3M Research -- Human Studies

Worker Studies

3M has evaluated the health of its fluorochemical production workers for almost 30 years. This includes medical testing and exposure measurements, which have been reported in:

- Ubel, F.A., Sorenson, S.D. and Roach, D.E. "Health Status of Plant Workers Exposed to Fluorochemicals a Preliminary Report," *American Industrial Hygiene Association Journal* 41: 584-589, 1980;
- Mandel, J.H. and Burris, J., "Antwerp Blood Testing Results from June 1995," EPA Docket No. AR226-0175, November 6, 1995;
- Gilliland, F.D. and Mandel, J.S. "Serum Perfluorooctanoic Acid and Hepatic Enzymes, Lipoproteins, and Cholesterol: A Study of Occupationally Exposed Men," *American Journal of Industrial Medicine* 29:560-568, 1996;
- Olsen, G.W., Burris, J.M., Mandel, J.H., and Zobel, L.R. "An Epidemiologic Investigation of Clinical Chemistries, Hematology and Hormones in Relation to Serum Levels of Perfluorooctanesulfonate in Male Fluorochemical Production Employees," April 22, 1998, EPA Docket No. AR226-0030;
- Olsen, G.W., Gilliland, F.D., Burlew, M.M., Burris, J.M., Mandel, J.S., and Mandel, J.H. "An Epidemiologic Investigation of Reproductive Hormones in Men with Occupational Exposure to Perfluorooctanoic Acid," *Journal of Occupational and Environmental Medicine* 40:614-620, July 1998;
- Olsen, G. W., Burris, J., Burlew, M.M., and Mandel, J.H. "An epidemiologic investigation of plasma cholecystokinin, hepatic function and serum perfluorooctanoic acid levels in production workers," 3M Final Report, 3M Company, St. Paul., September 4, 1998, EPA Docket No. AR226-0476;
- Olsen, G.W., Burris, J.M., Mandel, J.H., and Zobel, L.R. "Serum perfluorooctane sulfonate and hepatic and lipid clinical chemistry tests in fluorochemical production employees." *Journal of Occupational and Environmental Medicine* 41(9):799-806, 1999:
- Olsen, G. W., Logan, P.W., Simpson, C., Hansen, K.J., Burris, J.M., Burlew, M.M., Schumpert, J.C., and Mandel, J.H. "Final Report: Fluorochemical Exposure (Serum) Assessment of 3M Decatur Chemical and Film Plant Employees," August 11, 1999, EPA Docket No. AR226-0950;
- Olsen, G.W., Burris, J.M., Burlew, M.M., and Mandel, J.H. "Plasma Cholecystokinin and Hepatic Enzymes, Cholesterol and Lipoproteins in Ammonium Perfluorooctanoate Production Workers," *Drug and Chemical Toxicology* 23(4):603-620, 2000;

- Olsen, G.W., Logan, P.W., Simpson, C.A., Burris, J.M, Burlew, M.M., Lundberg, J.K., and Mandel, J.H. "Descriptive Summary of Serum FC Levels among Employee Participants of the Year 2000 Decatur Fluorochemical Medical Surveillance Program," March 19, 2001, EPA Docket No. AR226-1030a020a;
- Olsen, G.W., Schmickler, M., Tierens, J.M., Logan, P.W., Burris, J.M., Burlew, M.M., Lundberg, J.K., and Mandel, J.H. "Descriptive Summary of Serum FC Levels among Employee Participants of the Year 2000 Antwerp Fluorochemical Medical Surveillance Program," March 19, 2001, EPA Docket No. AR226-1030a020b;
- Olsen, G.W., Burlew, M.M., Burris, J.M., and Mandel, J.H. "A Cross-sectional Analysis of Serum Perfluorooctanesulfonate (PFOS) and Perfluorooctanoate (PFOA) in Relation to Clinical Chemistry, Thyroid Hormone, Hematology and Urinalysis Results from Male and Female Employee Participants of the 2000 Antwerp and Decatur Fluorochemical Medical Surveillance Program," October 11, 2001, EPA Docket No. AR226-1087;
- Olsen, G.W., Burlew, M.M., Burris, J.M., Mandel, J.H. (2001b) A longitudinal analysis of serum perfluorooctanesulfonate (PFOS) and perfluorooctanoate (PFOA) levels in relation to lipid and hepatic clinical chemistry test results from male employee participants of the 1994/95, 1997, and 2000 fluorochemical medical surveillance program. Final report. St. Paul, MN:3M Company. U.S. EPA docket AR-226-1048.
- Olsen, G.W., Burlew, M.M., Hocking, B.B., Skratt, J.C., Burris, J.M., and Mandel, J.H. "An Epidemiologic Analysis of Episodes of Care of 3M Decatur Chemical and Film Plant Employees, 1993-1998," May 18, 2001, EPA Docket No. AR226-1030a021;
- Olsen, G.W. and Mandel, J.H. "Descriptive Analysis of Serum Fluorochemical Concentrations From Cottage Grove Employee Participants of the 2002 Medical Surveillance Program," June 17, 2003, EPA Docket No. AR226-1352;
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- Olsen, G. W., Logan, P.W., Hansen, K.J., Simpson, C.A., Burris, J.M., Burlew, M.M., Vorarath, P.P., Venkateswarlu, P., Schumpert, J.C., and Mandel, J.H. "An occupational exposure assessment of a perfluorooctanesulfonyl fluoride production site: biomonitoring," *American Industrial Hygiene Association Journal* 64(5):651-659, 2003;
- Olsen, G.W., Burris, J.M., Burlew, M.M., and Mandel J.H. "Epidemiologic assessment of worker serum perfluorooctanesulfonate (PFOS) and perfluorooctanoate

