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# HIDDEN AND HAZARDOUS CHEMICALS IN EVERYDAY CONSUMER PRODUCTS

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# OVERVIEW OF PRESENTATION

- WHAT ARE THE HIDDEN HAZARDS?
  - WHY DON'T WE KNOW ABOUT THESE?
  - WHAT CAN WE DO TO REDUCE THE RISKS AND HEALTH EFFECTS?
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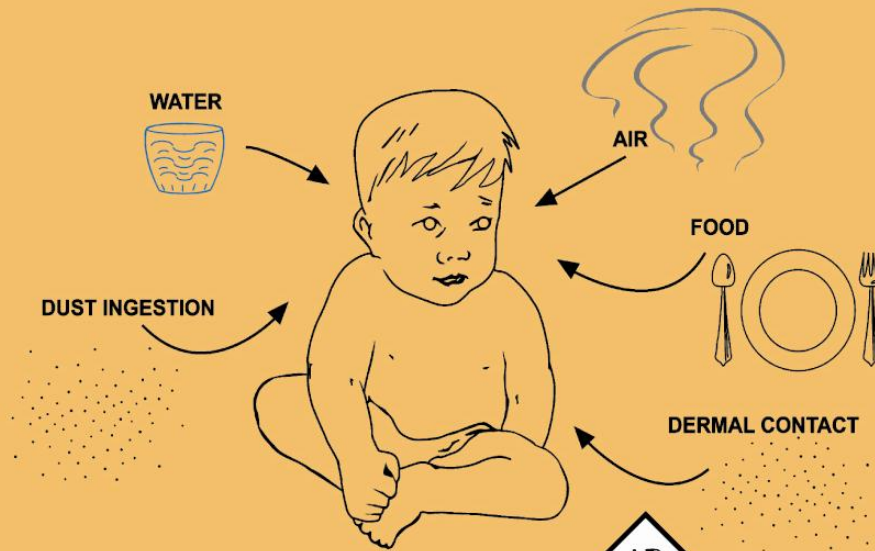
# THE SCIENCE AND TECHNOLOGY OF EXPOSURE ASSESSMENT

**EXPOSURE SCIENCE:** MEASURING WHAT, WHERE,  
WHEN, AND HOW POLLUTANTS REACH HUMANS  
AND THE ENVIRONMENT

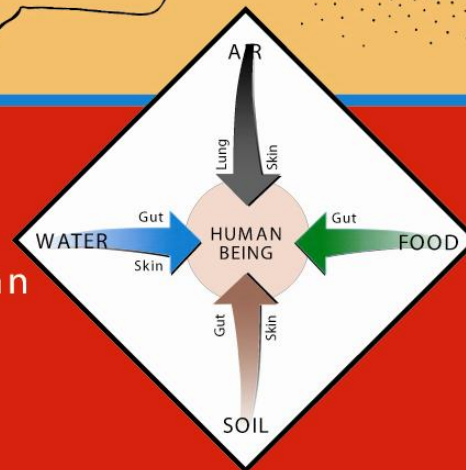
- PERSONAL EXPOSURE MONITORS
- POLLUTANT MONITORS
- BIOMONITORING
- CHEMICAL ANALYSIS



# EXPOSURE ANALYSIS



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# **HUMAN EXPOSURE STUDIES: SURPRISING RESULTS**

- WE ARE REGULARLY EXPOSED TO NUMEROUS HAZARDOUS CHEMICALS, AND CARRY MANY OF THEM IN OUR BODIES.
  - MOST OF THESE HAZARDOUS CHEMICALS COME FROM SOURCES THAT ARE CLOSE TO US.
  - BUT THESE SOURCES ARE LARGELY UNREGULATED—AND TOXIC CHEMICALS ARE NOT DISCLOSED ON PRODUCT LABELS OR MSDSs.
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# PRIMARY SOURCES: CONSUMER PRODUCTS

