
Op-Ed: Should EPA institute a workplace fragrance ban as part of its endocrine disruptor initiative?

3/9/09 -- Cate Jenkins, Ph.D., Waste Identification Branch, MRWMD, ORCR, OSWER, U.S. Environmental Protection Agency
The opinions are those of the author and do not necessarily reflect the official position of EPA

On February 27, 2009 our new Administrator Lisa Jackson told reporters that endocrine disruptor protocols would be finished by EPA sooner, rather than later.

This is good news for those involuntarily exposed in our workplace to perfumes. Fragrances contain phthalates (the carriers) as well as synthetic musks (odor imparting substances). Both are endocrine disruptors. Phthalates cause decreased testosterone levels and malformed penises, and are also implicated in causing breast cancer and interfering with tamoxifen-type breast cancer treatments.

EPA's Workplace Solutions Staff, OARM, issued cubicle etiquette guidance 2006, advising "Respect Common Space ... Odorous products can cause allergic reactions. These include: air fresheners, perfumes ..." But EPA managers claim it's unenforceable.



For men reporting to a fertility clinic, lower testosterone levels were associated with higher phthalate metabolites in urine. In another study, concentrations of urinary phthalate metabolites were associated with increased waist circumference and insulin resistance in adult men.

Governmental agencies and health organizations including the FDA, NIOSH, National Institute of Health, American Nursing Association, Lung Association, Canadian Centre for Occupational Health and Safety, Canada Safety Council, etc. state that fragrances can trigger asthma and allergies. Cities, state school systems, colleges, health care facilities, and businesses are increasingly establishing "scent-free" environments following model programs set up by these authorities.

EPA's Office of Research and Development has studied synthetic musks in the environment, finding they persist and bioaccumulate, and do not degrade in wastewater treatment systems. Thus musk contaminated soil amendments from sewage sludge biosolids are being applied near residences. In addition, synthetic musks are not efficiently removed by typical drinking water pre-treatments (ozone, chlorination). Synthetic musks are entering the environment primarily through sewage treatment systems after their use by people who wear fragrances: perfumes, colognes, after-shaves, scented deodorants, scented laundry products, etc. The European Union, but not the US, has banned some types of synthetic musk.

In several cases, employees have been terminated because they use perfumes. In one case, a newscaster won a \$10 million dollar award after she filed an EEO complaint over the perfume from a co-worker. And then she herself was discriminated against by her employer over the EEO complaint!! Fragrances in the workplace are a serious Americans with Disability Act (ADA) issue.

In my professional opinion as a staff scientist, EPA should take a leadership role by establishing a Scent-Free Policy for its own buildings, worksites, conferences, etc. See the following references and documentation of fragrance-free initiatives and the scientific basis for these programs.

Selected References and Fragrance Toxicity Resources



EPA POLICY – RESEARCH ON ENDOCRINE DISRUPTORS: PHTHALATES AND SYNTHETIC MUSK IN FRAGRANCES

Carolyn Davis, Director, EPA Workplace Solutions Staff. (2006) EPA Cubicle Etiquette. [The following link is an EPA intranet link, not accessible outside EPA:] <http://intranet.epa.gov/OARM/workplace/tom/2006-04-tom-cubicle-etiquette.pdf>

Respect Common Space ... Odorous products can cause allergic reactions. These include: air fresheners, perfumes, food, ointments, scented markers, and solvents.

EENews, Greenwire (2/27/09) INTERVIEW TRANSCRIPT: EPA Administrator outlines agency goals, priorities
http://www.eenews.net/eep/epa_jackson/interview_full

Bill Pritchard: Do you think there'll be endocrine disruptor screening tests going on at the end of this year? It's an issue that a lot of people said has been delayed over a long time by EPA.

Lisa Jackson: Yes, I think you should look forward to movement on that issue in the short term, sooner rather than later.

