Mercury

Your Health and the Environment

A Resource Tool

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Date: October 1, 2004

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Overview

This compendium of commonly asked questions and answers is intended to provide key information to Canadians on the topic of mercury, human health and the environment. In this section, the following general questions and answers describe why mercury can be a problem.

Q1. What is mercury?

Mercury is a naturally occurring element found in the earth's crust with natural deposits generally found as a vermilion red ore called cinnabar. Mercury exists in three different forms: elemental, inorganic and organic.

- Elemental (Hg^{+} or Hg^{2+}) or metallic mercury is a silvery, shiny liquid at room temperature that produces a colourless, odourless vapour at room temperature. The unique properties of elemental mercury, such as its ability to conduct electricity and its coefficient of expansion, make it useful for a variety of specialized uses, (e.g. temperature measurement in thermometers).
- Inorganic compounds can be formed when elemental mercury combines with elements such as sulphur, chlorine or oxygen. These compounds are usually known as mercury salts.
- Organic mercury compounds occur when elemental mercury combines with carbon and hydrogen.

In the environment, microorganisms (bacteria and fungi) and natural processes can change mercury from one form to another.

Q2. Why is mercury considered a health and environmental problem?

Mercury compounds can be toxic at low levels in the environment. The characteristics of mercury that make it a health and environmental problem are its toxicity and persistence in the environment, and its ability to accumulate and bioconcentrate as methyl mercury in fish and fish-eating predators such as large fish or loons (see Q.12). Mercury also moves over long distances on air currents and can be deposited on land and in rivers, lakes and oceans far from the source of release (see Q.12 & Q.48), therefore spreading the potential exposure to many more people.

Q3. What is methyl mercury?

Methyl mercury is an organic form of mercury. Biological processes, such as bacterial activity in plants and sediments on lake bottoms, in rivers and oceans, can transform elemental mercury to methyl mercury, the most bioaccumulative and toxic form. Levels of methyl mercury in animals increase up the food chain, from plankton to large fish, to birds and mammals, including humans. Once in the body, methyl mercury can affect many systems in the body, particularly fetal and adult nervous systems (see Q.35-46).

Q4. What are the main sources of natural mercury releases?

Mercury is released into the air, water and soils from a range of natural sources. These include volcanic eruptions, mercury-rich geologic zones and geothermal vents. Mercury is mobilized in the environment by natural weathering processes, forest fires and flooding.

Q5. What are the main sources of anthropogenic (human) mercury releases?

Mercury is released by a range of human activities, such as the burning of fossil fuels (particularly in coal fired power plants), mining and base metal smelting, the production of chlorine and sodium hydroxide in the mercury-cell chlor-alkali industry, cement production, and municipal and medical waste incineration. In addition, the improper disposal of mercury-containing products such as fluorescent light bulb tubes, high intensity discharge lamps, mercury vapour lamps, mercury fever thermometers and thermostats and dental amalgam waste can lead to the release of mercury from municipal landfills. Methyl mercury can also be generated by bacterial activity in submerged soil at new hydroelectric dam sites and from other flooded areas and be released to drainage systems.

Q6. Have mercury levels increased?

Relative to pre-industrial times, human activities have increased the amount of mercury circulating in the atmosphere, soils, and in lakes, streams and oceans by a factor of two to four. In Canada, mercury releases have declined since the 1980's, due to anti-pollution measures, particularly in the base metal smelting sector. In addition, the closure of all but one mercury cell chlor alkali facility in New Brunswick has assisted in reducing mercury releases in this sector. Although Canada and many other industrialized countries continue to substantially reduce mercury uses and releases from point source locations, these reductions are not generally reflected in lower environmental concentrations. This is mainly due to the persistent nature of mercury and the increased industrialization of other countries.

Exposure

This section covers the various potentially hazardous sources of exposure to mercury such as exposure through the consumption of fish, the use of certain consumer products, dental amalgam and thimerosal vaccines. Exposure to mercury can occur as part of everyday activities through contact with water and soil, exposure to products containing mercury and even in the air we breathe.

Q7. What are the main sources of mercury exposure?

Because mercury occurs naturally in the environment at low levels, everyone is exposed to some level of mercury in air, water and food.

- In the general population, the major sources of exposure to mercury occur through the consumption of larger species of fish (see Q.12 - Q.17) and from dental amalgam (see Q.28 - Q.29).
- Exposure can also occur when mercury-containing products are broken and mercury is released or spilled at home or in the workplace. (See Q.22 - Q.25)
- Another potential source of exposure is the use of mercury in various cultural practices and hobbies, including some types of jewellery, such as glass pendant necklaces and some artist's paints (see Q.20).
- Minor methyl mercury exposure can occasionally occur from handling contaminated soil or drinking contaminated water (see Q.55).

Q8. Are Canadians at risk from methyl mercury exposure?

The Canadian population, in general, is not being subjected to an increase in methyl mercury exposure, but some people may have higher exposure than others.

- People who eat a lot of fish and marine mammals as part of their daily diet tend to have higher methyl mercury exposures, because the potentially high levels of methyl mercury found in some of these species can be passed on to humans.
- Scientific research suggests that it is the developing fetus and the breast-fed children of women who consume greater amounts of the larger species of fish during pregnancy and lactation who are the most susceptible to health problems (see Q.43 - Q.46).

Q9. What uses of metallic (elemental) mercury in the home increase mercury exposure?

Any use of metallic (elemental) mercury in the home can be dangerous. A number

of unsafe household uses have been identified. These include:

- Sprinkling or spreading mercury in the house or car;
- Mixing mercury with water or other liquids and using this mixture as a washing solution;
- Burning mercury in candles for good luck (white magic);
- Hobbies: heating mercury on a stove to purify gold or silver;
- Using metallic mercury, often sold under the name "azogue", including placing it in a pouch worn around the neck, sprinkling it in the home, mixing it with bath water or perfume or placing it in devotional candles;
- Folk remedies: ingesting mercury (azogue) to treat constipation, colic or stomach ache (empacho), or;
- Playing with mercury as a novelty or carrying it as a charm.

Q10. What types of workplace environments potentially increase mercury exposure?

Workplaces and occupations that have a greater potential for elemental mercury exposure include:

- Manufacturers of electric equipment (mercury switches, dry cell batteries, mercury lamps, etc.), medical devices (thermometers, manometers, etc.) or automotive parts that contain mercury;
- Chemical processing plants that use mercury (production of chlorine, caustic soda, pesticides, biocides, slimicides and fungicides, latex and antifouling paints);
- Metal processing;
- Manufacturing plants producing explosive detonators;
- Waste incineration plants (municipal, medical and hazardous wastes), incinerators, landfills and crematoriums/cemeteries;
- Construction sites where building parts contain mercury (e.g. electrical switches, thermostats, thermometers, latex paints containing organomercurial fungicides, ship repair facilities);
- Medical facilities where equipment may contain elemental mercury (e.g. some blood pressure gauges, dental amalgams, thermometers, etc.); and
- Canada uses the *Threshold Limit Values (TLVs) for Chemical Substances*, as determined by the American Conference of Governmental Industrial Hygienists for national occupational health standards (Canada Labour Code and its Regulations). Federal regulations use the TLV's as amended from year to year, whereas most provinces use the TLV's as adopted for a specific year. For information on occupational exposure guideline limits, please refer

to Q.58.

Q11. Is there any method of testing that will determine individual exposure to mercury?

Yes. Hair, blood or urine samples are typically tested to detect elevated mercury levels in the body, if there is a suspected exposure. These samples can be easily taken in a doctor's office. Analytical methods can detect inorganic mercury and/or total mercury (the difference being considered organic mercury). The test for elemental mercury is the same test as for inorganic mercury, interpretation of the result being dependent on the type of exposure. While these tests are useful in determining the concentration of mercury, they cannot determine the type of mercury exposure beyond inorganic (includes elemental) or organic mercury exposure.

If your doctor suspects metallic (elemental) mercury poisoning, he/she will obtain a complete occupational and environmental history and may test your blood and/or urine for elemental mercury.

- For acute effects resulting from exposure to high levels of elemental or inorganic mercury, physicians often test whole blood. Whole blood is an indicator of recent mercury exposure. For occupational exposure, whole blood is collected at the end of the last work shift of the work week.
- If exposure to low levels of elemental or inorganic mercury vapour occurs over a period of time, a urine sample is preferred. Urine is collected pre-shift.
- Hair samples provide a good method for the determination of the variation of mercury intake over a long period of time, if the hair is analysed by segments.
- The concentration of mercury detectable in blood and urine in the non-occupationally exposed population is dependent on the analytical procedure used to measure the mercury and the living environment of the subject.
- Blood levels in the occupationally unexposed population vary between 0.1 and 10 micrograms of mercury per litre of blood. A whole blood concentration of 15 micrograms per litre is considered to be the biological exposure index (BEI) for occupational exposure. Blood concentrations above 15 micrograms per litre should be followed up by a physician. Symptoms should not be present at the BEI concentration. The BEI concentration of 15 micrograms per litre is equivalent to 0.008

micromoles/decilitre.

- Urine samples, for the non-occupationally exposed population, typically have a concentration of elemental or inorganic mercury of less than 3 micrograms per litre. For the occupationally exposed population or for populations with exposure to unusually high environmental concentrations, the elemental or inorganic BEI concentration limit is set at 35 micrograms mercury per gram of creatinine. The BEI concentration of 35 micrograms per gram of creatinine is equivalent to 20 micromoles of mercury per mole of creatinine.

Exposure through the Consumption of Fish

The main pathway for methyl mercury intake in humans is through the consumption of certain species of fish. Canadians living in Northern Canada whose diet consists mainly of a greater proportion of fish and marine mammals are at a higher risk for methyl mercury exposure than Canadians in more southern areas.

Q12. How do mercury releases end up in fish?

Mercury that is released into the environment may be deposited into water where microorganisms can convert it to methyl mercury, a highly toxic form of mercury that can build up, or bioaccumulate, in living tissue. Small organisms and plants take up mercury as they feed and this mercury tends to accumulate in their tissues. As larger animals, higher up the food chain, consume these plants and organisms, methyl mercury is bioaccumulatedat a more concentrated level. The process continues as you move up the food chain, with levels of mercury increasing in larger, predatory species. This process is known as biomagnification.

Q13. Does eating fish increase my exposure to mercury?

- People who eat a lot of fish and marine mammals as part of their daily diet tend to experience higher methyl mercury exposure, because the potentially high levels of methyl mercury found in some of these animals can be passed on to humans.
- Scientific research suggests that it is the developing fetus and the breast-fed children of women who consume greater amounts of the older, predatory species of fish during pregnancy and lactation who are the most susceptible to health problems (see Q.43 - Q.46) (National Academy of Sciences, 2000).

