

Appendix: Detailed information on all 26 chemicals detected by the chemical-detecting wristbands

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I. Definitions

Hazard – The hazard of a chemical refers to its intrinsic ability to cause harm or induce a toxic effect, such as those listed below in “Chemical Hazard Types.” Risk is a function of both *hazard* and *exposure*, the amount of the chemical substance that enters a person’s body. Assuming a constant exposure, chemicals will differ in the type and magnitude of toxic effect(s) that they may induce.

Persistent bioaccumulative toxic chemicals (“PBTs”) – Chemicals that do not break down readily from natural processes (persistent), accumulate in organisms concentrating as they move up the food chain (bioaccumulative), and are toxic.

Cancer (i.e., carcinogenicity) – Can cause or increase the risk of cancer.

Developmental effects – Can harm the developing fetus or child; effects may include birth defects, low birth weight, and biological or behavioral problems that appear as the child grows.

Reproductive effects – Can disrupt the male or female reproductive systems, resulting in effects such as decreased fertility, altered puberty, or loss of the fetus during pregnancy.

Endocrine disruption – Can interfere with hormone communication and production, which controls metabolism, development, growth, reproduction and behavior.

Respiratory effects – Can result in high sensitivity such that small quantities trigger asthma, rhinitis or other allergic reactions in the respiratory system.

Skin sensitization – Can trigger allergic reactions on the skin.

Skin irritation – Can irritate or seriously damage the skin.

Neurotoxicity – Can cause damage to the nervous system, including the brain.

II. Full List of Chemicals Detected

1-METHYLNAPHTHALENE (CASRN: 90-12-0)

Specific Hazards¹: Medium hazard for organ toxicity

Primary Function(s): Combustion by-product, chemical intermediate

Example uses and sources²: Air; pesticides (inert ingredient); food packaging and additives; ink, pigments, and dyes

Government Resource: <http://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=43>

3,4-DICHLOROPHENYL ISOCYANATE (CASRN: 102-36-3)

Specific Hazards: Medium hazard for organ toxicity

Primary Function(s): Chemical intermediate

Example uses and sources: Used in the manufacture of other chemicals and dyes

Government Resource: https://pubchem.ncbi.nlm.nih.gov/compound/3_4-dichlorophenyl_isocyanate

BENZOPHENONE (CASRN: 119-61-9)

Specific Hazards: High hazard for cancer; medium hazard for endocrine disruption activity

Primary Function(s): UV filter and fragrance enhancer in personal care products, food additive

Example uses and sources: Personal care products; pesticides (inert ingredient); food packaging and additives; cleaning products; building materials; fabric, furniture, and upholstery; paper products; ink, pigments, and dyes; toys and children's products; electronics; cigarette chemicals; pharmacological products

Government Resource: <https://hpd.nlm.nih.gov/cgi-bin/household/brands?tbi=chem&id=570&query=119-61-%209&searchas=TblChemicals>

BENZYL BENZOATE (CASRN: 120-51-4)

Specific Hazards: Little human data available; harmful if swallowed

Primary Function(s): Fragrance fixative and preservative in personal care products, food additive, antiparasitic (treats scabies), pesticide, solvent, plasticizer

Example uses and sources: Personal care products; air fresheners; pesticides (inert ingredient); food packaging and additives; cleaning products; building materials; manufacture/maintenance of vehicles; cigarette chemicals; pharmacological products

Government Resource: <https://toxnet.nlm.nih.gov/> (search term: benzyl benzoate)

BIS(2-ETHYLHEXYL) PHTHALATE (DEHP) (CASRN: 117-81-7)

Specific Hazards: High hazard for cancer, developmental effects, reproductive effects, endocrine disruption activity, organ toxicity; medium hazard for respiratory effects, skin irritation; potential hazard for neurotoxicity

Primary Function(s): Plasticizer

Example uses and sources: Air; personal care products; pesticides (inert ingredient); food packaging and additives; cleaning products; building materials; fabric, furniture, and upholstery; manufacture/maintenance of vehicles; ink, pigments, and dyes; arts, crafts, hobby materials; toys and children's products; electronics; pharmacological products

Government Resource: <http://www.atsdr.cdc.gov/phs/phs.asp?id=376&tid=65>

BUTYL BENZYL PHTHALATE (BBP) (CASRN: 85-68-7)

Specific Hazards: High hazard for developmental effects, reproductive effects, skin irritation; medium

¹ Chemical hazards based on the Pharos database, available here: <https://www.pharosproject.net/>

² Chemical uses data is based primarily on EPA's CPCat database, available here: <http://actor.epa.gov/cpcat/faces/home.xhtml>

hazard for cancer, endocrine disruption activity, respiratory effects, organ toxicity

Primary Function(s): Plasticizer

Example uses and sources: Air; personal care products; pesticides (inert ingredient); food packaging and additives; building materials; manufacture/maintenance of vehicles; paper products; ink, pigments, and dyes; arts, crafts, hobby materials; toys and children's products