Environmental Health News (12/18/08) Scientists to EPA: Risks of chemicals that alter male hormones should be analyzed together.
<http://www.environmentalhealthnews.org/ehs/news/scientists-to-epa-risks-of-chemicals-that-alter-male-hormones-should-be-analyzed-together-to-protect-human-health-national-panel-says>

The committee, assembled by the National Academy of Sciences, looked specifically at phthalates, controversial compounds widely found in consumer products. Phthalates soften plastic to make vinyl for toys, building materials, medical devices and other items, and they also are used in fragrances and other beauty products. ... Europe and the United States have restricted phthalates in toys and other children's products, and the EU has banned some in cosmetics. ... Several types of phthalates mimic or block testosterone and other androgens, which are the sex hormones that guide formation of testicles, sperm and other parts of the male reproductive system. In animal tests, exposure leads to infertility, malformed penises and abnormal testicles, which scientists call the "phthalate syndrome."

...

Peter Preuss, director of the EPA's National Center for Environmental Assessment, said his "best guess" is that the agency will conduct the recommended [by the National Academy of Science] cumulative assessment for phthalates.

EPA Office of Research and Development. Synthetic Fragrances in the Aquatic Environment: Overview of Chemistry, Monitoring, and Significance. http://www.epa.gov/esd/pdf/ecb/awwa_final041604.pdf

What are synthetic musk Compounds ... They have the characteristic odor of natural musks, hence the name synthetic musk compounds. Detergents, shampoo, bar soap, body lotion, and additives for perfumes. ...

- Musk ambrette is known to cause testicular atrophy in laboratory rats (Davis, 1967)
- Versalide [a synthetic musk] is known to cause the paralysis of the hind limbs in laboratory rats (Opdyke, 1979; Spencer et al., 1980)

Daughton, C. (EPA Office of Research and Development) (2001) "Pharmaceuticals in the Environment: Overarching Issues and Overview," in Pharmaceuticals and Personal Care Products in the Environment: Scientific and Regulatory Issues, Daughton, C.G. and Jones-Lepp, T. (eds.), Symposium Series 791; American Chemical Society: Washington, D.C, pp. 2-38.

Pharmaceuticals and Personal Care Products] PPCPs as Environmental Pollutants? PPCPs are a diverse group of chemicals that have received comparatively little attention as potential environmental pollutants. PPCPs comprise all drugs ... and other consumer chemicals, such as fragrances (e.g., musks)

...

Some PPCPs are extremely persistent and introduced to the environment in very high quantities (e.g., see chapters in this book on musks and on polyiodinated X-ray contrast media). ... A myriad of chemical classes, ranging from endocrine disruptors, antimicrobials, antidepressants ... to lipid regulators and synthetic musk fragrances: Excluding the antimicrobials and steroids (which include many members), over 50 individual PPCPs or metabolites (from more than 10 broad classes of therapeutic agents or personal care products) had been identified as of 1999 in environmental samples (mainly surface and ground waters)

Daughton, C. (EPA Office of Research and Development). Personal Care Products and Pharmaceuticals (PCPP's) in the Environment: Agents of Subtle Change? <http://www.epa.gov/esd/bios/daughton/254ecb99rev.pdf>

A class of potential pollutants receiving very little attention includes pharmaceuticals and active ingredients in personal care products (PPCPs), which are continually introduced to the environment via a number of routes. While their immediate biological actions on non-target species (esp. in aquatic habitats) may seem imperceptible, they nonetheless could lead to adverse impacts — as a result of subtle effects (from low, ppb-ppt concentrations, µg-ng/L) whose continual expression over long periods of time could lead to cumulative, insidious changes that would otherwise be attributed to "natural" change or adaptation. ... Sewage and solid waste are the primary sources of PPCPs in the environment:

Ubiquitous, persistent, and bioaccumulative: Many PPCPs and their metabolites are ubiquitous and display persistence in, and bioaccumulation (e.g., musk fragrances) from, surface waters on par with that of the widely recognized organochlorine pollutants (e.g., DDT, PCBs). ... Pollutant classes range from endocrine disruptors, antibiotics, antidepressants ... to synthetic musk fragrances ... and many others:

Representative classes of PPCPs that may occur in surface waters that receive STW effluents include ... nitro musk fragrances (toxic and they accumulate in fin and shellfish lipids) ... the nitro musks are being phased out of use in many parts of the world.