- AIR FRESHENERS, DEODORIZERS, SPRAYS, AND PLUG-INS
- LAUNDRY SUPPLIES (DRYER SHEETS, FABRIC SOFTENERS, DETERGENTS)
- DISINFECTANTS, CLEANSERS, AND ANTI-BACTERIAL PRODUCTS
- DISHWASHING DETERGENTS
- CLEANING PRODUCTS (WINDOW, FLOOR, SINK, CARPET, ALL-PURPOSE)
- COLOGNES, AFTER-SHAVES, PERFUMES, DEODORANTS
- PERSONAL CARE PRODUCTS (SHAMPOOS, CONDITIONERS, SOAPS, LOTIONS)
- HAIR SPRAYS AND GELS
- COSMETICS
- ESSENTIAL OILS
- DRY-CLEANED CLOTHES
- PESTICIDES, INSECTICIDES, AND HERBICIDES
- SCENTED CANDLES



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# TOXIC CHEMICALS FROM HOUSEHOLD CONSUMER PRODUCTS IN STORMWATER, WASTEWATER, AND PUGET SOUND

## ▪RESEARCH AND ANALYZE

- SOURCES OF CHEMICALS THAT ARE HAZARDOUS, EVEN AT LOW LEVELS
- PRESENCE IN SURFACE WATERS, WASTEWATERS, AND WATER BODIES
- ADVERSE EFFECTS

## ▪PROVIDE SOLUTIONS

- PUBLIC EDUCATION ABOUT CHEMICALS IN CONSUMER PRODUCTS AND LESS TOXIC ALTERNATIVES
- POLLUTANT REDUCTION PROGRAMS TO REDUCE COSTS AND HEALTH EFFECTS ON HUMANS AND AQUATIC SYSTEMS (E.G., PUGET SOUND)



# HOUSEHOLD PRODUCT CHEMICALS IN WATER SYSTEMS

Personal care products go down the drain during bathing and showering



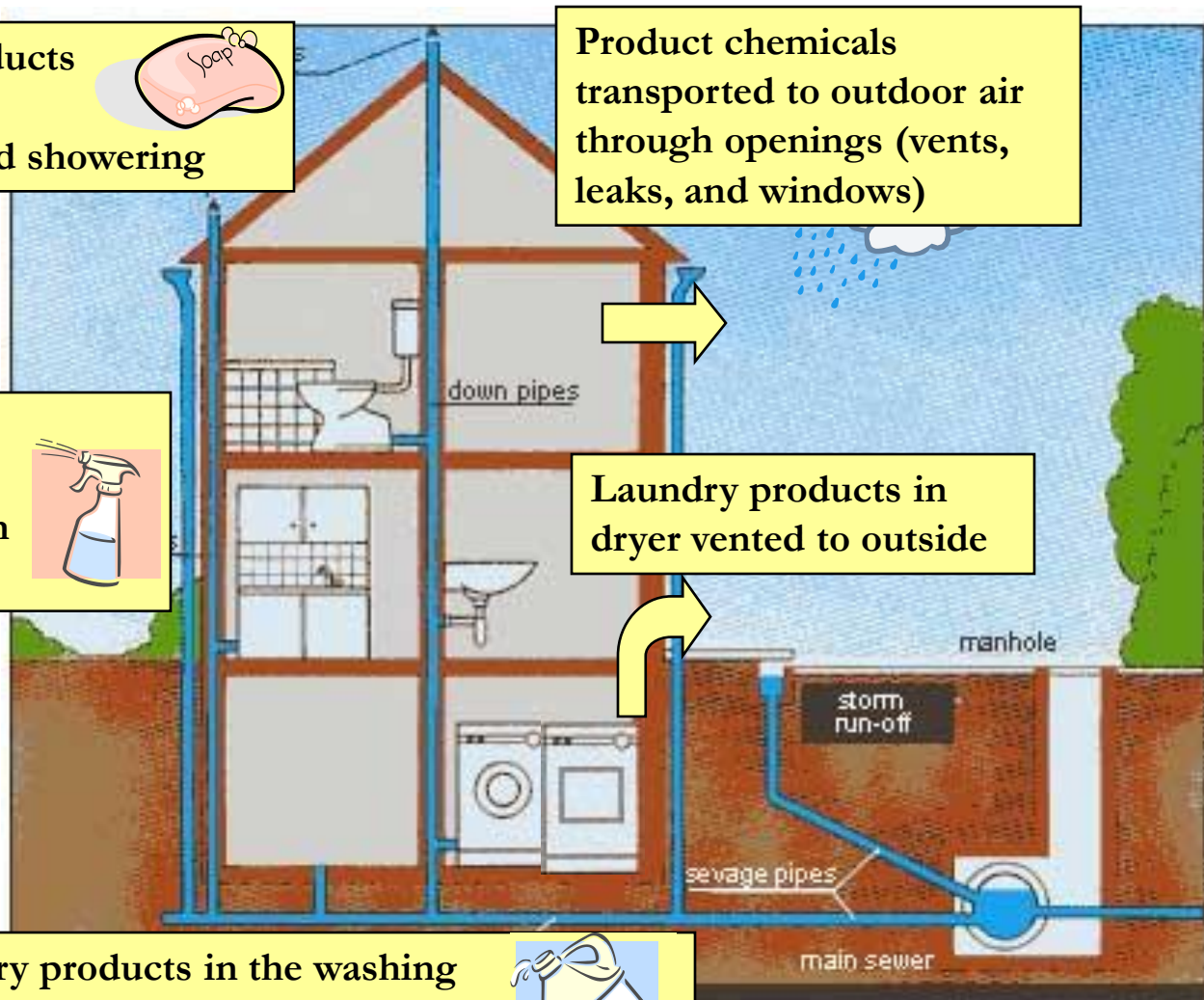
Product chemicals transported to outdoor air through openings (vents, leaks, and windows)

