DEPARTMENT OF HEALTH

Toxic Free Kids Program

TRAINING CURRICULUM

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Toxic Free Kids Program Training Curriculum

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Overview of the Toxic Free Kids Program Training Curriculum

The purpose of this training curriculum is to provide basic information about chemical exposure pathways, some chemicals of particular concern (Priority Chemicals in the Toxic Free Kids program), prenatal and postnatal exposure for high-risk groups, and tips on reducing families' exposures to toxic chemicals and decreasing their risk of adverse health outcomes. The training curriculum is intended for community health workers, community-based organizations, and other local public health staff.

What is the Toxic Free Kids program?

Through the Toxic Free Kids (TFK) program, the Minnesota Department of Health (MDH) is working to identify and communicate the potential for hazardous chemical exposures from consumer products that could be harmful to human health, particularly to vulnerable or susceptible populations such as children.

The TFK program began in 2009 after Minnesota passed legislation (Minnesota Statutes, sections 116.9401 to 116.9407) known as the Toxic Free Kids Act.
The legislation directed MDH to create a Chemicals of High Concern (CHC) list and a Priority Chemicals (PC) list. These lists focus on hazardous chemicals that could be found in consumer products with particular concern for hazardous chemicals found in children's products.
The TFK program responsibilities include:

- Identifying and communicating the potential for hazardous chemical exposure that could be harmful to human health, particularly in those who might be more vulnerable to chemical toxicity such as children and pregnant people.

- Reviewing and updating the Chemicals of High Concern and Priority Chemical lists established by Minnesota statute.
- Nominating chemicals for development of health-based guidance values within other MDH programs, such as the Contaminants of Emerging Concern (CEC) program.

The Toxic Free Kids program is housed in the Environmental Surveillance and Assessment Section within the Environmental Health Division and supports the Minnesota Department of Health's mission to protect, maintain, and improve the health of all Minnesotans.

Module 1: Chemical Exposure Overview

What are chemical substances?

Chemical substances can be either gases, solids, or liquids. They can also be found as single elements, or in mixtures and compounds. The US Environmental Protection Agency (EPA) defines them as any substance, organic or inorganic, or a combination of substances occurring in whole or part because of a chemical reaction, or naturally occurring, and any element or uncombined radical (EPA, 2024).

What makes a chemical hazardous?

Hazardous chemicals have properties that can make them toxic, explosive, chemically reactive, and/or flammable; these properties can potentially result in adverse effects to the environment, human health, and property. The Toxic Free Kids program has a focus on hazardous chemicals that are of a health concern because of toxic properties and associated negative health outcomes.

How do chemicals enter a person's body?

There are three general pathways through which chemicals can enter the body.

Inhalation: Breathing in the chemical.

Ingestion: Eating or drinking the chemical.

Dermal: Skin contact with or absorption of the chemical.

Not all chemicals enter the body through each pathway. For some chemicals, only one exposure pathway may be relevant. The pathway of exposure depends on the specific properties of a chemical and the way a person interacts with that chemical.

How do chemicals affect a person's body?

How a chemical interacts with a person's body and the types of negative health effects it causes is called toxicodynamics. The effect chemicals have on the body can vary from person to person because our bodies are different and can depend on many factors including, but not limited to, the type of chemical, how long you are exposed, your age and health, the amount you were exposed to, and the pathway of exposure.

- The type of chemical is important because some chemicals are more harmful to humans than others due to their structure and properties. In addition, the dose or amount that is absorbed by the body can also make some chemicals more harmful than others.
- The duration of exposure is also critical because, generally, the longer a person is exposed the more likely they are to have a negative health outcome. Short-term exposures can also lead to adverse health effects. However, experiencing adverse health effects in the short-term or long-term is also dependent on the dose, or amount, a person is exposed to. Exposure can also vary by different life stages. Through infancy, toddler stage, childhood and adolescence, people are more sensitive to chemical

exposure and at risk of negative health effects. Similarly, during older adulthood, geriatric adults are equally as vulnerable to adverse health effects from chemical exposure.