Osemwengie, L. (EPA Office of Research and Development) (2006) Determination of synthetic musk compounds in sewage biosolids by gas chromatography/mass spectrometry. *J. Environ. Monit.* 8: 897–903. <http://www.rsc.org/ej/EM/2006/b603113g.pdf>

A review of sewage sludge regulations and land application practices by the United States National Research Council (2002) recommended development of improved analytical techniques to adequately identify and quantify new chemical contaminants, such as synthetic musk compounds in Class A sewage sludge (i.e., biosolids).

...

Unfortunately, synthetic musk compounds, a class of compounds that belong to a group of compounds known as pharmaceuticals and personal-care products (PPCPs) and other persistent organic contaminants, such as nonylphenol and phthalates can remain in Class A biosolids

...

Currently, over 60% of the biosolids are recycled as soil conditioners to improve and maintain productive soils for plant growth.¹ Increasing land application of biosolids in close proximity to human dwellings poses questions regarding human health and environmental risks. Although these risks may not be directly associated with the presence of synthetic musks in land-applied biosolids, storm water run-off onto surrounding portable waters may be contaminated enough to be of concern.

...

This research confirms that synthetic musk compounds, specifically the polycyclic musks, are present in Class A biosolids at the part-per-million level ... By applying this methodology to test municipal sewage sludge and the resulting biosolids for synthetic musk compounds, POTW operators may find it convenient to determine which unit processes are more efficient in removing fragrance materials from the sludge during conversion processes to biosolids. With this knowledge in hand, designs could be altered where possible to generate sludge with low synthetic musks concentrations.

Liu, X. et al. (EPA Office of Research and Development) (2004) Full-Scale Chamber Investigation and Simulation of Air Freshener Emissions in the Presence of Ozone. *Environ. Sci. Technol.* 38: 2802-2812. <http://pubs.acs.org/doi/pdf/10.1021/es030544b>

Fragrance chemicals are often used as air fresheners. Several methods such as evaporation from wicks, aerosol sprays, and heated pots have been used to introduce the fragrance chemicals into the indoor air. Plug-in air fresheners using small electric heaters to volatilize the fragrance chemicals have recently become a dominant product in the air freshener market. There is little information about the volatile and semivolatile compounds (VOCs and SVOCs) emitted from these products and on their impact on indoor air quality (IAQ). Because many fragrance chemicals are unsaturated VOCs, they may react with indoor O₃ [ozone] to produce aldehydes, ketones, organic acids, particles, and free radicals in a manner similar to the reactions between O₃ and VOCs emitted from carpet, paint, and other materials.

Westerhoff, P. et al (2005) Fate of Endocrine-Disruptor, Pharmaceutical, and Personal Care Product Chemicals during Simulated Drinking Water Treatment Processes. *Environ. Sci. Technol.*, 2005, 39 (17), 6649-6663• <http://pubs.acs.org/doi/pdf/10.1021/es0484799>

The potential occurrence of endocrine-disrupting compounds (EDCs) as well as pharmaceuticals and personal care products (PPCPs) in drinking water supplies raises concern over the removal of these compounds by common drinking water treatment processes. ... simulate individual treatment processes in a water treatment plant (WTP) ... 6 of the ~60 compounds (TCEP, BHC, chlordane, dieldrin, heptachlor epoxide, musk ketone) were poorly oxidized (<20% reacted) by chlorine or ozone ...

OTHER GOVERNMENTAL AND HEALTH ORGANIZATION STATEMENTS AND POLICIES ON FRAGRANCES

National Center for Occupational Safety and Health (NIOSH), Centers for Disease Control. Indoor Environmental Quality. Chemicals and Odors. <http://www.cdc.gov/NIOSH/TOPICS/INDOORENV/ChemicalsOdors.html>

Volatile organic compounds (VOCs) are common chemical contaminants found in office and home environments and are a source of odors. VOCs are organic (containing carbon) chemicals that can easily evaporate into the air. Many products found in the office environment may have the potential to release VOCs. Examples include: ...

- Personal products of employees like perfume, shampoos, etc.