Q14. What advice would Health Canada offer Canadians concerning fish

consumption?

Health Canada gives the following advice concerning fish consumption:

- Consumers are advised to limit consumption of shark, swordfish and fresh or frozen tuna to a maximum of no more than one meal per week (excluding canned tuna, because these shipments are regularly tested and usually found to be well below the Health Canada guideline of 0.5 ppm), (see Q.15).
- For children, pregnant women and women of childbearing age, consumption of these fish should be limited to no more than one meal per month.
- For sport fish caught in local waters, consumers should be aware of any fish advisory from provincial and territorial authorities, and in some cases, the federal Department of Fisheries and Oceans) (see Q.73 for website details).

However, the benefits of including fish in a well balanced diet cannot be overlooked:

Fish is an excellent source of high-quality protein and omega-3 fatty acids, and it is low in saturated fat.

Consumers must consider the significant beneficial health effects of including fish in their diet, and take a best-balanced approach to possible exposure to methyl mercury and fish consumption.

Q15. What measures has Health Canada taken to reduce exposure to mercury through fish consumption?

Canada has set guidelines for mercury levels in domestically produced and imported fish.

- The Food Directorate of Health Canada has established a guideline level of 0.5 parts per million (ppm) for total mercury in domestically produced and imported fish considered to be the major source of dietary exposure (see Q.14). This guideline is enforced by the Canadian Food Inspection Agency (CFIA). It was first set in the 1970's and is currently undergoing further evaluation by the Bureau of Chemical Safety, Health Canada.
- Shark, swordfish, and fresh and frozen tuna sold commercially in Canada can contain mercury at levels that are known to exceed the 0.5 ppm guideline. However, an occasional meal of these types of fish would not significantly contribute to overall mercury exposure. Canned tuna tends to contain lower levels of mercury than fresh and frozen tuna because different species of tuna are used for canning. These species tend to be smaller and therefore have lower accumulations of mercury.
- The CFIA regularly tests domestic and imported commercial fish and shellfish, both freshwater and marine, in order to enforce the mercury

guideline.

- CFIA laboratory test results for mercury in canned tuna indicate that mercury levels will vary among species, but that these products consistently meet the guideline, with the lowest levels being found in light canned tuna (yellowfin and skipjack) (see Q.14).

Q16. Are any fish species exempt from the mercury content restrictions?

The Health Canada guideline for total mercury content in commercial fish species is 0.5 part per million (ppm). Large predatory fish species, such as swordfish, shark, and fresh and frozen tuna (not canned tuna) have been exempted from the 0.5 ppm mercury guideline. This means that the guideline does not apply to these fish, but instead a maximum consumption limit has been established by Health Canada for these species.

Although swordfish, shark, and fresh and frozen tuna (not canned tuna) are exempted from the 0.5 ppm guideline, CFIA tests these species as part of its overall contaminant monitoring program. Results from these tests are provided to Health Canada and used in their ongoing review of guidelines and exemptions. (see Q.14 & Q.73 - Health Canada Advisory: Information on Mercury Levels in Fish).

Q17. What are the current Health Canada <u>total</u> intake limits for methyl mercury for Canadians?

A provisional Tolerable Daily Intake (pTDI) of 0.47 microgram perkilogram of body weight perday for methyl mercury was established in 1972 by the Joint Food and Agriculture Organization/World Health Organization Expert Committee on Food Additives (JECFA) **and was adopted by Health Canada.** This level was reaffirmed in 1989 for the general population. However, through further studies, JECFA cautioned that pregnant women and nursing mothers were likely to represent a greater risk from the adverse effects of methyl mercury (WHO, 1989). This concern was shared by the bureau of Chemical Safety in the Foods Directorate of Health Canada and, in 1998, the Foods Directorate of Health Canada reviewed the new studies and lowered the maximum pTDI for methyl mercury to 0.2 microgram perkilogram of body weight perday for pregnant women, women of childbearing age and young children. A recent evaluation by JECFA (WHO, 2003) derived a similar value (pTWI of 1.6 microgram perkilogram of body weight perweek or 0.23 microgram perkilogram of body weight perday) to the Health Canada pTDI.

Exposure through Consumer Products

Q18. Which consumer products are known to contain mercury?

Despite its toxic nature, humans have used mercury in a range of products in order to take advantage of its unique properties to conduct electricity, measure temperature and pressure, and to act as a fungicide, preservative and disinfectant. These uses have been in decline in recent years.

Mercury-containing products currently used in Canada include the following:

- Fluorescent lamps, high intensity discharge lamps and mercury vapour lamps;
- Some fever thermometers;
- Some thermostats;
- Some electrical switches;
- Some medical equipment such as pressure sensing devices and blood pressure gauges;
- Dental amalgam;
- Disk ("button") batteries.

Other products that have been known to contain mercury in the past and that might still be in circulation, include:

- Lighted athletic shoes;
- Old latex and oil based paints;
- Vacuum gauges;
- Solvents, dyes and pigments;
- Wooden windows and doors;
- Barometers and manometers;
- Pottery and art objects;
- Pharmaceuticals including human and animal vaccines and cosmetics;
- Fungicides for seed and turf;
- Old toys, chemistry sets and scientific apparatus.

Also, note that mercury is no longer used in the manufacture of vinyl blinds, candles, shot, fishing jiggers or sinkers.

Q19. Why was mercury used in paints and what should I do about mercury-based paint in my home?

Mercury was used in paints as an anti-microbial pesticide or preservative in order to prevent mould growth. This practice ceased more than 10 years ago. It is

possible that homes more than 10 years old have paint on their walls and/or ceilings that contains minute quantities of mercury. This should pose virtually no health risks to inhabitants of these homes. Once a mercury-containing paint has cured, the mercury is incorporated into the paint matrix and cannot be released.

There is no need to remove mercury-containing paint from homes where it has been applied. If there is any concern over the presence of mercury-containing paint on walls or ceilings, application of a fresh coat of new paint will seal in all of the layers of paint beneath it and provide some peace of mind.

When stripping old paint, follow the instructions and recommendations found in the following pamphlets in order to ensure safe working conditions:
http://www.hc-sc.gc.ca/english/iyh/products/paint_strippers.html
http://www.hc-sc.gc.ca/english/iyh/leadpaint.html

Q20. As an artist, how can I reduce exposure to mercury?

Follow safe studio practices for reducing exposure to chemicals, such as the following:

- Do not eat, drink or smoke while using art materials;
- Always wash your hands carefully after using art materials;
- Use fume hoods or spray booths exhausting to the outside, or force the air to the outside by using fans;
- Be aware of the supplies you buy and, if available, obtain a Material Safety Data Sheet in order to ascertain the contents of the paint (mercury may be a preservative) used for arts and crafts.
- The following Health Canada webpage provides more information on precautionary practices for the artisan:
  http://www.hc-sc.gc.ca/english/iyh/products/arts.html

Q21. Does mercury in children's toys represent a hazard?

Health Canada's Consumer Product Safety Bureau is unaware of any manufacturers intentionally adding mercury to toys. If mercury were to be found in toys, it could represent a hazard, because children, especially under the age of three, tend to place objects in their mouths. In addition, the *Hazardous Products Act* prohibits the use of mercury in decorative or protective coatings applied to toys, equipment and other products destined for the educational or recreational use of children. The Consumer Product Safety Bureau has conducted surveys to ensure that toys do meet these requirements.

Q22. What can I do to manage mercury exposure in my home?

Although some consumer products such as electrical switches and fever thermometers still contain mercury, most products today can be manufactured without it. Because pollution prevention is preferable to pollution clean-up, consumers can help reduce mercury releases by identifying household items that might contain mercury, avoiding the purchase of mercury-containing products, and disposing of mercury-containing waste appropriately.

The best way to avoid mercury exposure from consumer products is to limit the presence of mercury-containing items in your home. Buy rechargeable batteries or batteries that are labelled "mercury free" or "no added mercury", and use digital or spirit (red) thermometers.

There is little chance for exposure to mercury when proper directions are followed for mercury-containing products. If unbroken, fluorescent light bulbs and mercury thermometers emit no mercury and are safe household items. If a breakage does occur, the risk of inhaling mercury vapour can increase, especially in enclosed indoor spaces with poor ventilation.

Q23. What happens when I use metallic mercury unsafely in the home?

At room temperature and especially when heated, elemental mercury produces a vapour that can cause serious lung damage and possible death if inhaled. In addition, as mercury cools, it condenses on household surfaces such as rugs, walls and furniture. These household surfaces can then continue to release low concentrations of mercury vapour slowly into the air. Mercury vapour is invisible, odourless and tasteless, and adults and children breathing this vapour at low levels for weeks or months will accumulate mercury in their bodies and may eventually become ill.

Q24. What should I do with a mercury-containing product when it has reached the end of its useful life?

Never discard mercury-containing products with household trash. Treat these items as hazardous waste and consult your local municipality for information on proper handling and disposal.

Q25. How should I clean up a mercury spill in my home (including a broken mercury fever thermometer)?

If mercury is burned, heated, sprinkled or spilled in the home, a poisonous gas can be produced, requiring a clean-up procedure. Mercury vapour is odourless and invisible, and special equipment is required to measure mercury concentrations in the home. A professional can determine the areas of the house that are affected by measuring the level of mercury vapour with special equipment, and by assessing how mercury was used in the house.
The amount of mercury found in household products does not usually lead to serious health problems and can often be cleaned up without the help of a trained professional. However, even small spills should be treated as hazardous and cleaned up with caution. Remember to report these spills to the local environmental health authorities. Depending on the size of the spill, hiring a Contractor to monitor mercury levels in air, and to conduct a professional clean-up, may be advisable. There are also commercially available small mercury spill kits that can be obtained. Never vacuum a mercury spill with a household vacuum cleaner. It will increase the vaporization of the mercury.

A few helpful hints to remember are:

- Do not put contaminated items in the washing machine;
- Do not vacuum the spill;
- Do not use a broom or a brush;
- Do not pour mercury down the drain; and
- Do not throw mercury or contaminated items in the garbage.

Risks to exposure from mercury can be minimized by taking the effective steps described in the Environment Canada website accessible through the following link:
http://www.ec.gc.ca/mercury/en/index.cfm

Q26. How much mercury is released from cigarette smoke?

Cigarette smoke contains up to 11.5 nanograms of mercury per cigarette in mainstream smoke and up to 16.6 nanograms of mercury per cigarette in side stream smoke.

