



The toxic trail of fragrance chemicals

Research Memo
by Material Research L3C
for Women's Voices for the Earth

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**MATERIAL
RESEARCH
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1. Findings

- The use of known toxic substances in fragrances is common. Industry reports using more than 3,000 chemicals. Many of these chemicals are known to be of concern, some are safe, but for most, the hazard profiles of many fragrance industry chemicals are unknown. Many chemicals on industry's list have not been studied for health and environmental impacts.
- There are at least 46 chemicals of concern commonly present in consumer products that are designed to expose people to these chemicals, such as body sprays and washes and air fresheners. Many are asthmagens, allergens. Some are suspected of disrupting human endocrine systems.
- People are exposed to these chemicals through their presence in products such as intimate care, personal care, and cleaning products and other articles to be used inside the home. The 46 priority fragrance chemicals identified in this research memo are present in high impact consumer products, including intimate care, personal care, and household cleaning products.
- Some products contain multiple toxic chemicals. One single product, Lysol Professional Disinfectant Spray, Lavender, Aerosol, Professional Use, contains four chemicals of high concern.
- Toxic fragrance chemicals are widely used in particularly inappropriate products. Chemicals that are skin allergens are present in tampons. Fragrances that cause asthma are used in cleaning products. Chemicals that are toxic to the aquatic environment are in body washes.
- Fragrance companies import, manufacture, and sell millions of pounds of toxic chemicals. In 2020, more than 46 million pounds of toxic fragrance chemicals were imported by the fragrance industry. (See accompanying Spreadsheet - Column I).
- The leading producers of fragrances used in intimate care, personal care, and cleaning products - factories in N.J. and Florida owned by Firmenich, Givaudan, and International Flavors and Fragrances -- manufacture or import at least 25,000 pounds, each, of 12 different chemicals that have had no published studies.

- Workers and neighbors are exposed to fragrance chemicals emitted by fragrance manufacturing facilities. Two of the most impactful fragrance chemical facilities in the U.S. are located in Jacksonville, Florida, in highly vulnerable, densely populated, low-income communities of color.
- Many fragrance chemicals are toxic to aquatic systems, and are discharged into wastewater at manufacturing plants and from consumer products such as body wash.¹
- Another way in which unregulated fragrances cause harm is their flammability. Explosions and other incidents involving fragrance chemicals are common in warehouses, in transportation, and manufacturing plants. (See Appendix.)

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https://ifrafragrance.org/docs/default-source/guidelines/effa-emission-scenarios-fragrance-ingredients-r-h.pdf?sfvrsn=4ad77d_0

Table 1. Dirty (Baker's) Dozen: Some Notable Fragrances of High Concern

Based on volume, toxicity, the products they are used in, and the facilities using/manufacturing them. Appendix 1 contains a complete list of the 46 fragrance chemicals of concern identified for this memo.

Chemical (CAS number)	Health and Environmental Impacts	High Impact Consumer Products
benzyl alcohol (100-51-6)	Allergen. Harmful if swallowed. Causes skin and eye irritation.	Sanitary pads, personal care, institutional and commercial cleaning products.
benzyl salicylate (118-58-1)	Allergen, Potential endocrine disruptor; contact sensitizer; causes serious eye irritation.	Deodorants (personal care), cleaning products, air fresheners.
citronellol (106-22-9)	Allergen; Contact sensitizer; irritating to the skin	Cleaning products and air fresheners.
d-limonene (138-86-3 / 5989-27-5)	Asthmagen; sensitizing substance; may cause skin and eye irritation; toxic to aquatic life.	Sanitary and incontinence pads, body wash, general purpose household cleaners.
galaxolide (HHCB) (1222-05-05)	Suspected of damaging fertility; developmental toxicity; endocrine disruption; toxic to aquatic life.	Deodorant (personal care), institutional and in-home cleaning products and detergents.
geraniol (106-24-1)	Allergen; Causes skin and eye irritation; sensitizing substance.	Tampons, institutional cleaning products, air fresheners.
hexyl cinnamal (101-86-0)	Allergen; causes skin irritation; may cause allergic skin reaction.	Tampons, sanitary pads, disinfectants and cleaners.
lilial (80-54-6)	May damage fertility; potential endocrine disruptor; skin and eye irritant; allergen; may cause allergic skin reaction; harmful if swallowed; toxic to aquatic life; persistent.	Body sprays, household disinfectants and air fresheners.
linalool (78-70-6)	Allergen; skin and eye irritant; may cause allergic skin reaction.	Tampons, sanitary pads, household cleaning products and air fresheners.
methyl salicylate (119-36-8)	Asthmagen; Potential endocrine disruptor; skin and eye irritant.	Commercial and household cleaning products.
octinoxate (5466-77-3)	Endocrine disruptor.	Body sprays, other personal care products.
OTNE (Iso E Super / Timbersilk) (54464-57-2)	Bioaccumulative; may cause allergic skin reaction.	Personal care (deodorant), in-home cleaning products.

turpentine oil (8006-64-2)	Asthmagen; evidence of carcinogenic effects; sensitizing substance; causes skin and eye irritation.	Furniture polish and inside-home cleaning products

Health and environmental hazard information based on Pharos Project database, <http://www.pharosproject.net>.

The above table is a snapshot of some of the known harmful fragrances used in high exposure consumer products. It is not a complete list. Much about this industry is unknown. For most chemicals on the market, there have been only a few studies on their potential to harm the environment or human health.

Many have been the subject of 50, 100, even thousands of studies for everything from cancer to endocrine disruption, asthma to ecotoxicity. But no studies have been published for millions of pounds of fragrance chemicals used by this industry. The leading producers of fragrances used in intimate care, personal care, and cleaning products - factories in N.J. and Florida owned by Firmenich, Givaudan, and IFF' -- manufacture or import at least 25,000 pounds, each, of at least 12 different chemicals that have had no published studies, according to Healthy Building Network's Pharos database. These unstudied chemicals are then distributed into consumer products typically under the catch-all phrase, "fragrance."

