in Japan. *Indoor Air*, **13** (Suppl. 6), 35–41

Partanen, T. (1993) Formaldehyde exposure and respiratory cancer — A meta-analysis of the epidemiologic evidence. *Scand. J. Work Environ. Health,* **19**, 8–15

Partanen, T., Kauppinen, T., Nurminen, M., Nickels, J., Hernberg, S., Hakulinen, T., Pukkala, E. & Savonen, E. (1985) Formaldehyde exposure and respiratory and related cancers: A case–referent study among Finnish woodworkers. *Scand. J. Work Environ. Health*, **11**, 409–415

Partanen, T., Kauppinen, T., Hernberg, S., Nickels, J., Luukkonen, R., Hakulinen, T. & Pukkala, E. (1990) Formaldehyde exposure and respiratory cancer among woodworkers — An update. *Scand. J. Work Environ. Health*, **16**, 394–400

Partanen, T., Kauppinen, T., Luukkonen, R., Hakulinen, T. & Pukkala, E. (1993) Malignant lymphomas and leukemias, and exposures in the wood industry: An industry-based case–referent study. *Int. Arch. occup. environ. Health*, **64**, 593–596

Patel, K.G., Bhatt, H.V. & Choudhury, A.R. (2003) Alteration in thyroid after formaldehyde (HCHO) treatment in rats. *Ind. Health*, **41**, 295–297

Patterson, R., Dykewicz, M.S., Evans, R.III, Grammer, L.C., Greenberger, P.A., Harris, K.E., Lawrence, I.D., Pruzansky, J.J., Roberts, M., Shaughnessy, M.A. & Zeiss, C.R. (1989) IgG antibody against formaldehyde human serum proteins: A comparison with other IgG antibodies against inhalant proteins and reactive chemicals. *J. Allergy clin. Immunol.*, **84**, 359–366

Paustenbach, D., Alarie, Y., Kulle, T., Schachter, N., Smith, R., Swenberg, J., Witschi, H. & Horowitz, S.B. (1997) A recommended occupational exposure limit for formaldehyde based on irritation. *J. Toxicol. environ. Health*, **50**, 217–263

Pazdrak, K., Górski, P., Krakowiak, A. & Ruta, U. (1993) Changes in nasal lavage fluid due to formaldehyde inhalation. *Int. Arch. occup. environ. Health*, **64**, 515–519

Petersen, D. & Lindahl, R. (1997) Aldehyde dehydrogenases. In: Guengerich, F.P., ed., *Comprehensive Toxicology*, New York, Pergamon, pp. 97–118

Petersen, G.R. & Milham, S. (1980) *Occupational Mortality in the State of California 1959–1961* (DHEW (NIOSH) Publication No. 80-104), Cincinatti, OH, National Institute for Occupational Safety and Health

Pickrell, J.A., Mokler, B.V., Griffis, L.C., Hobbs, C.H. & Bathija, A. (1983) Formaldehyde release rate coefficients from selected consumer products. *Environ. Sci. Technol.*, **17**, 753–757

Pickrell, J.A., Griffis, L.C., Mokler, B.V., Kanapilly, G.M. & Hobbs, C.H. (1984) Formaldehyde release from selected consumer products: Influence of chamber loading, multiple products, relative humidity, and temperature. *Environ. Sci. Technol.,* **18**, 682–686

Pinkerton, L.E., Hein, M.J. & Stayner, L.T. (2004) Mortality among a cohort of garment workers exposed to formaldehyde: An update. *Occup. environ. Med*., **61**, 193–200

Pitten, F.-A., Kramer, A., Herrmann, K., Bremer, J. & Koch, S. (2000) Formaldehyde neurotoxicity in animal experiments. *Pathol. Res. Pract*., **196**, 193–198

Pocker, Y. & Li, H. (1991) Kinetics and mechanism of methanol and formaldehyde interconversion and formaldehyde oxidation catalyzed by liver alcohol dehydrogenase. *Adv. exp. Med. Biol*., **284**, 315–325

Pohanish, R.P. (2002) *Sittig's Handbook of Toxic and Hazardous Chemicals and Carcinogens*, 4th Ed., Norwich, NY, Noyes Publications/William Andrew Publishing, pp. 1179–1182

Pool, B.L., Frei, E., Plesch, W.J., Romruen, K. & Wiessler, M. (1984) Formaldehyde as a possible mutagenic metabolite of *N*-nitrodimethylamine and of other agents which are suggested to yield non-alkylating species *in vitro*. *Carcinogenesis*, **5**, 809–814

Popa, V., Teculescu, D., Stanescu, D. & Gavrilescu, N. (1969) Bronchial asthma and asthmatic bronchitis determined by simple chemicals. *Dis. Chest*, **56**, 395–404

Porter, J.A.H. (1975) Acute respiratory disease following formalin inhalation. *Lancet*, **ii**, 603–604

Possanzini, M., Di Palo, V., Petricca, M., Fratarcangeli, R. & Brocco, D. (1996) Measurements of lower carbonyls in Rome ambient air. *Atmos. Environ*., **30**, 3757–3764

Poverenny, A.M., Siomin, Y.A., Saenko, A.S. & Sinzinis, B.I. (1975) Possible mechanisms of lethal and mutagenic action of formaldehyde. *Mutat. Res.*, **27**, 123–126

Pratt, G.C., Palmer, K., Wu, C.Y., Oliaei, F., Hollerbach, C. & Fenske, M.J. (2000) An assessment of air toxics in Minnesota. *Environ. Health Perspect*., **108**, 815–825

Preuss, P.W., Dailey, R.L. & Lehman, E.S. (1985) Exposure to formaldehyde. In: Turoski, V., ed., *Formaldehyde. Analytical Chemistry and Toxicology* (Advances in Chemistry Series, Vol. 210), Washington DC, American Chemical Society, pp. 247–259

Priha, E., Riipinen, H. & Korhonen, K. (1986) Exposure to formaldehyde and solvents in Finnish furniture factories in 1975–1984. *Ann. occup. Hyg.*, **30**, 289–294

Priha, E., Vuorinen, R. & Schimberg, R. (1988) [Textile Finishing Agents] (Työolot 65), Helsinki, Finnish Institute of Occupational Health (in Finnish)

Pushkina, N.N., Gofmekler, V.A. & Klevtsova, T.N. (1968) [Changes in the ascorbic acid titer and in the nucleinic acids following action of benzol and formaldehyde.] *Bjull. eksp. Biol. Med.*, **66**, 51–53 (in Russian)

Puxbaum, H., Rosenberg, C., Gregori, M., Lanzerstorfer, C., Ober, E. & Winiwarter, W. (1988) Atmospheric concentrations of formic and acetic acid and related compounds in eastern and northern Austria. *Atmos. Environ*., **22**, 2841–2850

Quievryn, G. & Zhitkovich, A. (2000) Loss of DNA–protein crosslinks from formaldehyde-exposed cells occurs through spontaneous hydrolysis and an active repair process linked to proteosome function. *Carcinogenesis*, **21**, 1573–1580