Q27. What is the source of mercury in cigarettes?

Mercury is taken into the plant primarily by the growing root and subsequently translocated to the leaves along with other nutrients. Mercury exists in the tobacco plant as a result of its deposition from the air, combined with the soil uptake of mercury. It is released in tobacco smoke as the cigarette burns, and exposure to

tobacco smoke contributes to the total body burden of mercury.

Exposure from Dental Amalgam and Thimerosal Vaccines

Q28. Should I avoid mercury amalgam dental fillings?

Current evidence does not indicate that dental amalgam is causing illness in the general population. However, it is generally a good idea to reduce exposure to mercury if this can be achieved at a reasonable cost and without other adverse effects. Health Canada recommends non-mercury filling materials be considered for restoring the primary teeth of children where the mechanical properties of the material are suitable. Pregnant women and people who may have allergic hypersensitivity to mercury or who have impaired kidney function should avoid the use of dental fillings containing mercury amalgam.

Q29. Should I have my existing mercury amalgam dental fillings replaced?

Health Canada does not support removal of sound amalgam fillings in patients who have no indication of related adverse health effects. Individuals who have developed hypersensitivity to amalgam should replace existing mercury amalgam fillings with another material if their physician recommends this. Amalgam fillings should not be removed while a woman is pregnant because she might be exposed to mercury vapour during removal.

Q30. What is thimerosal and why is it used in vaccines?

Thimerosal is a preservative that contains mercury and it has been used in some vaccines and other products since the 1940's to prevent spoilage and contamination. Efforts are under way to eliminate thimerosal from product formulations, where possible.

Q31. If patients have a choice of vaccines, one with mercury or one without, which should they choose?

They should choose mercury-free vaccines, if they are available and if they are just as suitable as thimerosal vaccines. Patients should discuss this with their doctor and follow his/her advice. The most important consideration is that parents should not miss an opportunity to have their children immunized. Currently, the only thimerosal-containing vaccine in routine use in the infant immunization schedules of some Canadian jurisdictions is the hepatitis B vaccine.
(See
http://www.hc-sc.gc.ca/pphb-dgspsp/publicat/ccdr-rmtc/02vol28/dr2809ea.html

http://www.hc-sc.gc.ca/pphb-dgspsp/publicat/ccdr-rmtc/03vol29/acs-dcc-1/index.html)

Q32. Why is the federal government not recommending removal of thimerosal vaccines from use if there is a concern?

Making vaccines safer and more effective is a constant goal for the federal government and vaccine manufacturers. But decisions must be based on weighing the risks and benefits of each vaccine. In some cases, mercury-free alternatives may not be available or may not be as suitable as the thimerosal formulations. Missing vaccinations would put children at risk from disease. Since thimerosal vaccines contain only minute levels of mercury, the benefits of vaccination with them far outweigh the minimal risks associated with thimerosal.

Q33. What degree of mercury exposure has my six-month-old baby encountered from vaccines? Is there a health risk associated with this level of exposure?

There is little chance for a six month old to be exposed to mercury through vaccination. Most vaccines licensed in Canada do not contain thimerosal. Since 1994, all routine childhood vaccines, with the exception of the flu vaccine, administered in Canada have not contained thimerosal. Thimerosal is not added to single dose vaccines.

In Canada, vaccines to prevent the following diseases are used for routine immunization of children and do not contain thimerosal:

- diphtheria
- tetanus (lockjaw)
- pertussis (whooping cough)
- polio
- rubella (German measles)
- measles (red measles)
- mumps
- hepatitis B (available free to children only in some provinces and territories)
- Haemophilus influenzae type b disease

For immunization of infants against hepatitis B, parents or guardians in some provinces and territories have the choice of a thimerosal-free vaccine.

Q34. Do children receive toxic levels of mercury from vaccines?

No. Children who receive vaccines containing thimerosal may be exposed to

minute levels of mercury, but these are very far below any toxic level.

Health Concerns

In this section, health concerns resulting from mercury exposure in adults, pregnant women and children are discussed. Exposure to mercury mostly affects the nervous system, the cardiovascular system, the immune system, and the kidneys. Fetal mercury exposure can lead to neurodevelopmental problems in children.

The health effects of mercury in its various forms are well documented. For further consultation, the public health statement for mercury produced by the Agency for Toxic Substances and Disease Registry is available at the following site: http://www.atsdr.cdc.gov/toxprofiles/tp46-c1.pdf

Q35. What happens to elemental mercury in the body and where does it accumulate?

- Elemental mercury can enter the body by absorption through the skin, by absorption through the stomach if swallowed, or by inhalation. Absorption depends on the route of exposure (inhalation, ingestion or dermal).
- When mercury vapour is inhaled, the lung is the main site of absorption. Approximately 80% of the inhaled vapour enters the bloodstream and is rapidly transported to other parts of the body, including the brain and kidneys. It readily crosses the blood-brain and placental barriers. Elemental mercury, in the blood of pregnant women, may be passed on to the developing fetus.
- If small amounts of metallic mercury are ingested from a broken oral thermometer, less than 0.01% of the mercury will be absorbed by the body through the stomach or intestine. A condition such as a bleeding ulcer in the gastrointestinal tract can increase the rate of absorption into the bloodstream.
- Once in the body, elemental mercury can stay there for weeks or months. Most of it will accumulate in the kidneys and, to a lesser extent, in the brain, where it is readily converted to an inorganic form and remains there for a long time. More mercury is deposited in the brain after exposure to elemental mercury than after exposure to inorganic mercury compounds.

Q36. What happens to inorganic mercury in the body and where does it accumulate?

- Inorganic mercury salts or compounds do not generally vaporize at room temperatures and, upon inhalation, these compounds are not as likely to enter your body as easily as inhaled metallic mercury vapour.
- When inorganic mercury compounds are ingested, generally less than 10% is absorbed through the intestinal tract; however, under certain conditions, such as bleeding ulcers, up to 40% can be absorbed into the body through the lesion in the stomach and/or intestines.
- Smaller amounts of inorganic mercury can be absorbed through the skin, but ingestion is the main pathway into the body.
- Absorbed inorganic mercury accumulates mostly in the kidneys and does not cross placental or blood-brain barriers as easily as elemental or methyl mercury. It is, however, accumulated in placental tissues.
- In a nursing mother, some of the inorganic mercury from her body will be passed on to her child through her breast milk.

Q37. What happens to methyl mercury in the body and where does it accumulate?

- When fish or other foods contaminated with methyl mercury are consumed, approximately 95% of the methyl mercury is absorbed through the stomach and intestinal tract, then transferred to the blood stream and distributed throughout the body.
- Only small amounts of methyl mercury can be absorbed into the bloodstream directly through the skin, but other forms of organic mercury (in particular dimethyl mercury) can rapidly enter the body through skin.
- It readily passes the blood-brain barrier and enters the brain.
- In pregnant women, methyl mercury easily crosses the placental barrier and moves into the blood of the developing child and subsequently into the child's brain and other tissues. As with inorganic mercury, some of the methyl mercury in a nursing woman's body will mobilize into her breast milk.
- Methyl mercury can be changed, within the body, into inorganic mercury. When this happens in the brain, mercury can remain there for a long time.

Q38. How long does it take to excrete mercury (all forms) from the body?

- The majority of inorganic and elemental mercury compounds exit the body in the urine and faeces over a period of several weeks to months; smaller amounts of absorbed mercury vapours exit the body in exhaled breath and through perspiration, more rapidly.
- The half-life in the whole body has been observed to be within the range of 29 to 60 days, with an average of 42 days for inorganic mercury.

- Methyl mercury leaves slowly over a period of several months, mostly as inorganic mercury in faeces. After stopping exposure to methyl mercury, it takes between 45 and 70 days to decrease methyl mercury concentrations by half in a person's blood and slightly longer in the whole body.

Q39. What are the health effects and symptoms of inorganic mercury exposure in adults?

- Acute poisoning following exposure to mercury vapours at high levels (over 1 milligram per cubic meter) for a short period, may cause severe irritation of the airways, pneumonitis, pulmonary edema and other symptoms of lung damage. It can damage the brain, nerves, kidneys and lungs and, in extreme cases, may cause coma or death. Some people have experienced tremors, difficulty in coordinating the movement of their feet or hands, problems with balance, and a numbness or prickly sensation in their fingers.
- Following chronic exposure to low levels of mercury vapour (50 to 100 microgram per cubic meter), it may take some time to cause adverse effects on the central nervous system, kidney and thyroid, and the effects could be more subtle. It is difficult to distinguish mercury symptoms from some other common ailments. Symptoms include tremors (shaking), muscular weakness, depression, personality changes and short-term memory loss in adults, and skin rashes, particularly redness and peeling of the hands and feet, in children.

- Acute poisoning from inorganic mercury salts is rare, except in cases of accidental ingestion. The kidney is the primary target organ. Chronic occupational exposure to mercury salts has been associated with effects on the central nervous system similar to those associated with exposure to elemental mercury vapour.

Q40. What are the health effects and symptoms of methyl mercury exposure in adults?

A wide range of adverse health effects have been observed in adults following methyl mercury exposure, the severity depending largely upon the magnitude of the dose and the duration of exposure.

- Devastating neurological damage, and death occurred after the extremely high exposures stemming from the poisoning episodes in Minamata, Japan and in Iraq. Methyl mercury may also cause adverse effects on other organs in the body.
- Effects noted at the earliest stages of exposure include paresthesia (numbness

or “pins and needles” sensation) in the extremities of the hands and feet, malaise or blurred vision. This may progress to ataxia (loss of the ability to coordinate muscular movement), dysarthria (speech difficulties) or loss of hearing and constriction of visual fields.

- Methyl mercury poisoning is characterized by a latent period between exposure and onset of symptoms. The latent period can vary from one to several months, depending on the dose and duration of the exposure.
- In Nunavik, mercury exposure is chronic (exposure at low doses over a long period of time) and, so far, no cases with these symptoms have been reported. Nutritional benefits of selenium and omega-3 fatty acid, both commonly found in fish and/or marine mammals, might counteract the adverse effects of methylmercury to some degree.

Q41. What type of treatment exists to remove mercury from blood?

If the level of mercury detected in the blood or urine is considered high, a doctor might prescribe chelating agents that bind mercury ions. The mercury and the chelating agent are then excreted from the body together. If no chelating agent is used, mercury can still be excreted by the body, but not as quickly. The excretion half-life (time for the amount of mercury to be reduced by half in the body) for metallic mercury is 33.1 days. A number of chelating agents that bind to the mercury are available and can increase the excretion rate up to threefold. As with any medicine, chelating agents can cause side effects.