Chemicals like grapefruit oil terpenes and lemon oil terpenes have had no published human or environmental health studies, but are imported or manufactured by Givaudan in New Jersey, and used in products like Febreze Small Spaces Air Freshener, Gain Moonlight Breeze,² Innersense Hair Love Prep Spray³ and Dawn Ultra, Botanicals, Dishwashing Liquid, Aloe Water Scent.⁴

2

https://whatsinproducts.com/types/type_detail/1/24302/standard/p%20class=%22p1%22%3EFebreze%20Small%20Spaces%20Air%20Freshener,%20Gain%20Moonlight%20Breeze-11/03/2020/p%3E/16-033-877

³ https://www.ewg.org/skindeep/products/962909-Innersense_Hair_Love_Prep_Spray/

4

https://whatsinproducts.com/types/type_detail/1/24262/standard/p%20class=%22p1%22%3EDawn%20Ultra,%20Botanicals,%20Dishwashing%20Liquid,%20Aloe%20Water%20Scent-11/13/2018/p%3E/16-033-837

2. Methodologies

Identification of hazardous fragrance chemicals: The International Fragrance Association (IFRA) Transparency list⁵ of 3,999 chemicals was scanned for chemical hazards using the Pharos database.⁶ These chemicals also were cross-referenced with the European Union list of allergens⁷ and the Association of Occupational and Environmental Clinics (AOEC) list of asthmagens.⁸

Identification of manufacturers: Chemicals with high human health and environmental hazard profiles were cross-referenced with two primary sources of use, import, and manufacturing information: Chemical Data Reports filed quadrennially by industry with the U.S. Environmental Protection Agency; and, the Datamyne trade database of U.S. Customs and Border Protection records.

Identification of products: Information on the fragrance ingredients used for most consumer products is not routinely disclosed. There are some databases, however, that help consumers know what is in the products. One of them is the Consumer Product Information Database (CPID)⁹ which was used to identify examples of products that contain several fragrance chemicals of concern included in this document. The database Skin Deep^{®10} maintained by the Environment Working Group that provides information on chemicals used in personal care products was another source for this part of the research. The database SMARTLABEL^{®11} was also used in this research to identify intimate care consumer products. It was created by the Trading Partner Alliance (TPA) to offer information on some products on different issues and practices associated with them. However, results from the SMARTLABEL database are limited. Only three companies that manufacture intimate care products - Procter & Gamble, supermarket corporations Ahold Delhaize and Topco Associates - have products listed in the database. Of the three, only one, Procter & Gamble, provides fragrance ingredients for their products.

Identification of priority chemicals: From these cross-referencing techniques, Material Research identified a shorter list of priority fragrance chemicals. Appendix 1 lists these

⁵ <https://ifrafragrance.org/priorities/ingredients/ifra-transparency-list>

⁶ pharosproject.net

⁷

<https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02009R1223-20190813&from=EN>

⁸ <http://www.aoec.org/OEM-list.htm>

⁹ <https://www.whatsinproducts.com/pages/index/1>

¹⁰ <https://www.ewg.org/skindeep/>

¹¹ <http://www.smartlabel.org/>

46 chemicals and their hazards. This list was prioritized based upon known fenceline impacts, human health and environmental hazards, volumes and uses in target consumer products. There are many other chemicals of concern on IFRA's list, but were not found to be common in the target product categories or are otherwise used/imported/manufactured by the main fragrance companies specifically. Some are used by fragrance companies, but mainly in other types of products or in quantities below the EPA threshold.

3. Manufacturing

Material Research dived into 2020 trade data for the chemicals of concern used by the fragrance industry, and the latest chemical data records available from EPA,, and identified the main fragrance-related facilities that are importing and/or manufacturing these chemicals in the U.S. for use in target product categories. A list of key facilities was further refined based on the markets they serve.

Eight key facilities were identified, all clustered in two areas: in the port city of Jacksonville, Florida, and around the port of Newark, New Jersey. These facilities import, use, and manufacture fragrances for use in intimate care, personal care, and household cleaning products.

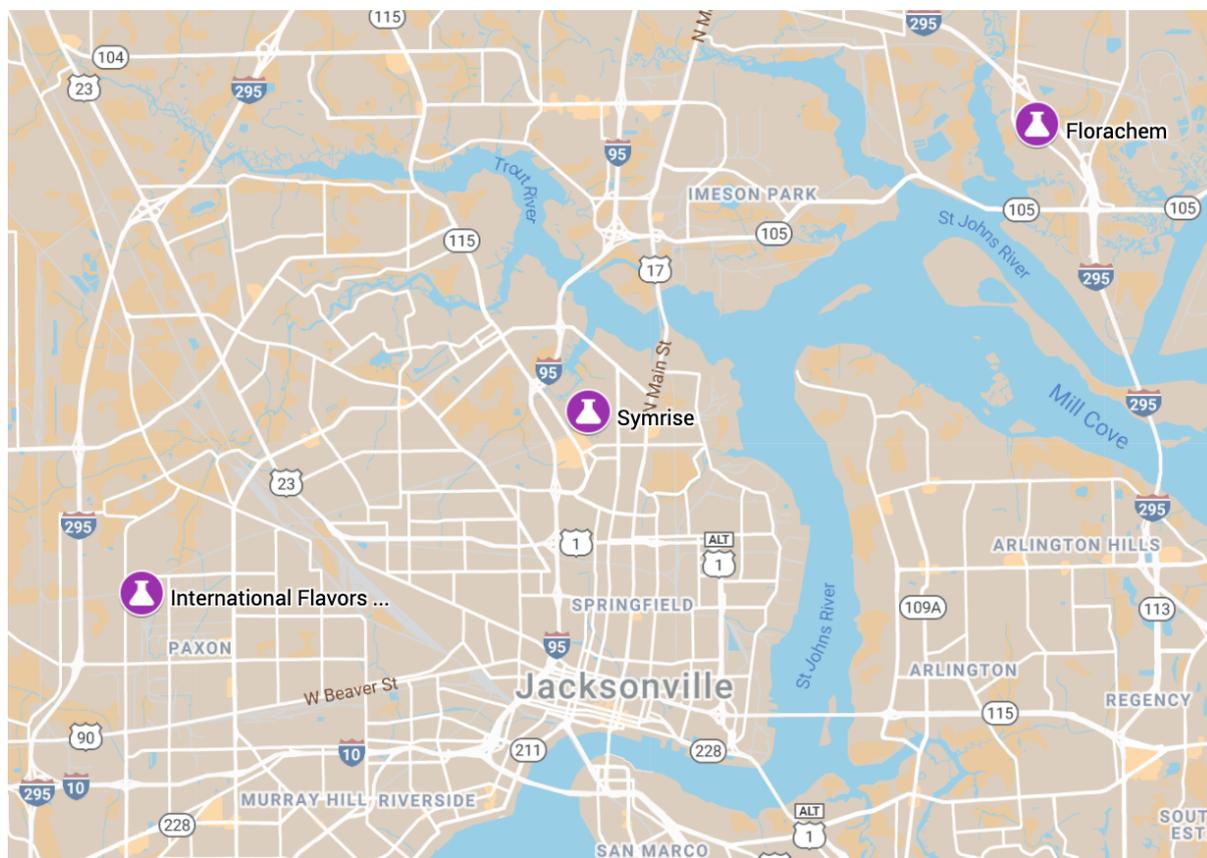
Jacksonville cluster

- Florachem in Jacksonville, Florida.
- Symrise (formerly Renessenz) in Jacksonville, Florida
- International Flavors and Fragrances Inc. in Jacksonville, Florida