Cleaning products in kitchen and bathroom go down the drain



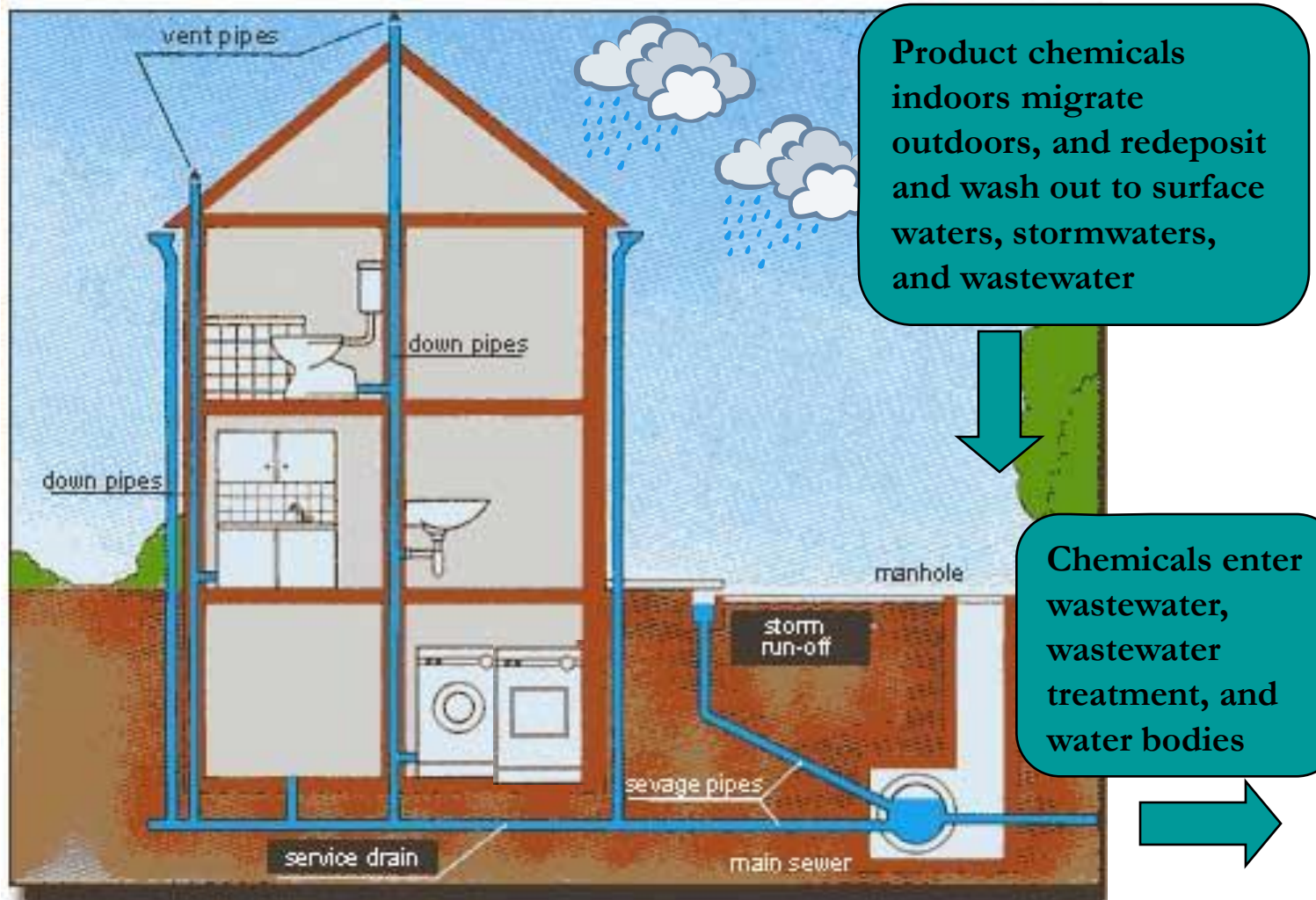
Laundry products in dryer vented to outside