Food and Drug Administration (FDA) Breathing Better: Action Plans Keep Asthma in Check. http://www.fda.gov/fdac/features/2003/203_asthma.html

Common asthma triggers include dust, pollen, cockroaches, cold air, smoke, and other strong odors, such as paint, cleaning fluids, perfume, hair spray, and powder.

National Heart, Lung and Blood Institute, Nat'l Inst. Health. National Asthma Education and Prevention Program (NAEPP) School Asthma Education Subcommittee. How Asthma-Friendly Is Your School? <http://www.nhlbi.nih.gov/health/public/lung/asthma/friendly.htm>

Does the school have good indoor air quality? Does the school help to reduce or prevent students' contact with allergens or irritants, indoors and outdoors, that can make their asthma worse? Allergens and irritants include tobacco smoke, pollens, animal dander, mold, dust mites, cockroaches, and strong odors or fumes from things like bug spray, paint, perfumes, and cleaners.

Canadian Centre for Occupational Health and Safety. Scent-Free Policy for the Workplace. http://www.ccohs.ca/oshanswers/hsprograms/scent_free.html#print

Allergic and asthmatic patients, as well as those with other conditions, report that certain odours, even in the smallest amounts, can trigger an attack. The severity of these symptoms can vary. Some people report mild irritation while others are incapacitated and/or must give up many 'normal' activities in order to avoid exposure (such as going to public places). ... While it depends on the formula, there can be chemicals in fragrances and related products that have been determined to cause cancer in occupational settings or in laboratory animals.

...

Policy: Due to the health concerns arising from exposure to scented products, ABC Company Inc. has instituted this policy to provide a scent-free environment for all employees and visitors.

Canada Safety Council. Perfume in the Workplace. <http://www.safety-council.org/info/OSH/perfume.html>

The Lung Association. Pollution & air quality. Indoor air quality. Scents. What do we mean by "scents"? When we talk about scents, we mean fragrances, aromas or perfumes – anything that adds a smell to something else. http://www.lung.ca/protect-protegez/pollution-pollution/indoor-interieur/scents-parfums_e.php

Barbara Sattler, RN, DrPH, FAAN and Kathryn Hall, RN, MSN (5/31/07) Healthy Choices: Transforming Our Hospitals into Environmentally Healthy and Safe Places. The Online Journal of Issues in Nursing, American Nursing Association <http://www.nursingworld.org/MainMenuCategories/ANAMarketplace/ANAPeriodicals/OJIN/TableofContents/Volume122007/No2May07/HealthyChoices.aspx?css=print>

FRAGRANCE BANS AND TERMINATION OF EMPLOYEES WEARING PERFUME

Z. Hildebrandt, Chair, ADA Committee, Shutesbury, Massachusetts. What is Fragrance Free, anyway? FAQ About Fragrances http://www.shutesbury.org/ada_committee/project_underway.htm

There are two big problems with fragrances. The first—that fragrances contain highly toxic chemicals—affects everyone. The second problem affects only people who are chemically sensitive, or have related health problems such as chronic fatigue syndrome, fibromyalgia, asthma, and immune dysfunction. The neurotoxic, carcinogenic, endocrine disrupting and other toxic chemicals contained in fragrances can make anyone sick in large enough quantities.

...

Q: I wear fragranced products but no one ever complains, so I'm ok, right?

A: Wrong. There are many reasons why someone who is affected by your fragrance is silent. There is a strong taboo in our society against talking about how we smell. Many people avoid confrontation and making a fuss about their own needs in public.

...

Fragrance free is a civil rights issue. The federal Americans with Disabilities Act (ADA) guarantees disabled persons access to all public services and programs. This includes public meetings, events, and services such as education and library programs.

Wall Street Journal (8/25/07) Why School Stinks This Year. As perfume makers target teens with new scents, some critics worry about health risks. <http://online.wsj.com/article/SB118799086084008302.html#printMode>

But the burst of new scents could exacerbate debates over whether kids in school should be wearing perfumes and colognes at all. School districts in Rhode Island, Minnesota and Massachusetts have recently launched public-service campaigns that target fragrances as potential allergens. The proponents of curbing or banning fragrances in schools -- mostly school officials and legislators in different states -- argue that excessive use of scents can trigger asthma attacks and cause headaches. Some workplaces and schools have scent bans in Canada, where strong odors have long been viewed as an air-quality issue.

