TESTMARK Laboratories Ltd.
Committed to Quality and Service

elements

SITE INVESTIGATIONS

What Are You Looking For?

in this issue

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What are you looking for?

A site assessment at any level, whether for the purpose of a Record of Site Condition filing, for risk determination or simply for general industrial investigative purposes, typically aims to find out what potentially hazardous substances exist on the site and at what levels. The investigator becomes a detective of sorts, gleaning as much credible information as possible from historical documents, previous filings and industrial data before deciding whether to physically sample the site and conduct analytical testing. In the words of Conan Doyle's Sherlock Holmes "My name is Sherlock Holmes. My business is to know what other people do not know."

If results of your sleuthing indicate that you will indeed need to sample the site then do yourself a favour – stop and ask yourself "what am I looking for?" True, the site investigations and sampling protocols under O. Reg. 153/04 for Brownfield investigations are so well-established that they almost preclude original thought. However, there is a very strong argument to be made for the intelligent investigator who attempts to understand what they are likely to find on a site and why — someone who brings value to the process. Asking "what am I looking for?" or perhaps more cautiously worded "what am I probably looking for?" is key to a successful sampling and testing plan. Certain industrial processes lend themselves to the production of certain toxic substances. If you are an industrial chemist, knowing what to test for probably isn't too hard to figure out given what you know about the sites' industrial past. For the other 99.9% of the population however, this information isn't always intuitive, and you probably didn't cover it in Grade 12 Chemistry.

Where to start?

A good place to start is by trying to chemically profile the site given what you know of its industrial past. To assist with this, the Canadian Environmental Protection Act (EPA) is an excellent resource as it has always concerned itself with maintaining a list of Toxic Substances. These are substances that have or may have an immediate or long-term harmful effect on the environment, humans, animals or on biological diversity in general. Not surprisingly, if something is found on the EPA's Toxic Substance List, it is typically a compound of interest in other environmental regulations and guidelines that have been built around this information, so it is worth taking a close look at the list.

And for those without a PhD in industrial chemistry, the EPA listing also sheds light on the common sources associated with these compounds which means you don't have to chase ghosts when selecting your testing regime and you can minimize the risk of under-testing as well. For example, a former plastic manufacturing site is likely to have residues that will be related to the type of plastic being manufactured. Investigations related to the raw materials as well as the type of process involved may yield a list of target analytes which may or may not be priority pollutants. A wood preservation treatment operation is likely to be affected by those chemicals in the process. One site may have used a metals substrate and another a coal tar creosote-based material to treat the wood. Depending on the process used, a site specific list of analytes should be used to investigate the site conditions.

The following table provides **TESTMARK'S REFERENCE GUIDE** to the names, availability and common sources of the EPA's list of toxic substances (adapted from the EPA's list of Toxic Substances as of March 2013):

Name	Chemical Abstract Service (CAS) Registry Number	Currently Used or Produced in Canada?	Potential Sources** and Uses
1,1,1-Trichloroethane	71-55-6	No - since 1996*	Solvents
1-2-Benzenediol	120-8-9	Yes	Photographic developer; antioxidant in rubber and lubricating oils; oxidant in hair products (colourant); antioxidant in perfumes; pharmaceuticals
1,2-Dichoroethane	107-06-2	Yes	Intermediate in the synthesis of vinyl chloride; motor antiknock fluids
1,3-Butadiene	106-99-0	Yes	Incomplete combustion; production of polymers and synthetic rubbers; vehicle exhaust emissions
1,4-Benzenediol	123-31-9	Yes	Adhesive; sealant; photographic chemicals
2-Butoxyethanol	111-76-2	Imported only	Chemical processing aid
2-Methoxyethanol	109-86-4	Imported only	Chemical processing aid
2-Propenoic Acid, ethyl ester	140-88-5	Imported only (apart from naturally occurring)	Naturally occurs in certain berries and fruit; used in the synthesis of polymers for paints, coatings, caulking, floor sealers and lacquers
3,3-Dichlorobenzidine	91-94-1	Imported only	Pigments for printing inks, textiles, paints, plastics and crayons
(4-Chlorophenyl) cyclopropylmethanone	94097-88-8	No*	Intermediate in the production of certain pesticides
Acetaldehyde	75-07-0	Yes	Forest fires; incomplete combustion of fuel in internal combustion engines and industrial processes; atmospheric oxidation of organic compounds
Acrolein	107-02-8	Yes	Aquatic herbicide; photooxidation of organic pollutants in air (i.e. from vehicle exhausts)
Acrylonitrile	107-13-1	Imported only	Monomer/reactant in production of SAN foams and polymers, acrylic emulsions and diamines