- The dose a person is exposed to can help determine the risk of a negative health outcome. Typically, a person needs to be exposed to a higher dose in the short-term or small doses over a longer period to have a negative health effect. However, potential effects depend on the chemical, the person's sensitivity to a particular chemical, and other interacting factors discussed in this section.
- Age can be a factor in chemical exposure because fetuses, infants, and young children are more sensitive to negative health consequences. Since their bodies are still developing, these populations may be more susceptible (and therefore at greater risk) to the negative health effects of a chemical than adults. Geriatric persons may also have elevated risk to the adverse effects of some substances because their bodies' defense systems may be less effective because of aging.
- The route of exposure (inhalation, ingestion, or dermal) is also noteworthy because it can determine how much of a chemical a person is exposed to. The amount of a chemical that is absorbed and where it is distributed in the body often depends on the route of exposure.

The type of chemical, duration of exposure, dosage, route of exposure, as well as other factors, all interact and can contribute to effects on a person's health. Other factors including genetics, health status, and other types of exposures occurring at the same time can also influence susceptibility to developing negative health effect(s) from exposure to a chemical in individuals. There are different combinations of factors driving health outcomes.

How does your body process and remove chemicals?

The human body utilizes several pathways to absorb, distribute, metabolize (break down) and excrete chemicals from the body. Collectively, these are described as the toxicokinetics (or sometimes ADME) of a chemical.

- Absorption: The rate at which a chemical enters the blood stream.
- Distribution: The types of tissues in the body that the chemical targets.
- Metabolism: The body's internal process of breaking down or changing the chemical.
- Excretion: how the chemical exits the body, often through urine, feces, or exhalation.

The process of absorption, distribution, metabolism, and excretion varies from person to person, and is also dependent upon the properties of the chemical. It is an important process to be aware of as it provides information about how the human body processes chemicals and handles chemical exposures. Where toxicodynamics refers to what the toxic chemical does to the body, toxicokinetics refers to what the body does to or with the toxic chemical.

Module 2: The Toxic Free Kids Program Priority Chemicals

Priority Chemicals Overview

Priority Chemicals are derived from the list of Chemicals of High Concern (CHC). To be listed as a Chemical of High Concern, the chemical has to meet at least one of the following criteria laid out in Minnesota statute: harm the normal development of a fetus or child or cause other developmental toxicity; cause cancer, genetic damage, or reproductive harm; disrupt the endocrine or hormone system; damage the nervous system, immune system, or organs, or cause other systemic toxicity; be persistent, bioaccumulative, and toxic; or be very persistent and very bioaccumulative.

Priority Chemicals must meet the CHC criteria and have also been identified as high-production volume chemicals by the EPA. The Priority Chemicals are additionally required to meet any of the following criteria: the chemical has been found through biomonitoring to be present in human blood, including umbilical cord blood, breast milk, urine, or other bodily tissues or fluids; the chemical has been found through sampling and analysis to be present in household dust, indoor air, drinking water, or elsewhere in the home environment; or the chemical has been found through monitoring to be present in fish, wildlife, or the natural environment. The following chemicals are the nine TFK Priority Chemicals named to the list in 2011.

Bisphenol A (BPA)

Bisphenol A (BPA) is a chemical commonly used in plastics, food cans, and thermal receipt paper. BPA is present in many consumer products and in the environment.

Studies show that high levels of BPA harm laboratory animals and have the potential to affect human health. Animal studies have shown that high oral amounts of BPA may affect development, reproductive organs and functions, and other organs, such as the liver, kidney, and thyroid.

For most people, packaged food is the largest source of BPA exposure. Metal food cans and cardboard containers may be lined with resins made from BPA. The liners protect food from contamination, protect the container from corrosion, and extend the shelf life of foods and beverages. Some canned food producers have begun to switch to linings made without BPA.

BPA is also commonly detected at low concentrations in indoor and outdoor air, in surface water, and house dust.

In terms of policy regulations, Minnesota and the US Food and Drug Administration (FDA) have banned the sale of infant and child bottles and cups containing BPA. Minnesota has also banned the use of BPA in children's food containers. The FDA has banned the use of BPA in infant formula packaging.

Butyl benzyl phthalate (BBP)

BBP is a phthalate and is commonly used as a plasticizer to make some plastic items more flexible. BBP is restricted in toys but can be found in other household products.

BBP has been found in vinyl flooring, sealants, and paints. It has also been found in some handbags, belts, footwear, and artificial leather products that are made with flexible polyvinyl chloride (PVC). BBP has also been found in clothing, mattresses, curtains, carpets, and older toys.