Ragan, D.L. & Boreiko, C.J. (1981) Initiation of C3H/10T1/2 cell transformation by formaldehyde. *Cancer Lett.*, **13**, 325–331

Ratnayake, W.E. (1968) Tests for an effect of the Y-chromosome on the mutagenic action of formaldehyde and X-rays in *Drosophila melanogaster*. *Genet. Res. Camb.*, **12**, 65–69

Ratnayake, W.E. (1970) Studies on the relationship between induced crossing-over and mutation in *Drosophila melanogaster*. *Mutat. Res.*, **9**, 71–83

Recio, L. (1997) Oncogene and tumor suppressor gene alterations in nasal tumors. *Mutat. Res*., **380**, 27–31

Recio, L., Sisk, S., Pluta, L., Bermudez, E., Gross, E.A., Chen, Z., Morgan, K. & Walker, C. (1992) *p53* Mutations in formaldehyde-induced nasal squamous cell carcinomas in rats. *Cancer Res.*, **52**, 6113–6116

Reed, C.E. & Frigas, E. (1984) Does formaldehyde cause allergic respiratory disease? In: Gammage, R.B. & Kay, S.V., eds, *Indoor Air and Human Health*, Boca Raton, FL, Lewis, pp. 379–386

Reh, C.M., Letts, D. & Deitchman, S. (1994) *National Park Service, Yosemite National Park, CA* (Health Hazard Evaluation Report, HETA 90-0365-2415), Cincinnati, OH, National Institute of Occupational Safety and Health, Centers for Disease Control and Prevention

Reinhardt, T.E., Ottmar, R.D. & Castilla, C. (2001) Smoke impacts from agricultural burning in a rural Brazilian town. *J. Air Waste Manage. Assoc*., **51**, 443–450

Reiss, R., Ryan, P.B., Tibbetts, S.J. & Koutrakis, P. (1995) Measurement of organic acids, aldehydes, and ketones in residential environments and their relation to ozone. *J. Air Waste Manage. Assoc*., **45**, 811–822

Restani, P. & Galli, C.L. (1991) Oral toxicity of formaldehyde and its derivatives. *Crit. Rev. Toxicol.*, **21**, 315–328

Restani, P., Restelli, A.R. & Galli, C.L. (1992) Formaldehyde and hexamethylenetetramine as food additives: Chemical interactions and toxicology. *Food Addit. Contam*., **9**, 597–605

Reuss, G., Disteldorf, W., Gamer, A.O. & Hilt, A. (2003) Formaldehyde. In: *Ullmann's Encyclopedia of Industrial Chemistry*, 6th rev. Ed., Vol. 15, Weinheim, Wiley-VCH Verlag GmbH & Co., pp. 1–34

Reuzel, P.G.J., Wilmer, J.W.G.M., Woutersen, R.A. & Zwart, A. (1990) Interactive effects of ozone and formaldehyde on the nasal respiratory lining epithelium in rats. *J. Toxicol. environ. Health*, **29**, 279–292

Reynolds, S.J., Black, D.W., Borin, S.S., Breuer, G., Burmeister, L.F., Fuortes, L.J., Smith, T.F., Stein, M.A., Subramanian, P., Thorne, P.S. & Whitten, P. (2001) Indoor environmental quality in six commercial office buildings in the Midwest United States. *Appl. occup. environ. Hyg.*, **16**, 1065–1077

Riala, R.E. & Riihimäki, H.A. (1991) Solvent and formaldehyde exposure in parquet and carpet work. *Appl. occup. environ. Hyg.*, **6**, 301–308

Rice, R.H. & Green, H. (1979) Presence in human epidermal cells of a soluble protein precursor of the cross-linked envelope: Activation of the cross-linking by calcium ions. *Cell*, **18**, 681–694

Rietbrock, N. (1965) [Formaldehyde oxidation in the rat.] *Naunyn-Schmiedeberg's Arch. exp. Pathol. Pharmakol.*, **251**, 189–190 (in German)

Risby, T.H., Sehnert, S.S., Jakab, G.J. & Hemenway, D.R. (1990) Model to estimate effective doses of adsorbed pollutants on respirable particles and their subsequent release into alveolar surfactant. I. Validation of the model for the adsorption and release of formaldehyde on a respirable carbon black. *Inhal. Toxicol.*, **2**, 223–239

Robins, J.M., Pambrun, M., Chute, C. & Blevins, D. (1988) Estimating the effect of formaldehyde exposure on lung cancer and non-malignant respiratory disease (NMRD) mortality using a new method to control for the healthy worker survivor effect. In: Hogstedt, C. & Reuterwall, C., eds, *Progress in Occupational Epidemiology*, Amsterdam, Elsevier Science, pp. 75–78

Rosén, G., Bergström, B. & Ekholm, U. (1984) [Occupational exposure to formaldehyde in Sweden.] *Arbete Hälsa*, **50**, 16–21 (in Swedish)

Ross, W.E. & Shipley, N. (1980) Relationship between DNA damage and survival in formaldehyde-treated mouse cells. *Mutat. Res.*, **79**, 277–283

Ross, W.E., McMillan, D.R. & Ross, C.F. (1981) Comparison of DNA damage by methylmelamines and formaldehyde. *J. natl Cancer Inst.*, **67**, 217–221

Rothenberg, S.J., Nagy, P.A., Pickrell, J.A. & Hobbs, C.H. (1989) Surface area, adsorption, and desorption studies on indoor dust samples. *Am. ind. hyg. Assoc. J.*, **50**, 15–23

Roush, G.C., Walrath, J., Stayner, L.T., Kaplan, S.A., Flannery, J.T. & Blair, A. (1987) Nasopharyngeal cancer, sinonasal cancer, and occupations related to formaldehyde: A case–control study. *J natl Cancer Inst*., **79**, 1221–1224

Rusch, G.M., Clary, J.J., Rinehart, W.E. & Bolte, H.F. (1983) A 26-week inhalation toxicity study with formaldehyde in the monkey, rat, and hamster. *Toxicol. appl. Pharmacol.*, **68**, 329–343

Sadakane, K., Takano, H., Ichinose, T., Yanagisawa, R. & Shibamoto, T. (2002) Formaldehyde enhances mite allergen-induced eosinophilic inflammation in the murine airway. *J. environ. Pathol. Toxicol. Oncol*., **21**, 267–276

Sadtler Research Laboratories (1991) *Sadtler Standard Spectra. 1981–1991 Supplementary Index*, Philadelphia, PA

Saillenfait, A.M., Bonnet, P. & de Ceaurriz, J. (1989) The effects of maternally inhaled formaldehyde on embryonal and foetal development in rats. *Food chem. Toxicol.*, **27**, 545–548

Sakaguchi, J. & Akabayashi, S. (2003) Field survey of indoor air quality in detached houses in Niigata Prefecture. *Indoor Air*, **13** (Suppl. 6), 42–49