WCVB Boston (3/7/06) School Mulls Fragrance Ban Officials Say Fragrances Can Trigger Allergy, Asthma Attacks. <http://www.thebostonchannel.com/news/7789276/detail.html>

Matthew Hogg (10/04/07) STUDENT GROUP PUSHES FOR FRAGRANCE BAN ON COLLEGE CAMPUS. A group at a California college are calling for a ban on perfumes and colognes on campus due to possible health effects. <http://www.ei-resource.org/news/multiple-chemical-sensitivity-news/student-group-pushes-for-fragrance-ban-on-college-campus/>

Associated Press (May 2005) Perfume Allergy Case Brings \$10M Judgment. <http://www.aapd-dc.org/News/disability/allergycase.html>

A jury awarded \$10.6 million to one-time radio host who was fired after complaining a coworker's perfume made her sick. Erin Weber said WYCD-FM fired her in 2001 after she complained she was allergic to another host's perfume. She said the station owner, Infinity Broadcasting Inc., discriminated against her for a disability - allergies - and retaliated after she filed a complaint with the Equal Employment Opportunity Commission.

New York Times (5/25/05) Michigan: Fired Employee Wins Judgment. A jury in Detroit awarded \$10.6 million to a radio host who was fired after complaining that a co-worker's perfume made her sick. <http://query.nytimes.com/gst/fullpage.html?res=9C06E2DA1339F936A15756C0A9639C8B63>

New York Post (10/1/07) LOST JOB 'OVER MY PERFUME'. http://www.nypost.com/seven/10012007/news/regionalnews/lost_job_over_my_perfume.htm

She wore too much Red Door, so they showed her the door. That's the claim of a Brooklyn woman who says she was fired as a customer service rep because she wore too much perfume.

Cosmetics Design (3/21/08) US concern over fragrance use hits Europe: Hospital authorities in Gothenburg, Sweden, are mulling plans to ban perfumes and heavily fragranced personal care products in a move that mirrors similar moves by public authorities in the US. <http://www.cosmeticsdesign-europe.com/content/view/print/174200>

A total of 49 municipalities in the Gothenburg region are said to be considering the introduction of a complete fragrance ban in all hospitals in the region, according to a report by online Swedish publication The Local.

Articles Base (12/11/08) Perfume Becomes the Reason for Discharge <http://www.articlesbase.com/careers-articles/perfume-becomes-the-reason-for-discharge-680036.html>

The consequences of the economic crisis are sharply felt by female employees who are fired for their predilection for perfume. ... Prior to the beginning of world's economic hysteria this problem existed along with others. Chiefs tried not to advertise their personal dislike of a colleague who overused a fragrance and would officially credit that colleague's dismissal to entirely other reasons. Crisis has cleared the air. Now managers are not hesitating to declare that an employee's release is in connection with the fact that an employee, "has created uncomfortable (or conflicting) situation because of the excessive use of perfume." Not so long ago in the Swedish city of Malmö, a collaborator of a shipping company was fired because she used toilet water with a too sweet, luscious aroma, which created in her boss a choking sensation. After a warning from management, she refused to change her. At first this case was the recipient of wide public attention, but interest in it abated after the appearance of a pair of similar situations. An even better precedent has happened in the English city of Norfolk. Linda Gorman filed lawsuit against several colleagues at the same time and even against her own chief for the use of perfume in the work place.

DECISION AND AWARD (2/22/06) Minneapolis Public Schools and AFSCME Council 5, Local 56, BMS CASE NO. 05-PA-1233
<http://www.bms.state.mn.us/documents/awards/ssd1.pdf>

Grievant was directed not to wear any scented products to work ... About 140 of the students at Ramsey have respiratory health problems such as asthma and allergies. ...

...