Q42. Should I be concerned about mercury concentrations in drinking water?

Mercury levels in Canadian drinking water are generally well below the established maximum acceptable concentration (MAC) of 0.001 milligram per litre (Health Canada, Guidelines for Drinking Water Quality). While mercury levels may be elevated in certain source waters, because of natural mercury deposits or pollution, exposure via drinking water is not generally a concern. In those situations where mercury levels are deemed to be too high, effective treatment technologies exist for private and municipal water supplies.

<u>Pregnant Women and Children</u>

Q43. Why is mercury a special concern for pregnant and breastfeeding women?

Methyl mercury ingested by a pregnant woman, or metallic mercury that may enter her body from breathing contaminated air, can be passed from the maternal blood to the developing fetus by crossing the placental barrier. Inorganic mercury and

methyl mercury can be transferred from maternal breast milk to a nursing infant. Methyl mercury can also accumulate in an unborn baby's blood to a concentration higher than the concentration in the mother. The amount of mercury in milk will vary, depending on the degree of exposure and the amount of mercury taken up by the nursing mother. Concern over mercury levels in breast milk should be discussed with the nursing mother's doctor, considering the significant benefits of breastfeeding to the developing infant. Advice on fish consumption is given in Q.13.

Q44. Why are children and the developing fetus at a greater risk than adults for adverse health effects associated with mercury?

There are a number of reasons why the developing fetus and children are at greater risk for acquiring a higher blood mercury level than adults.

- Children have different behaviours than adults, which involve direct contact with surfaces that may be contaminated (such as crawling and producing mouth contact with surfaces and toys). These activities may place them at higher risk.
- The intake of air, water and food for children may be greater per kg of body weight than for an adult, which could result in far greater exposure to the different forms of mercury.
- Because children are developing rapidly, their metabolic rate is higher than that of an adult, resulting in a greater efficiency at absorbing substances (e.g. their level of gastro-intestinal absorption and retention are greater).
- In addition, the immature or developing organs and systems of children are less able to eliminate mercury. Cellular repair mechanisms are similarly underdeveloped, providing a diminished capacity to repair damage caused by mercury.
- Scientific evidence indicates that exposure to methyl mercury is more dangerous for young children than for adults. This is because of lower neurological effect thresholds for methyl mercury and the distribution of higher levels of methyl mercury to the developing brain of young children, which may interfere with the development of motor and cognitive skills.

Q45. What are the health effects of metallic or inorganic mercury exposure in children?

- Limited information is available on the effects of mercury vapour on early stages of childhood. High exposure to mercury vapours can cause lung,

stomach and intestinal damage. In severe cases, induced respiratory failure may result in death. "Pink disease" or acrodynia has been reported most frequently in children treated with teething powders that contained calomel (mercury) or in children who inhaled mercury vapour, such as from broken thermometers. These children also developed irritability, insomnia, increases in perspiration and photophobia (sensitivity to light). Teething powders are no longer used in Canada (see Q.43 - Q.44).

- Children exposed to excessive amounts of mercury chloride tablets for constipation, worms or to mercurous chloride-containing powders for teething discomfort, had swollen red gums, excessive salivation, weight loss, diarrhea and/or abdominal pain, and muscle twitching or cramping in the legs and/or arms, increased heart rates and elevated blood pressure. Kidney damage is very common after exposure to toxic levels of inorganic mercury.

Q46. What are the health effects associated with exposure to methyl mercury in children?

Children are more susceptible to the adverse effects of methyl mercury than adults. Methyl mercury exposure is commonly associated with neurodevelopmental effects. The effects on infants may be subtle or more pronounced, depending on the degree of exposure received by the fetus or young child.

- Infants exposed *in utero* to high levels of methyl mercury during the Minamata and Iraqi incidents were born with severe disabilities, such as mental retardation, seizure disorders, cerebral palsy, blindness, and deafness.
- At much lower doses resulting from chronic maternal fish consumption, infants might appear normal during the first few months of life but later display IQ deficits, abnormal muscle tone, reduced motor function, and lower attention and visuospatial performance. In recent human studies, neuropsychological deficits are detected in children aged seven years, following prenatal exposure to methyl mercury.
- Increased blood pressure in children exposed prenatally to methyl mercury has also been reported.

Mercury in the Environment

Mercury and its compounds can be toxic to living organisms at very low concentrations in aquatic and terrestrial ecosystems. Since mercury is an element, it cannot be created or destroyed and it persists in the environment. In addition, mercury can bioaccumulate

in organisms. This ongoing accumulation in the body tissues of various species leads to biomagnification in the predator species as they consume organisms lower down in the food chain.

This section covers topics such as how mercury affects fish and wildlife and the concentrations of mercury present in various components of the environment such as air and freshwater.

Q47. How much does Canada contribute to worldwide mercury releases?

Total global mercury emissions from human sources are currently thought to be approximately 2400 tons per year. In 2000, the Canadian contribution to global releases was approximately 8 tons.

It is assumed that a large portion of the mercury present in the atmosphere today is a result of many years of releases stemming from anthropogenic activities. The natural component of the total atmospheric burden is difficult to estimate, but is probably in the order of 25% to 50%. Anthropogenic activities have thus increased the levels of mercury in background air by roughly a factor of 3. Current estimates indicate that total global mercury releases to the atmosphere are in the area of 5000 metric tons peryear, of which roughly 50% are of anthropogenic origin.

Q48. How are anthropogenic (human) mercury emissions transported through the atmosphere?

- Because mercury evaporates relatively easily, mercury emissions can be transported on wind currents, either as a vapour or bound to particles.
- Elemental or metallic mercury vapour can circulate in the atmosphere for a year or more and can travel long distances. In contrast, oxidized or reactive mercury has an atmospheric residence time of less than two weeks due to its solubility in water and its reactivity.
- As a result, mercury emissions from industrial point sources might remain localized in the environment, or might be transported regionally and even globally. In addition, mercury is thought to participate in a global distillation phenomenon that transfers mercury and other chemical emissions from equatorial, subtropical and temperate regions to the polar regions via the "grasshopper effect". When this phenomenon takes place, the emitted substance reenters the atmosphere by volatilizing after initial deposition and continues over time to "hop" through the environment until there is insufficient solar energy to revolatilize the substance. This favours contaminant

accumulation in the colder polar regions.

Mercury from the atmosphere reaches land and surface waters either through wet deposition in precipitation or through dry deposition bound to particles, and can also enter water bodies as runoff from soil or through groundwater. In surface waters and sediments, biological processes can transform mercury into methyl mercury – a highly toxic form that can accumulate in living organisms and biomagnify up the food chain.

Q49. How is mercury transformed in the environment?

- Natural transformations and environmental pathways of mercury are very complex and are greatly affected by local conditions.
- There are two main types of chemical reactions in the mercury cycle that convert mercury through its various forms: oxidation-reduction and methylation-demethylation.
- In oxidation-reduction reactions, mercury is either oxidized to a higher valence state through the loss of electrons (e.g. from elemental mercury as Hg^0 to the more reactive form as Hg^{2+}) or mercury may be reduced to a lower valence state by gaining electrons.
- Mercury is transformed into methyl mercury when the oxidized, or mercuric species (Hg^{2+}), gains a methyl group (CH_3). The methylation of Hg^{2+} is primarily a natural, biological process resulting in the production of highly toxic and bioaccumulative methyl mercury compounds that build up in living tissue and increase in concentration up the food chain.

Q50. What is polar sunrise depletion?

A Canadian atmospheric researcher, Dr. Bill Schroeder, has shown in recent studies the rapid oxidation of Hg^0 vapour to Hg^{2+} in Arctic surface air during and after the polar sunrise at Alert, Nunavut Territory, and this has more recently been observed in Pt. Barrow, Alaska. This reaction is thought to occur photochemically (in the presence of sunlight) and in the presence of reactive chemicals released from sea salt (for example, bromine and chlorine ions). As a result, a pulse of reactive mercury enters the Arctic environment when the short-lived growing season is beginning. It remains a research question to determine what fraction of this reactive mercury is converted to toxic methyl mercury and taken up by animals and plants.

It is suggested that significant atmospheric mercury is being deposited to the snow

pack during the period following polar sunrise. It has been found that, in the springtime, the accumulation rate of mercury in the snow is enhanced by a factor of four. Elevated concentrations of mercury have been found in snow melt-water collected near Arctic communities. Concentrations of mercury ranged from 2.1 nanograms per litre at Baker Lake to 237 nanograms per litre at Cambridge Bay. A nanogram is one-billionth (10^{-9}) of a gram. Future research will help to assess the environmental fate and impacts of this significant influx of mercury into the Arctic ecosystem.

Q51. How does mercury affect fish and wildlife?

Mercury is toxic, persistent, and can build up or bioaccumulate in living organisms, inflicting increasing levels of risk on higher order species (see Q.12). Although the long-term effects of mercury on whole ecosystems are unclear, the survival of affected populations and overall biodiversity could be at risk.

Fish:

Methyl mercury is bound tightly to fish protein when absorbed through the gills or when contaminated food sources are eaten. In some cases, methyl mercury levels in higher trophic level (food chain) fish species such as freshwater bass, walleye and pike, and marine shark and swordfish, can be up to a million times greater than in the surrounding water. In general, levels of mercury increase with fish size and age. Levels also vary by species and location. Bioaccumulation in fish is influenced by the amount of methyl mercury present, which is in turn affected by local biogeochemical processes.

Birds:

Piscivorous (fish eating) predators such as loons, merganser ducks, osprey, eagles, herons and kingfishers generally have high concentrations of mercury in their systems. Mercury has been detected in common loons from Alaska to Atlantic Canada, and blood concentrations have been correlated with levels in prey fish species. Research indicates that loon blood mercury concentrations increase from west to east across Canada and the United States, with the highest levels in Southeast Canada. High levels of mercury are associated with impaired loon reproductive success as well as with growth related problems. These problems can lead to an increased death rate and a decreased birth rate, resulting in a reduction in the abundance of natural populations.

Mammals:

Mercury has been found in predatory mammals such as otters from south central Ontario. It is thought that elevated mercury levels in otters may cause early mortality due to toxicity and behavioural changes. While the reproduction and behaviour of bird species is generally affected by exposure to methyl mercury, mammals most often suffer neurological effects. The severity of the toxic effects will depend on the degree of exposure and can range from a slight impairment to reproductive failure or death.

Q52. Is mercury present in the air and at what concentration?