New Jersey cluster

- International Flavors and Fragrances Inc. in Hazlet, New Jersey
- Firmenich in Plainsboro, New Jersey
- Givaudan in Budd Lake, New Jersey
- John D. Walsh in Ringwood, New Jersey
- Phoenix Aromas in Norwood, New Jersey

Profile of Jacksonville, Florida, cluster



Screenshot of [Google Map](#) produced for this research memo.

Three major fragrance factories are located inside the city limits. IFF's is the oldest and largest. Within 3 miles of the plant live 29,520 people. 62% are people of color. The Per Capita Income is just \$18,837¹². Symrise is also big, and surrounded by densely populated neighborhoods. 69,738 people live within 3 miles of the plant, 86% of whom are people of color. The Per Capita Income is \$17,925.¹³

The third, Florachem, is a bit more remote and smaller, and in a community that is less diverse and has higher income.

IFF and Symrise's facilities are located in communities that score high in the Centers for Disease Control's social vulnerability index (SVI): 0.8709 for IFF¹⁴ (1 being the worst), and 0.8608 for Symrise¹⁵. These scores indicate high levels of vulnerability. The CDC explains,

¹² EJ Screen results based on 3 miles Ring Centered at 30.34774,-81.7494 <https://ejscreen.epa.gov/mapper/>

¹³ EJ Screen results based on 3 miles Ring Centered at 30.380132, -81.664311 <https://ejscreen.epa.gov/mapper/>

¹⁴ Social Vulnerability index calculated in lat/long: 30.34774,-81.7494 <https://svi.cdc.gov/map.html>

¹⁵ Social Vulnerability index calculated in lat/long: 30.380132, -81.664311 <https://svi.cdc.gov/map.html>

“Social vulnerability refers to the potential negative effects on communities caused by external stresses on human health. Such stresses include natural or human-caused disasters, or disease outbreaks. Reducing social vulnerability can decrease both human suffering and economic loss.”

The IFF facility imports a lot of fragrance chemicals from around the world, including its own subsidiaries in China and Spain.¹⁶

One of its biggest imports by volume is gum turpentine. In 2021, it imported over 3.3 million pounds from resin companies in Brazil and Mexico.¹⁷ Turpentine is the source of ongoing impacts on Jacksonville’s residents.

In October 2021, IFF in Jacksonville was issued a cease and desist order for the second time in 10 months. The order came after the city responded to 16 complaints from residents in a two week period. A previous cease and desist was issued in December 2020 after 6 more complaints were received.¹⁸ The company was also being sued by three Murray Hill residents who claimed the odor was destroying “their way of life.”

“The factory, which opened in the 1930s, processes turpentine to make ingredients for fragrances that can be used in air fresheners, sanitizers, deodorants. To some, the smell is almost inescapable,” reported the Florida Times-Union in 2021. “It’s a really strong chemical smell, similar to turpentine or Pine Sol,” said Ben Thompson, who has lived 13 years in his house in Jacksonville’s Murray Hill area. He said the odor there, which comes and goes erratically, has gotten stronger in the past few years and harder to ignore. ‘Previously, you had the option to retreat into your house, Thompson said. “Now, it’s such an invasive thing that you’ll be lying in bed and smell it.”¹⁹

The lawsuit was filed in January 2021. It notes that the factory’s fragrances are used in “beauty, detergent, and household goods” and employs a refining process that “involves distilling crude sulfate turpentine into intermediate terpene fractions and aroma chemical precursors.”

¹⁶ Datamyne trade database of US Customs and Border Protection records (2020 full year)

¹⁷ Ibid

¹⁸

<https://www.firstcoastnews.com/article/news/local/jacksonville-fragrance-factory-issued-another-cess-and-desist-order/77-96c206ae-f2b9-4da2-a07a-0c478e5b318c>

¹⁹ (Factory faces citation and lawsuit over odor - Resident: 'It's such an invasive thing that you'll be lying bed and smell it' February 7, 2021 | Florida Times-Union, The (Jacksonville, FL)

Author/Byline: Steve Patterson; Jacksonville Florida Times-Union | Page: A2 | Section: News

<https://www.jacksonville.com/story/news/environment/2021/02/07/odor-gripes-lead-citation-law-suit-westside-jacksonville-plant/4236561001/>

It continues, "The end result provides a raw material which can be used for the production of products such as flavors and fragrances.

"Sulfate turpentine is characterized by a vile, sickening odor, which it is believed is due to the formation of various mercaptans during the delignification of wood.

"Defendants' Facility produces highly odiferous emissions which are regularly dispersed across the surrounding neighborhood. Because of the noxious odors it emits into surrounding neighborhoods, the odor emitted by the Facility is regularly referred to "as a sickly sweet, turpentine smell" that typically lasts for three hours at a time.

"Local media reports have documented that the odors from the Facility interfere with public and private activities, in both public and private spaces, in the areas surrounding the Facility including jogging, biking, sports, hiking, taking children to the park, maintaining residential property, landscaping, and grilling."²⁰

In 2012, a 250,000 gallon turpentine tank exploded at IFF's Jacksonville plant . There were no injuries.²¹

Most fragrance chemicals' releases are not required to be reported to EPA's Toxic Release Inventory. The facility does report some toxic pollution to TRI, including hydrochloric acid and chlorine gasses.²²

The Symrise plant in central Jacksonville releases ammonia and hydrochloric acid in its production of toxic fragrance chemicals. This plant, formerly known as Rennessenz, is also the source of many odor complaints.