Sakai, K., Norbäck, D., Mi, Y., Shibata, E., Kamijima, M., Yamada, T. & Takeuchi, Y. (2004) A comparison of indoor air pollutants in Japan and Sweden: Formaldehyde, nitrogen dioxide, and chlorinated volatile organic compounds. *Environ. Res*., **94**, 75–85

Saladino, A.J., Willey, J.C., Lechner, J.F., Grafström, R.C., LaVeck, M. & Harris, C.C. (1985) Effects of formaldehyde, acetaldehyde, benzoyl peroxide, and hydrogen peroxide on cultured normal human bronchial epithelial cells. *Cancer Res.*, **45**, 2522–2526

Salisbury, S. (1983) *Dialysis Clinic Inc., Atlanta, GA, Health Hazard Evaluation Report* (NIOSH Report No. HETA 83-284-1536), Cincinnati, OH, US Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health

Sandner, F., Dott, W. & Hollender, J. (2001) Sensitive indoor air monitoring of formaldehyde and other carbonyl compounds using the 2,4-dinitrophenylhydrazine method. *Int. J. Hyg. environ. Health*, **203**, 275–279

Sanghani, P.C., Stone, C.L., Ray, B.D., Pindel, E.V., Hurley, T.D. & Bosron, W.F. (2000) Kinetic mechanism of human glutathione-dependent formaldehyde dehydrogenase. *Biochemistry*, **39**, 10720–10729

Sass-Kortsak, A.M., Holness, D.L., Pilger, C.W. & Nethercott, J.R. (1986) Wood dust and formaldehyde exposures in the cabinet-making industry. *Am. ind. Hyg. Assoc. J.*, **47**, 747–753

Satsumabayashi, H., Kurita, H., Chang, Y.-S., Carmichael, G.R. & Ueda, H. (1995) Photochemical formations of lower aldehydes and lower fatty acids under long-range transport in central Japan. *Atmos. Environ*., **29**, 255–266

Sauder, L.R., Chatham, M.D., Green, D.J. & Kulle, T.J. (1986) Acute pulmonary response to formaldehyde exposure in healthy nonsmokers. *J. occup. Med.*, **28**, 420–424

Sauder, L.R., Green, D.J., Chatham, M.D. & Kulle, T.J. (1987) Acute pulmonary response of asthmatics to 3.0 ppm formaldehyde. *Toxicol. ind. Health*, **3**, 569–578

Schachter, E.N., Witek, T.J., Jr, Tosun, T. & Beck, G.J. (1986) A study of respiratory effects from exposure to 2 ppm formaldehyde in healthy subjects. *Arch. environ. Health*, **41**, 229–239

Schachter, E.N., Witek, T.J., Jr, Brody, D.J., Tosun, T., Beck, G.J. & Leaderer, B.P. (1987) A study of respiratory effects from exposure to 2 ppm formaldehyde in occupationally exposed workers. *Environ. Res*., **44**, 188–205

Schäfer, D., Brommer, C., Riechelmann, H. & Mann, J.W. (1999) In vivo and in vitro effect of ozone and formaldehyde on human mucociliary transport system. *Rhinology*, **37**, 56–60

Schifter, I., Vera, M., Díaz, L., Guzmán, E., Ramos, F. & López-Salinas, E. (2001) Environmental implications on the oxygenation of gasoline with ethanol in the metropolitan area of Mexico City. *Environ. Sci. Technol*., **35**, 1893–1901

Schlink, K., Janssen, K., Nitzsche, S., Gebhard, S., Hengstler, J.G., Klein, S. & Oesch, F. (1999) Activity of O^6-methylguanine DNA methyltransferase in mononuclear blood cells of formaldehyde-exposed medical students. *Arch. Toxicol.*, **73**, 15–21

Schlosser, P.M. (1999) Relative roles of convection and chemical reaction for the disposition of formaldehyde and ozone in nasal mucus. *Inhal. Toxicol*., **11**, 967–980

Schlosser, P.M., Lilly, P.D., Conolly, R.B., Janszen, D.B. & Kimbell, J.S. (2003) Benchmark dose risk assessment for formaldehyde using airflow modeling and a single-compartment, DNA–protein cross-link dosimetry model to estimate human equivalent doses. *Risk Anal*., **23**, 473–487

Schmid, E., Göggelmann, W. & Bauchinger, M. (1986) Formaldehyde-induced cytotoxic, genotoxic and mutagenic response in human lymphocytes and *Salmonella typhimurium*. *Mutagenesis*, **1**, 427–431

Schreider, J.P. (1986) Comparative anatomy and function of the nasal passages. In: Barrow, C.S., ed., *Toxicology of the Nasal Passages*, Washington DC, Hemisphere, pp. 1–25

Schwartz, S.M., Doody, D.R., Fitzgibbons, E.D., Ricks, S., Porter, P.L. & Chen, C. (2001) Oral squamous cell cancer risk in relation to alcohol consumption and alcohol dehydrogenase-3 genotypes. *Cancer Epidemiol. Biomarkers Prev*., **10**, 1137–1144

Seila, R.L., Main, H.H., Arriaga, J.L., Martínez, G.V. & Ramadan, A.B. (2001) Atmospheric volatile organic compound measurements during the 1996 Paso del Norte Ozone Study. *Sci. total Environ*., **276**, 153–169

Sellakumar, A.R., Snyder, C.A., Solomon, J.J. & Albert, R.E. (1985) Carcinogenicity of formaldehyde and hydrogen chloride in rats. *Toxicol. appl. Pharmacol.*, **81**, 401–406

Sensidyne (2004) *Sensidyne Detector Tube Selection Guide*, Clearwater, FL

Sensidyne (undated) *Sensidyne Gas Detector Tube Handbook*, Clearwater, FL, pp. 129–131

de Serres, F.J. & Brockman, H.E. (1999) Comparison of the spectra of genetic damage in formaldehyde-induced *ad-3* mutations between DNA repair-proficient and deficient heterokaryons of *neurospora crassa*. *Mutat. Res.*, **437**, 151–163

de Serres, F.J., Brockman, H.E. & Hung, C.Y. (1988) Effect of the homokaryotic state of the *uvs*-2 allele in *Neurospora crassa* on formaldehyde-induced killing and *ad*-3 mutation. *Mutat. Res.*, **199**, 235–242

de Serves, C. (1994) Gas phase formaldehyde and peroxide measurements in the Arctic atmosphere. *J. geophys. Res.*, **99**, 25391–25398

Sexton, K., Liu, K.-S. & Petreas, M.X. (1986) Formaldehyde concentrations inside private residences: A mail-out approach to indoor air monitoring. *J. Air Pollut. Control Assoc*., **36**, 698–704

Sexton, K., Petreas, M.X. & Liu, K.-S. (1989) Formaldehyde exposures inside mobile homes. *Environ. Sci. Technol.*, **23**, 985–988

Shah, J.J. & Singh, H.B. (1988) Distribution of volatile organic chemicals in outdoor and indoor air. A national VOCs data base. *Environ. Sci. Technol*., **22**, 1381–1388