In 1996 Environment Canada initiated the Canadian Atmospheric Mercury Measurement Network (CAMNet). Currently, there are stations in rurally representative locations across Canada measuring gaseous elemental mercury on a continuous basis. Typical ambient air concentrations at these sites range from 1.5 to 1.7 nanograms per cubic metre. The concentrations show a seasonal variation and, when air from industrialized regions arrives at a site, are correlated with other pollutants. Studies are also being undertaken in urban areas to further investigate the behaviour of mercury.

Q53. Is mercury present in dust & soil and at what concentration?

Concentrations of mercury in Canadian soils are in the range of 0.01 to 0.4 milligram per kilogram of dry weight, though higher levels tend to be reported in areas of ore deposits, spills, landfills and metal processing plants.

Q54. Is mercury present in precipitation and at what concentration?

Results at seven Canadian Atmospheric Mercury Measurement Network sites in 2001 showed an average concentration of 6.8 nanograms of mercury per litre of precipitation, with higher values recorded in the summer. Concentrations and deposition were highest in summer and lowest in winter. Deposition is a function of the concentration of mercury in precipitation and the amount of precipitation. The average annual deposition rate in 2001 for the seven sites noted above was 5.5 micrograms of mercury per square metre per year.

Q55. Is mercury present in freshwater and at what concentration?

Based on information largely from Ontario and Quebec, levels for methyl mercury are usually less than 1 nanogram per litre in natural surface waters, although concentrations up to 4.1 nanograms per litre have been reported. Methyl mercury concentrations are higher (0.6 nanogram per litre) in water draining from wetland

areas relative to concentrations in water from other areas (0.03 nanogram per litre). Generally, methyl mercury accounts for less than 10 percent of total mercury found in surface water (see Q. 7).

Q56. Is mercury present in sediment and at what concentration?

Concentrations of mercury in freshwater and marine sediments vary considerably.

Background levels in lakes and rivers average 0.07 milligram per kilogram of dry weight. Mercury levels in contaminated lake sediments are as high as 15 milligrams per kilogram of dry weight, and as high as 25 milligrams per kilogram of dry weight for contaminated river sediments

In marine environments (coastal and estuary), background concentrations range from 0.010 to 0.521 milligram per kilogram of dry weight, while concentrations up to 23 milligrams per kilogram of dry weight have been measured in contaminated marine sediments.

Government Action on Mercury

The Government of Canada is involved in the development and implementation of several initiatives to help reduce mercury releases and manage risks associated with exposure to mercury. Although domestic measures will continue to reduce the risk of mercury in Canada, efforts must also be made on a regional and global scale, because a portion of the mercury in our lakes and soil originates from other countries via long-range atmospheric transport. This section covers strategies to manage mercury in Canada, and provides further sources of information.

Q57. What Canadian legislation pertains to the management of mercury?

Canadian legislation pertaining but not limited to the management of mercury is listed in the following table:

Legislation	Description
Canadian Environmental Protection Act, 1999 (CEPA) (Environment Canada & Health Canada)	The goal of the renewed *CEPA (1999)* is to contribute to sustainable development through pollution prevention and to protect the environment, human life and health from the risks associated with toxic substances. CEPA also recognises the contribution of pollution prevention and the management and control of toxic substances and hazardous waste to reducing threats to Canada's ecosystems and biological diversity. http://www.ec.gc.ca/CEPARegistry/the_act/
Fertilizers Act (Canadian Food Inspection Agency)	An *Act* to regulate agricultural fertilizers. http://laws.justice.gc.ca/en/F-10/
Fisheries Act (Fisheries & Oceans Canada)	An *Act* respecting fisheries; the proper management and control of the sea-coast and inland fisheries; the conservation and protection of fish; the catching, loading, landing, handling, transporting, possession and disposal of fish; the operation of fishing vessels and other regulations. http://laws.justice.gc.ca/en/F-14/
Food & Drugs Act (Health Canada)	This *Act* applies to all food, drugs, cosmetics and medical devices sold in Canada, whether manufactured in Canada or imported. The *Act* and Regulations ensure the safety of and prevent deception in relation to foods, drugs, cosmetics and medical devices by governing their sale and advertising and in addition set out the labelling requirements for food. http://www.hc-sc.gc.ca/english/about/acts_regulations.html
Hazardous Products Act (Health Canada)	The *Act* and its Regulations, are in place to protect the health and safety of Canadians by prohibiting, regulating or controlling the sale, advertisement, or importation of hazardous or potentially hazardous products used by consumers and workers. However, this *Act* does not cover products that are regulated by other federal legislation, for example, pesticides (regulated by the *Pest Control Products Act*) or food, drugs or cosmetics (regulated by the *Food and Drugs Act*). http://www.hc-sc.gc.ca/english/about/acts_regulations.html
Pest Control Products Act (Health Canada)	This *Act* and Regulations are intended to protect people and the environment from risks posed by pesticides. Pesticides include a variety of products such as insecticides, herbicides and fungicides. Any pesticide imported, sold or used in Canada must first be registered under this Act, which is administered by the Pest Management Regulatory Agency of Health Canada. http://www.hc-sc.gc.ca/english/about/acts_regulations.html
Transportation of Dangerous Goods Act (Transport Canada)	The Transportation of Dangerous Goods Directorate and its corresponding *Act* and Regulations are the focal point for the national program to promote public safety during the transportation of dangerous goods. The TDG Directorate serves as the major source of regulatory development, information and guidance on dangerous goods transport for the public, industry and government employees. http://laws.justice.gc.ca/en/T-19.01/

Q58. What is the Government of Canada doing, in collaboration with provincial

and international governments, to reduce mercury in the environment?

Federal-Provincial:

- The primary policy tools currently in use for mercury release reductions in Canada are Canada-wide Standards (CWS). These are standards developed cooperatively by the Canadian Council of Ministers of the Environment (CCME), which comprises the environment ministers of the 14 jurisdictions in Canada (federal, provincial, and territorial). While CWSs are developed jointly, ministers are responsible for implementation in their jurisdiction.
- In 2000, CCME developed several Canada-wide Standards for mercury. Standards have been developed, or are being developed, for certain mercury containing products and for mercury emissions from selected industries. For more information on Canada-wide Standards, see Q.66 - Q.70, or visit: http://www.ccme.ca/initiatives/standards.html
- In addition, the 1994 Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA) targeted mercury pollution for control. A new COA was signed by the Governments of Canada and Ontario in March, 2002. One of the anticipated results of this agreement is a 90% reduction in mercury by 2010. For more information, visit: http://www.ec.gc.ca/MERCURY/MM/EN/mm-coa.cfm?SELECT=MM.

International:

Canada is working with the USA and Mexico through the North American Commission for Environmental Co-operation to address mercury issues under the North American Regional Action Plan on Mercury. For more information, see: http://www.cec.org/programs_projects/pollutants_health/smoc/smoc-rap.cfm?varlan=english

In addition, Canada is taking a lead role to reduce mercury releases into the environment both in Canada and on a global scale through other regional and international initiatives, including:

- Great Lakes Binational Toxics Strategy; http://www.epa.gov/glnpo/bns/index.html
- New England Governors and Eastern Canadian Premiers;

http://www.scics.gc.ca/pdf/850088019_e.pdf

- United Nations Economic Council for Europe Convention on Long-Range Transboundary Air Pollution; http://www.unece.org/env/lrtap/
- United Nations Environment Program, Global Mercury Assessment; http://www.chem.unep.ch/mercury/Report/final-report-download.htm

Q59. How is Health Canada helping to reduce exposure to mercury?

Health Canada, as the federal regulatory body, sets the health standards and issues health advisories, when necessary, to help reduce mercury exposure (see Q.7 - Q.34). Health Canada has a number of guidelines/recommendations on mercury as follows:

Health Canada Guidelines/Recommendations for Mercury Exposure

Guideline:	Canadian Drinking Water Quality; (Maximum Acceptable Concentration; MAC)	**0.001** mg total mercury per Litre	
Guideline:	Soil (inorganic mercury) - Agricultural - Residential/Parkland - Commercial - Industrial	 **6.6** mg/kg **6.6** mg/kg **24** mg/kg **50** mg/kg	
Guideline:	Commercial Fish	**0.5** part per million total mercury[1]	
Guideline:	Provisional Tolerable Daily Intake (pTDI) - adults Provisional Tolerable Daily Intake (pTDI) - children and women of childbearing age	 **0.47** µg MeHg per kg bw per day **0.2** µg MeHg per kg bw per day	
Guideline:	Biological Materials - Normal Acceptable Range - Increasing Risk - At Risk	Blood **<20** ppb **20-100** ppb **>100** ppb	Hair **<6** ppm **6-30** ppm **>30** ppm
	Occupational Exposure - Mercury-alkyl compounds - Mercury-aryl compounds - Mercury - elemental & inorganic forms	TLV-TWA[2] 0.01 mg/m^3 0.1 mg/m^3 0.025 mg/m^3	TLV-STEL[3] 0.03 mg/m^3

[1] This guideline applies to commercial fish only and not to fish caught for such non-commercial purposes as sport, recreation, or subsistence.

[2] Threshold Limit Values - Time Weighted Average (American Conference of Governmental Industrial Hygienists).

[3] Threshold Limit Values - Short Term Exposure Limit (American Conference of Governmental Industrial Hygienists).

- To ensure that mercury levels in fish consumed by Canadians meet Health Canada standards, the Canadian Food Inspection Agency (CFIA) regularly monitors domestically produced and imported fish to determine if the product meets federal standards. Test results obtained by the CFIA, under the contaminants monitoring program, are provided to Health Canada to assist in the review of guidelines.
- Provincial governments are responsible for monitoring mercury levels and for setting and publicizing safe consumption standards and guidelines for the recreational fishing industry. In certain specific instances, e.g. where fish habitat has been intentionally altered, the federal Department of Fisheries and Oceans may also be involved in local advisories if necessary.

Q60. Does Canada monitor the release of mercury into the environment from anthropogenic (human) sources?

Yes, the public can access information on mercury released into air, water and soil from Canadian industry and transportation sectors through the National Pollutants Release Inventory (NPRI), established in 1992 to provide a national, publicly accessible database of pollutants. Each year, releases and transfers of pollutants from facilities nationwide are reported. Mercury (and its compounds) have been on the NPRI substance list since 1992, at the 10-tons reporting threshold. In the year 2000, the NPRI reporting threshold for mercury was reduced to five kilograms. For more information see:
http://www.ec.gc.ca/pdb/

Q61. Does Canada monitor levels of mercury in the environment?

