

WHAT'S THAT SMELL?



**HOW THE PINE FOREST IN YOUR
CLEANING PRODUCT MAY BE
HAZARDOUS TO YOUR HEALTH**



WVE

**A REPORT BY WOMEN'S VOICES FOR THE EARTH
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WHAT'S THAT SMELL?

A look at common chemicals in fragrance in cleaning products and their associated health impacts.

By Alexandra Scranton, June 2010

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Report design by Amy Kelley, Bozeman, MT.



WVE WOMEN'S VOICES FOR THE EARTH



Imagine yourself in a flower garden, a shady pine forest, a lemon grove on a summer day or on a tropical island at sunset. Peaceful, joyous images come to mind for most of us—and this is exactly what the manufacturers of many cleaning products aim to deliver to your very own home! Cleaning product manufacturers anticipate and respond to the needs and desires of their customers, predominantly women, who look for products that enhance the experience of cleaning and add a sensory pleasure to their homes. But most of us are unaware that thousands of synthetic chemicals are used to create modern day fragrances for our products, and that some of these chemicals have been linked to health impacts ranging from eye and skin irritation to hormone imbalance and increased risk of breast cancer.

Furthermore, these ingredients are kept secret—the vast majority of manufacturers currently are not disclosing fragrance ingredients on websites or on the product label, and these ingredients are frequently claimed as confidential business information. This means that consumers are unable to avoid certain chemicals even if they desired to do so. The only current solution to reducing exposure to chemicals of concern is to avoid fragranced products all together, and this is simply an unfair choice.

WHAT'S THAT SMELL? is designed to shed some light on the associated human health impacts of common fragrance ingredients in cleaning products. Specifically, it presents the current scientific findings on allergens linked to eye and skin irritation and breathing problems, synthetic musks linked to hormone disruption and potential increased risk of cancer, and phthalates linked to reproductive and developmental harm.

This report also highlights the need for additional studies to better understand the impacts that exposure to these chemicals have on human health, particularly during critical stages of development such as pregnancy and infancy.

WHAT'S THAT SMELL? is intended to provide consumers with alternatives for reducing their exposure to potentially harmful chemicals in fragranced cleaning products and to offer some policy solutions for protecting public health in the long term.

CHEMICALS OF CONCERN COMMONLY FOUND IN FRAGRANCE

Allergens: Numerous fragrance ingredients, even those which are natural compounds found in lavender oil and lemon oil, for example, can lead to allergies in sensitive persons. Exposure to allergens in fragrance through inhalation or absorption through the skin can cause skin and eye irritation, as well as more serious impacts such as breathing problems.

Synthetic Musks: Synthetic musks are man-made chemicals produced to replicate musk scents originally obtained from musk deer and musk ox. The most commonly-used synthetic musks are polycyclic musks, galaxolide and tonalide, and two types of nitro musks, musk xylene and musk ketone. Research indicates that synthetic musks are persistent, can bioaccumulate, are potential hormone disruptors, and may break down the body's defenses against other toxic chemical exposure.

Phthalates: Phthalates are a class of chemicals used in fragrance that do not contribute a scent, as musks or plant essences do, but rather act as solvents and carriers for those chemicals that create the scent in a fragrance. Phthalates have been shown to cause reproductive and developmental harm in laboratory animals, and are linked to similar impacts in humans.

WHAT IS FRAGRANCE?

Many of us associate the term fragrance with beautiful bottles of fine perfumes and colognes. The term “fragrance” is actually much broader than that, covering any substance, either natural or man-made, which conveys an odor or scent. Any one fragrance can be made up of potentially hundreds of different ingredients. The International Fragrance Association (IFRA) defines a fragrance ingredient as:



“Any basic substance used in the manufacture of fragrance materials for its odorous, odor-enhancing or blending properties. Fragrance ingredients may be obtained by chemical synthesis from synthetic, fossil or natural raw materials or by physical operations from natural sources.”¹

Any one fragrance be made up of potentially hundreds of ingredients.

Fragrance has been used for thousands of years, but it has changed significantly over time. Some of the earliest documented uses of fragrance trace back to ancient Egypt, where perfumes have been found in the tombs of pharaohs.² In the 1400s, the technology of distilling was developed, which is the process of concentrating fragrance essences from natural sources.³ The age of modern perfumery began in the late 19th century as the first synthetic fragrance ingredients were designed to replace the more expensive, and harder to obtain, natural fragrance ingredients.⁴ Today, fragrances created for cosmetics, personal care and cleaning products are dominated by synthetic, instead of natural, ingredients. Estimates indicate 80-90% of the raw materials used in fragrances today are synthetic.⁵ However, there has been very little research on the potential impacts of all these new synthetic ingredients on human health.