Shaham, J., Bomstein, Y., Meltzer, A., Kaufman, Z., Palma, E. & Ribak, J. (1996a) DNA–protein crosslinks, a biomarker of exposure to formaldehyde — *In vitro* and *in vivo* studies. *Carcinogenesis*, **17**, 121–125

Shaham, J., Bomstein, Y., Meltzer, A. & Ribak, J. (1996b) Response. *Carcinogenesis*, **17**, 2098–2101

Shaham, J., Bomstein, Y., Melzer, A. & Ribak, J. (1997) DNA–protein crosslinks and sister chromatid exchanges as biomarkers of exposure to formaldehyde. *Int. J. occup. environ. Health*, **3**, 95–104

Shaham, J., Gurvich, R. & Kaufman, Z. (2002) Sister chromatid exchange in pathology staff occupationally exposed to formaldehyde. *Mutat. Res*., **514**, 115–123

Shaham, J., Bomstein, Y., Gurvich, R., Rashkovsky, M. & Kaufman, Z. (2003) DNA–protein crosslinks and p53 protein expression in relation to occupational exposure to formaldehyde. *Occup. environ. Med*., **60**, 403–409

Shepson, P.B., Hastie, D.R., Schiff, H.I., Polizzi, M., Bottenheim, J.W., Anlauf, K., Mackay, G.I. & Karecki, D.R. (1991) Atmospheric concentrations and temporal variations of C_1–C_3 carbonyl compounds at two rural sites in central Ontario. *Atmos. Environ*., **25A**, 2001–2015

Shields, P.G., Xu, G.X., Blot, W.J., Fraumeni, J.F., Jr, Trivers, G.E., Pellizzari, E.D., Qu, Y.H., Gao, Y.T. & Harris, C.C. (1995) Mutagens from heated Chinese and US cooking oils. *J. natl Cancer Inst*., **87**, 836–841

Shumilina, A.V. (1975) [Menstrual and child-bearing functions of female workers occupationally exposed to the effects of formaldehyde.] *Gig. Tr. prof. Zabol.*, **12**, 18–21 (in Russian)

Siboulet, R., Grinfeld, S., Deparis, P. & Jaylet, A. (1984) Micronuclei in red blood cells of the newt *Pleurodeles waltl* Michah: Induction with X-rays and chemicals. *Mutat. Res.*, **125**, 275–281

Siemiatycki, J., Day, N.E., Fabry, J. & Cooper, J.A. (1981) Discovering carcinogens in the occupational environment: A novel epidemiological approach. *J. natl Cancer Inst.*, **66**, 217–225

Siemiatycki, J., Dewar, R., Nadon, L. & Gérin, M. (1994) Occupational risk factors for bladder cancer: Results from a case–control study in Montreal, Quebec, Canada. *Am. J. Epidemiol*., **140**, 1061–1080

Sin, D.W.M., Wong, Y.-C. & Louie, P.K.K. (2001) Trends of ambient carbonyl compounds in the urban environment of Hong Kong. *Atmos. Environ*., **35**, 5961–5969

SKC® (2005) *Gastec® Color Detector Tubes Price List*, Eighty Four, PA

Skisak, C.M. (1983) Formaldehyde vapor exposures in anatomy laboratories. *Am. ind. Hyg. Assoc. J.*, **44**, 948–950

Slemr, J. (1992) Development of techniques for the determination of major carbonyl compounds in clean air. In: *EUROTRAC Annual Report for 1991*, Part 9, Mainz, Max Planck Institute for Chemistry, pp. 110–113

Slemr, J., Junkermann, W. & Volz-Thomas, A. (1996) Temporal variations in formaldehyde, acetaldehyde and acetone and budget of formaldehyde at a rural site in southern Germany. *Atmos. Environ*., **30**, 3667–3676

Smedley, J. (1996) Is formaldehyde an important cause of allergic respiratory disease? *Clin. exp. Allergy*, **26**, 247–249

Smith, E.L., Hill, R.L., Lehman, I.R., Lefkowitz, R.J., Handler, P. & White, A. (1983) *Principles of Biochemistry: Mammalian Biochemistry*, New York, McGraw-Hill, pp. 3–4, 142

Snyder, R.D. & Van Houten, B. (1986) Genotoxicity of formaldehyde and an evaluation of its effects on the DNA repair process in human diploid fibroblasts. *Mutat. Res.*, **165**, 21–30

Sobels, F.H. & van Steenis, H. (1957) Chemical induction of crossing-over in *Drosophila* males. *Nature*, **179**, 29–31

Soffritti, M., Maltoni, C., Maffei, F. & Biagi, R. (1989) Formaldehyde: An experimental multipotential carcinogen. *Toxicol. ind. Health*, **5**, 699–730

Soffritti, M., Belpoggi, F., Lambertini, L., Lauriola, M., Padovani, M. & Maltoni, C. (2002) Results of long-term experimental studies on the carcinogenicity of formaldehyde and acetaldehyde in rats. *Ann. N.Y. Acad. Sci*., **982**, 87–105

Sorg, B.A., Bailie, T.M., Tschirgi, M.L., Li, N. & Wu, W.-R. (2001) Exposure to repeated low-level formaldehyde in rats increases basal corticosterone levels and enhances the corticosterone response to subsequent formaldehyde. *Brain Res*., **898**, 314–320

Spanel, P., Smith, D., Holland, T.A., Al Singary, W. & Elder, J.B. (1999) Analysis of formaldehyde in the headspace of urine from bladder and prostate cancer patients using selected ion flow tube mass spectrometry. *Rapid Commun. mass Spectrom.*, **13**, 1354–1359

Speit, G. & Merk, O. (2002) Evaluation of mutagenic effects of formaldehyde *in vitro*: Detection of crosslinks and mutations in mouse lymphoma cells. *Mutagenesis*, **17**, 183–187

Speit, G., Schütz, P. & Merk, O. (2000) Induction and repair of formaldehyde-induced DNA–protein crosslinks in repair-deficient human cell lines. *Mutagenesis*, **15**, 85–90

Spitzer, H.L. (1997) An analysis of the health benefits associated with the use of MTBE reformulated gasoline and oxygenated fuels in reducing atmospheric concentrations of selected volatile organic compounds. *Risk Anal*., **17**, 683–691

Šrám, R.J. (1970) The effect of storage on the frequency of dominant lethals in *Drosophila melanogaster*. *Mol. gen. Genet.*, **106**, 286–288

Standardiseringen i Sverige (1996) [Plywood — Formaldehyde Release Classes Determined by the Gas Analysis Method] (SS EN 1084:1995), Stockholm, Swedish Standards Institute (in Swedish)

Stayner, L., Smith, A.B., Reeve, G., Blade, L., Elliott, L., Keenlyside, R. & Halperin, W. (1985) Proportionate mortality study of workers in the garment industry exposed to formaldehyde. *Am. J. ind. Med.*, **7**, 229–240

Stayner, L.T., Elliott, L., Blade, L., Keenlyside, R. & Halperin, W. (1988) A retrospective cohort mortality study of workers exposed to formaldehyde in the garment industry. *Am. J. ind. Med.*, **13**, 667–681