Mercury levels in the Canadian environment are measured through a number of programs, including:

- The Canadian Atmospheric Mercury Measurement Network http://www.msc-smc.ec.gc.ca/arqp/camnet_e.cfm
- The Ecological Monitoring and Assessment Network; http://www.eman-rese.ca/
- The National Air Pollution Surveillance System; http://www.etcentre.org/naps/index_e.html
- The Arctic Monitoring and Assessment Program; http://www.amap.no/
- The Integrated Atmospheric Deposition Network;

http://www.msc.ec.gc.ca/iadn/index_e.html

Q62. What mercury research is supported by the Government of Canada?

The Government of Canada is involved in a number of mercury-related research and monitoring initiatives including:

- Northern Contaminants Program;
  http://www.ainc-inac.gc.ca/ncp/index_e.html
- The National First Nations Environmental Contaminants Program;
  http://www.hc-sc.gc.ca/fnihb/cp/annualreview/environmental_contaminants.htm
- Great Lakes Program and the St. Lawrence Vision 2000 Program;
  http://www.slv2000.qc.ca/
- COMERN (Collaborative Mercury Research Network-includes Health Canada);
  http://www.unites.uqam.ca/comern/
- METAALICUS (Mercury Experiment to Assess Atmospheric Loading In Canada and the United States);
  http://www.biology.ualberta.ca/old_site/metaalicus//metaalicus.htm
- Work conducted through the Atlantic Region Mercury Team;
  http://atlenv.ns.ec.gc.ca/msc/as/chemistry_mercury.html
- The Northeastern Mercury Cooperative (NSRC) Mercury Research Group;
  http://www.briloon.org/bri/workinggroups/nsrc.htm
- Natural Resources Canada mercury research;
  http://rncan.gc.ca/es/etb/cetc/cetc01/htmldocs/factsheet_mercury_research_program_e.html

Q63. Are consumer products regulated for acceptable levels of mercury?

Yes, the amount of mercury allowed in some consumer products is prohibited or restricted under the authority of Health Canada's *Hazardous Products Act*. Selling, advertising or importing toys, equipment and other products for use by a child in learning or play is prohibited if there is any decorative or protective coating on these items that contains any mercury compound. Restrictions are also being introduced on the sale, advertisement or importation of surface coating materials containing mercury.

Q64. What action has Health Canada taken to reduce mercury levels in paint used in the home?

- The *Hazardous Products Act* prohibits the use of mercury in decorative or protective coatings applied on toys, equipment and other products for

use by a child in learning or play.

- In 1991, a voluntary agreement between Health Canada and the Canadian Paint and Coatings Association resulted in removal of mercury compounds from interior latex paints. As of December 2000, mercury-based anti-microbial pesticides are no longer registered under the *Pest Control Products Act* administered by the Pest Management Regulatory Agency and are not allowed to be intentionally added to any Canadian-produced interior and exterior paints.
- Revisions are being made to existing regulations, which will prohibit the intentional addition of mercury to all paints.
- Mercury limits in recycled paint will be decreased from 65 milligram per kilogram to 10 milligram per kilogram over a number of years. For these paints, the presence of mercury must be clearly identified on the paint container label, along with a warning not to apply the paint to surfaces accessible to children or pregnant women.

Q65. Does Canada have regulations in place to control the amount of mercury in compost?

Centralized composting sites are becoming increasingly widespread as a result of recycling activities. The number of centralized, private and municipal composting facilities throughout Canada has more than quadrupled, from 30 sites in 1989 to over 120 sites in 1994. The maximum amount of mercury allowed in compost is 5 milligrams per kilogram under the *Fertilizers Act*, administered by Agriculture Canada.

Q66. Does Canada have regulations in place to control mercury levels in mercury-containing fluorescent lamps?

The Canadian Council of Ministers of the Environment has developed a Canada-wide Standard for mercury-containing lamps. The standard takes a pollution prevention approach by reducing the mercury content of lamps sold in Canada. The standard has set a goal of a 70% reduction by 2005, as compared to a 1990 baseline, and an 80% reduction by 2010 in the average content of mercury in all mercury-containing lamps sold in Canada.

Q67. Does Canada have regulations in place to control mercury releases from dental amalgam waste?

The Canadian Council of Ministers of the Environment has developed a Canada-

wide Standard for Dental Amalgam Waste. The standard is the application of "best management practices" to achieve a 95% national reduction in mercury releases from dental amalgam waste discharges to the environment by 2005, from a base year of 2000. Best Management Practices are defined as including the use of an ISO-certified amalgam separator, or its equivalent, and the appropriate management of waste to minimise mercury discharge to the environment.

Q68. Does Canada have regulations in place to control mercury releases from base metal smelting?

The Canadian Council of Ministers of the Environment has developed a Canada-wide Standard for mercury releases from this sector. The standard establishes environmental source performance guidelines for base metal smelters. For existing facilities, the guideline is 2 grams mercury released per ton of finished metal produced. For new and expanded facilities, the performance guideline is 0.2 gram of mercury perton of finished zinc, nickel and lead produced; and 1 gram of mercury perton of finished copper produced.

Q69. Does Canada have regulations in place to control mercury emissions from waste incineration?

The Canadian Council of Ministers of the Environment has developed a Canada-wide Standard for mercury emissions from the waste incineration sector, which includes medical, hazardous, sludge and municipal wastes. Improvements in process and treatment technologies and reductions in waste inputs have resulted in lowered mercury emissions from these incinerators by 60% (2 tons) since 1990. The Canada-wide Standards for the allowable concentration of mercury ranges from 20 to 70 microgram percubic metre. These standards are among the lowest found globally, and will further trim present emissions of 1200 kilograms per year by over 70% by 2006.

Q70. Does Canada have regulations in place to control mercury emissions from the Electric Power Generating Sector?

The Canadian Council of Ministers of the Environment has committed to develop a Canada-wide Standard by 2005 to reduce mercury emissions from the coal-fired electric power generation sector by 2010, to explore the national capture of mercury from coal burned in the range of 60-90%, and to align with US standards for mercury. The standard will apply to existing and new plants.

Q71. Does Canada regulate mercury-containing waste disposal at sea?

Yes, Canada controls waste disposal at sea and meets its international obligations under the London Convention (and its 1996 Protocol) by means of a permit system, in place since 1975. CEPA (1999) contains provisions concerning disposal at sea.

Q72. What action has Health Canada taken to eliminate the use of mercury in fungicides?

The sale of all mercurial fungicides was discontinued under the authority of the *Pest Control Products Act* as of December 31, 1995. Existing stocks of these products were allowed to be sold and used until December 31, 2000, at which time it was assumed that the supply of products would be exhausted.

Q73. Where can I get more information about mercury?

Canada-wide Standards for Mercury. Canadian Council of Ministers of the Environment, 123 Main Street, Suite 360, Winnipeg, Manitoba R3C 1A3; http://www.ccme.ca/initiatives/standards.html

Environment Canada. *Mercury and the Environment*; http://www.ec.gc.ca/mercury/ This website includes information and links regarding:

- Sources and environmental cycling and fate of mercury;
- Environmental impacts of mercury;
- Federal/Provincial/Territorial and International initiatives to manage mercury releases;
- Information on fish consumption advisories;
- Information on cleaning up small mercury spills.

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GLOSSARY of TERMS

abiotic	Refers to the non-living components of the environment. Climate is an example of an abiotic factor.
absorption	A process in which one substance permeates another; a fluid permeates or is dissolved by a liquid or solid.
adsorption	Removal of a pollutant from air or water by collecting the pollutant on the surface of a solid material.
acute effects	Sensing or perceiving accurately, clearly, effectively, or sensitively ***acute*** *vision,* characterized by sharpness or severity ***acute*** *pain an* ***acute*** *infection* 1. Having a sudden onset, sharp rise, and short course *an* ***acute*** *disease an* ***acute*** *inflammation* 2. Lasting a short time ***acute*** *experiments*
acute exposure	A single exposure to a toxic substance which may result in severe biological harm or death. Acute exposures are usually characterized by short-term impacts leading to more subtle impacts, as compared to longer, or chronic, exposure over a period of time.
acute toxicity	The ability of a substance to cause severe biological harm or death soon after a single exposure or dose. Also, any poisonous effect resulting from a single short-term exposure to a toxic substance.
adverse effects	A biochemical change, functional impairment, or pathological lesion that impairs performance and reduces the ability of the organism to respond to additional challenges.
advisory	A non-regulatory document that communicates risk information to those who may have to make risk management decisions. Advisories are generally a precautionary method used to protect individuals from health hazards. For instance, fish advisories warn against the consumption of fish from certain water bodies due to excessive contamination of fish tissue.
air pollutant	Any substance in air that could harm humans, other animals, vegetation, or material. Pollutants may include almost any natural or artificial composition of airborne matter. They may be in the form of solid particles, liquid droplets, gases, or in some combination thereof. Generally, they fall into two main groups: (1) those emitted directly from identifiable sources (primary pollutants) and; (2) those produced in the air by interaction between two or more primary pollutants, or by reaction with normal atmospheric constituents, with or without photo activation.
air quality criteria	The levels of pollution and lengths of exposure above which adverse health and welfare effects may occur.

air quality standards	The level of pollutants prescribed by regulations that are not be exceeded during a given time in a defined area.
airways	A passageway for air into or out of the lungs
ambient air	Any unconfined portion of the atmosphere: open air, surrounding air.
anaerobic	Living, active, occurring, or existing in the absence of free oxygen.
anthropogenic	Relating to, or resulting from the influence of human beings on nature, caused by humans; ***anthropogenic*** *sources of pollution.*
anti-fouling paints	The prevention of the building up of deposits on underwater surfaces, such as the undersides of boats: *antifouling paint*.
antibody	A protein substance produced in the blood or tissues in response to a specific antigen, such as a bacterium or a toxin, that destroys or weakens bacteria.
antigen	Any of various substances, including toxins, bacteria, and the cells of transplanted organs, that when introduced into the body stimulate the production of antibodies.
apparatus	An appliance or device for a particular purpose: *an x-ray apparatus.* An integrated group of materials or devices used for a particular purpose: dental apparatus.
aquatic environment	Growing, living in, or frequenting water, ***aquatic*** *mosquito larvae*.
area source	Any source of air pollution that is released over a relatively small area but which cannot be classified as a point source. Such sources may include vehicles and other small engines, small businesses and household activities, or biogenic sources such as a forest that releases hydrocarbons.
atmosphere	The gaseous mass or envelope surrounding a celestial body, especially the one surrounding the earth, and retained by the celestial body's gravitational field. The air or climate in a specific place.
autotrophic	Describes organisms which do not eat other life forms, but derive carbon for metabolic synthesis from carbon dioxide, such as plants. Many such organisms are eaten by other organisms.
background level	The concentration of a substance in an environmental media (air, water, or soil) that occurs naturally and is not the result of human activities.
barometers	An instrument for measuring atmospheric pressure, used especially in weather forecasting.
base metal smelting	To melt or fuse (ores) in order to separate the metallic parts. Base metals include copper, nickel, lead and zinc.
bioaccumulation factor (BAF)	The ratio of the concentration of a given compound in the tissues of an organism and its concentration either in the media in which the organism lives or in the tissues of biota on which the organism feeds.