PRODUCT MARKETING TARGETS WOMEN

Fragrances have long been added to cleaning products to enhance the experience of cleaning. It is commonly believed that fragrances are key to increasing sales of cleaning products, as individuals become accustomed to certain scents and the associations that are conjured up by them.⁶ Sophisticated marketing techniques have convinced many of us that a clean home should smell like a pine forest or lemons, despite the lack of any logical relevant connection between them. Women are uniquely targeted by fragrance marketing efforts, since they hold the purse strings of a household. Women make 85% of household purchasing decisions for consumer products including cleaning

products⁷. In addition, in the U.S., women still tend to do 70% of the housework in the average home, making them far greater users of cleaning products than men.⁸

Studies have also shown that women are more emotionally impacted by fragrance than men, indicating a potential biological difference in how women experience scents and odors.^{9,10} Sensitivity to fragrance has also been found to change in women depending on the stage of their menstrual cycle at the time¹¹. So, it is not surprising that fragrance has become a key element in successful marketing of products to women. This success may well be driving a significant increase in the use of fragrance chemicals in products in the last few decades: estimates indicate that fragrance usage (consumption) in the United States has more than doubled since 1990.¹² A walk down the cleaning products aisle in any grocery store will reveal how inundated we are with fragranced products.



Fragrance chemicals are being detected in our bodies: in our blood, in breast milk, and even in newborn children.

FRAGRANCE CHEMICALS IN CLEANING PRODUCTS DISPROPORTIONATELY AFFECT WOMEN

Recent research has examined the impact of fragrance and fragrance chemicals on human health, and women are more likely to suffer adverse effects from exposure to these chemicals. As mentioned above, women use cleaning products on average more than men do, and women who spend most of their time at home may also have higher exposure to potentially hazardous chemicals in fragranced cleaning products. Women also generally carry a higher percentage of body fat, and many chemicals tend to accumulate in fat tissue. Finally, women can pass chemicals on to their developing children during pregnancy and later through breastfeeding.

Acute health effects from fragrance exposure vary from mild irritation, skin rashes or headaches, to breathing problems, exacerbation of asthma symptoms and significant disability for people who are chemically sensitive. Women are more likely to suffer from fragrance allergy than men. There is also concern about chronic health impacts from daily exposure to fragrance chemicals. Chemicals of concern found in fragrance, such as synthetic musks and phthalates, have been linked in animal and some human studies to the disruption of hormones such as estrogen, testosterone and thyroid hormone. Disruption of these hormone systems can have significant lifelong effects on reproductive health and development, particularly when exposure occurs during a critical time such as pregnancy. Furthermore, these chemicals are detected in our bodies: in our blood, in breast milk and even in newborn children.



Fragrance ingredients are kept secret from consumers, meaning we can't avoid certain chemicals if we wish to.

HAZARDOUS FRAGRANCE CHEMICALS IN CLEANING PRODUCTS ARE DIFFICULT TO AVOID

By reducing our exposure to fragrance chemicals, we can lessen health impacts and lower levels of these chemicals in our bodies. However, most information about fragrance ingredients in products is kept secret from consumers, making it difficult to discern which products are more or less likely to affect a person's health. Currently, manufacturers of cleaning products aren't required to list ingredients in their products—you can't look on a cleaning product label to see if there are any chemicals you want to avoid, the way you can look at a food label for ingredients. This poses an even greater dilemma for women and children at critical stages in their lives, such as pregnancy or early development—it's difficult for women to avoid exposure to hormone-disrupting chemicals that could lead to lifelong effects.. While some manufacturers voluntarily disclose cleaning product ingredients, there are no legal requirements to do so. **Currently, the only practical solution is to reduce or completely avoid fragranced products entirely. This is simply an unfair choice: women must either abstain from the use of fragrance or assume potential health risks.**

MORE RESEARCH AND BETTER POLICY CAN ENSURE FRAGRANCED PRODUCTS ARE SAFE FOR EVERYONE

The good news is that there is a better way:

- ▼ Increasing the disclosure of fragrance ingredients in products can help us better understand what we are exposed to, so that we can avoid certain chemicals;
- ▼ Improved independent research on fragrance chemicals will help reveal how much we are exposed to and which chemicals are more likely to enter our bodies and pose harm; and
- ▼ Revised chemical use policies can restrict the use of chemicals known to build up in our bodies and contribute to hormone disruption, cancer, birth defects or other serious conditions.

These steps will serve to protect the most vulnerable members of society, including pregnant women, the very young, and those who may be disproportionately exposed in their workplaces.

HAZARDOUS FRAGRANCE CHEMICALS COMMONLY FOUND IN CLEANING PRODUCTS

Unfortunately, information about fragrance ingredients in products remains largely undisclosed to consumers. The fragrance industry argues that the list of ingredients in a particular fragrance is a trade secret.¹⁴ In a recent effort to expand information about ingredients in fragrance, however, the International Fragrance Research Association (IFRA) released a list of over 3,100 fragrance chemicals, based on a 2008 survey of manufacturers. The IFRA list contains a number of chemicals of concern, including those that are linked to cancer, reproductive harm like infertility and birth defects, asthma and allergies, among other health concerns. The list only contains the names of chemicals and did not reveal how frequently each chemical is applied, nor which products or types of products contain which chemicals. While this list helps define the general universe of potential chemicals in fragrance, it is not useful for consumers who may want to avoid certain chemicals in their favorite products. Currently, the only means for avoiding these chemicals is to abandon fragranced products altogether. While there are thousands of chemicals used in fragrance, this report focuses on phthalates, synthetic musks and allergens, which are commonly found in cleaning products and have been linked to health concerns.