In animal studies, both short- and long-term health effects resulted from BBP exposure including rash, reproductive harm, and nervous system damage. As an endocrine disruptor, BBP leads to concerns that it can negatively affect the way hormones act in the body.

Cadmium

Cadmium is a naturally occurring metal found in the earth's crust and is used in many products, such as metal plating, "NiCad" (NiCd) batteries, stabilizers in plastics, and phosphate fertilizers. People may be exposed to cadmium through foods, such as leafy vegetables, sunflower seeds, peanuts, potatoes, organ meats, or shellfish. Leafy plants, like tobacco and lettuce, take up cadmium from the soil as they grow.

Smoking tobacco products, including cigarettes, can also be a major source of cadmium exposure. Other sources of cadmium exposure can be drinking water, certain types of jewelry, and cadmium pigments used on pottery finishes or in cheap plastics.

Infants and children may have an increased risk of exposure to cadmium as they frequently put things in their mouth. Children and infants are also more likely to accidentally swallow small toys, jewelry, or small batteries that could contain cadmium.

If ingested, large amounts of cadmium may cause acute cadmium poisoning with the following symptoms: nausea, abdominal pain, vomiting, diarrhea, muscle ache in rare circumstances, and possible death. Long-term exposure at low levels can have adverse effects on the kidneys, lungs, and bones.

Effective July 1, 2023, a new law, Minnesota statute 325E.3892, was passed that restricted the use of cadmium in consumer products to 75 parts per million or 0.0075 percent per total weight. Products included under this new law are jewelry, toys, cosmetics and personal care products, puzzles, board games, card games, and similar games, play sets and play structures, outdoor games, school supplies, pots and pans, cups, bowls, and other food containers, craft supplies and jewelry-making supplies, chalk, crayons, paints, and other art supplies, fidget spinners, costumes, costume accessories, and children's and seasonal party supplies, keys, key chains, and key rings, clothing, footwear, headwear, and accessories.

Dibutyl phthalate (DBP)

DBP is a phthalate and is commonly used as a plasticizer to make some plastic items more flexible. DBP has been found in various household products including personal care products, some perfumes, nail polish, shoes, gloves, garden hoses, tubing, insect repellents, and some wire and insulation cables. However, DBP is restricted in children's toys and products.

DBP is an endocrine disrupting chemical which leads to concerns that it can negatively affect the way hormones act in the body. In animal studies it has been shown to cause reproductive harm and developmental effects.

Di (2-ethyhexyl) phthalate (DEHP)

DEHP is a phthalate and is commonly used as a plasticizer to make plastics flexible. This chemical has been used in various household products, such as lunch boxes, binders, backpacks, rainwear and shoes, and plastic food packaging materials. However, DEHP has been restricted in children's toys and products.

DEHP is also used in medical devices and equipment, such as tubing for dialysis, feeding tubes, oxygen masks, and gloves for surgery. Research from animal studies have shown reproductive harm, increased allergic disease, and liver and kidney damage from exposure to DEHP. As an endocrine disruptor, DEHP can negatively affect the way hormones act in the body.

Decabromodiphenyl ether (decaBDE)

DecaBDE is a flame retardant added to plastics, textiles, and other materials to make them less flammable. DecaBDE has previously been found in carpets, cushions, mattresses, tents, and upholstery fabric.

This chemical is also found in plastics used for electrical appliances such as stereos, computers, televisions, circuit boards, casings, and cable insulation.

Commercial producers and suppliers of decaBDE committed to ending their use of decaBDE by 2013. Minnesota statute 325F.071 also limits the manufacture, sale, offer for sale, distribution for sale, or distribution for use in Minnesota of children's products, upholstered residential furniture, residential textile, or mattresses that contain decaBDE in amounts greater than 1,000 parts per million in any component of those products.

Scientific research in animal studies have shown some adverse health effects, including brain development issues, poor fetal and infant development, liver concerns, thyroid issues, and reproductive toxicity (low sperm count and pregnancy loss).

Formaldehyde

Formaldehyde is a chemical that is used in the manufacturing of composite wood products, building materials, and insulation. It can also be found in household products, including paints, coatings, paper products, permanent press fabrics, dishwashing soaps, fabric softeners, some cosmetics, fertilizers, and pesticides.