Notwithstanding the foregoing, there is no written rule or directive in the District which flatly forbids the use of scented products by staff, including health staff. There is a directive which strongly discourages the practice. No evidence was produced that anyone else in the District had ever been ordered not to wear scented products to work. There was testimony that it was common for classroom teachers to wear cologne or perfume. There was no evidence that any student at Ramsey had ever had an asthma attack triggered by perfume. Not one of the students at Ramsey with asthma had listed perfume as a trigger on his or her medical records.

...

Because of the unique circumstances of the case, this particular act of insubordination, standing alone, might have fallen short of grounds for discharge. However, given the totality of the circumstances, grievant's disobeying of the order regarding scented products along with the job performance and attendance and tardiness issues cumulatively constituted just cause for discharge.

TESTICULAR ATROPHY AND MALFORMED PENISES FROM PHTHALATES (FRAGRANCE CONSTITUTENT)

John D. Meeker [Univ. Michigan], Antonia M. Calafat [CDC], Russ Hauser [Harvard] (2008) Urinary Metabolites of di(2-ethylhexyl) phthalate Are Associated with Decreased Steroid Hormone Levels in Adult Men. Published-Ahead-of-Print on December 4, 2008 by Journal of Andrology. <http://www.andrologyjournal.org/cgi/rapidpdf/jandrol.108.006403v1>

In the present study, urine and serum samples were collected from 425 men recruited through a US infertility clinic. ... In conclusion, these results suggest that urinary metabolites of DEHP [di(2-ethylhexyl) phthalate] are inversely associated with circulating steroid hormone levels in adult men. ... In the present study, urinary MEHP [mono(2-ethylhexyl) phthalate] concentrations were inversely associated with circulating testosterone and estradiol levels in adult men recruited through an infertility clinic. ... In conclusion, the present study found that urinary DEHP metabolites, at levels that are representative of those found among the general US population may be associated with altered steroid hormone levels and perhaps aromatase activity.

Nabae, K. et al (2006) Toxicity of di(2-ethylhexyl)phthalate (DEHP) and di(2-ethylhexyl)adipate (DEHA). Repr. Tox. 22: 411–417. http://www.sciencedirect.com/science?_ob=MIimg&_imagekey=B6TC0-4KFT879-1-H&_cdi=5156&_user=14684&_orig=browse&_coverDate=10%2F31%2F2006&_sk=999779996&_view=c&_wchp=dGLzVtz-zSkzS&_md5=c6786a7b2297a6f235eac364dc939c85&_ie=/sdarticle.pdf

Decreased testicular weights, seminiferous atrophy with vacuolization of sertoli cells and diminished sperm counts were more prominent in rats ...

R Hauser and A M Calafat (2005) Phthalates and Human Health. Occup. Environ. Med. 2005;62;806-818
<http://oem.bmj.com/cgi/reprint/62/11/806>

Because phthalates are widely used in many personal care and consumer products, the opportunity is high for non-occupational human exposure. ... Although phthalates have low volatility, they off-gas and are present in residential indoor air. Dermal contact and parenteral exposure from medical devices containing phthalates may also contribute to exposure.

Han Lin, et al (2008) Involvement of testicular growth factors in fetal Leydig cell aggregation after exposure to phthalate in utero. Proc. Nat'l Acad. Sci. 105(20): 7218–7222. <http://www.pubmedcentral.nih.gov/picrender.fcgi?artid=2438230&blobtype=pdf>

Exposures to di-(2-ethylhexyl) phthalate (DEHP) have been shown to be associated with decreased adult testosterone (T) levels ... Increasing public concern over lack of regulation on their use in the United States, in contrast to the European Union and 14 other countries (1), has arisen in response to reports that exposures to phthalates may be linked to abnormal reproductive development in the human male (2, 3). Epidemiological studies show statistical correlations between serum concentrations of phthalate monoesters, the primary metabolites of phthalates, and the incidence of anomalies such as cryptorchidism and shortened anogenital distance (AGD) (4, 5). Di-(2-ethylhexyl) phthalate (DEHP), the most abundant phthalate in the environment, has been shown to have adverse effects on androgen synthesis in the rodent (6).