Steenland, K., Nowlin, S., Ryan, B. & Adams, S. (1992) Use of multiple-cause mortality data in epidemiologic analyses: US rate and proportion files developed by the National Institute for Occupational Safety and Health and the National Cancer Institute. *Am. J. Epidemiol.*, **136**, 855–862

Steinhagen, W.H. & Barrow, C.S. (1984) Sensory irritation structure–activity study of inhaled aldehydes in B6C3F1 and Swiss-Webster mice. *Toxicol. appl. Pharmacol.*, **72**, 495–503

Stellman, S.D., Demers, P.A., Colin, D. & Boffetta, P. (1998) Cancer mortality and wood dust exposure among participants in the American Cancer Society Cancer Prevention Study-II (CPS-II). *Am. J. ind. Med.*, **34**, 229–237

Sterling, T.D. & Weinkam, J.J. (1976) Smoking characteristics by type of employment. *J. occup. Med.*, **18**, 743–754

Sterling, T.D. & Weinkam, J.J. (1988) Reanalysis of lung cancer mortality in a National Cancer Institute study on mortality among industrial workers exposed to formaldehyde. *J. occup. Med.*, **30**, 895–901

Sterling, T.D. & Weinkam, J.J. (1989a) Reanalysis of lung cancer mortality in a National Cancer Institute study on 'Mortality among industrial workers exposed to formaldehyde'. *Exp. Pathol.*, **37**, 128–132

Sterling, T.D. & Weinkam, J.J. (1989b) Reanalysis of lung cancer mortality in a National Cancer Institute study of 'Mortality among industrial workers exposed to formaldehyde': Additional discussion. *J. occup. Med.*, **31**, 881–884

Sterling, T.D. & Weinkam, J.J. (1994) Mortality from respiratory cancers (including lung cancer) among workers employed in formaldehyde industries. *Am. J. ind. Med.*, **25**, 593–602

Sterling, T.D. & Weinkam, J.J. (1995) Comments on the Blair and Stewart comments on the Sterling and Weinkam analysis of data from the National Cancer Institute Formaldehyde Study. *Am. J. ind. Med.*, **27**, 301–305

Stewart, P.A., Blair, A., Cubit, D.A., Bales, R.E., Kaplan, S.A., Ward, J., Gaffey, W., O'Berg, M.T. & Walrath, J. (1986) Estimating historical exposures to formaldehyde in a retrospective mortality study. *Appl. ind. Hyg.*, **1**, 34–41

Stewart, P.A., Cubit, D.A. & Blair, A. (1987) Formaldehyde levels in seven industries. *Appl. ind. Hyg.*, **2**, 231–236

Stewart, P.A., Herrick, R.F., Feigley, C.E., Utterback, D.F., Hornung, R., Mahar, H., Hayes, R., Douthit, D.E. & Blair, A. (1992) Study design for assessing exposures of embalmers for a case–control study. Part I. Monitoring results. *Appl. occup. environ. Hyg.*, **7**, 532–540

Stone, R.A., Youk, A.O., Marsh, G.M., Buchanich, J.M., McHenry, M.B. & Smith, T.J. (2001) Historical cohort study of US man-made vitreous fiber production workers: IV. Quantitative exposure–response analysis of the nested case–control study of respiratory system cancer. *J. occup. environ. Med*., **43**, 779–792

Stragier, A, Wenderickx, D. & Jadoul, M. (1995) Rinsing time and disinfectant release of reused dialyzers: Comparison of formaldehyde, hypochlorite, Warexin, and Renalin. *Am. J. Kidney Dis*., **26**, 549–553

Stroup, N.E., Blair, A. & Erikson, G.E. (1986) Brain cancer and other causes of death in anatomists. *J. natl Cancer Inst.*, **77**, 1217–1224

Stücker, I., Caillard, J.-F., Collin, R., Gout, M., Poyen, D. & Hémon, D. (1990) Risk of spontaneous abortion among nurses handling antineoplastic drugs. *Scand. J. Work Environ. Health*, **16**, 102–107

Stumm-Tegethoff, B.F.A. (1969) Formaldehyde-induced mutations in *Drosophila melanogaster* in dependence of the presence of acids. *Theoret. appl. Genet.*, **39**, 330–334

Suh, H.H., Bahadori,T., Vallarino, J. & Spengler, J.D. (2000) Criteria air pollutants and toxic air pollutants. *Environ. Health Perspect*., **108** (Suppl. 4), 625–633

Suruda, A., Schulte, P., Boeniger, M., Hayes, R.B., Livingston, G.K., Steenland, K., Stewart, P., Herrick, R., Douthit, D. & Fingerhut, M.A. (1993) Cytogenetic effects of formaldehyde exposure in students of mortuary science. *Cancer Epidemiol. Biomarkers Prev.*, **2**, 453–460

Suva (2003) *Grenzwerte am Arbeitsplatz 2003*, Luzern, Swiss Accident Insurance [Swiss OELs]

Svensson, S., Some, M., Lundsjö, A., Helander, A., Cronholm, T. & Höög, J.-O. (1999) Activities of human alcohol dehydrogenases in the metabolic pathways of ethanol and serotonin. *Eur. J. Biochem*., **262**, 324–329

Swenberg, J.A., Kerns, W.D., Mitchell, R.I., Gralla, E.J. & Pavkov, K.L. (1980) Induction of squamous cell carcinomas of the rat nasal cavity by inhalation exposure to formaldehyde vapor. *Cancer Res*., **40**, 3398–3402

Swenberg, J.A., Gross, E.A., Randall, H.W. & Barrow, C.S. (1983) The effect of formaldehyde exposure on cytotoxicity and cell proliferation. In: Clary, J.J., Gibson, J.E. & Waritz, R.S., eds, *Formaldehyde: Toxicology, Epidemiology, Mechanisms*, New York, Marcel Dekker, pp. 225–236

Swiecichowski, A.L., Long, K.J., Miller, M.L. & Leikauf, G.D. (1993) Formaldehyde-induced airway hyperreactivity *in vivo* and *ex vivo* in guinea pigs. *Environ. Res.*, **61**, 185–199

Takahashi, K., Morita, T. & Kawazoe, Y. (1985) Mutagenic characteristics of formaldehyde on bacterial systems. *Mutat. Res.*, **156**, 153–161

Takahashi, M., Hasegawa, R., Furukawa, F., Toyoda, K., Sato, H. & Hayashi, Y. (1986) Effects of ethanol, potassium metabisulfite, formaldehyde and hydrogen peroxide on gastric carcinogenesis in rats after initiation with *N*-methyl-*N*′-nitro-*N*-nitrosoguanidine. *Jpn. J. Cancer Res.*, **77**, 118–124

Tan, Y.-M., DiBerardinis, L. & Smith, T. (1999) Exposure assessment of laboratory students. *Appl. occup. environ. Hyg*., **14**, 530–538