Laundry products in the washing machine, and product chemicals on clothing, go down the drain





# HOUSEHOLD PRODUCT CHEMICALS IN WATER SYSTEMS



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# **ANALYTIC APPROACH**

**CHEMICAL ANALYSIS, USING GAS CHROMATOGRAPHY-MASS SPECTROMETRY, OF VOLATILE ORGANIC COMPOUNDS (VOCs) AND SEMI-VOLATILE ORGANIC COMPOUNDS (SVOCs) IN**

- FRAGRANCED CONSUMER PRODUCTS
  - PRODUCT EMISSIONS AND EFFLUENTS FROM HOUSEHOLDS
  - STREAMS AND RIVERS
  - STORMWATER
  - WASTEWATER
  - WASTEWATER EFFLUENT
  - PUGET SOUND
-

# CHEMICAL ANALYSIS OF FRAGRANCED CONSUMER PRODUCTS

## PRODUCTS INCLUDE:

- AIR FRESHENERS
- DEODORIZERS
- LAUNDRY DETERGENTS
- DISHWASHING DETERGENTS
- FABRIC SOFTENERS
- DRYER SHEETS
- SHAMPOOS
- SOAPS
- LOTIONS
- CLEANING SUPPLIES
- ANTIPERSPIRANTS
- HAND SANITIZERS



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# WHAT IS A “FRAGRANCE”?

- SEVERAL DOZEN TO SEVERAL HUNDRED CHEMICALS
  - PRIMARILY SYNTHETIC CHEMICALS, DERIVED FROM PETROLEUM
  - MANY CLASSIFIED AS TOXIC OR HAZARDOUS
  - BUT NONE NEED TO BE TESTED OR DISCLOSED
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# FRAGRANCED PRODUCTS: HUMAN HEALTH EFFECTS

- HEADACHES
  - FEVERS
  - COGNITIVE DIFFICULTIES
  - LETHARGY
  - DIZZINESS
  - SORE THROAT
  - CONGESTION
  - NAUSEA
  - BLURRY VISION
  - ASTHMA ATTACKS
  - MEMORY LOSS
  - JOINT AND MUSCLE PAIN
  - GASTROINTESTINAL PROBLEMS
  - RASHES
  - THYROID DYSFUNCTION
  - IMMUNE SYSTEM WEAKENED
  - BREATHING DIFFICULTIES
  - SEIZURES
  - LOSS OF CONSCIOUSNESS
  - VOCATIONAL DISABILITY
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# FRAGRANCED PRODUCTS: HUMAN HEALTH EFFECTS

**STUDIES FOUND 31%-33% OF AMERICANS EXPERIENCE  
ADVERSE HEALTH EFFECTS FROM SCENTED PRODUCTS.**

- AIR FRESHENERS CAUSE BREATHING DIFFICULTIES AND HEADACHES

ENTIRE POPULATION: 19.0%

ASTHMATICS: 33.5%

- SCENTED LAUNDRY PRODUCTS CAUSE ADVERSE HEALTH EFFECTS

ENTIRE POPULATION: 10.9%

ASTHMATICS: 21.2%

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# **FRAGRANCED PRODUCTS: IMPLICATIONS FOR WATER SYSTEMS**

## **CHEMICALS ENTER AND PERSIST IN SURFACE WATERS, WASTEWATER, AND WATER BODIES**

- COMMONLY FOUND IN WATER SOURCES AND DRINKING WATER
- ALSO FOUND BEFORE AND AFTER WASTEWATER TREATMENT
- DIFFICULT AND COSTLY TO REMOVE, ONCE IN ENVIRONMENT