- (PFOA) concentrations and medical surveillance examinations," *Journal of Occupational and Environmental Medicine* 45 (3): 260-70, 2003;
- Olsen, G.W., Burlew, M.M., Marshall, J.C., Burris, J.M., and Mandel, J.H. "Analysis of Episodes of Care in a Perfluorooctanesulfonyl Fluoride Production Facility," *Journal of Environmental Medicine* 46:837-46, 2004; and
- Olsen, G.W. and Zobel, L.R. "An Analysis of the 2000 Fluorochemical (Perfluoroctanoate, PFOA) Medical Surveillance Program at 3M Company's Antwerp (Belgium), Cottage Grove (Minnesota), and Decatur (Alabama) Facilities," 3M Medical Department Epidemiology, May 16, 2006. EPA Docket AR226-3678; and
- Olsen, G.W. and Zobel, L.R., "Assessment of lipid, hepatic, and thyroid parameters with serum perfluorooctanoate (PFOA) concentrations in fluorochemical production workers," *International Archives Occupational Environmental Health*, in press, DOI 10.1007/s00420-007-0213-0, available at http://www.springerlink.com/content/h800067741442887/

3M's work also includes epidemiology studies, including those in:

- Ubel, F.A., Sorenson, S.D. and Roach, D.E. "Health Status of Plant Workers Exposed to Fluorochemicals a Preliminary Report," *American Industrial Hygiene Association Journal* 41: 584-589, 1980;
- Schuman, L.M. and Mandel, J.S., "An Epidemiologic Mortality Study of Employees at the Chemolite Plant," February 1980, EPA Docket No. AR226-0470;
- Mandel, J.S. and Schuman, L.M., "Mortality Study at the 3M Chemolite Plant," January 1989, EPA Docket No. AR226-0471;
- Gilliland, F.D. and Mandel, J.S., "Mortality Among Employees of a Perfluorooctanoic Acid Production Plant," *Journal of Occupational Medicine* 35 (9): 950-954, 1993;
- Mandel, J.S. and Johnson, R.A., "Mortality Study of Employees at 3M Plant in Decatur, Alabama," University of Minnesota, March 13, 1995, EPA Docket No. AR226-0032;
- Alexander, B.H., "Mortality Study of Workers Employed at the 3M Cottage Grove Facility," Final Report, Division of Environmental and Occupational Health, School of Public Health, University of Minnesota, April 26, 2001, EPA Docket No. AR226-1030a018;
- Alexander, B.H., "Mortality Study of Workers Employed at the 3M Decatur Facility," Division of Environmental and Occupational Health, School of Public Health, University of Minnesota, April 26, 2001, EPA Docket No. AR226-1030a019;

- Alexander, B.H., Olsen, G.W., Burris, J.M., Mandel, J.H., and Mandel J.S. "Mortality of employees of a perfluorooctanesulphonyl fluoride manufacturing facility," *Occupational and Environmental Medicine* 60:722-29, 2003;
- Alexander, B.H. "Bladder cancer in perfluorooctanesulfonyl fluoride manufacturing workers," November 21, 2004, EPA Docket AR-226-1958;
- Alexander, B.H. and Grice, M. "Self-Reported Medical Conditions in Perfluorooctanesulfonyl Fluoride Manufacturing Workers," University of Minnesota School of Public Health, February 1, 2006. EPA Docket AR226-3677;
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- Grice, M.M., Alexander, B.H., Hoffbeck, R., and Kampa, D.M. "Self-Reported Medical Conditions in Perfluorooctanesulfonyl Fluoride Manufacturing Workers," *Journal of Occupational and Environmental Medicine* 49(7):722-729, 2007.

3M has also published its study of the half-life of PFOS, PFOA and PFHS in workers:

Olsen, G.W., Burris, J.M., Ehresman, D.J., Froehlich, J.W., Seacat, A.M., Butenhoff, J.L., and Zobel, L.R., "Half-life of serum elimination of perfluorooctanesulfonate, perfluorohexanesulfonate, and perfluorooctanoate in retired fluorochemical production workers," *Environmental Health Perspectives*, in press, doi:10.1289/ehp.10009, available at http://www.ehponline.org/docs/2007/10009/abstract.html.