Howdeshell KL, Rider CV, Wilson VS, Gray LE Jr. (2008) Mechanisms of action of phthalate esters, individually and in combination, to induce abnormal reproductive development in male laboratory rats. *Environ Res.* 2008 Oct;108(2):168-76. Reproductive Toxicology Division, National Health and Environmental Effects Laboratory, Office of Research and Development, United States Environmental Protection Agency, Research Triangle Park, NC 27711, USA. howdeshell.kembra@epa.gov

In the male laboratory rat, the period of sexual differentiation in utero is particularly sensitive to certain phthalate esters, which induce a suite of reproductive malformations, including epididymal and gubernacular agenesis. The fetal rat testes are a main target for phthalate esters as evidenced by a reduction in testosterone production and insulinlike hormone 3 (insl3) expression, a peptide hormone critical for testis descent. Histopathology of fetal and postnatal testes reveals that in utero exposure to phthalate esters disrupts Leydig and Sertoli cell maturation leading to a reduction in germ cells in the malformed seminiferous tubules in adulthood as well as an increased incidence of multinucleated germ cells.

Howdeshell KL, et al (2008) A mixture of five phthalate esters inhibits fetal testicular testosterone production in the sprague-dawley rat in a cumulative, dose-additive manner. *Toxicol Sci.* 105(1):153-65. Epub 2008 Apr 14.
<http://toxsci.oxfordjournals.org/cgi/reprint/105/1/153>

Stahlhut, R. et al. (2007) Concentrations of Urinary Phthalate Metabolites Are Associated with Increased Waist Circumference and Insulin Resistance in Adult U.S. Males. *Environ Health Perspect* 115:876–882.
<http://www.pubmedcentral.nih.gov/picrender.fcgi?artid=1892109&blobtype=pdf>

In this national cross-section of U.S. men, concentrations of several prevalent phthalate metabolites showed statistically significant correlations with abdominal obesity and insulin resistance. If confirmed by longitudinal studies, our findings would suggest that exposure to these phthalates may contribute to the population burden of obesity, insulin resistance, and related clinical disorders.

Institute of Medicine, National Academy of Sciences (1998) *Veterans and Agent Orange: Update 1998*. Pages 446-447. Downloadable page by page at the following links:
http://books.nap.edu/openbook.php?record_id=6415&page=446
http://books.nap.edu/openbook.php?record_id=6415&page=447

The study (Henriksen et al., 1996; Henriksen and Michalek, 1996) ... found a general pattern of no association between dioxin levels and several semen quality and hormone endpoints. The results for testosterone showed a weak pattern of decreasing hormone level with increasing dioxin level.

FEMALE-RELATED ENDOCRINE DISRUPTION BY FRAGRANCE CONSTITUTENTS

Breast Cancer Fund. PHTHALATES: RISK FACTORS FOR BREAST CANCER
<http://www.breastcancerfund.org/atf/cf/%7BDE68F7B2-5F6A-4B57-9794-AFE5D27A3CFF%7D/PHTHALATES%20AND%20BREAST%20CANCER.PDF>
<http://www.breastcancerfund.org/site/pp.asp?c=kwKXLdPaE&b=84570>

Environmental Working Group (9/24/08) Teen Girls' Body Burden of Hormone-Altering Cosmetics Chemicals. Adolescent exposures to cosmetic chemicals of concern. <http://www.ewg.org/book/export/html/26953>

Environmental Working Group (EWG) detected 16 chemicals from 4 chemical families - phthalates, triclosan, parabens, and musks - in blood and urine samples from 20 teen girls aged 14-19. Studies link these chemicals to potential health effects including cancer and hormone disruption. These tests feature first-ever exposure data for parabens in teens ...

Lignell, S., et al (2008) Temporal Trends of Synthetic Musk Compounds in Mother's Milk and Associations with Personal Use of Perfumed Products. *Environ. Sci. Technol.* 42(17): 6743-6748
<http://pubs.acs.org/doi/pdf/10.1021/es800626n>

Women with a high use of perfume during pregnancy had elevated milk concentrations of HHCB, and elevated concentrations of AHTN were observed among women reporting use of perfumed laundry detergent. This strongly suggests that perfumed products are important sources of musk exposure both among the mothers and the nursed infants.

van der Burg, B. et al (2008) Endocrine effects of polycyclic musks: do we smell a rat? *Int J Androl.* 31(2):188-93.