## **FRAGRANCE COMPOUNDS HARM AQUATIC LIFE**

- DAMAGE BIOLOGICAL DEFENSE MECHANISMS
- DISRUPT ENDOCRINE AND REPRODUCTIVE SYSTEMS, EVEN AT LOW CONCENTRATIONS

## **FRAGRANCE CHEMICALS AFFECT OTHER USES**

- RECLAIMED WATER FOR IRRIGATION OR DRINKING WATER
  - BIOSOLIDS FOR FERTILIZER
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# RESULTS OF ANALYSIS

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# FRAGRANCED PRODUCT CHEMICALS AND TOXIC EFFECTS

Compound	Neuro	Resp	Cancer	Gast/ Liver	Kidney	Cardio	Dev	Repro	Skin/ Sense	Endo	Immun
ACETALDEHYDE	√	√	√		√		√		√		√
ACETONE	√	√		√	√	√			√		
BENZALDEHYDE	√	√		√	√				√		
BENZYL ACETATE	√	√		√	√						
TERT-BUTYL ALCOHOL	√				√		√				
BUTANAL		√							√		
2-BUTANONE	√	√		√	√	√	√	√	√		
2-BUTOXY ETHANOL	√	√		√	√	√	√	√	√	√	
1-BUTOXY-2-PROPANOL	√										
CAMPHOR	√	√		√					√		
CHLOROMETHANE	√	√		√	√	√	√	√	√		
CUMENE	√			√					√		
CYCLOHEXANE	√										
N,N-DIMETHYL ACETAMIDE	√			√					√		
1,4-DIOXANE	√	√	√	√	√	√			√		√

Neuro = Neurotoxicant, Resp = Respiratory toxicant, Cancer = Carcinogen, Gast/Liver = Gastrointestinal or liver toxicant, Kidney = Kidney toxicant, Cardio = Cardiovascular or blood toxicant, Dev = Developmental toxicant, Repro = Reproductive toxicant, Skin/Sense = Skin or sense organ toxicant, Endo = Endocrine toxicant, Immun = Immunotoxicant

SOURCE: NATIONAL LIBRARY OF MEDICINE'S TOXICOLOGY DATA NETWORK (TOXNET®)

# FRAGRANCED PRODUCT CHEMICALS AND TOXIC EFFECTS

Compound	Neuro	Resp	Cancer	Gast/ Liver	Kidney	Cardio	Dev	Repro	Skin/ Sense	Endo	Immun
ETHANOL	√	√		√	√	√	√	√	√	√	
ETHYL ACETATE	√	√							√		
FORMALDEHYDE	√	√	√	√				√	√		√
N-HEPTANAL	√										
N-HEXANE	√	√					√	√			
ISOAMYL ACETATE	√										
ISOPROPYL ALCOHOL	√	√		√	√	√	√		√		
METHANOL	√	√		√	√		√	√	√	√	
METHYL BENZOATE	√			√					√		
5-METHYL-3-HEPTANONE	√										
METHYLENE CHLORIDE	√	√	√	√	√	√		√		√	
O, M, OR P-CYMENE	√	√				√					
α-PINENE	√	√							√		
P-XYLENE	√	√		√	√	√	√	√	√		√

Neuro = Neurotoxicant, Resp = Respiratory toxicant, Cancer = Carcinogen, Gast/Liver = Gastrointestinal or liver toxicant, Kidney = Kidney toxicant, Cardio = Cardiovascular or blood toxicant, Dev = Developmental toxicant, Repro = Reproductive toxicant, Skin/Sense = Skin or sense organ toxicant, Endo = Endocrine toxicant, Immun = Immunotoxicant

SOURCE: NATIONAL LIBRARY OF MEDICINE'S TOXICOLOGY DATA NETWORK (TOXNET®)

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# FABRIC SOFTENER: LISTED INGREDIENTS

## LISTED ON LABEL:

BIODEGRADABLE FABRIC SOFTENING AGENTS  
(CATIONIC)

## LISTED ON MSDS:

NONIONIC AND CATIONIC FABRIC SOFTENING AGENTS

PERFUME

COLORANT

QUALITY CONTROL AGENTS

HAZARDOUS INGREDIENTS: NONE LISTED

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# FABRIC SOFTENER:

## OTHER LANGUAGE ON LABEL:

“I REMEMBER THE SMELL OF SHEETS WHEN MY MOM TUCKED ME INTO BED, AND THE SMELL OF HER SHIRT WHEN SHE LEANED IN FOR A GOOD-NIGHT KISS; LIGHT, FLORAL, AND FAMILIAR AS HOME.”