INDEPENDENT RESEARCH ON CONSUMER PRODUCTS

There has been some independent (non-industry) research on certain fragrance ingredients in consumer products. Results indicate frequent use of these chemicals in a wide range of fragranced household products.

For example, the most recent testing report issued by the Campaign for Safe Cosmetics found that popular brands of perfume, cologne and body sprays commonly contain synthetic musks, diethyl phthalate and a number of other hormone-disrupting chemicals and skin sensitizers.¹⁵ A 2007 study conducted by the National Resources Defense Council (NRDC) found several types of phthalates, chemicals linked to reproductive harm, in many name-brand air fresheners.¹⁶ Several studies have examined the presence of synthetic musks in both cosmetic and cleaning products, due to concern that these chemicals are increasingly detected in people's bodies



In 2010, the fragrance industry released a master list of chemicals used in fragrance—the list contains chemicals linked to cancer, reproductive harm, asthma, and allergies.



Tests on household cleaning products found the highest levels of musks in three types of products: laundry detergent, furniture polish and fabric softener.

and may affect hormone balance. One study found the synthetic musk galaxolide in 72% of products sampled, and tonalide in 32%. The highest levels of each found in cosmetics were in perfume and body lotion; for cleaning products, the highest levels were found in laundry detergent, furniture polish and fabric softener.¹⁷ Another study found similar results for galaxolide and tonalide in cosmetic and cleaning products, and also tested for two other synthetic musks; musk xylene was found in 10% of products tested and musk ketone in 9%.¹⁸

Chemicals linked to allergies and sensitization are also a concern in fragrances. European Union regulations require the disclosure of 26 allergenic chemicals known to be used in fragrance directly on the label of cleaning products and cosmetics.^{19,20} Studies reviewing these labels have found that allergenic chemicals are frequently incorporated into household products. A survey of cosmetics and cleaning products in the United Kingdom found at least one of the allergens on 89% of the product labels examined. Perfumes contained the most allergens, some with as many as 21 different chemicals. Household cleaners contained an average of three different allergens, and some products contained as many as 12 allergens. The most commonly labeled allergens were linalool, limonene, geraniol and citronellol.²¹ These results were similar to a Danish study on hand soaps, which also most frequently found linalool, geraniol and citronellol.²² A chemical analysis of six popular cleaning products in the United States (air fresheners and laundry products) found similar results, with d-limonene found in all products and linalool found in half of the products. This study also detected 58 other volatile organic compounds (VOCs) emitted from these products, several of which are considered hazardous or toxic under U.S. law.²³ **These studies clearly demonstrate that we are consistently exposed to several fragrance chemicals of concern in products that we use on a daily basis.**

IMPACT ON HUMAN HEALTH

Recent research has examined the impact of fragrance and fragrance chemicals on human health. While available research on fragrance exposure in humans is limited, it appears that a significant proportion of the general population suffers adverse effects from exposure to fragrances—especially women. Acute health effects from fragrance exposure vary from mild irritation, skin rashes or headaches, to breathing problems and exacerbation of asthma symptoms, to significant disability for people who are chemically sensitive.

A 2009 study surveyed 2,000 Americans about any negative impacts associated with exposure to fragrance. Over 30% responded that they found scented products irritating, 19% reported adverse health effects such as headaches or breathing problems, particularly from air fresheners, and 10%

were especially bothered by the scent of laundry products vented to the outdoors. The percentages were even higher among women, asthmatics and especially high among chemically sensitive persons. For example, almost twice as many asthmatics reported health problems from exposure to air fresheners compared to the general population.²⁴ We do not fully understand why certain people are much more sensitive to fragrance than others, but animal research may provide some answers. One study exposed mice to several different perfumes and colognes. Researchers detected significant acute toxic effects including breathing difficulties and neurological problems in the exposed mice. The mice were also found to be more severely affected after repeated exposure to fragrances. While exact correlations cannot be drawn, these results mirror what has been seen in some humans.²⁵