bioaccumulation	The process by which chemical substances are accumulated by organisms from exposure to water, sediments, or soil directly or through consumption of food containing the chemical.
bioavailable	The fraction of the total chemical in the surrounding environment that can be taken up by organisms.
biocides	A chemical agent, such as a pesticide, that is capable of destroying living organisms.
bioconcentration	The process by which contaminants are directly taken up by organisms from the medium in which the live.
biodiversity	1. The number and variety of organisms found within a specified geographic region. 2. The variability among living organisms on the earth, including the variability within and between species and within and between ecosystems.
biogeochemistry	A science that deals with the relation of earth chemicals to plant and animal life in an area.
biological exposure index (BEI)	A human indicator of excess exposure to a hazard, usually chemical. BEI's are used to determine action limits when conducting health surveillance or biological monitoring programs.
biomagnification	An increase in concentration of a pollutant from one link (trophic level) in the food chain to another.
biomethylate	To introduce a chemical, functional group called a methyl group (containing 1 carbon and 3 hydrogen atoms) into a molecule via a biological process.
biosphere	The portion of the Earth and its atmosphere that can support life.
biotic	The living components of the environment, such as plants, animals and microorganisms.
body burden	The amount of a chemical stored in the body at a given time, especially a potential toxin, as the result of exposure.
budget	A quantity (as of energy or matter) involved in, available for, or assignable to a particular situation; also : an account of gains and losses of such a quantity.
cardiovascular system	Involving the heart and the blood vessels: *cardiovascular disease.*
carcinogen	Any substance that can cause or aggravate cancer.
cation	A molecule which has a positive electrostatic charge.
caustic soda (NaOH)	A strongly alkaline compound, sodium hydroxide (NaOH), used in the manufacture of chemicals and soaps and in petroleum refining.

chelation therapy	A non-surgical treatment used to rid the body of excess toxins, particularly metals. Chelators have to ability to combine with toxic metals and other harmful substances that impair bodily functions and help the body eliminate these toxins via the kidneys.
chemical compound	A distinct substance formed by the union or two or more elements in definite proportion by weight.
chlorine	A halogen element that is isolated as a heavy greenish yellow gas of pungent odour and is used especially as a bleach, oxidizing agent, and disinfectant in water purification. *symbol*: Cl
chronic	1. Marked by long duration, by frequent recurrence over a long time, and often by slowly progressing seriousness or not acute; ***chronic*** *indigestion*; *her hallucinations became* ***chronic*** 2. Suffering from a disease or ailment of long duration or frequent recurrence: *a* ***chronic*** *arthritic;* ***chronic*** *sufferers from asthma*
cinnabar	1. Native red sulfide of mercury (mercuric sulfide or *symbol* HgS) that is the only important ore of mercury. 2. Artificial red sulfide of mercury used especially as a pigment is known as vermilion red ore.
cognitive	1. The mental process of knowing, including aspects such as awareness, perception, reasoning, and judgment. 2. That which comes to be known, as through perception, reasoning, or intuition; knowledge.
compound	1. A combination of two or more elements or parts. 2. A pure, macroscopically homogeneous substance that consists of atoms or ions of different elements in definite proportions.
constriction	1. To make narrow or draw together: ***constrict*** *the pupil of the eye* 2. To subject (as a body part) to compression: ***constrict*** *a nerve* {bswdsh} *vi* To become constricted.
consumption	To take in as food; eat or drink up.
creatinine	A protein produced by muscle and is a breakdown product of creatine which can be released into the blood, and is normally excreted in the urine as a metabolic waste.
crematorium	A furnace or establishment for the incineration of corpses.
decilitre	A metric unit of volume equal to one-tenth (10^{-1}) of a litre.
dental amalgam	An alloy of mercury with another metal (commonly silver) that is solid or liquid at room temperature according to the proportion of mercury present and is used especially in making tooth cements.

deposition	1. To put or set down; place. 2. To lay down or leave behind by a natural process: *layers of sediment that were deposited on the ocean floor; glaciers that deposited their debris as they melted.*
dermal toxicity	The ability of a toxic chemical to poison people or animals by contact with the skin.
detonators	1. A device, such as a fuse or percussion cap, used to set off an explosive charge. 2. An explosive.
digital thermometer	An instrument for measuring temperature that can read, write, or store information that is represented in numerical form.
disinfectant	An agent, such as heat, radiation, or a chemical, that destroys, neutralizes, or inhibits the growth of disease-carrying microorganisms.
domestic	Produced in or indigenous to a particular country: domestic oil; domestic wine.
ecology	The relationship of living things to one another and their environment, or the study of such relationships.
ecosystems	A collection of living things and the environment in which they live. For example, a prairie ecosystem includes coyotes, the rabbits on which they feed, and the grasses that feed the rabbits.
effluent	Wastewater (treated or untreated) that flows out of a treatment plant, sewer, or industrial facility; generally refers to wastes discharged into surface waters.
electrons	An elementary particle that circles the nucleus of an atom. Electrons are considered to be negatively charged.
element(al)	A substance composed of atoms having an identical number of protons in each nucleus. Elements cannot be reduced to simpler substances by normal chemical means.
environment	The circumstances or conditions that surround one; surroundings.
erosion	1. To wear (something) away by or as if by abrasion: *Waves eroded the shore.* 2. To eat into; corrode. 3. To make or form by wearing away: *The river eroded a deep valley.* 4. To cause to diminish or deteriorate as if by eating into or wearing away: *"Long enduring peace often erodes popular resolution* (C.L. Sulzberger).
exposure	The condition of being subject to some detrimental effect or harmful condition *repeated **exposure** to bronchial irritants risk **exposure** to the flu benign skin discolourations caused by sun **exposure** -Katie Tyndall*.
fetus	An unborn or unhatched vertebrate especially after attaining the basic structural plan of its kind; *specifically*. A developing human from usually three months after conception to birth.

flux	A flowing or flow of energy or matter between different media.
food chain	Movement of energy through the trophic levels of organisms. In most ecosystems, this process begins with plants (photosynthetic autotrophs) and ends with animals (carnivores and detritivores).
food web	The feeding relationships by which energy and nutrients are transferred from one species to another.
formulation	To prepare according to a specified formula.
fossil fuels	A hydrocarbon deposit, such as petroleum, coal, or natural gas, derived from living matter of a previous geologic time and used for fuel.
fume hood	A cabinet with a moveable front sash (window) made out of safety glass where air is drawn into the hood under and through the opened sash and is typically exhausted through an exhaust stack on the roof of the building, to minimize exposure to airborne contaminants.
fungicides	A chemical substance that destroys or inhibits the growth of fungi.
gastrointestinal tract	The stomach and intestine as a functional unit.
geothermal vents	An opening of a volcano in the earth's crust, or an opening on the ocean floor that emits hot water and dissolved minerals.
grasshopper effect	Term used to describe the movement of toxic compounds in the environment from more southerly climes where pollutants are emitted into the environment to northern (Arctic) regions. Certain pollutants can be carried high into the atmosphere, then cool and condense to settle on land and in water bodies, where they can then gather more heat energy and become airborne again, moving still farther north in the direction of the prevailing winds/ocean currents. Once these pollutants have travelled far enough north that there is insufficient heat energy to allow for further volatilization into the atmosphere, they remain in northerly environments for long periods.
ground water	The supply of fresh water found beneath the Earth's surface, usually in aquifers, which supplies wells and springs.
habitat	The place where a population (e.g., human, animal, plant, microorganism) lives and its surroundings, both living and non-living.
half-life	The time required for half the amount of a substance (as a drug or radioactive tracer) in or introduced into a living system or ecosystem to be eliminated or disintegrated by natural processes: *the serum **half-life** is about 2 days*
heavy metals	A group of toxic metallic elements and their compounds.
heterotrophic	Refers to organisms which consume other life forms to acquire complex organic compounds of nitrogen and carbon for metabolism.
Hg	The symbol used to denote elemental mercury on the periodic table of elements.

Hg^{0}	The chemical symbol used to denote mercury in its elemental, or uncharged, form.
Hg^{2+}	The chemical symbol used to denote mercury in its positively charged (cationic), or reactive, state.
$Hg^{(p)}$	The symbol used to denote mercury attached onto or absorbed into a particle.
hypersensitivity	An excessive or abnormal sensitivity to a substance. A person who is hypersensitive to a certain drug will often suffer a severe allergic reaction (*see* allergy) if given the drug.
immune system	The integrated body system of organs, tissues, cells, and cell products such as antibodies that differentiates self from nonself and neutralizes potentially pathogenic organisms or substances.
immunization	The creation of an inherited, acquired or reduced tendency for infection to a specific pathogen by the introduction of antigens into the body in order to stimulate the development of this tendency.
in utero	In the uterus; before birth, as *a disease acquired in utero; an in utero diagnosis*
incinerate	To cause to burn to ashes.
inorganic	Refers to chemical substances that do not contain carbon.
ions	An atom or a group of atoms that has acquired a net electric charge by gaining or losing one or more electrons.
lactation	Secretion or formation of milk by the mammary glands.
latent period	1. The interval between exposure to an infectious organism or a carcinogen and the clinical appearance of disease. 2. The interval between stimulus and response.
leachate	Water that has collected contaminants as it trickles through wastes or soils. Leaching may occur in farming areas, feedlots, and landfills, and may result in hazardous substances entering surface water, ground water, or soil.
leaching	The process by which soluble constituents are dissolved and filtered through the soil by a percolating fluid (see: leachate).
manometer	An instrument used for measuring the pressure of liquids and gases (ie.) a sphygmomanometer.
marine mammals	Any of various warm-blooded vertebrate animals of the class Mammalia, native to, inhabiting, or formed by the sea and, in the female, the presence of milk-producing mammary glands for nourishing the young.