Name	Chemical Abstract Service (CAS) Registry Number	Currently Used or Produced in Canada?	Potential Sources** and Uses
Ammonia (dissolved in water)	7664-41-7	Yes	Fertilizers, wastewater effluent, waste byproduct of animals/fish; microbial metabolism
Asbestos	1332-21-4	Yes	Naturally occurring mineral; reinforcing agent in cement industry; fire retardant in textiles and paper products; asphalt cohesive; filler in resins, plastics, caulking and sealants; insulator for pipes, boilers and buildings
Benzenamine, N-phenyl- (BNST)	68921-45-9	Yes	Antioxidant used as an additive in engine oils and lubricants to reduce the creation of fouling agents
Benzene	71-43-2	Yes	Vehicle emissions
Benzidine and benzidine dihydrochloride	92-87-5 and 531-85-1	Imported only	Intermediate in the manufacture of dyes and pigments
Bis(2-ethylhexyl) phthalate	117-81-7	Yes	Manufacturing of plastics
Bis(chloromethyl) ether	542-88-1	No*	
Bromic Acid, Potassium Salt	7758-01-2	Yes	Powerful oxidizing agent; hair products (permanent wave solutions); dyeing of textiles; formerly permitted as a food additive
Bromochlorodifluoromethane	353-59-3	No - since 1994*	Fire extinguishing agents
Bromochloromethane	74-97-5	No - since 2002*	Fire extinguishing agents
Bromofluorocarbons	numerous	No - since 1994, 1996, 2002*	Fire extinguishing agents
Bromotrifluoromethane	75-63-8	No - since 1994*	Fire extinguishing agents
Carbon dioxide	124-38-9	Yes	Photosynthesis; decomposition of organic matter; combustion of fossil fuels; manufacture of cement
Chlorinated Alkanes	not applicable	Imported	Cutting oils; high pressure lubricating oils; plasticizers; flame retardant; adhesives; paints; sealants; plastics

Name	Chemical Abstract Service (CAS) Registry Number	Currently Used or Produced in Canada?	Potential Sources** and Uses
Chlorinated wastewater effluents	not applicable	Yes	Addition of chlorine as treatment agent
Chlorofluorocarbon (CFCs)	numerous	No - since 1996*	Used in refrigerants, solvents, foam blowing agents
Chloromethyl methyl ether	107-30-2	No*	Industrial solvent used to manufacture water repellents, ion-exchange resins and polymers
Ciclotetrasiloxane	566-67-2	Yes	Used in hair/skin products; lubricant; sealer; polymer
Colour Index Pigment Red 104	12656-85-8	Yes	Colour pigment used for commercial plastics and paints; typically found in high visibility safety paints (traffic signs, airports etc.)
Colour Index Pigment Yellow 34	1344-37-2	Yes	Colour pigment used for commercial plastics and paints; typically found in high visibility safety paints (traffic signs, airports etc.)
Creosote-impregnated waste materials	8001-58-9	Yes	Wood preservative
Dibenzofuran	132-64-9	Yes	Defoamers from pulp and paper mills
Dibenzo-para-dioxin	262-12-4	Yes	Defoamers from pulp and paper mills
Dibromotetrafluoroethane	124-73-2	No - since 1994*	Fire extinguishing agents
Dichlorodiphenyltrichloroethane (DDT)	789-02-6 and 50-29-3	No - since mid 1970s*	Pesticide
Dichloromethane	75-09-2	Yes	Paint remover; blowing agent in foam production; aerosol component
Dodecachloropentacyclodecane (Mirex)	2385-85-5	No*	Pesticide; fire retardant agent in plastics, rubber, paint, paper and electrical goods
Effluents from pulp mills using bleaching	not applicable	Yes	Wastewater discharge from pulp and paper mills
Effluents from textile mills that use wet processing	not applicable	Yes	Wastewater discharge from textile mills involved in wet processes such as scouring, neutralizing, dyeing and printing
Ethanol, 2-(2-methoxyethoxy)-	111-77-3	Yes	Ice inhibitor in jet fuel
Ethylene oxide	75-21-8	Yes	Manufacture of ethylene glycol and surfactants