In a story that echoes those reported today, in 2011, the Florida Time-Union noted, "Of the 291 odor complaints received by the city in 2014, residents lodged 71 complaints against Rennessenz and eight against IFF, which is short for International Flavors & Fragrances... "We feel like they are violating the smell ordinance but there's no way to measure it, so we are stuck," she said...

"The city filed a citation against Rennessenz in April after city staff verified five complaints from five different households within a 90-day period. Rennessenz said it responded to

²⁰ <https://drive.google.com/drive/folders/1hQ95bpozPk95hK4dn705YWOBZpZteC1S>

²¹

<https://www.worldofchemicals.com/media/explosion-occurs-at-iff-chemical-plant-in-jacksonville/3907.html>

²² https://enviro.epa.gov/enviro/tris_control_v2.tris_print?pPrev=1&tris_id=32205NNCMP2051N

the citation with a written reply and provided information and records sought by the city. The case remains open. Renessenz says it "believes it has fully responded to the citation."²³

Turpentine oil is used in furniture polish and inside-home Lysol-branded cleaning products made by Reckitt Benckiser, such as Old English Furniture Polish (Reckitt Benckiser), and Lysol Cleaner concentrate (RB).²⁴

Terpenes also are in cleaning products such as lemon-scented Lysol.²⁵

These turpentine-related chemicals are manufactured or imported by IFF and Symrise in Jacksonville:

Chemical (CAS)	IFF or Symrise ?	No. of studies (a)	Products	Known hazards (b)
alpha-Terpinyl acetate (80-26-2)	IFF	15	Air Wick V.I.P. Pre-Poop Spray, Rosy Starlet, Pump Spray ²⁶ Personal Care products such as: Alba Botanica Kids Sunscreen Lotion, Tropical Fruit, SPF 45 ²⁷	None, but there have been no studies for developmental, respiratory hazards and many other endpoints.
alpha-Terpineol (98-55-5)	IFF and Symrise	>50	Personal care products such as Henry Rose Fragrance, Flora Carnivora. ²⁸ Cleaning products such as Tide Heavy Duty Liquid Laundry Detergent. ²⁹	Irritating to the skin, irritating to the eye.
sulfate turpentine, distillation residue	IFF	None	None found	No studies, no hazards associated.

²³ Helping prevent a 'bland world' Chemical company has had a lot of names, but it's been here 100 years October 17, 2011 | Florida Times-Union, The (Jacksonville, FL) Author/Byline: David Bauerlein | Page: B-1 972 Words

²⁴ <https://whatsinproducts.com/chemicals/view/1/319/008006-64-2/Turpentine>

²⁵ https://whatsinproducts.com/types/type_detail/1/16117/standard/p%20class=%22p1%22%3ELysol%20Professional%20Disinfectant%20Deodorizing%20Cleaner%20Concentrate,%20Lemon%20Scent,%20Professional%20Use-04/01/2015/p%3E/18-001-808

²⁶ https://whatsinproducts.com/types/type_detail/1/21126/standard/p%20class=%22p1%22%3EAir%20Wick%20V.I.P.%20Pre-Poop%20Spray,%20Rosy%20Starlet,%20Pump%20Spray-03/22/2018/p%3E/18-030-027

²⁷ https://www.ewg.org/sunscreen/about-the-sunscreens/928590/Alba_Botanica_Kids_Sunscreen_Lotion_Tropical_Fruit_SPF_45/

²⁸ https://www.ewg.org/skindeep/products/970538-Henry_Rose_Fragrance_Flora_Carnivora/

²⁹ https://whatsinproducts.com/types/type_detail/1/22882/standard/p%20class=%22p1%22%3ETide%20Heavy%20Duty%20Liquid%20Laundry%20Detergent-06/24/2019/p%3E/16-033-613

(68938-00-1)				
Oil of turpentine, 30% or greater limonene fraction (65996-99-8)	IFF, Symrise	None	None found	No studies, no hazards associated.
alpha-terpinene (99-86-5)	Symrise	58	Inside the home products such as Febreze Sport Odor Defense Fabric Softener Dryer Sheet. ³⁰	Acute mammalian toxicant.
turpentine (9005-90-7)	Symrise	>300	Dreft Blissfuls In-Wash Scent Booster. ³¹	Possible mammalian toxicant, systemic toxicant.
turpentine oil (8006-64-2)	IFF	>300	Personal care products such as White Cloverine White Petrolatum Salve. ³² Old English Furniture Polish (Reckitt Benckiser), Lysol Cleaner concentrate (RB) and other cleaning and inside the Home products. ³³	Evidence of carcinogenic effects; sensitizing substance; causes skin and eye irritation.

- (a) Number of PubChem listed studies per HBN's Pharos database. <http://www.pharosproject.net>.
(b) As listed in Pharos.

³⁰

https://whatsinproducts.com/types/type_detail/1/23092/standard/div%20id=%22cke_pastebin%22%3EBounce%20+%20Febreze%20Sport%20Odor%20Defense%20Fabric%20Softener%20Dryer%20Sheets-05/11/2017/div%3E/16-033-676

³¹

https://whatsinproducts.com/types/type_detail/1/24288/standard/p%20class=%22p1%22%3EDreft%20Blissfuls%20In-Wash%20Scent%20Booster-03/25/2015r1/p%3E/16-033-863