Government Resource: http://toxtown.nlm.nih.gov/text_version/chemicals.php?id=24

BUTYLATED HYDROXYANISOLE (BHA) (CASRN: 25013-16-5)

Specific Hazards: High hazard for cancer, skin sensitization; medium hazard for developmental effects, reproductive effects, endocrine disruption activity, organ toxicity

Primary Function(s): Preservative (antioxidant) in personal care products and food

Example uses and sources: Personal care products; pesticides (inert ingredient); food packaging and additives; building materials; toys and children's products; pharmacological products

Government Resource: <https://ntp.niehs.nih.gov/ntp/roc/content/profiles/butylatedhydroxyanisole.pdf>

CAFFEINE (CASRN: 58-08-2)

Specific Hazards: High hazard for reproductive effects; medium hazard for endocrine disruption activity; potential hazard for cancer

Primary Function(s): Food additive

Example uses and sources: Personal care products; pesticides (inert ingredient); food packaging and additives; cigarette chemicals; pharmacological products

Government Resource: <http://www.fda.gov/downloads/UCM200805.pdf>

DI-N-HEXYL PHTHALATE (DHEXP) (CASRN: 84-75-3)

Specific Hazards: High hazard for reproductive effects; medium hazard for developmental effects, endocrine disruption activity, respiratory effects

Primary Function(s): Plasticizer

Example uses and sources: Pesticides (inert ingredient); food packaging and additives; building materials; manufacture/maintenance of vehicles; toys and children's products

Government Resource: http://toxtown.nlm.nih.gov/text_version/chemicals.php?id=24

DIETHYL PHTHALATE (DEP) (CASRN: 84-66-2)

Specific Hazards: High hazard for reproductive effects, skin sensitization, skin irritation; medium hazard for endocrine disruption activity, respiratory effects, organ toxicity; potential hazard for cancer

Primary Function(s): Plasticizer

Example uses and sources: Personal care products; pesticides (inert ingredient); food packaging and additives; cleaning products; building materials; manufacture/maintenance of vehicles; ink, pigments, and dyes; toys and children's products; pharmacological products

Government Resource: <http://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=112>

DIISOBUTYL PHTHALATE (DIBP) (CASRN: 84-69-5)

Specific Hazards: High hazard for developmental effects, reproductive effects; medium hazard for endocrine disruption activity, respiratory effects, organ toxicity

Primary Function(s): Plasticizer

Example uses and sources: Food packaging and additives; building materials; fabric, furniture, and upholstery; manufacture/maintenance of vehicles; paper products; ink, pigments, and dyes; toys and children's products

Government Resource: http://toxtown.nlm.nih.gov/text_version/chemicals.php?id=24

DI-N-BUTYL PHTHALATE (DBP) (CASRN: 84-74-2)

Specific Hazards: High hazard for developmental effects, reproductive effects, organ toxicity, skin sensitization; medium hazard for cancer, endocrine disruption activity, respiratory effects, skin irritation; potential hazard for neurotoxicity

Primary Function(s): Plasticizer

Example uses and sources: Personal care products; pesticides (inert ingredient); food packaging and additives; cleaning products; building materials; fabric, furniture, and upholstery; manufacture/maintenance of vehicles; ink, pigments, and dyes; paper products; toys and children's products; arts, crafts, hobby materials; electronics; petroleum products/ fuels; pharmacological products

Government Resource: <https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=167>

DI-N-NONYL PHTHALATE (CASRN: 84-76-4)

Specific Hazards: Little human data available; harmful if swallowed

Primary Function(s): Plasticizer

Example uses and sources: Data unavailable

Government Resource: http://toxtown.nlm.nih.gov/text_version/chemicals.php?id=24

ETHOFENPROX (CASRN: 80844-07-1)

Specific Hazards: Very high hazard for organ toxicity; high hazard for developmental effects; medium hazard for endocrine disruption activity

Primary Function(s): Pesticide (used to repel bed bugs)

Example uses and sources: Pesticides

Government Resource: <https://householdproducts.nlm.nih.gov/cgi-bin/household/brands?tbl=chem&id=2105&query=80844-07-1&searchas=TblChemicals>

EXALTOLIDE (CASRN: 106-02-5)

Specific Hazards: Little human data available

Primary Function(s): Fragrance

Example uses and sources: Personal care products; pesticides (inert ingredient); food packaging and additives; cleaning products; cigarette chemicals

Government Resource: On EPA's Safer Choice list of safer fragrances:

<https://www.epa.gov/saferchoice/safer-ingredients#pop106025>

GALAXOLIDE (CASRN: 1222-05-5)

Specific Hazards: PBT; high hazard for developmental effects³; medium hazard for endocrine disruption activity, reproductive effects

Primary Function(s): Fragrance

Example uses and sources: Personal care products; air fresheners; pesticides (inert ingredient); cleaning products; building materials; manufacture/maintenance of vehicles

Government Resource: http://cfpub.epa.gov/si/si_public_record_report.cfm?dirEntryID=245534

GAMMA- CHLORDANE (CASRN: 5103-74-2)

Specific Hazards: PBT; medium hazard for endocrine disruption activity

Primary Function(s): Pesticide

Example uses and sources: gamma-chlordane was banned in the U.S. as a pesticide in 1988 due to concerns about its human health impacts and persistence in the environment.