ALLERGENS

Fragrance contact allergy is a serious health problem from exposure to fragranced products, particularly for women. A European study conducted in 2009 found that more than 75% of 147 patients diagnosed with fragrance contact allergy were women, most of whom developed excema or skin rash on their hands or face when exposed to fragrances. Forty-five percent of survey respondents claimed “fragrance allergy significantly affected their daily living.”²⁶ An occupational health study found that health care workers were significantly more likely to have fragrance contact allergy than many other occupations. Again, the most common reaction was dermatitis (skin rash) on the hands. Researchers concluded that health care workers were likely at greater risk because they are required to wash their hands frequently, and thus are also recurrent users of soap and hand lotion; fragrance is a common ingredient in both soaps and lotions.²⁷ A similar study in Germany found a greater occupational risk of fragrance contact allergy for massage therapists and geriatric nurses, who have greater exposure to skin disinfectants, cleaning products and personal care products such as lotions. This study also found that women were significantly more likely to be affected by fragrance contact allergy than men. Researchers recommended that fragrance-free products be substituted for those at higher risk.²⁸ There is also evidence that persons affected by fragrance contact allergy or hand eczema are more likely to experience respiratory symptoms (breathing problems) when exposed to fragrance. Respiratory symptoms among those with fragrance contact allergy also tended to be more frequent and more severe than in those without the allergy.²⁹



Twenty-six allergens that are components of fragrance must be listed on the labels of cosmetics and cleaning products sold in the European Union (EU). If companies are required to label allergens in the EU, why are they permitted to keep them a secret from consumers in the U.S.?

SYNTHETIC MUSKS

Synthetic musks are found in a wide array of fragranced consumer goods such as cleaning and beauty products. These musks are man-made chemicals produced to replicate the musk scents originally obtained from musk deer and musk ox.³⁰ The most commonly used synthetic musks are polycyclic

musks galaxolide and tonalide, and two types of nitro musks, musk xylene and musk ketone. The use of musk xylene and musk ketone in consumer products has declined in recent years as a result of concerns about their persistent nature and potential impacts on the environment. At the same time, increasing quantities of galaxolide and tonalide are used in fragranced products.³¹ Research indicates that synthetic musks are persistent, meaning they don't break down in the environment, and can bioaccumulate, meaning that they build up in our bodies. Synthetic musks are potential hormone disruptors and may break down the body's defenses against other toxic chemical exposures. In addition, biomonitoring results tell us that humans are widely exposed to these chemicals, and in ever increasing amounts, which is yet another cause for concern.

A study on musk exposure in aquatic mussels found a disturbing effect on the cells' ability to defend against other toxic chemicals.³² Exposure to musks like the four mentioned above led to an increased accumulation of foreign substances in the cell (in this case an added fluorescent dye). Without musk exposure, the cells would have been able to substantially remove the dye and prevent any excess buildup. The surprising aspect of this research was that when mussels were exposed to the musks for only two hours, the cells' defense system was still affected for up to 48 hours. Another paper also found that musk ketone had the potential to increase rat's susceptibility to toxic compounds such as carcinogens, by affecting liver enzymes.³³ Further research is needed to better understand the implications of these findings, including the concentration of musks needed to create this effect of breaking down the body's defenses

against other chemical exposures, and the degree to which these findings are applicable to humans. It raises a concern, however, that **musk exposure could make our bodies more vulnerable to other toxic chemicals on a daily basis.**

At least two studies have pointed to the potential for synthetic musks to disrupt hormone levels, estrogen in particular. A 2002 study used a technique called the E-screen, which examines how much a chemical acts like estrogen in cell tissue. The study found that tonalide, musk xylene and musk ketone

HORMONE DISRUPTION

Chemicals of concern in fragrance, including synthetic musks and phthalates, have been linked in animal and some human studies to the disruption of hormones such as estrogen, testosterone and thyroid hormone. Disruption of these hormone systems can have significant lifelong effects on reproductive health and development, particularly when exposure occurs during pregnancy. While research studies have not yet examined reproductive health outcomes specifically in response to fragrance exposure in humans, increasing levels of these chemicals in our bodies are cause for concern. Synthetic musks and phthalates are found in the blood and fat tissues of most people tested, including newborns. These toxic chemicals are also commonly found in breast milk. **Research indicates that the more we use fragranced cleaning products and cosmetics, the higher the levels of fragrance chemicals in our bodies.**

all showed weak estrogenic effects on human breast cancer cells. **Nonetheless, researchers expressed concern that an additional increase in estrogen-like activity from musks could lead to increased growth of breast cancer cells.**³⁴ A second study examined the impacts of tonalide and galaxolide on choriocarcinoma cells (cancer of the placenta). They found an increase in activity in these cells that could augment estrogen levels, promoting further tumor growth.³⁵



Synthetic musks have also been detected in our bodies. One study looked at levels of galaxolide and tonalide in the fat tissue of individuals undergoing liposuction procedures in the United States. Galaxolide was detected in all of the samples tested and tonalide was detected in 86%. Levels among individuals varied significantly indicating that some people have much greater exposure to or retention of synthetic musks than others. Detected levels of both musks were two to three-fold higher than those found in a German study ten years earlier.³⁶