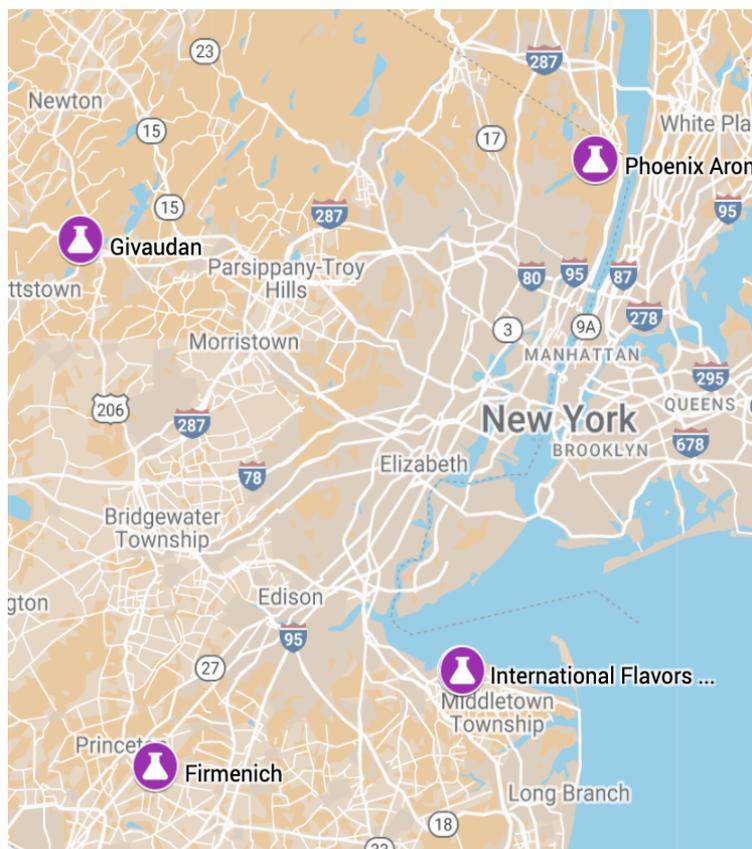
³²

https://www.ewg.org/skindeep/products/515863-White_Cloverine_White_Petrolatum_Salve_2016_formulation/

³³

<https://whatsinproducts.com/chemicals/view/1/319/008006-64-2/Turpentine>

3b. New Jersey Cluster



New Jersey cluster³⁴

- International Flavors and Fragrances Inc. in Hazlet, New Jersey
- Firmenich in Plainsboro, New Jersey
- Givaudan in Budd Lake, New Jersey
- John D. Walsh in Ringwood, New Jersey³⁵
- Phoenix Aromas in Norwood, New Jersey

New Jersey is a fragrance chemical distribution hub. Current trade records reveal substantial imports of toxic chemicals by these plants,

which are consistent with prior Chemical Data Reports (2015 and earlier). For example, IFF in Hazlet, New Jersey, is a major importer of one of the dirty (baker's) dozen chemicals, HHCB or Galaxolide. In 2020, it imported 1,613 tons from its operations in Europe and China. It imported 141 tons of another priority chemical, Lilial, from Europe.

Firmenich's flavor and fragrance operation in Plainsboro, N.J. was out of compliance with the Clean Water Act for 8 of the last 12 quarters. The plant imports fragrance chemicals and manufactures food flavorings. In 2000, a cooking tank at the plant exploded, scalding a worker with third-degree burns.³⁶ Firmenich imports toxic fragrance chemicals including HHCB from IFF in Europe, rose oxide from India, and diethyl phthalate from Italy.

Givaudan in Budd Lake, N.J., imports OTNE from France, limonene from many countries, and galaxolide from India.

³⁴ Link to this map:

https://www.google.com/maps/d/u/0/viewer?mid=1BRj1d-BE5H_51q_IsF86imNbTDW6NX4b&ll=40.52898162143419%2C-139.974108&z=2

³⁵ John D. Walsh's location is right across the street from IFF and can't be differentiated in the scale used for this map.

³⁶ https://www.osha.gov/pls/imis/accidentsearch.accident_detail?id=170851612

John D. Walsh in Ringwood, N.J., is a major importer of fragrance chemicals. It stores and distributes chemicals from Asia, Latin America, and Europe. It imports lialial and rose oxide from India, and gamma terpinene from Europe, for example.

Phoenix Aromas of Norwood, N.J., also provides raw materials to fragrance manufacturers. It imports galaxolide (HHCB) from China, lialial from Europe, OTNE from the U.K., and rose oxide from India.

4. Use Cases

Fragrance chemicals are used in different consumer goods, in products designed to expose people to them. This research memo focuses on toxic fragrances used in intimate care, cleaning products and other articles to be used inside the home.

A spreadsheet developed for this project cross-references known chemicals of concern with use in these products and is available here:

<https://docs.google.com/spreadsheets/d/1bb0j7OshuDtWXcDnhYg4vnNaZqIAmu1bbBUJfZbMo4Y/edit#gid=2115989064>. A simplified list of this cross-referencing exercise may be of interest for public use.



Each of the 46 priority chemicals of concern are used in one of the above categories of products.

Just as an example, different Lysol disinfectant products manufactured by Reckitt Benckiser, use over a dozen fragrance chemicals of concern. A single product such as “Lysol Professional Disinfectant Spray, Lavender, Aerosol, Professional Use” contains hexyl cinnamal, d-limonene, eugenol, linalool, lialial, ambroxide and tert-butyl alcohol.³⁷ The Lysol factory in New Jersey is profiled in our companion brief on quaternary ammonium compounds in disinfectants.

Some of these chemicals may be used in other relevant products but are not disclosed due to the common practice of concealing chemical identities under the phrase, “fragrances.”

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https://whatsinproducts.com/types/type_detail/1/21904/standard/p%20class=%22p1%22%3ELysol%20Professional%20Disinfectant%20Spray,%20Lavender,%20Aerosol,%20Professional%20Use-01/05/2017/p%3E/18-030-108



Toxic fragrances are frequently used in intimate care products. As an example, the “ALWAYS Radiant Extra Heavy Flow Sanitary Pads Size 3 Light Clean Scent With Wings” contains 15 different fragrance chemicals, including limonene, hexyl cinnamal, ethyl linalool and geranyl acetate.³⁸



The product Arm & Hammer Clean Scentsations, In-Wash Scent Booster, Sun-Kissed Flowers contains about 6 of the list of chemicals of concern including galaxolide, hexyl cinnamal, hamber/OTNE, linalool, octinoxate and d-limonene.³⁹

³⁸ <https://smartlabel.pg.com/00037000765028.html>

³⁹

https://whatsinproducts.com/types/type_detail/1/23286/standard/div%20id=%22cke_pastebin%22%3EArm%20&Hammer%20Clean%20Scentsations.%20In-Wash%20Scent%20Booster.%20Sun-Kissed%20Flowers-08/09/2018/div%3E/03-005-301

Appendix 1. Priority fragrance chemicals for avoidance

The International Fragrance Association, IFRA, discloses the so-called IFRA Transparency List, which is “an ordered register of all fragrance ingredients used in consumer goods by the fragrance industry’s customers worldwide.”⁴⁰ As per February 2022, that list included 3,999 chemicals.