material safety data sheet (MSDS)	A fact sheet summarizing information about material identification; hazardous ingredients; health, physical, and fire hazards; first aid; chemical reactivities and incompatibilities; spill, leak, and disposal procedures; and protective measures required for safe handling and storage.
maternal	1. Relating to or characteristic of a mother or motherhood; motherly: *maternal instinct.* 2. Inherited from one's mother: *a maternal trait.* 3. Related through one's mother: *my maternal uncle*.
mercury (Hg)	Highly toxic heavy metal that can accumulate in the environment and living tissue.
mercury-cell chlor alkali	Process where aaustic soda (NaOH) and chlorine are produced by the electrolysis of an aqueous solution of sodium chloride (brine). Previous technologies used in the chlor-alkali process included the use of mercury and diaphragm cells. Due to pollution concerns, the mercury cell technology has nearly been displaced.
metabolic rate	Metabolism per unit time especially as estimated by food consumption, energy released as heat, or oxygen used in metabolic processes.
methyl group	An alkyl group (CH3) derived from methane by removal of one hydrogen atom.
methylate	To introduce a chemical, functional group called a methyl group (containing 1 carbon and 3 hydrogen atoms) into a molecule, either biotically or abiotically.
methylation-demethylation	The process of adding (methylation) or removing (demethylation) a methyl group from a chemical compound.
micrograms	A unit of mass equal to one thousandth (10^{-3}) of a milligram or one millionth (10^{-6}) of a gram.
micromole	One millionth of a mole. A mole is defined as the amount of a substance that contains as many atoms, molecules, ions, or other elementary units as the number of atoms in 0.012 kilogram of carbon 12. The mass in grams of this amount of a substance, numerically equal to the molecular weight of the substance. Also called *gram-molecular weight*.
microorganisms	An organism of microscopic or submicroscopic size, especially a bacterium or protozoan.
mobilize	To put into movement or circulation, make mobile; *specifically* To release (something stored in the body) *the body* ***mobilize****s its antibodies*
molecule	The smallest division of a substance that still retains or exhibits all the properties of the substance and is comprised of at least 2 atoms.
motor skills	Proficiency, facility, or dexterity that is acquired or developed through motoneurons or nerves containing motoneurons; ***motor*** *fibers,* ***motor*** *cells* and relating to, concerned with, or involving muscular movement; ***motor*** *areas of the brain*.

mould	1. Any of various fungi that often cause disintegration of organic matter. 2. The growth of such fungi.
nanogram	One billionth (10^{-9}) of a gram.
natural populations	All organisms that constitute a specific group or occur in a specified habitat that are present in or produced by nature: *a natural pearl.*
nervous system	The system of cells, tissues, and organs that regulates the body's responses to internal and external stimuli. In vertebrates it consists of the brain, spinal cord, nerves, ganglia, and parts of the receptor and effector organs.
neurodevelopmental	The development of the nervous system.
neurology	The medical science that deals with the nervous system and disorders affecting it.
neuropsychology	The branch of psychology that deals with the relationship between the nervous system, especially the brain, and cerebral or mental functions such as language, memory, and perception.
neurotoxin	Neurotoxins affect the central nervous system and can cause brain damage.
non-point sources	Diffuse pollution sources (i.e., without a single point of origin or not introduced into a receiving stream from a specific outlet). The pollutants are generally carried off the land by stormwater. Common non-point sources are agriculture, forestry, urban, mining, construction, dams, channels, land disposal, saltwater intrusion, and city streets.
occupational	Relating to, or caused by engagement in a particular activity that serves as one's regular source of livelihood; a vocation. An activity engaged in especially as a means of passing time; an avocation.: *occupational hazards.*
omega-3 fatty acids	Any of several polyunsaturated fatty acids found in leafy green vegetables, vegetable oils, and fish such as salmon and mackerel, capable of reducing serum cholesterol levels and having anticoagulant properties.
organic	Refers to compounds containing carbon.
organisms	An individual form of life, such as a plant, animal, bacterium, protist, or fungus; a body made up of organs, organelles, or other parts that work together to carry on the various processes of life.
oxidation-reduction	Oxidation is the combination of a substance with oxygen; or a reaction in which the atoms in an element lose electrons and the valence of the element is correspondingly increased. Reduction is the decrease in positive valence or an increase in negative valence by the gaining of electrons, or a reaction in which hydrogen is combined with a compound, or a reaction in which oxygen is removed from a compound.
parts per million (ppm)	Used to specify the concentration (by volume) of a gas or vapour at low concentration, or a dissolved material at high dilution.

pathway	The physical course a chemical or pollutant takes from its source to the exposed organism.
persistent	Existing or continuing for a long time; degraded only slowly by the environment , (ie.) ***persistent*** *pesticides*
pigments	A colouring matter in animals and plants especially in a cell or tissue; *also* any of various related colourless substances.
pharmaceutical	Engaged in the art, practice, or profession of preparing, preserving, compounding, and dispensing medical drugs.
photochemical	Describes a process resulting from the chemical properties of radiant energy (for example, sunlight).
piscivorous	Refers to organisms that consume fish.
placenta	The membranous vascular organ in female mammals that permits metabolic interchange between fetus and mother.
plankton	The collection of small or microscopic organisms, including algae and protozoans, that float or drift in great numbers in fresh or salt water, especially at or near the surface, and serve as food for larger organisms.
pneumonitis	A disease characterized by inflammation of the lungs; *especially* Pneumonia
point source	A source, especially of pollution or radiation, occupying a very small area and having a concentrated output.
pollutant	Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.
pollution	Generally, the presence of a substance in the environment that, because of its chemical composition or quantity, prevents the functioning of natural processes and produces undesirable environmental and health effects.
pollution prevention	The use of processes, practices, materials, products or energy that avoid or minimize the creation of pollutants and waste, and reduce overall risk to human and environmental health. Pollution prevention focuses on avoiding the creation of pollutants rather than trying to manage them after they have been created.
pool	The quantity of a given substance found in an environmental "compartment", or media, such as the air, water, soil, or a given geographic area or feature.
population	A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area.
ppm	Abbreviation for parts per million, describing the number of unit parts of a substance contained in a million unit parts of another substance.
predation	The mode of life where the primary means for obtaining food is through the killing and eating of other creatures (prey).

predatory	An organism that lives by hunting, catching, or eating another organism hunted or caught for food, known as quarry or prey: *Owls prey on mice; a predatory mammal; a predatory insect.*
prenatal exposure	Exposure (see above) existing or occurring before birth: ***prenatal*** *medical care.*
preservative	To keep or save from decomposition; *specifically* An additive used to protect against decay, discolouration, or spoilage; *a food* ***preservative***
protein	Any of the group of highly complex organic compounds containing carbon, hydrogen, oxygen, nitrogen and sulfur, and composed of one or more chains of amino acids. They are found in all living cells.
provisonal tolerable daily intake (pTDI)	Estimate of the amount of a potentially harmful substance (e.g., contaminant) in food or drinking water that can be ingested daily over a lifetime without appreciable health risk, usually expressed as: mg substance/kg bodyweight/day. This value may be expressed as a more conservative number (additional safety factor included) than a tolerable daily intake (TDI), and be further revised as new data is submitted.
pulmonary edema	An abnormal excess accumulation of serous fluid associated with the lungs
residence time	The period of time to be inherently present, exist in a place.
route of exposure	The avenue by which a chemical comes into contact with an organism, e.g., inhalation, ingestion, dermal contact, injection.
safe water	Water that does not contain harmful bacteria, toxic materials, or chemicals, and is considered safe for drinking even if it may have taste, odour, colour, and certain mineral problems.
saturated fats	A fat, most often of animal origin, that is solid at room temperature and whose fatty acid chains cannot incorporate additional hydrogen atoms. An excess of these fats in the diet is thought to raise the cholesterol level in the bloodstream.
sediments	Soil, sand, and minerals that are suspended in water, or are being transported, or that settle in loose layers, typically as mud.
sink	Place in the environment where a compound or material collects.
slimicide	Substance intended to kill slime-producing organisms (used on paper stock, water cooling systems, paving stones etc.)
smog	Air pollution typically associated with oxidants.
sodium hydroxide (NaOH)	A strongly alkaline compound, NaOH, used in the manufacture of chemicals and soaps and in petroleum refining. Also called *caustic soda*, *lye*.
species	A fundamental category of taxonomic classification, ranking below a genus or subgenus and consisting of related organisms capable of interbreeding.

sport fish	Species like trout, salmon, or bass, caught for sport.
surface water	All water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc).
terrestrial	Of or relating to land as distinct from air or water.
thimerosal	A mercury-containing organic compound (an organomercurial). Since the 1930s, it has been widely used as a preservative in a number of biological and drug products, including many vaccines, to help prevent potentially life threatening contamination with harmful microbes.
thyroid	A large gland in the neck that functions in the endocrine system. The thyroid secretes hormones that regulate growth and metabolism.
tissue	An aggregate of cells usually of a particular kind together with their intercellular substance that form one of the structural materials of a plant or an animal and that in animals include connective tissue, epithelium, muscle tissue, and nerve tissue.
toxic	Of, relating to, or caused by a poisonous substance or other poison, especially a protein, that is produced by living cells or organisms and is capable of causing disease when introduced into the body tissues but is often also capable of inducing neutralizing antibodies or antitoxins: *a toxic condition; toxic hepatitis.*
trace amount	1. An extremely small amount. 2. A constituent, such as a chemical compound or element, present in quantities less than a standard limit.
transboundary pollutants	Air pollution that travels from one jurisdiction to another, often crossing provincial or international boundaries. Also applies to water pollution.
translocation	To cause to change from one place or position to another; displace.
trophic level	A group of organisms that occupy the same position in a food chain.
µg	Abbreviation for microgram, meaning one one-millionth of a gram.
uptake	An act or instance of absorbing and incorporating something especially into a living organism.
valence	1. The combining capacity of an atom or radical determined by the number of electrons that it will lose, add, or share when it reacts with other atoms. 2. A positive or negative integer used to represent this capacity: *The valences of copper are 1 and 2.*
vapourize	To convert or be converted into a substance in the gaseous state as distinguished from the liquid or solid state.
vermilion red ore	Vermilion is the standard name in English given to the red artists' pigment based on artificially made mercuric sulfide, while cinnabar is the name given to the natural mineral.

visuospatial	Of or relating to visual perception of spatial relationships among objects: *the visuospatial skills needed to complete a jigsaw puzzle.*
volatile	Any substance that evaporates readily.
volatilize	To become or make readily vaporizable at a relatively low temperature; or to evaporate readily at normal temperatures and pressures.
watershed	The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common point.
wet deposition	The deposition of a substance in the atmosphere to land or water via rain or snow.

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