In a 2009 study, 100 students in Austria had their blood plasma tested for 11 different types of synthetic musks. Only seven of the 100 students had no detectable levels of musks. The most frequently detected musks were galaxolide (91%) and musk xylene (79%). Surprisingly, two students also had measurable levels of musk ambrette in their blood, despite the fact that this chemical had been banned for many years in the European Union due to its known toxicity. Blood levels of galaxolide and tonalide were significantly correlated with regular body lotion, perfumes and deodorant use. Participants were not questioned about their use of fragranced cleaning products.³⁷

While breast milk studies have been conducted in Europe for some time, the first breast milk study looking for musks in the U.S. wasn't conducted until 2007. At least one type of musk was found in each woman tested, and 82% of participants had at least two musks in their breast milk.³⁸ In 2008, another study examined musks in the breast milk of American women. Greater use of perfume during pregnancy was significantly correlated with higher levels of galaxolide in breast milk. Heavier use of fragranced laundry detergent during pregnancy led to significantly higher levels of tonalide in breast milk.³⁹ This research indicates that newborns and infants can be exposed to significant levels of synthetic musks through breastfeeding, which appears to be related to their mothers' use of fragranced products in the household. Exposure to synthetic musks also occurs during pregnancy. A 2009 study, which looked at various pollutants detected in umbilical cord blood, found galaxolide and tonalide present in seven of ten newborns tested.⁴⁰ The potential health

Studies have found synthetic musks present in 7 out of 10 newborns tested.



Synthetic musks have been detected in soil, water, and wildlife.

impacts of synthetic musk exposure so early in life are still unknown and warrant more research.

Synthetic musks have also been detected in soil, water, and wildlife. High levels of musks, including those examined in this report, have been detected in sewage sludge, indicating that sewage treatment plants are removing musks from wastewater.⁴¹ A certain percentage of synthetic musks, however, are being detected in surface water and river and lake sediment, which means they appear to escape the sewage treatment process.⁴² Musks have been detected, for example, in river sediment in Germany and lake sediment in the Great Lakes of the United States.⁴³ In Lake Erie, sediment core sampling has shown that levels of musks entering sediment doubled between 1990 and 2004.⁴⁴ Fish living downstream from wastewater treatment plants have also been found to have high levels of tonalide and galaxolide in their fillet tissue.⁴⁵ Other wildlife studies have detected synthetic musks in harbor seals, sea lions, river otters, dolphins and ducks, among other species.⁴⁶ It appears that musks may affect the health of wildlife as well. A study exposing zebrafish to musk ketone found decreased fertility and lower survival of embryos at relatively low levels of exposure. **Clearly, fragrance chemicals like musks are having an impact on the environment, beyond their original intended use in household products.**

HOW DANGEROUS ARE MUSKS, REALLY?

Truly, the research is still preliminary and not yet definitive. While legislative restrictions or bans on the use of synthetic musks are few and far between, some manufacturers of fragrance and fragrance products are choosing alternatives. In 1993, the German Cosmetic, Toiletry, Perfumery and Detergent Association initiated a voluntary phase-out of the use of musk xylene in household products.⁴⁷ Japan banned the use of musk xylene in the 1980s.⁴⁸ More recently, several corporations have taken steps to eliminate the use of musks. For example, the Clorox Company, Boots and The Body Shop have all announced they would no longer use certain synthetic musks in products that contain fragrance.^{49,50,51} Widespread exposure to synthetic musks, especially during critical windows of development such as pregnancy and infancy, justifies a cautionary approach. **We simply cannot afford to continually expose new generations at current levels, particularly when manufacturers have access to safer alternatives.**

PHTHALATES

Phthalates are a class of chemicals used in fragrance, which do not contribute to a scent like musks or plant essences do, but rather act as solvents and carriers for those chemicals that create scent in a fragrance. Phthalates are what makes a scent linger in the air or on your skin. According to a 2008 global survey by the International Fragrance Research Association (IFRA),

several types of phthalates, including dibutyl phthalate (DBP), diethylhexyl phthalate (DEHP), dimethyl phthalate (DMP), di-isononyl phthalate (DINP), di-isobutyl phthalate (DIBP) and diethyl phthalate (DEP), are known ingredients in fragrance.⁵² IFRA has not revealed, however, the types of fragrance or products that are most likely to contain these phthalates.

Phthalates are known to cause reproductive and developmental harm in laboratory animals and are linked to similar impacts in humans. For example, “phthalate syndrome” describes a well-documented constellation of reproductive abnormalities, including malformations of the penis, testicles and prostate in laboratory animals exposed to phthalates like DBP and DEHP in the womb.⁵³ More recently, research in humans indicates that phthalate exposure, particularly in males, shows some similar reproductive impacts.⁵⁴ For example, one study found that men exposed to higher levels of phthalates have lower sperm counts and altered sperm quality.⁵⁵ Another study showed that male workers exposed to phthalates had significantly lower levels of testosterone.⁵⁶ Some research on women’s exposure to phthalates also presents a concern. Research indicates that exposure to DBP, for example, can affect thyroid hormone levels and may alter thyroid function.⁵⁷