Tanaka, K., Nishiyama, K., Yaginuma, H., Sasaki, A., Maeda, T., Kaneko, S.-y., Onami, T. & Tanaka, M. (2003) [Formaldehyde exposure levels and exposure control measure during an anatomy dissecting course.] *Kaibogaku Zasshi*, **78**, 43–51 (in Japanese)

Tanner, R.L., Zielinska, B., Uberna, E., Harshfield, G. & McNichol, A.P. (1996) Concentrations of carbonyl compounds and the carbon isotopy of formaldehyde at a coastal site in Nova Scotia during the NARE summer intensive. *J. geophys. Res.*, **101**, 28961–28970

Tarkowski, M. & Gorski, P. (1995) Increased IgE antiovalbumin level in mice exposed to formaldehyde. *Int. Arch. Allergy Immunol*., **106**, 422–424

Taskinen, H., Kyyrönen, P., Hemminki, K., Hoikkala, M., Lajunen, K. & Lindbohm, M.-L. (1994) Laboratory work and pregnancy outcome. *J. occup. Med.*, **36**, 311–319

Taskinen, H.K., Kyyrönen, P., Sallmén, M., Virtanen, S.V., Liukkonen, T.A., Huida, O., Lindbohm, M.-L. & Anttila, A. (1999) Reduced fertility among female wood workers exposed to formaldehyde. *Am. J. ind. Med.*, **36**, 206–212

Tatham, L., Tolbert, P. & Kjeldsberg, C. (1997) Occupational risk factors for subgroups of non-Hodgkin's lymphoma. *Epidemiology*, **8**, 551–558

Temcharoen, P. & Thilly, W.G. (1983) Toxic and mutagenic effects of formaldehyde in *Salmonella typhimurium*. *Mutat. Res.*, **119**, 89–93

Teng, S., Beard, K., Pourahmad, J., Moridani, M., Easson, E., Poon, R. & O'Brien, P.J. (2001) The formaldehyde metabolic detoxification enzyme systems and molecular cytotoxic mechanism in isolated rat hepatocytes. *Chem.-biol. Interactions*, **130–132**, 285–296

Thermo Electron Corporation (2005) *Product Specifications: MIRAN SapphIRe ML Portable Infrared Ambient Analyzer for the Medical Industry*, Franklin, MA

Thornton-Manning, J.R. & Dahl, A.R. (1997) Metabolic capacity of nasal tissue interspecies comparisons of xenobiotic-metabolizing enzymes. *Mutat. Res*., **380**, 43–59

Thrasher, J.D. & Kilburn, K.H. (2001) Embryo toxicity and teratogenicity of formaldehyde. *Arch. environ. Health*, **56**, 300–311

Tikuisis, T., Phibbs, M.R. & Sonnenberg, K.L. (1995) Quantitation of employee exposure to emission products generated by commercial-scale processing of polyethylene. *Am. ind. Hyg. Assoc. J*., **56**, 809–814

Til, H.P., Woutersen, R.A., Feron, V.J. & Clary, J.J. (1988) Evaluation of the oral toxicity of acetaldehyde and formaldehyde in a 4-week drinking-water study in rats. *Food chem. Toxicol.*, **26**, 447–452

Til, H.P., Woutersen, R.A., Feron, V.J., Hollanders, V.H.M. & Falke, H.E. (1989) Two-year drinking-water study of formaldehyde in rats. *Food. chem. Toxicol.*, **27**, 77–87

Titenko-Holland, N., Levine, A.J. , Smith, M.T., Quintana, P.J.E., Boeniger, M., Hayes, R., Suruda, A. & Schulte, P. (1996) Quantification of epithelial cell micronuclei by fluorescence in situ hybridization (FISH) in mortuary science students exposed to formaldehyde. *Mutat. Res*., **371**, 237–248

Tobe, M., Naito, K. & Kurokawa, Y. (1989) Chronic toxicity study on formaldehyde administered orally to rats. *Toxicology*, **56**, 79–86

Tokars, J.I., Miller, E.R., Alter, M.J. & Arduino, M.J. (2000) *National Surveillance of Dialysis-associated Diseases in the United States, 1997*, Atlanta, GA, National Center for Infectious Diseases, Centers for Disease Control and Prevention

Triebig, G., Schaller, K.-H., Berger, B., Müller, J. & Valentin, H. (1989) Formaldehyde exposure at various workplaces. *Sci. total Environ.*, **79**, 191–195

Tuomi, T., Engström, B., Niemelä, R., Svinhufvud, J. & Reijula, K. (2000) Emission of ozone and organic volatiles from a selection of laser printers and photocopiers. *Appl. occup. environ. Hyg.*, **15**, 629–634

Tyihák, E., Bocsi, J., Timár, F., Rácz, G. & Szende, B. (2001) Formaldehyde promotes and inhibits proliferation of cultured tumour and endothelial cells. *Cell Prolif.*, **34**, 135–141

Työsuojelusäädöksiä (2002) *HTP arvot 2002*, Helsinki, Sosiaali-ja terveysministeriön [Finnish OELs]

Uotila, L. & Koivusalo, M. (1974) Formaldehyde dehydrogenase from human liver. Purification, properties, and evidence for the formation of glutathione thiol esters by the enzyme. *J. biol. Chem*., **249**, 7653–7663

Uotila, L. & Koivusalo, M. (1987) Multiple forms of formaldehyde dehydrogenase from human red blood cells. *Hum. Hered.*, **37**, 102–106

Uotila, L. & Koivusalo, M. (1989) Glutathione-dependent oxidoreductases: Formaldehyde dehydrogenase. In: Dolphin, D., Poulson, R. & Avramovic, O., eds, *Coenzymes and Cofactors*, Vol. III, *Glutathione. Chemical, Biochemical and Medical Aspects*, Part A, New York, John Wiley & Sons, pp. 517–551

Uotila, L. & Koivusalo, M. (1997) Expression of formaldehyde dehydrogenase and *S*-formylglutathione hydrolase activities in different rat tissues. *Adv. exp. Med. Biol*., **414**, 365–371

Vargová, M., Janota, S., Karelová, J., Barancokova, M. & Šulcová, M. (1992) Analysis of the health risk of occupational exposure to formaldehyde using biological markers. *Analysis*, **20**, 451–454

Vaughan, T.L. (1989) Occupation and squamous cell cancers of the pharynx and sinonasal cavity. *Am. J. ind. Med.*, **16**, 493–510

Vaughan, T.L. & Davis, S. (1991) Wood dust exposure and squamous cell cancers of the upper respiratory tract. *Am. J. Epidemiol.*, **133**, 560–564

Vaughan, T.L., Strader, C., Davis, S. & Daling, J.R. (1986a) Formaldehyde and cancers of the pharynx, sinus and nasal cavity: I. Occupational exposures. *Int. J. Cancer*, **38**, 677–683

Vaughan, T.L., Strader, C., Davis, S. & Daling, J.R. (1986b) Formaldehyde and cancers of the pharynx, sinus and nasal cavity: II. Residential exposures. *Int. J. Cancer*, **38**, 685–688