Health effects from exposure to formaldehyde include skin, eye, nose, and throat irritation. Very high levels of exposure may cause certain cancers, such as myeloid leukemia, and cancers of the paranasal sinuses, nasal cavity, and nasopharynx.

Hexabromocyclododecane (HBCD)

HBCD is a flame-retardant chemical that is used to make items less flammable. This chemical has been found in textiles, polystyrene foam, draperies, wall coverings, wires, cables, and electronic appliances.

Since 2018, U.S. manufacturers have discontinued use of HBCD in products. HBCD has also been limited in use under Minnesota statute 325F.071. These limits apply to the manufacture, sale, offer for sale, distribution for sale, or distribution for use in the state of children's products, upholstered residential furniture, residential textile, or mattresses that contain HBCD in amounts greater than 1,000 parts per million in any component of those products.

Health effects from animal studies of HBCD include behavioral health effects, brain development concerns, reproductive harm, thyroid issues, and toxic effects on the liver.

Lead

Lead is a heavy metal that has been used for thousands of years to make a variety of products and is still in use today. Lead has been found in spices, skin lightening creams and medication, especially from outside the United States. It has also been found in paint in older homes, jewelry, ceramics, and antiques. Concentrations of lead in the body that were once considered safe are now dealt with as a medical emergency.

There is no safe level of lead. Often, there are no outward signs from exposure to lead. However, exposure can cause damage to the brain, kidneys, and nervous system. In children, lead can also slow development or cause learning, behavior, and hearing problems.

Effective July 1, 2023, a new law, Minnesota statute 325E.3892, was passed that restricted lead use in consumer products to 90 parts per million or 0.009 percent per total weight. Products included under this new law are jewelry, toys, cosmetics and personal care products, puzzles, board games, card games, and similar games, play sets and play structures, outdoor games, school supplies, pots and pans, cups, bowls, and other food containers, craft supplies and jewelry-making supplies, chalk, crayons, paints, and other art supplies, fidget spinners, costumes, costume accessories, and children's and seasonal party supplies, keys, key chains, and key rings, clothing, footwear, headwear, and accessories.

Module 3: Maternal and Child Health Overview

Prenatal Chemical Exposure

During pregnancy, both the pregnant person and fetus can be exposed to chemicals. Exposure for the pregnant person can occur through different routes, including dermal, ingestion, and inhalation. During pregnancy certain chemicals can cross the placental barrier and could pass to the fetus. For some chemicals, there is concern that exposure could cause negative health issues in utero and potentially contribute to negative birth outcomes, such as pre-term birth and low birthweight. Consult with your healthcare team if you are concerned about chemical exposures and the risk of health effects.

Postnatal Chemical Exposure

Once the baby is born, they can be exposed to some chemicals through breast/chest feeding. The Minnesota Department of Health's advice is that the benefits of breast/chest feeding outweigh the potential chemical exposures from breast/chest milk. Other sources of exposure could be from baby food contamination. Food contamination can occur during food preparation and handling practices. Scientific studies have shown chemical exposure from ingesting baby foods that had toxicants, such as arsenic, cadmium, and other chemicals. Consult with your healthcare team if concerned about chemical exposures and risk of poor health.

Children's Chemical Exposure

Children's frequent hand to mouth activity can put them at increased risk of chemical exposures compared to adults. Since chemicals can leach out of products and into household dust, children are at risk of exposure via ingestion from hand to mouth activity. Mouthing and chewing toys, and other items in the home, also increases children's risk of chemical exposure. In addition, children's smaller size compared to adults and developmental stage can put them at increased risk for adverse health effects.

Module 4: Exposure Reduction Overview and Case Study

How to reduce your exposure?

For specific concerns speak with your healthcare team. Here are some general steps you can take to reduce exposures in your home:

- Vacuum your home and wipe household surfaces with a damp cloth to remove household dust.
- Check product brands and labels to avoid chemicals you are concerned about and purchase items that are made with safer chemicals.
- If possible, remove and dispose of household items (old baby bottles, furniture, electronics) that are known to be made with chemicals of high concern and priority chemicals.

Example Scenario

Jen is a new mom who is really concerned about chemical exposures from toys and other consumer products in her home. What advice and information can you provide Jen to help address her concerns and protect the health of her growing family?