# FABRIC SOFTENER: ACTUAL CHEMICALS

**ETHANOL**

**D-LIMONENE**

**METHOXY ETHANE**

**$\alpha$ -PINENE**

**BENZYL ACETATE**

**ISOCINEOLE**

**$\beta$ -PINENE**

**2-METHOXY PROPANE**

**LINALOOL**

**(Z)-3,4-DIMETHYL-3-HEXEN-2-ONE**

**\*CHLOROMETHANE**

**GAMMA-TERPINENE**

**COELUTED WITH 2,7-DIMETHYL-2,7-OCTANEDIOL**

**\*ACETALDEHYDE**

**2,4-DIMETHYL-1,3-CYCLOPENTANEDIONE**

**3-METHYL-2-BUTEN-1-OL ACETATE**

**$\alpha$ -TERPINOLENE**

**DIETHOXY METHANE**

**1,5-DIMETHYL-1,4-CYCLOHEXADIENE**

**1-METHYLTRICYCLO[2.2.1.0(2,6)]-HEPTANE**

**$\alpha$ -TERPINENE**

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# BAR SOAP: LISTED INGREDIENTS

LISTED ON LABEL:

NO INGREDIENTS LISTED

LISTED ON MSDS:

NO INGREDIENTS LISTED

HAZARDOUS INGREDIENTS: NONE LISTED

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# BAR SOAP:

## OTHER LANGUAGE ON LABEL:

“99 44/100% PURE. SIMPLE. NATURALLY CLEAN. LEAVES YOUR SKIN FEELING NATURALLY CLEAN. CONTAINS NO DYES OR HEAVY PERFUMES OR LOTIONS.”



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# BAR SOAP: ACTUAL CHEMICALS

**$\alpha$ -PINENE**

**ETHANOL**

**EUCALYPTOL (1,8-CINEOLE)**

**D-LIMONENE**

**CITRONELLA (3,7-DIMETHYL-6-OCTENAL)**

**CAMPHOR**

**GAMMA-TERPINENE COELUTED  
WITH 2,7-DIMETHYL-2,7-OCTANEDIOL**

**BENZYL ACETATE**

**O, M, OR P-CYMENE**

**$\beta$ -PINENE**

**PENTANE**

**HEPTANE**

**OCTANE**

**ACETIC ACID, 2-PHENYLETHYL  
ESTER**

**BENZYL ALCOHOL,  
 $\alpha$ -METHYL-, ACETATE ( $\alpha$ -  
PHENYLETHYL ACETATE)**

**CAMPHENE**

**CARENE ISOMER**

**$\alpha$ -TERPINENE**

**BUTANE**

**HEXANE**

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# LIQUID SOAP: LISTED INGREDIENTS

## LISTED ON LABEL:

ORGANIC HERBAL BLEND [PURIFIED WATER, ORGANIC CHAMOMILE (MATRICARIA RECUTITA) FLOWERS\*, ORGANIC ALOE VERA\* (ALOE BARBADENIS), ORGANIC CALENDULA (CALENDULA OFFICINALIS) FLOWERS\* AND ORGANIC WHITE TEA (CAMELLIA SINENSIS) LEAF\*], COCAMIDOPROPYL HYDROXYSULTAINE\*\*, SODIUM METHYL COCOYL TAURATE\*\*, SODIUM COCO-SULFATE\*\*, POLYSORBATE 60, FRENCH LAVENDER (LAVENDULA OFFICINALIS) ESSENTIAL OIL, CITRIC ACID, DISODIUM EDTA, PHENOXYETHANOL, BENZYL ALCOHOL, POTASSIUM SORBATE. \*CERTIFIED ORGANIC \*\* COCONUT CLEANSING

## LISTED ON MSDS:

NO INGREDIENTS LISTED

HAZARDOUS INGREDIENTS: NONE LISTED

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# LIQUID SOAP:

## OTHER LANGUAGE ON LABEL:

“NATURALLY ANTISEPTIC & GENTLE  
WITH PURE ESSENTIAL OILS & ORGANIC HERBAL  
INFUSIONS.”