Government Resource: <https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=62>

NAPHTHALENE (CASRN: 91-20-3)

Specific Hazards: PBT; very high hazard for organ toxicity; high hazard for cancer, skin sensitization; medium hazard for endocrine disruption activity, skin irritation

Primary Function(s): Combustion by-product, chemical intermediate (manufacture of plastic and moth repellants)

³ Evidence for reproductive/developments effects for galaxolide are based on preliminary studies. The majority of research demonstrates that galaxolide exerts its toxic effects on the environment; there is limited data to indicate that this chemical is toxic to humans.

Example uses and sources: Air; pesticides (inert ingredient); cleaning products; building materials; fabric, furniture, and upholstery; manufacture/maintenance of vehicles; ink, pigments, and dyes; petroleum products/fuels; pharmacological products

Government Resource: <https://www.epa.gov/sites/production/files/2016-09/documents/naphthalene.pdf>

N,N-DIETHYL-M-TOLUAMIDE (DEET) (CASRN: 134-62-3)

Specific Hazards: High hazard for skin irritation; medium hazard for organ toxicity

Primary Function(s): Pesticide (insect repellent)

Example uses and sources: Personal care products; pesticides

Government Resource: <http://www2.epa.gov/insect-repellents/deet>

PERMETHRIN (CASRN: 52645-53-1)

Specific Hazards: High hazard for respiratory effects, organ toxicity; medium hazard for endocrine disruption activity, skin sensitization, skin irritation; potential hazard for cancer

Primary Function(s): Pesticide

Example uses and sources: Personal care products; pesticides; building materials; fabric, furniture, and upholstery; paper products; pharmacological products

Government Resource: <https://www.epa.gov/mosquitocontrol/permethrin-resmethrin-d-phenothrin-sumithrinr-synthetic-pyrethroids-mosquito-control>

PIPERONYL BUTOXIDE (CASRN: 51-03-6)

Specific Hazards: Medium hazard for endocrine disruption activity, skin irritation; potential hazard for cancer

Primary Function(s): Pesticide (synergist)

Example uses and sources: Personal care products; pesticides (inert ingredient); pharmacological products

Government-Academic Collaboration: <http://npic.orst.edu/factsheets/archive/pbotech.pdf>

2,2',3,3'-TETRABROMODIPHENYL ETHER (BDE 47) (CASRN: 5436-43-1)

Specific Hazards: PBT; high hazard for neurotoxicity; medium hazard for developmental effects, endocrine disruption activity; potential hazard for cancer

Primary Function(s): Flame retardant

Example uses and sources: PBDE flame retardants were phased out of use in the U.S. in the early 2000s. PBDE 47 previously was used in foam for cushioning in upholstery, mattresses, car seats, carpet padding, and more.

Government Resource: <https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=183>

PROMECARB ARTIFACT [5-isopropyl-3-methylphenol] (CASRN: 485106)

Specific Hazards: Little human data available; harmful if swallowed

Primary Function(s): Pesticide

Example uses and sources: Pesticides

Government Resource: Not available

TONALIDE (CASRN: 1506-02-1)

Specific Hazards: Medium hazard for endocrine disruption activity; potential PBT

Primary Function(s): Fragrance

Example uses and sources: Personal care products; pesticides (inert ingredient); cleaning products; building materials

Government Resource: <http://toxnet.nlm.nih.gov/> (search term: tonalide)

TRIPHENYL PHOSPHATE (TPP) (CASRN: 115-86-6)

Specific Hazards: Medium hazard for endocrine disruption activity; potential hazard for neurotoxicity

Primary Function(s): Flame retardant

Example uses and sources: Pesticides (inert ingredient); food packaging and additives; building materials; fabric, furniture, and upholstery; manufacture/maintenance of vehicles; paper products; ink, pigments, and dyes; arts, crafts, hobby materials; toys and children's products; electronics

Government Resource: <http://www.atsdr.cdc.gov/phs/phs.asp?id=1118&tid=239>

TRIS(2-CHLORO-1-PROPYL) PHOSPHATE (TCPP) (CASRN: 13674-84-5)

Specific Hazards: PBT; high hazard for organ toxicity; medium hazard for reproductive effects, endocrine disruption activity

Primary Function(s): Flame retardant

Example uses and sources: Pesticides (inert ingredient); building materials; fabric, furniture, and upholstery; electronics

Government Resource: <http://www.atsdr.cdc.gov/phs/phs.asp?id=1118&tid=239>