Of those chemicals, only a few have been thoroughly studied in relation to their health effects and to their environmental fate and potential impacts. Some have, however, been included in different government lists of chemicals of concern as new evidence arises on their health and ecological impacts.

The following table lists 46 chemicals with known or suspected human health and environmental impacts.

CAS number	Chemical Name	Known health and environmental hazards
138-86-3 / 5989-27-5	(d)-Limonene (Syn. limonene, dipentene)	Asthmagen; Sensitizing substance; may cause skin and eye irritation; toxic to aquatic life, asthmagen (AOEC)
68155-67-9	1-(1,2,3,4,6,7,8,8a-octahydro-2,3,8,8-tetramethyl-2-naphthyl)ethan-1-one	Bioaccumulative; may cause an allergic skin reaction
68155-66-8	1-(1,2,3,5,6,7,8,8a-octahydro-2,3,8,8-tetramethyl-2-naphthyl)ethan-1-one	Bioaccumulative; may cause an allergic skin reaction; chronic aquatic toxicity
99-87-6	1-ISOPROPYL-4-METHYLBENZENE (syn. p-cymene, paracymene)	Skin and eye irritant; toxic to aquatic life
3738-00-9	1,5,5,9-Tetramethyl-13-oxatricyclo (8.3.0.0.(4.9))tridecane (Syn. Ambroxan, Ambroxide--CAS # 6790-58-5)	Bioaccumulative
101-86-0	2-(PHENYLMETHYLENE)OCTANAL (Syn. Hexyl Cinnamal, Hexyl Cinnamic Aldehyde)	Allergen; causes skin irritation; may cause allergic skin reaction. EU Fragrance allergen
122-40-7	2-benzylideneheptanal	Very toxic to aquatic life; sensitizing substance; causes skin irritation, EU Fragrance allergen
118-58-1	2-HYDROXYBENZOIC ACID, PHENYLMETHYL ESTER (Syn. Benzyl Salicylate)	Allergen, Potential endocrine disruptor; contact sensitizer; causes serious eye irritation, EU Fragrance allergen

⁴⁰ <https://ifrafragrance.org/priorities/ingredients/ifra-transparency-list>

104-54-1	2-PROPEN-1-OL, 3-PHENYL- (Syn. Styrene, Cinnamic alcohol Cinnamic alcohol (natural) CINNAMYL ALCOHOL)	Sensitizing substance, EU Fragrance allergen
90480-35-6	2,6-Octadienal,3,7-dimethyl-, acid-isomerized (Syn. Citrylal?)	Suspected of damaging fertility; Potential concern for skin and eye irritation.
127-51-5	3-BUTEN-2-ONE,3-METHYL-4-(2,6,6-TRIMETHYL-2-CYCLOHEXEN-1-YL)-	Causes skin irritation, EU Fragrance allergen
13466-78-9	3-Carene	Very toxic to aquatic life; asthmagen; causes skin irritation; may cause allergic skin reaction, asthmagen (AOEC)
68039-49-6	3-Cyclohexenene-1-carboxaldehyde, 2,4-dimethyl	Skin and eye irritant.
78-69-3	3,7-dimethyl-3-octanol	Causes serious eye irritation
7785-26-4	alpha-pinene	Skin and eye irritant; Toxic if swallowed.
123-69-3	Ambrettolide, (Z)-Oxacycloheptadec-8-en-2-one	Bioaccumulative
105-13-5	Anise alcohol	Corrosive to ocular tissue; contact sensitizer; harmful if swallowed, EU Fragrance allergen
100-51-6	Benzyl alcohol	Allergen. Harmful if swallowed. Causes skin and eye irritation. EU Fragrance allergen
128-37-0	Butylated hydroxytoluene	Endocrine disruptor
5392-40-5	Citral/Geraniol	Causes skin irritation; may cause an allergic skin reaction; toxic to aquatic life, EU Fragrance allergen
106-23-0	Citronellal	Contact sensitizer; skin and eye irritant
106-22-9	Citronellol	Allergen; Contact sensitizer; irritating to the skin, EU Fragrance allergen
91-64-5	COUMARIN	Toxic if swallowed; contact sensitizer; irritating to the skin, EU Fragrance allergen
84-66-2	Diethyl phthalate (DEP)	Endocrine disruptor; may cause allergic skin reaction
131-11-3	Dimethyl Phthalate	skin irritant, acute mammalian toxicity, eye irritant, very persistent
141-43-5	Ethanolamine	Potential endocrine disruptor; sensitizing substance; asthmagen; causes severe skin burns and eye damage, asthmagen (AOEC)
97-53-0	EUGENOL	Sensitizing substance; may cause skin and eye irritation, asthmagen (AOEC), EU Fragrance allergen
1222-05-05	Galaxolide (Syn. Musk Yinghai)	Suspected of damaging fertility; developmental toxicity; endocrine disruption; aquatic to marine life.
99-85-4	gamma-terpinene	May be fatal if swallowed
106-24-1	Geraniol	Allergen; Causes skin and eye irritation; sensitizing substance. EU Fragrance allergen
107-75-5	Hydroxycitronellal	Sensitizing substance; causes serious eye irritation, EU Fragrance allergen
97-54-1	Isoeugenol	Potential endocrine disruptor; harmful if swallowed;

		sensitizing substance; cause skin irritation; causes serious eye irritation, EU Fragrance allergen
80-54-6	Lilial	May damage fertility; potential endocrine disruptor; skin and eye irritant; allergen; may cause allergic skin reaction; harmful if swallowed; toxic to aquatic life; persistent. EU Fragrance allergen,
78-70-6	Linalool	Allergen; Skin and eye irritant; may cause allergic skin reaction, EU Fragrance allergen
115-95-7	Linalyl acetate	Causes skin and eye irritation; may cause an allergic skin reaction; toxic to aquatic life
91-51-0	methyl 2-[[3-[4-(1,1-dimethylethyl)phenyl]-2-methyl propylidene]amino]benzoate (Syn. Lilial-methylanthranilate, Schiff's base, Verdantiol)	Bioaccumulative.
119-36-8	Methyl salicylate	Asthmagen (AEOC); Potential endocrine disruptor; skin and eye irritant
123-35-3	Myrcene	Suspected of damaging fertility; skin and eye irritant.
106-25-2	Nerol	Causes serious eye damage; causes skin irritation; may cause allergic skin reaction
5466-77-3	Octinoxate	Endocrine disruptor
54464-57-2	OTNE (Isocyclemonone E / Hamber / Anthamber/ Sylvamber/ Iso E Super / Timbersilk)	Bioaccumulative; may cause allergic skin reaction.
57-55-6	Propylene glycol	Potential endocrine disruptor
75-65-0	TERT-BUTYL ALCOHOL	Causes serious eye irritation/damage; harmful if inhaled; may cause respiratory damage; persistent; highly flammable, EU Fragrance allergen
16409-43-1	tetrahydro-4-methyl-2-(2-methylprop-1-enyl)pyran (Syn. Rose Oxide)	Potential skin and eye irritant.
21145-77-7	Tonalide/Tonalid	Potential endocrine disruptor; harmful if swallowed
102-71-6	Trolamine	Potential endocrine disruptor; may cause an allergic skin reaction; skin irritant; serious eye irritant; asthmagen (AEOC)
8006-64-2	Turpentine oil	Asthmagen (AOEC); evidence of carcinogenic effects; sensitizing substance; causes skin and eye irritation