# LIQUID SOAP: ACTUAL CHEMICALS

**D-LIMONENE**

**$\alpha$ -PINENE**

**LINALOOL**

**ETHANOL**

**CAMPHOR**

**$\beta$ -PINENE**

**CARENE ISOMER**

**3-METHYL-2-BUTENOIC ACID,  
2-PENTYL ESTER**

**PROPANOIC ACID, 2-METHYL-,  
2-METHYLPROPYL ESTER**

**METHACROLEIN**

**2-BUTOXY-ETHANOL**

**2-BUTENOIC ACID, 3-METHYL-,  
PENTYL ESTER**

**2(10)-PINEN-3-ONE**

**TRANS-OCIMENE**

**CARENE ISOMER**

**BUTANE**

**CIS-OCIMENE**

**PROPENE, 2-METHYL-**

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# AIR FRESHENER: LISTED INGREDIENTS

LISTED ON LABEL:

NO INGREDIENTS LISTED

LISTED ON MSDS:

ESSENTIAL OILS

ORGANIC PERFUME

FOOD-GRADE GELLING AGENT (PROPRIETARY TRADE  
SECRET)

HAZARDOUS INGREDIENTS: NONE LISTED

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# AIR FRESHENER: ACTUAL CHEMICALS

## **D-LIMONENE**

3-METHOXY-3-METHYLBUTANOL

**LINALOOL**

CARENE ISOMER

NONANAL

2,4-DIMETHYL-3-CYCLOHEXENE-1-CARBOXALDEHYDE

2-METHYL-2,4-DIMETHOXYBUTANE

BENZYL ALCOHOL,  $\alpha$ -METHYL-, ACETATE

$\beta$ -PINENE

3-HEXEN-1-OL

OCTANAL

**ETHANOL**

GAMMA-TERPINENE

DECANAL

## **ACETONE**

**CIS-LIMONENE OXIDE**

**LIMONENE OXIDE**

CIS-ROSE OXIDE

(4-METHYL-2-(2-METHYL-1-PROPENYL)-TETRAHYDROPYRAN)

CITRONELLA (3,7-DIMETHYL-6-OCTENAL)

DIMETHYL-3-CYCLOHEXENE-1-CARBOXALDEHYDE

$\alpha$  -PINENE

2,4,6-TRIMETHYLOCTANE

**ETHYL ACETATE**

$\beta$ -PHELLANDRENE

$\alpha$ -TERPINOLENE

3-METHYL DODECANE

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# DRYER SHEET: LISTED INGREDIENTS

## LISTED ON LABEL:

CONTAINS BIODEGRADABLE CATIONIC FABRIC SOFTENING AGENTS AND PERFUME.

## LISTED ON MSDS:

NONIONIC AND CATIONIC FABRIC CONDITIONING AGENTS

A PERFUME CARRIER

PERFUME

NON-WOVEN CLOTH

HAZARDOUS INGREDIENTS: NONE LISTED

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# DRYER SHEET: ACTUAL CHEMICALS

LINALOOL

ETHANOL

BENZYL ACETATE

CIS-ROSE OXIDE (4-METHYL-2-(2-METHYL-1-PROPENYL)-TETRAHYDROPYRAN)

CARENE ISOMER

2,4-DIMETHYL-3-CYCLOHEXENE-1-CARBOXALDEHYDE

D-LIMONENE

3-METHYL-2-BUTEN-1-OL  
ACETATE

2,7-DIMETHYL-2,7-OCTANEDIOL

$\alpha$ -PINENE

TRANS-ROSE OXIDE

EUCALYPTOL (1,8-CINEOLE)

BENZYL ALCOHOL,  $\alpha$ -METHYL-,  
ACETATE ( $\alpha$ -PHENYLETHYL  
ACETATE)

$\beta$ -PINENE

DIMETHYL-3-CYCLOHEXENE-1-  
CARBOXALDEHYDE

METHYL BENZOATE

ACETONE

DECANAL

NERYL OR GERANYL NITRILE

## FINDINGS:

# VOCS IN FRAGRANCED CONSUMER PRODUCTS

- MORE THAN 450 VOCs IN 25 PRODUCTS
- ONLY ONE LISTED ON ANY PRODUCT LABEL
- ONLY TWO LISTED ON ANY MSDS
- MORE THAN 100 REGULATED IN OTHER SOURCES, BUT NOT IN FRAGRANCED CONSUMER PRODUCTS
- MORE THAN 150 TOXIC TO MANY BODY SYSTEMS:  
CARDIOVASCULAR, DEVELOPMENTAL,  
GASTROINTESTINAL, ENDOCRINE, IMMUNE,  
URINARY, REPRODUCTIVE, RESPIRATORY,  
AND NEUROLOGICAL SYSTEMS