Name	Chemical Abstract Service (CAS) Registry Number	Currently Used or Produced in Canada?	Potential Sources** and Uses
Ethyloxirane	106-88-7	Imported only	Used as a stabilized in industrial solvents that are mainly used as electronic and industrial degreasers and cleaners; also found in some dry cleaning fluids
Formaldehyde	50-00-0	Yes	Production of resins and fertilizers; forest fires; fuel combustion; oxidation of organic compounds
Fuel containing toxic substances that are “Dangerous Goods”	not applicable	Yes	Contaminated fuel
Gaseous ammonia	7664-41-7	Yes	Waste byproduct from animals; industrial emissions
Hexabromocyclododecane	numerous	Yes	Flame retardant used in foam, insulation, textiles, floor coverings; also used in some glues, paints, adhesives and polymers contained in electronic equipment
Hexachlorobenzene (HCB)	118-74-1	Yes	Chlorinated solvents and pesticides; incinerator emissions
Hexachlorobutadiene	87-68-3	No*	Solvents
Hexane	110-54-3	Yes	Solvent; food additive; cosmetics
Hexavalent chromium compounds	numerous	Yes	Naturally occurring metal; production of stainless and heat-resistant steels; pigments; metal finishing; leather tanning; wood preservatives; combustion of fossil fuels; smelting and refining of non-ferrous-based metals
Hydrazine	302-02-1	Yes	Used as a pesticide; in fuel for rockets and jets; textile dyes; intermediary for pharmaceuticals; photography chemicals; corrosion inhibitor
Hydrobromofluorocarbons (HBFCs)	numerous	No - since 1996*	Past experimental production
Hydrochlorofluorocarbons (HCFCs)	numerous	Phase out by 2020	Used in refrigerants, solvents, foam blowing agents; fire extinguishing agents
Hydrofluorocarbons (HFCs)	numerous	Yes	Refrigerants; foam blowing; semi-conductor manufacturing

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Inorganic arsenic compounds	numerous	Yes	Natural weathering and erosion of rock/soil; coal-fired power generation; gold- and base-metal processing
Inorganic cadmium compounds	numerous	Yes	Natural weathering of rock/soil; volcanic emissions; forest fires; base metal smelting and refining; stationary fuel combustion; sewage sludge application
Inorganic chloramines	10599-90-3, 3400-09-0 and 10025-85-1	Yes	Disinfection for drinking water
Inorganic fluorides	numerous	Yes	Phosphate fertilizer production; chemical production; aluminum smelting; natural sources
Lead	7439-92-1	Yes	Natural weathering of rock/soil; manufacturing of lead-acid batteries, radiation shields, gasoline, paint and pewter; plumbing; mining activities
MAPBAP acetate	72102-55-7	Yes	Dye used mainly in the production of paper products
Mercury	7439-97-6	Yes	Coal combustion; incineration of waste; natural sources; mining activities
Methane	74-82-8	Yes	Naturally occurring from anaerobic decomposition of organic matter and through digestive process of insects and animals; fossil fuel extraction; coal mining; incomplete fossil fuel combustion; landfills
Methanone bis[4-(dimethylamino) phenyl]- (Michler's ketone)	90-94-8	Yes	An intermediary formed in colourants used mostly in the paper industry; minor sources include dry films and electronics manufacturing
Methyl bromide	74-83-9	No - since 2005*	Fumigant to control insects, pathogens and weeds
Methyl Ethyl Ketone (2-Butanone)	78-93-3	Yes	An organic solvent used in the synthetic rubber industry and also found in varnishes, lacquers, paint removers and glues; can also form naturally from photooxidation of certain air pollutants like hydrocarbons and butane