Appendix 2. Fragrance factory and warehouse chemical incidents

Fragrance chemicals frequently explode and burst into flames in warehouses and factories and during transportation. Coming Clean notes, “Stronger federal prevention rules, especially requirements to switch to safer chemicals and technologies when available, could help prevent future disasters.”

Two of the key facilities researched for this brief have Risk Management Plans. IFF and Symrise in Jacksonville store chlorine compounds such as hydrogen chloride, Phosphorus trichloride and/or chlorine gas.

More than 200,000 people live within 3-miles of the U.S. fragrance factories profiled in this research memo.

Fragrance Facility	Population within 3-miles radius
International Flavors and Fragrances, Jacksonville, Florida	29,520 ⁴¹
International Flavors and Fragrances, Hazlet, New Jersey	66,738 ⁴²
Symrise, Jacksonville, Florida	69,738 ⁴³
Florachem, Jacksonville, Florida	7,716 ⁴⁴
Givaudan, Budd Lake, New Jersey	20,831 ⁴⁵
John D. Walsh, Ringwood, New Jersey	8,211 ⁴⁶
Phoenix Aromas, Norwood, New Jersey	50,537 ⁴⁷

⁴¹ EJ Screen results based on 3 miles Ring Centered at 30.34774,-81.7494

<https://ejscreen.epa.gov/mapper/>

⁴² EJ Screen results based on 3 miles Ring Centered at 40.43576610779392, -74.15936799046166

<https://ejscreen.epa.gov/mapper/>

⁴³ EJ Screen results based on 3 miles Ring Centered at 30.380132, -81.664311

<https://ejscreen.epa.gov/mapper/>

⁴⁴ EJ Screen results based on 3 miles Ring Centered at 30.42636199959669, -81.57589308709402

<https://ejscreen.epa.gov/mapper/>

⁴⁵ EJ Screen results based on 3 miles Ring Centered at 40.907034 -74.731248

<https://ejscreen.epa.gov/mapper/>

⁴⁶ EJ Screen results based on 3 miles Ring Centered at 41.123296, -74.276247

<https://ejscreen.epa.gov/mapper/>

⁴⁷ EJ Screen results based on 3 miles Ring Centered at 40.993609, -73.954141

<https://ejscreen.epa.gov/mapper/>

TOTAL POPULATION	253,291
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Summaries of Some Recent Incidents Worldwide

Dec. 16, 2021

[Fire at a “perfume and plastics” factory in Palghar, India](#)

Loud noises, which were thought to be bursting drums of chemicals, occurred after a fire broke out at an unnamed factory that was reported to produce plastics and perfumes. The fire leveled about 20 nearby dwellings and 10 to 15 warehouses, also known as godowns.



Nov. 6, 2021

[Fire at Perfume Factory, Umm Al Quwain, United Arab Emirates](#)

A [video](#) released by the United Arab Emirates on Instagram revealed thick black smoke billowing from a fire at a perfume factory in the Umm Al Thuob industrial area. [Swiss Perfume Industries](#) is listed as one perfume factory operating in this area. This was the second recent perfume factory fire at Umm Al Thuob. (See August 23, 2016)

January 4, 2021

[Fire at International Flavors and Fragrances Plant, Rockland, Maine](#)

“A product overheated” and workers became overcome by fumes and called in firefighters to help out. The plant is a [merger](#) of DuPont’s Nutrition and Biosciences division and IFF in 2019 and is part of IFF’s Nourish brand, which is part of its food and beverage segment.

January 28, 2020

[Explosion and fire, 11 people killed, at a perfume factory in Pakistan](#)

Among the dead were two women as well as two children, ages six and nine. Local residents were shocked to learn of the presence of the perfume factory stating they thought the building was used for textile manufacturing. “We only got to know about the presence of perfume and other chemicals after the fire broke out,” said a neighbor. The incident occurred when gas cylinders at the facility exploded.

March 11, 2019

[Workers hospitalized in “chemical mishap”, Ungerer & Company \(now Givaudan\), Bethlehem, Pennsylvania](#)

Three employees of the Ungeree flavor and fragrances factory were hospitalized in a “chemical mishap.” The incident followed an OSHA investigation that led to \$64,530 fine. The agency determined that workers were exposed to hydrogen sulfide at rates 14 times above allowed. OSHA said Ungerer had “No developed emergency response plan; a lack of proper engineering controls; no maintenance of safety records; inadequate safety features on a mobile ladder stand; and a lack of explosion protection or suppression systems on a device that collects combustible dust.” The violations carry a \$63,450 fine. Ungerer & Company produces flavors, fragrances and essential oils. In February 2020, Givaudan completed its [acquisition](#) of Ungerer.

August 31, 2018

[Exploding Axe body spray, Interstate 35, Belton, Texas](#)

A truck transporting the highly flammable body spray, Axe, caught fire and exploded causing part of the roadway to be “reduced to the consistency of gravel” shutting down the roadway for eight hours. “Spray cans were launched in both directions of I-35.” It was reported that sections of the roadway would likely need to be replaced after the incident.