Attention to the toxicity of these substances has apparently reduced the use of several types of phthalates in consumer products in recent years. European Union regulations, for example, have banned DBP and DEHP from personal care products sold in Europe due to toxicity concerns. These regulations have driven reformulation of consumer products, including some of those sold in the United States. In 2002, the Campaign for Safe Cosmetics tested 72 perfumes and cosmetic products manufactured in the United States for the presence of phthalates and found that 72% contained at least one type of phthalate, including DBP, DEP and DEHP. In 2008, the Campaign retested 12 of those products (those with some of the highest levels from the 2002 study) and found only one phthalate, DEP, present in any of the products, implying a reduction in the use of this potentially hazardous class of chemicals. Several of the products also had considerably lower levels of DEP than in 2002, and two products had no phthalates at all.⁵⁸ Cosmetic testing in 2009 still found DEP present in 12 of 17 fragranced personal care products tested.⁵⁹

THAT FRESH SMELL OF CLEAN LAUNDRY



Do you love the way your laundry detergent makes your clothes smell? Have you thought about what it takes to manufacture that scent? In general, laundry detergent does a great job of removing odors from clothing. But what kind of chemistry is needed to apply a new scent to your clothes? The question then becomes—where do those chemicals go from there? One study found that women who regularly used fragranced laundry detergent during pregnancy had higher levels of potentially toxic synthetic musks in their breast milk.



**Phthalate exposure
in pregnant women is
linked to reproductive
malformations in their
baby boys.**

While earlier animal research indicated that DEP showed considerably less toxicity than other phthalates such as DBP or DEHP, recent studies on DEP reveal the potential for hormone disruption and reproductive impacts. In several laboratory studies, DEP was found to have weak estrogenic effects in cells, including human breast cancer cells.^{60,61} One study of baby boys found that their mothers' exposure to phthalates, including DEP, during pregnancy was associated with a shortened distance between the anus and genitals, a sign of feminization.⁶² In a study of men undergoing treatment at an infertility clinic, higher levels of MEP (the breakdown product of DEP) were strongly associated with higher levels of sperm DNA damage, raising concern that DEP exposure could affect fertility.⁶³ In a 2010 study of women in Arizona, higher levels of MEP in urine were associated with an increased risk of breast cancer.⁶⁴ Also in 2010, a paper from the Mt. Sinai Children's Environmental Health Center showed that women with high levels of certain phthalates (including DEP) during pregnancy were more likely to have children with behavioral

problems such as attention disorders and depression.⁶⁵ Additional research is needed to substantiate these findings.

Biomonitoring data shows extensive exposure to DEP in the general U.S. population. According to the Centers for Disease Control (CDC), DEP was found in nearly every (97 percent) American tested in 2000.⁶⁶ A study of infants in 2008 found the breakdown product of DEP in the urine of 98% of the 163 children tested.⁶⁷ This ubiquitous exposure, and the associated risks for health impacts among such a large portion of the population, raises considerable concern about the impacts of DEP and deserves serious attention. Action must be taken to reduce exposure until we know more.

There has been relatively little testing of cleaning products for the presence of phthalates. As mentioned earlier in this report, a 2007 study detected phthalates in a number of name-brand air fresheners.⁶⁸ Despite the need for additional research, cleaning product manufacturers have taken steps to remove them from some products. Recently, both SC Johnson & Son, Inc. and the Clorox Company announced that they have eliminated all phthalates, including DEP, from their brand products.^{69,70} This indicates that viable alternatives are available for these toxic compounds and that the toxic compounds can and should be replaced by all companies to help reduce unnecessary exposure in the general population.

VARIANCES IN HUMAN EXPOSURE

A common finding in many of the studies on fragrance chemicals is that there is a wide range in the levels of human exposure and how much of each chemical is detected in the human body. For example, one study, which

measured synthetic musks in breast milk, found some women with 400 times as much galaxolide as others, and some women with 100 times as much musk ketone as others.⁷¹ Another study that looked at the concentrations of musks in personal care and cleaning products created estimates of exposure based on average consumer use patterns. It found that those who tend to use a greater number of heavily fragranced products could end up with an exposure to certain musks that is 10,000 times as great as those who use fewer products.⁷² These vast ranges of exposure are significant, indicating that personal consumption choices can make a big difference in the impact of these chemicals on human health. These differences must also be accounted for when manufacturers assess products for safety. Manufacturers of fragranced products should ensure that even those with the greatest use of fragranced products are well protected from harm. In the case of fragranced cleaning products, the potential health impacts to cleaning workers, such as maids and housekeepers, who use the products on a daily basis, must be considered.