Vaughan, T.L., Stewart, P.A., Teschke, K., Lynch, C.F., Swanson, G.M., Lyon, J.L. & Berwick, M. (2000) Occupational exposure to formaldehyde and wood dust and nasopharyngeal carcinoma. *Occup. environ. Med*., **57**, 376–384

Vaught, C. (1991) *Locating and Estimating Air Emissions From Sources of Formaldehyde (Revised)* (Report No. EPA-450/4-91-012; US NTIS PB91-181842), Research Triangle Park, NC, Environmental Protection Agency

Vinzents, P. & Laursen, B. (1993) A national cross-sectional study of the working environment in the Danish wood and furniture industry — Air pollution and noise. *Ann. occup. Hyg.*, **37**, 25–34

Viskari, E.-L., Vartiainen, M. & Pasanen, P. (2000) Seasonal and diurnal variation in formaldehyde and acetaldehyde concentrations along a highway in Eastern Finland. *Atmos. Environ*., **34**, 917–923

Vock, E.H., Lutz, W. K., Ilinskaya, O. & Vamvakas, S. (1999) Discrimination between genotoxicity and cytotoxicity for the induction of DNA double-strand breaks in cells treated with aldehydes and diepoxides. *Mutat. Res*., **441**, 85–93

Wagner, F.W., Parés, X., Holmquist, B. & Vallee, B.L. (1984) Physical and enzymatic properties of a class III isozyme of human liver alcohol dehydrogenase: χ-ADH. *Biochemistry*, **23**, 2193–2199

Walrath, J. & Fraumeni, J.F., Jr (1983) Mortality patterns among embalmers. *Int. J. Cancer*, **31**, 407–411

Walrath, J. & Fraumeni, J.F., Jr (1984) Cancer and other causes of death among embalmers. *Cancer Res.*, **44**, 4638–4641

Walrath, J., Rogot, E., Murray, J. & Blair, A. (1985) *Mortality Patterns among US Veterans by Occupation and Smoking Status* (NIH Publ. No. 85-2756), Bethesda, MD, Department of Health and Human Services

Wang, R.-S., Nakajima, T., Kawamoto, T. & Honma, T. (2002) Effects of aldehyde dehydrogenase-2 genetic polymorphisms on metabolism of structurally different aldehydes in human liver. *Drug Metab. Dispos*., **30**, 69–73

Wantke, F., Demmer, C.M., Tappler, P., Götz, M. & Jarisch, R. (1996a) Exposure to gaseous formaldehyde induces IgE-mediated sensitization to formaldehyde in school-children. *Clin. exp. Allergy*, **26**, 276–280

Wantke, F., Focke, M., Hemmer, W., Tschabitscher, M., Gann, M., Tappler, P., Götz, M. & Jarisch, R. (1996b) Formaldehyde and phenol exposure during an anatomy dissection course: A possible source of IgE-mediated sensitization? *Allergy*, **51**, 837–841

Wantke, F., Focke, M., Hemmer, W., Bracun, R., Wolf-Abdolvahab, S., Götz, M., Jarisch, R., Tschabitscher, M., Gann, M. & Tappler, P. (2000) Exposure to formaldehyde and phenol during an anatomy dissecting course: Sensitizing potency of formaldehyde in medical students. *Allergy*, **55**, 84–87

Ward, J.B., Jr, Hokanson, J.A., Smith, E.R., Chang, L.W., Pereira, M.A., Whorton, E.B., Jr & Legator, M.S. (1984) Sperm count, morphology and fluorescent body frequency in autopsy service workers exposed to formaldehyde. *Mutat. Res.*, **130**, 417–424

Weast, R.C. & Astle, M.J., eds (1985) *CRC Handbook of Data on Organic Compounds*, Vol. I, Boca Raton, FL, CRC Press, p. 641

Werle, P., Maurer, K., Kormann, R., Mücke, R., D'Amato, F., Lancia, T. & Popov, A. (2002) Spectroscopic gas analyzers based on indium-phosphide, antimonide and lead-salt diode-lasers. *Spectrochim. Acta*, **A58**, 2361–2372

Weschler, C.J. & Shields, H.C. (1996) Production of the hydroxyl radical in indoor air. *Environ. Sci. Technol.*, **30**, 3250–3258

West, S., Hildesheim, A. & Dosemeci, M. (1993) Non-viral risk factors for nasopharyngeal carcinoma in the Philippines: Results from a case–control study. *Int. J. Cancer*, **55**, 722–727

West, R.R., Stafford, D.A., Farrow, A. & Jacobs, A. (1995) Occupational and environmental exposures and myelodysplasia: A case–control study. *Leuk. Res*., **19**, 127–139

WHO (1989) *Formaldehyde* (Environmental Health Criteria 89), Geneva, International Programme on Chemical Safety

WHO (1991) *Formaldehyde Health and Safety Guide* (Health and Safety Guide No. 57), Geneva, International Programme on Chemical Safety

Wieslander, G., Norbäck, D., Björnsson, E., Janson, C. & Boman, G. (1997) Asthma and the indoor environment: The significance of emission of formaldehyde and volatile organic compounds from newly painted indoor surfaces. *Int. Arch. occup. environ. Health*, **69**, 115–124

Wieslander, G., Norbäck, D., Wålinder, R., Erwall, C. & Venge, P. (1999a) Inflammation markers in nasal lavage, and nasal symptoms in relation to relocation to a newly painted building: A longitudinal study. *Int. Arch. occup. environ. Health*, **72**, 507–515

Wieslander, G., Norbäck, D., Nordström, K., Wålinder, R. & Venge, P. (1999b) Nasal and ocular symptoms, tear film stability and biomarkers in nasal lavage, in relation to building-dampness and building design in hospitals. *Int. Arch. occup. environ. Health*, **72**, 451–461

Wilkins, R.J., & MacLeod, H.D. (1976) Formaldehyde induced DNA–protein crosslinks in *Escherichia coli*. *Mutat. Res.*, **36**, 11–16

Williams, T.M., Levine, R.J. & Blunden, P.B. (1984) Exposure of embalmers to formaldehyde and other chemicals. *Am. ind. Hyg. Assoc. J.*, **45**, 172–176

Williams, I.D., Revitt, D.M. & Hamilton, R.S. (1996) A comparison of carbonyl compound concentrations at urban roadside and indoor sites. *Sci. total Environ*., **189/190**, 475–483

Wilmer, J.W.G.M., Woutersen, R.A., Appelman, L.M., Leeman, W.R. & Feron, V.J. (1987) Subacute (4-week) inhalation toxicity study of formaldehyde in male rats: 8-hour intermittent *versus* 8-hour continuous exposures. *J. appl. Toxicol.*, **7**, 15–16

Wilmer, J.W.G.M., Woutersen, R.A., Appelman, L.M., Leeman, W.R. & Feron, V.J. (1989) Subchronic (13-week) inhalation toxicity study of formaldehyde in male rats: 8-hour intermittent versus 8-hour continuous exposures. *Toxicol. Lett.*, **47**, 287–293