Truck carrying Axe body spray explodes in Texas: bit.ly/2wyVdfe



8:15 PM · Aug 31, 2018 · TweetDeck

April 27, 2018

[Massive blaze, Privi Organics, Mahad, India](#)

No one was injured but a massive blaze destroyed a fragrance factory in India. It was reported that general manager [Gokarnam Erankai](#) was most likely responsible for saving many workers' lives by alerting people on break in a cafeteria to evacuate the building. Privi Organics is a major supplier of aroma chemicals to Givaudan, Procter & Gamble, Firmenich, IFF Chemical Holdings and Phoenix Aromas, according to Datamyne shipping records.

March 27, 2018

[Fire, Ungerer & Company, Chester, United Kingdom](#)

It took fire crews over three hours to control a fire at the perfume factory, which was reported to be caused when a forklift truck caught on fire in the loading area. In February 2020 Givaudan completed its [acquisition](#) of Ungerer

November 20, 2017

[One killed, more than 125 injured in explosion, Verla International, Windsor, New York](#)

A pair of explosions, which were deemed by fire officials to be accidentally initiated by static electricity igniting flammable liquid, killed one employee and left more than 100 other injured. However an OSHA investigation revealed that the company “failed to properly dispense flammable liquids and did not properly dispose of combustible waste material on the day” of the incident. The agency proposed the company pay \$281,220 in fines. Verla is a private-label producer of cosmetics, fragrances and nail polish, according to the company;s [website](#).

November 10, 2017

[Fire, BASF SE, Ludwigshafen, Germany](#)

A fire at BASF's headquarters in Germany forced the company to conduct a force majeure regarding its citral and isoprenol-based chemical products, which are used in flavoring and fragrances. In 2020 BASF SE exported over 85 tons of citral to US fragrance company Givaudan.

November 8, 2017

[Five injured in an explosion, fire, Desert Whale Jojoba Company, Tucson, Arizona](#)

Five workers were hospitalized after an explosion caused a gas line to break fueling a massive fire. “Fire crews did encounter problems when fighting the flames including power lines, a broken gas line, a broken fire sprinkler line and a partial building collapse.” Desert Whale provides jojoba oils as a substitute for sperm whale oil for the personal care and cosmetic industries, according to the company [website](#).

September 20, 2017

[One person killed, schools evacuated, cosmetics warehouse explosion, Karachi, Pakistan](#)

A watchman was killed and another person was wounded when an explosion ripped through a cosmetics warehouse. The warehouse, also known as a godown, was located in the basement of a multi-story building, which became totally engulfed in flames. “The blast, which occurred before the fire spread, caused windows of nearby buildings to shatter and an adjoining wall of a school to collapse. People rushed out of their houses and offices in horror and the nearby school was evacuated.”

A manager for the warehouse denied any responsibility for the explosion, blaming it on a possible terrorist attack. However, experts from the bomb squad, which investigated

the scene, stated: "We have examined the entire site but could not find any trace of explosive material, suggesting that [the incident] occurred due to the presence of chemicals inside the warehouse".

April 12, 2017

[Explosion, Elan Foods Extracts and Ingredients, Newark, NJ](#)

According to authorities, an explosion occurred when a 900 gallon tank of methyl anthranilate was mixed with hydrogen. [Methyl anthranilate](#) is commonly used in the manufacture of synthetic perfumes. Elan produces chemicals for the flavor, fragrance, personal care, pharmaceutical and petrochemical industries, according to the company [website](#).

March 4, 2017

[Fire, perfume factory at Kinrara Industrial Park, Bandar Kinrara, Puchong, Malaysia](#)

At the time a spokesperson stated, "about 50% of the factory have been razed by the fire and no casualties were reported. A video of the fire can be seen here:

<https://www.facebook.com/watch/?v=1934302290173708>.

August 23 2016

[Fire destroys perfume factory, Umm al Quwain, U.A.E.](#)

A reported 400 people from a fragrance factory and surrounding area were evacuated while the unnamed factory was destroyed by the fire. There were no injuries reported.

July 28, 2015

[Numerous Safety Hazards, Contract Filling perfume factory, Cedar Grove, New Jersey](#)

OSHA announced it fined Contract Filling Inc., a Cedar Grove, N.J. perfume factory, \$50,000 for eight serious violations that exposed workers exposed to fire and explosion hazards."The company was using flammable liquids above the threshold quantities that could present a potential for a catastrophic event," according to the agency. "The numerous safety hazards found at Contract Filling's facility exposed employees to the dangers of potentially fatal fires, which is unacceptable," said Kris Hoffman, OSHA's area director in Parsippany. "This company must strengthen and improve its chemical safeguards to prevent a life-threatening incident."

September 13, 2014

[Fire, two injuries, Rowayton Trading Company, Bridgeport, Connecticut](#)

A five-alarm fire at a facility that housed industrial fragrances destroyed two buildings It was reported, "the sidewalk was stained with blood-like blotches of perfume."

Deputy Fire Chief Dominick Carfi said it was “almost a miracle” the homes didn't burn.



“The potential was for disaster.”

The fire, which left two firefighters injured, caused authorities to call for a [fishing ban](#) after it was discovered that 55,000 gallons of unidentified chemicals were housed in the Rowayton plant and that some had [leaked into the Long island Sound](#). A week after the incident, the [CTPost reported](#): “(A) five-alarm blaze literally blew the lid off what, intentionally or not, had been the Rowayton Trading Co.'s quiet operation as purveyors of pigments, fragrance oils, dyes and other materials to manufacturers worldwide. Hundreds of metal drums of chemicals burst, accompanied by loud booms and fireballs, turning the dense residential neighborhood into what some witnesses described as a war zone... (A)ccording to city officials, firefighters arrived on the scene at 6:45 p.m., but did not have good data on whether there might be hazardous substances inside until the owner showed up around 9:30 p.m.... Rowayton's owner, Carl Westhella, did not return requests for comment for this story. But in a brief interview following the disaster, Westhella said the drums held ‘concentrated fragrance oils.’

According to import records Rowayton Trading imported over 17 tons of [Mirasil CM5](#) in 2014, the earliest year available for import data.

May 31, 2013

[Explosion, fire, two injured, at Ungerer & Company, Bethlehem, Pennsylvania](#)

A 55 gallon barrel of ethanol exploded, injuring 2 employees and starting a fire which was reported to have burned [potpourri](#) manufactured at the plant. According to one [local report](#): “There were initial reports of hazardous materials inside the building and that several people on the scene had to be decontaminated.” Highly flammable ethanol, also known as “perfumer’s alcohol” is used as a carrying agent to dilute fragrances.