IMPACT ON AIR QUALITY

Fragranced cleaning products can affect indoor air quality. Numerous chemicals used in fragranced products off-gas into the air as volatile organic compounds (VOCs). VOCs can cause eye, nose and throat irritation as well as headaches, nausea and damage to the liver, kidney and central nervous system. A 2009 study in the U.S. found that common name brand air fresheners and laundry supplies (detergent, dryer sheets and fabric softener) all emit numerous VOCs, many of which are known to be toxic or hazardous. Hazardous chemicals such as ethanol, 1,4 dioxane, chloromethane and acetaldehyde were chemically detected in the air from these products. Neither product labels nor Material Safety Data Sheets (MSDSs) listed these chemicals as ingredients. Additional research is needed to fully assess the impact of these products on air quality and associated potential health risks.⁷³ Common fragrance chemicals called terpenes also contribute to indoor air pollution by generating secondary pollutants, including carcinogens and ultra-fine particles.⁷⁴ Terpenes, such as d-limonene and alpha-pinene, can react with ozone in the air to form formaldehyde and acetaldehyde, both carcinogenic “hazardous air pollutants” that have no safe exposure level, according to the Environmental Protection Agency.^{75, 76}

The potential health impacts to cleaning workers, such as maids and housekeepers, must be considered.





There is an inherent conflict of interest when a trade group, funded by industry, holds the responsibility of regulating itself.

LACK OF EXISTING REGULATION IS CAUSE FOR CONCERN

Chemicals used in fragrance are virtually unregulated by governmental agencies in the United States. Neither the Food and Drug Administration (FDA) nor the Environmental Protection Agency (EPA) has direct authority to monitor or require safety testing for fragrances used in cleaning products or cosmetics. Instead, the International Fragrance Research Association (IFRA), an industry trade group, sets standards for fragrance manufacturers and facilitates safety reviews of fragrance ingredients. IFRA publishes a Code of Practice, which establishes voluntary standards for manufacturers of fragrance. The Code of Practice, initially published in 1973 and updated over the years, includes a list of fragrance ingredients that are prohibited or restricted by IFRA based on the organization's safety analyses.⁷⁷ The Research Institute for Fragrance Materials (RIFM) is the "science arm" of IFRA. RIFM conducts its own fragrance research and coordinates an independent expert panel of dermatologists, toxicologists and environmental scientists called REXPAN. REXPAN's role is to assess data and draw conclusions about the safety of fragrance ingredients.

While these efforts towards independence and transparency are laudable, there remains an inherent conflict of interest when a trade group, funded by industry, holds the responsibility for regulating itself. The potential for undue corporate influence into safety mechanisms is simply a reality. For example, the headquarters of IFRA in Geneva, Switzerland, is located at the same address as the head office of Givaudan, a global fragrance manufacturer with the largest international market share. Safety assessments conducted by REXPAN are also not entirely transparent. Although the safety assessments are published in publicly available scientific journals, a large proportion of the data on which the conclusions are based is unpublished research provided by the manufacturers of these products. This unpublished data is not made available for public scrutiny.

IFRA standards for prohibited and restricted chemicals are voluntary with little or no enforcement. It was only a few years ago, in 2007, that IFRA implemented the first compliance program to determine whether manufacturers were in fact complying with the standards. The program only tests 50 fragranced products per year from the global marketplace to look for the presence of any prohibited ingredients, and none has been detected so far. The compliance program will continue to examine products for restricted ingredients (which are ingredients allowed under certain conditions, or in lower concentrations).⁷⁸ While these efforts may be relatively far-reaching for a self-policing industry, they are simply not a sufficient substitute for government regulation and oversight. An external, unbiased approach is necessary to protect public health from the potential impact of exposure to fragrance chemicals.

The good news is that there are steps that you can take to reduce your exposure to fragrance chemicals in short term, and policies you can support to protect public health for the long term.

PERSONAL ALTERNATIVES

- ▼ Reduce or eliminate use of fragranced products (See *Alternatives to Fragranced Cleaning Products* on page 19).
- ▼ If you are concerned about a fragranced product that you currently use (and like), call the company's toll free number and ask if it contains any of the problem ingredients discussed in this report.
- ▼ Look for companies that disclose fragrance ingredients on the product label or on a website.
- ▼ Make your own cleaners! Until we know what's in cleaning products, you can make your own non-toxic cleaners with ingredients like vinegar and baking soda with Women's Voices for the Earth's Green Cleaning Party Kit. Visit www.womenandenvironment.org.

RECOMMENDED POLICY CHANGES & HOW YOU CAN INFLUENCE THEM

- ▼ Companies should voluntarily disclose fragrance ingredients in fragranced products. **Ask the makers of your favorite product to do so!**
- ▼ Companies should voluntarily remove chemicals of concern such as phthalates and synthetic musks from their products. **Call the maker of your favorite cleaning product and ask them to list all ingredients—including fragrance ingredients—directly on the label. We all deserve to know what we're buying at the point of purchase.**
- ▼ Federal legislation is needed to require companies to disclose all product ingredients, including fragrance ingredients. The Household Products Labeling Act has been introduced in Congress and would require that household cleaning products bear a label including a full list of product ingredients. **Ask your legislators to support the Household Products Labeling Act.**

WARNING:



"Unscented" does not always mean "fragrance-free!" Some "unscented" products actually contain a fragrance that masks the smell of other chemicals in the product. Double check any products marketed as "unscented" to ensure the ingredient list does not include the word "fragrance."