Wilson, R.T., Moore, L.E. & Dosemeci, M. (2004) Occupational exposures and salivary gland cancer mortality among African American and white workers in the United States. *J. occup. environ. Med.*, **46**, 287–297

Witek, T.J., Jr, Schachter, E.N., Tosun, T., Beck, G.J. & Leaderer, B.P. (1987) An evaluation of respiratory effects following exposure to 2.0 ppm formaldehyde in asthmatics: Lung function, symptoms, and airway reactivity. *Arch. environ. Health*, **42**, 231–237

Wolf, D.C., Gross, E.A., Lyght O., Bermudez, E., Recio, L. & Morgan, K. T. (1995) Immunohistochemical localization of p53, PCNA, and TGF-α proteins in formaldehyde-induced rat nasal squamous cell carcinomas. *Toxicol. appl. Pharmacol.*, **132**, 27–35

Wolkoff, P., Johnsen, C.R., Franck, C., Wilhardt, P. & Albrechtsen, O. (1992) A study of human reactions to office machines in a climatic chamber. *J. Expo. Anal. environ. Epidemiol.*, **Suppl. 1**, 71–96

Wong, O. (1983) An epidemiologic mortality study of a cohort of chemical workers potentially exposed to formaldehyde, with a discussion on SMR and PMR. In: Gibson, J.E., ed., *Formaldehyde Toxicity*, Washington DC, Hemisphere, pp. 256–272

Wortley, P., Vaughan, T.L., Davis, S., Morgan, M.S. & Thomas, D.B. (1992) A case–control study of occupational risk factors for laryngeal cancer. *Br. J. ind. Med*., **49**, 837–844

Woutersen, R.A., Appelman, L.M., Wilmer, J.W.G.M., Falke, H.E. & Feron, V.J. (1987) Subchronic (13-week) inhalation toxicity study of formaldehyde in rats. *J. appl. Toxicol.*, **7**, 43–49

Woutersen, R.A., van Garderen-Hoetmer, A., Bruijntjes, J.P., Zwart, A. & Feron, V.J. (1989) Nasal tumours in rats after severe injury to the nasal mucosa and prolonged exposure to 10 ppm formaldehyde. *J. appl. Toxicol.*, **9**, 39–46

Wu, P.-C., Li, Y.-Y., Lee, C.-C., Chiang, C.-M. & Su, H.-J.J. (2003) Risk assessment of formaldehyde in typical office buildings in Taiwan. *Indoor Air*, **13**, 359–363

Yanysheva, N.A., Balenko, N.V., Chernichenko, I.A., Litvichenko, O.N., Sovertkova, L.S. & Babij, V.F. (1998) [Characteristics of modifying effects of formaldehyde on carcinogenesis.] *Gig. Sanit*., **8**, 51–54 (in Russian)

Yasuhara, A. & Shibamoto, T. (1995) Quantitative analysis of volatile aldehydes formed from various kinds of fish flesh during heat treatment. *J. agric. Food Chem.*, **43**, 94–97

Yi, J., Zhang, J. & Gao, Y. (2000) [Experiment on effect of formaldehyde on sperm toxicity of mice] (Abstract). *Gongye Weisheng Yu Zhiyebing*, **26**, 263–264 (in Chinese)

Ying, C.-J., Yan, W.-S., Zhao, M.-Y., Ye, X.-L., Xie, H., Yin, S.-Y. & Zhu, X.-S. (1997) Micronuclei in nasal mucosa, oral mucosa and lymphocytes in students exposed to formaldehyde vapor in anatomy class. *Biomed. environ. Sci*., **10**, 451–455

Ying, C.-J., Ye, X.-L., Xie, H., Yan, W.-S., Zhao, M.-Y., Xia, T. & Yin, S.-Y. (1999) Lymphocyte subsets and sister-chromatid exchanges in the students exposed to formaldehyde vapor. *Biomed. environ. Sci*., **12**, 88–94

Yokoyama, A., Kato, H., Yokoyama, T., Tsujinaka, T., Muto, M., Omori, T., Haneda, T., Kumagai, Y., Igaki, H., Yokoyama, M., Watanabe, H., Fukuda, H. & Yoshimizu, H. (2002) Genetic polymorphisms of alcohol and aldehyde dehydrogenases and glutathione *S*-transferase M1 and drinking, smoking, and diet in Japanese men with esophageal squamous cell carcinoma. *Carcinogenesis*, **23**, 1851–1859

Youk, A.O., Marsh, G.M., Stone, R.A., Buchanich, J.M. & Smith, T.J. (2001) Historical cohort study of US man-made vitreous fiber production workers: III. Analysis of exposure-weighted measures of respirable fibers and formaldehyde in the nested case–control study of respiratory system cancer. *J. occup. environ. Med*., **43**, 767–778

Zhang, J., Wilson, W.E. & Lloy, P.J. (1994) Indoor air chemistry: Formation of organic acids and aldehydes. *Environ. Sci. Technol.*, **28**, 1975–1982

Zhang, L., Chung, F.-L., Boccia, L., Colosimo, S., Liu, W. & Zhang, J. (2003) Effects of garage employment and tobacco smoking on breathing-zone concentrations of carbonyl compounds. *Am. ind. Hyg. Assoc. J*., **64**, 388–393

Zheng, W., Blot, W.J., Shu, X.O., Diamond, E.L., Gao, Y.T., Ji, B.T. & Fraumeni, J.F., Jr (1992) A population-based case–control study of cancers of the nasal cavity and paranasal sinuses in Shanghai. *Int. J. Cancer*, **52**, 557–561

Zhitkovich, A. & Costa, M. (1992) A simple, sensitive assay to detect DNA–protein crosslinks in intact cells and *in vivo*. *Carcinogenesis*, **13**, 1485–1489

Zijlstra, J.A. (1989) Liquid holding increases mutation induction by formaldehyde and some other cross-linking agents in *Escherichia coli* K12. *Mutat. Res.*, **210**, 255–261

Zimmermann, F.K. & Mohr, A. (1992) Formaldehyde, glyoxal, urethane, methyl carbamate, 2,3-butanedione, 2,3-hexanedione, ethyl acrylate, dibromoacetonitrile and 2-hydroxypropionitrile induce chromosome loss in *Saccharomyces cerevisiae*. *Mutat. Res.*, **270**, 151–166

Zito, R. (1999) Cancer risk assessment of direct acting carcinogens. *J. exp. clin. Cancer Res*., **18**, 273–278

Zwart, A., Woutersen, R.A., Wilmer, J.W.G.M., Spit, B.J. & Feron, V.J. (1988) Cytotoxic and adaptive effects in rat nasal epithelium after 3-day and 13-week exposure to low concentrations of formaldehyde vapour. *Toxicology*, **51**, 87–99

Zweidinger, R.B., Sigsby, J.E., Jr, Tejada, S.B., Stump, F.D., Dropkin, D.L., Ray, W.D. & Duncan, J.W. (1988) Detailed hydrocarbon and aldehyde mobile source emissions from roadway studies. *Environ. Sci. Technol.*, **22**, 956–962