Reference

EPA | About the TSCA Chemical Substance Inventory (https://www.epa.gov/tsca-inventory/about-tsca-chemical-substance-inventory)

Additional Resources

ATSDR | Sensitive Population and Chemical Exposure (PDF) (https://www.atsdr.cdc.gov/emes/public/docs/Sensitive%20Populations%20FS.pdf)

EPA | Benzyl Butyl Phthalate (https://iris.epa.gov/ChemicalLanding/&substance_nmbr=293)

CDC | Polybrominated Diphenyl Ethers (PBDEs) Public Health Statement (PDF) (https://www.atsdr.cdc.gov/ToxProfiles/tp207-c1-b.pdf)

CPSC | Phthalates Business Guidance & Small Entity Compliance Guide (https://www.cpsc.gov/Business--Manufacturing/Business-Education/Business-Guidance/Phthalates-Information)

CDC | ToxFAQs™ for Di-n-butyl Phthalate (https://wwwn.cdc.gov/TSP/ToxFAQs/ToxFAQsDetails.aspx?faqid=858&toxid=167)

CDC | ToxFAQs™ for Di(2-ethylhexyl)phthalate (DEHP) (https://wwwn.cdc.gov/TSP/ToxFAQs/ToxFAQsDetails.aspx?faqid=377&toxid=65)

EPA | Reducing Decabromodiphenyl Oxide Waste Management (PDF) (https://www.epa.gov/sites/default/files/2016-04/documents/p2_spotlight_decabde_final.pdf)

EPA | About the TSCA Chemical Substance Inventory (https://www.epa.gov/tsca-inventory/about-tsca-chemical-substance-inventory)

EPA | Biomonitoring – Bisphenol A (https://www.epa.gov/americaschildrenenvironment/biomonitoring-bisphenol-bpa)

FDA | Bisphenol A (BPA): Overview & Updates (https://www.fda.gov/food/food-packaging-other-substances-come-contact-food-information-consumers/bisphenol-bpa)

FDA | Bisphenol A (BPA): Use in Food Contact Application (https://www.fda.gov/food/food-packaging-other-substances-come-contact-food-information-consumers/bisphenol-bpa-use-food-contact-application)

MDH | Bisphenol A in Drinking Water (PDF) (https://www.health.state.mn.us/communities/environment/risk/docs/guidance/gw/bpainfosheet.pdf)

MDH | Bisphenol A (https://www.health.state.mn.us/communities/environment/risk/chemhazard/bisphenola.html)

PCA | BPA and BPS in thermal paper (https://www.pca.state.mn.us/business-with-us/bpa-and-bps-in-thermal-paper)

NIH | Bisphenol A (BPA) (https://www.niehs.nih.gov/health/topics/agents/sya-bpa)

EPA | Nontechnical Summary of the Risk Evaluation for Cyclic Aliphatic Bromide Cluster (HBCD) (PDF) (https://www.epa.gov/system/files/documents/2022-06/non_tech_summary_HBCD_6_22_22.pdf)

EPA | Addition of Hexabromocyclododecane (HBCD) Category to TRI List Final Rule (https://www.epa.gov/toxics-release-inventory-tri-program/addition-hexabromocyclododecane-hbcd-category-tri-list-final)

Office of the Revisor of Statutes | 325F.071 FLAME-RETARDANT CHEMICALS; PROHIBITION (https://www.revisor.mn.gov/statutes/cite/325F.071)

MDH | Decabromodiphenyl Ether Screening Profile (PDF) (https://www.health.state.mn.us/communities/environment/risk/docs/guidance/dwec/screening/decabde.pdf)

MDH | Bisphenol A Information Sheet (PDF) (https://www.health.state.mn.us/communities/environment/childenvhealth/docs/bpa.pdf)

MDH | Phthalates Information Sheet (PDF) (https://www.health.state.mn.us/communities/environment/childenvhealth/docs/phthalates2.pdf)

MDH | Hexabromocyclododecane (HBCD) Information Sheet (PDF) (https://www.health.state.mn.us/communities/environment/childenvhealth/docs/hexabrom.pdf)

MDH | Decabromodiphenyl ether (decaBDE) Information Sheet (PDF) (https://www.health.state.mn.us/communities/environment/childenvhealth/docs/decabrom.pdf)

MDH | Phthalates Information Sheet (PDF) (https://www.health.state.mn.us/communities/environment/childenvhealth/docs/pclist/phthalates.pdf)