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- ▼ Chemicals should be evaluated for safety before they are included in products. Comprehensive chemical policy reform is needed to ensure that people and the environment are protected from toxic chemicals. The Safe Chemicals Act of 2010 would require chemicals to meet a health-based safety standard. **Ask your legislators to support the Safe Chemicals Act and protect consumers from toxic exposures.**
 - ▼ **Join Women’s Voices for the Earth to learn more about how you can support policies that protect us from toxic chemical exposure. Visit www.womenandenvironment.org.**

Common ingredients in fragrance, such as phthalates, synthetic musks, and allergens, have been linked to health impacts ranging from eye and skin irritation to hormone disruption, increased risk of breast cancer, and reproductive and developmental harm. If you choose to avoid fragranced products from the store, there are alternatives to ensuring a pleasant-smelling home.

TIPS FOR REDUCING ODORS AROUND THE HOME

GENERAL	Open a window or turn on a fan and let in some fresh air! Good ventilation is one of the best ways to remove odors from your home. It can also help reduce levels of indoor air pollutants that commonly build up in our homes.
BATHROOM	Open the window in the bathroom to decrease humidity after a shower, reducing the potential for growth of mildew and mold.
	Keep it clean! Even just a regular swish of your toilet with a brush can prevent toilet rings and reduce odors.
KITCHEN	Put an open box of baking soda in the fridge.
	Sprinkle baking soda or coffee grounds in your trash can to mask odors.
	Ground up a half lemon (you can use one you've just squeezed for juice) in your sink garbage disposal for a fresh lemon scent.

REPLACING AIR FRESHENERS

If you want to add a particular scent to your home, here are some natural alternatives:

FRESH OR DRIED FLOWERS	Setting out a fresh bouquet of flowers is not only pretty, but can add a lovely floral scent to your home. A bowl of dried flowers (potpourri) can have a similar effect – and lasts even longer.
COOKING UP SOME HERBS OR SPICES ON THE STOVE	Adding spices like cinnamon, vanilla, or even cut-up fruit like lemon or apple to a pot of boiling water and letting it simmer on the stove can infuse a scent throughout your home. Seasonal alternatives can also include flower petals, pinecones or pine needles.

UNSCENTED ALTERNATIVES TO STORE-BOUGHT SCENTED CLEANING PRODUCTS

ALL PURPOSE CLEANER	Mix 1 part white distilled vinegar and 1 part water in a spray bottle.
SOFT SCRUB CLEANSER	Mix 2 cups baking soda, ½ cup liquid castile soap, and 4 teaspoons vegetable glycerin in a sealed glass jar.
CARPET DEODORIZER	Sprinkle baking soda on carpet. Let sit for an hour or overnight. Vacuum it up.
LAUNDRY DETERGENT	Mix 1 cup soap flakes (just finely grate a bar of unscented soap), ½ cup borax and ½ cup washing soda. Use just 1-2 tablespoons per load.
FABRIC SOFTENER	Add ½ cup white distilled vinegar to rinse cycle of your washer.
	Use wool dryer balls in your dryer to fluff up clothes and absorb static.
DRYER SHEETS	Hang your laundry out to dry in nice weather instead of using your dryer, for fresh smelling clothes and sheets. (You can also save loads on your electricity bill!)

NOTE ON ESSENTIAL OILS

Essential oils are liquids formed from the distillation of the leaves, stems, or flowers of a plant. They are very concentrated liquids, so a little (even just a few drops) goes a long way. They can be used to add a scent to the recipes and alternatives listed above. In addition, some essential oils have natural anti-bacterial properties and can be used as a preservative. They are commonly available in health food stores, and are sold online. With certain scents, there may be a concern for overharvesting sensitive or rare plants, so you want to look for essential oils marketed as “sustainably harvested.”

WARNING: It should be noted that some people can be highly sensitive to essential oils, leading to symptoms such as headaches, asthma exacerbation, skin irritation or other health effects. Essential oils, in their concentrated form, should be used with caution to avoid unintended health impacts. It is strongly recommended to dilute essential oils in water or another substance when you use them. Undiluted essential oils will evaporate, and can emit volatile organic compounds (VOCs) which can interact with other compounds in the air to form hazardous air pollutants. More research is needed to assess the impacts of these emissions on human health.

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WOMEN'S VOICES FOR THE EARTH

Women's Voices for the Earth is a national organization that works to eliminate toxic chemicals that impact women's health by changing consumer behaviors, corporate practices, and government policies.



WVE

Women's Voices for the Earth
P.O. Box 8743
Missoula, MT 59807
Phone: 406/543-3747

www.womenandenvironment.org
wve@womenandenvironment.org