Schreurs, M. et al (2004) In Vitro and in Vivo Antiestrogenic Effects of Polycyclic Musks. *Environ. Sci. Technol.* 38(4): 997-1002
<http://pubs.acs.org/doi/pdf/10.1021/es034648y>

Kim HS, Ishizaka M, Kazusaka A, Fujita S. (2006) Di-(2-ethylhexyl) phthalate suppresses tamoxifen-induced apoptosis in GH3 pituitary cells. *Arch Toxicol.* 2007 Jan;81(1):27-33.

Tamoxifen, an estrogen receptor antagonist, has been clinically used as an antitumor drug and induces apoptosis in GH3 pituitary cells. Although di-(2-ethylhexyl) phthalate (DEHP) is a well-known environmental estrogen and the exposure to this chemical is well expected, reports are limited regarding effects of DEHP on tamoxifen-induced apoptosis in pituitary cells. ... Flow cytometric analysis revealed that the number of apoptotic cells induced by tamoxifen was significantly decreased by DEHP treatment. Enhanced poly (ADP-ribose) polymerase (PARP) cleavage by tamoxifen treatment was also inhibited by DEHP. These results suggest that DEHP suppresses tamoxifen-induced apoptosis in association with its estrogenic effect in GH3 cells and might counteract the therapeutic effect of tamoxifen.

ARE MORE HARMFUL PHTHALATES IN FRAGRANCES?

Food and Drug Administration (2008) Phthalates and Cosmetic Products. <http://www.cfsan.fda.gov/~dms/cos-phth.html>

How do I know if there are phthalates in the cosmetics I use? Under the authority of the Fair Packaging and Labeling Act (FPLA), FDA requires an ingredient declaration on the cosmetic products sold at the retail level to consumers. Consumers can tell whether some products contain phthalates by reading the ingredient declaration on the labels of such products.

However, the regulations do not require the listing of the individual fragrance ingredients; therefore, the consumer will not be able to determine from the ingredient declaration if phthalates are present in a fragrance. Also, because the FPLA does not apply to products used exclusively by professionals--for example, in salons--the requirement for an ingredient declaration does not apply to these products.

News (2006) Safe Cosmetics Act Aims To Lessen Cancer Risk. *J. Nat'l Cancer Inst.* 98(20): 1441.
<http://jnci.oxfordjournals.org/cgi/reprint/98/20/1441>

The current movement to determine the safety of toiletries grew from the discovery about 6 years ago that people absorb the endocrine disruptor dibutyl phthalate (DBP) through their skin. DBP is one of a class of phthalates that are widely used in cologne, aftershave, nail polish, hair spray, and moisturizer. It acts against male sex hormones, called androgens. Studies suggest that DBP has the most impact on males and that the effects are strongest during fetal development. Young mothers were particularly frightened by the finding that phthalate levels are highest in women of reproductive age. Research on DBP's effects is still in its infancy, but the evidence was strong enough to convince the European Union to banish it from cosmetics. DBP is among many cosmetics ingredients that Europe banned in 2004 because of their association with endocrine disruption, cancer, or birth defects.

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Paul Foster, Ph.D., who's studying the effects of phthalates at the National Institute of Environmental Health Sciences, admits that even if phthalates do cause measurable abnormalities, the source of exposure is tough to pin down. "Phthalates are in the air," he said. "They're in food. They're in drinking water. Even some drugs use them for enteric coatings."

EnviroNews (2001) Baby Ills from Beauty Aids? • *Environmental Health Perspectives.* 109(5) A 202.
<http://www.pubmedcentral.nih.gov/picrender.fcgi?artid=1240318&blobtype=pdf>

They found that ingredients were often listed in tiny print, inside the packaging, or not at all, despite Food and Drug Administration requirements. In addition, says Houlihan, manufacturers need not list fragrance ingredients (which may include DBP) or any chemical mixture considered to be a trade secret.