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# TROUBLE WITH THE LAWS

- CONSUMER PRODUCTS DO NOT NEED TO DISCLOSE ALL INGREDIENTS—EITHER ON THE PRODUCT LABEL OR THE MSDS.
  - CONSUMER PRODUCTS DO NOT NEED TO BE TESTED FOR SAFETY BEFORE MARKETING.
  - FRAGRANCE CHEMICALS ARE COMPLETELY EXEMPT FROM DISCLOSURE—EVEN IF THEY ARE HAZARDOUS, WITH NO “SAFE” LEVEL OF EXPOSURE.
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# FRAGRANCE CHEMICALS IN LAUNDRY WATER

- BENZALDEHYDE
- BENZYL ACETATE
- POLYCYCLIC MUSKS
- NITRO MUSKS
- MACROCYCLIC MUSKS
- DICHLOROMETHANE



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# FRAGRANCE CHEMICALS IN SURFACE WATERS IN PUGET SOUND REGION

- LIMONENE
  - LIMONENE OXIDE
  - LINALOOL
  - BENZALDEHYDE
  - BENZYL ACETATE
  - CUMENE
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# FRAGRANCE CHEMICALS IN PUGET SOUND

- BENZALDEHYDE
  - BENZYL ACETATE
  - BENZYL PROPIONATE
  - CUMENE
  - LIMONENE
  - LIMONENE OXIDE
  - METHYL BENZOATE
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# HIDDEN RISKS: WHY SHOULD WE CARE?

- MULTIPLE AND UNKNOWN CHEMICAL EXPOSURES
  - MULTIPLE AND UNCERTAIN HEALTH EFFECTS
  - CUMULATIVE AND SYNERGISTIC EFFECTS
  - “BODY BURDEN” AND PERSISTENCE
  - LAG TIME BETWEEN EXPOSURES AND EFFECTS
  - LOW-LEVEL EXPOSURES CAN BE HAZARDOUS
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# ARE “NATURAL” FRAGRANCED PRODUCTS ANY SAFER?

- NO, NOT GENERALLY. AND THEY CAN BE MORE HAZARDOUS.
  - ALL FRAGRANCED PRODUCTS TESTED (EVEN THOSE LABELED “100% ORGANIC,” “ALL-NATURAL,” OR “GREEN”) EMITTED TOXIC CHEMICALS.
  - “FRAGRANCE-FREE” OR “UNSCENTED” PRODUCTS CAN STILL CONTAIN HAZARDOUS FRAGRANCE CHEMICALS, WITH A “MASKING FRAGRANCE.”
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# WHAT CAN WE DO?

- AVOID PRODUCTS WITH ANY “FRAGRANCE,” “PERFUME,” OR “SCENT”
- AVOID ANY AIR FRESHENER OR DEODORIZER

## FOR CLEANING:

- WHITE VINEGAR
  - BAKING SODA
  - HYDROGEN PEROXIDE
  - LEMON JUICE
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# **FUTURE WORK**

- **EFFECTS ON HUMANS AND AQUATIC SPECIES**
  - **TOXICITY TESTING AND EVALUATION**
  - **POLLUTANT DETECTION TECHNOLOGIES**
  - **SOURCE REDUCTION PROGRAMS**
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# MAIN MESSAGES

- FRAGRANCED CONSUMER PRODUCTS CONTAIN CHEMICALS THAT CAN HARM YOUR HEALTH AND THE ENVIRONMENT.
  - BUT YOU WON'T SEE ALL THESE CHEMICALS ON PRODUCT LABELS OR MSDSs.
  - CLAIMS OF “ORGANIC,” “NATURAL,” “GREEN,” AND “SAFE” ARE MISLEADING AND MEANINGLESS.
  - LESS TOXIC, LESS EXPENSIVE, AND EFFECTIVE ALTERNATIVES ARE AVAILABLE.
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# THE END

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