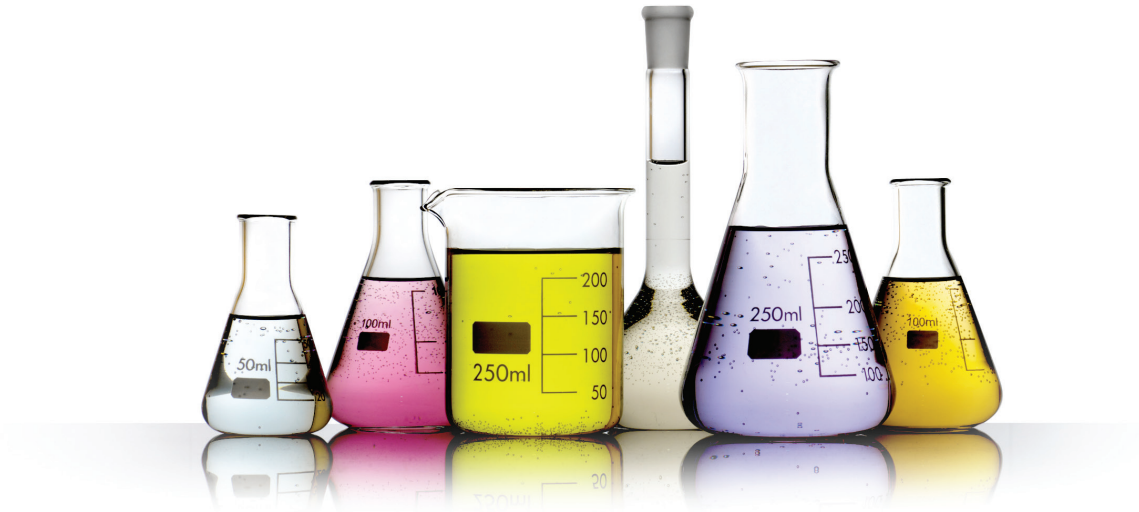
Name	Chemical Abstract Service (CAS) Registry Number	Currently Used or Produced in Canada?	Potential Sources** and Uses
Methyloxirane (propylene oxide)	75-56-9	Yes	Used as a monomer in the production of polyether polyols, which are used in the production of polyurethane foams; also used as a starch modifying agent and in cosmetics, resins, synthetic lubricants, inks, de-icing fluids, pesticides (for dry fruit products) and food additive (anti-microbial)
Naphthalene	91-20-3	Yes	Paints; solvents; adhesives; pest control products; corrosion inhibitor; driveway sealant
Nitric oxide	10102-43-9	Yes	Combustion of fossil fuels; electric power generation; forest fires; soil microbial activity
Nitrogen dioxide	10102-44-0	Yes	Combustion of fossil fuels; electric power generation; forest fires; soil microbial activity
Nitrous oxide	10024-97-2	Yes	Anaesthetic; production of nylon and nitric acid; combustion of fossil fuels; commercial and organic fertilizers; natural emissions from oceans, bacteria in soils and animal waste
n-Butyl glycidyl ether	2426-08-6	Yes	A component of epoxy resins commonly used in protective coatings, reinforced plastics and bonding adhesives
N-Nitrosodimethylamine (NDMA)	62-75-9	Yes	By-product from industries and municipal wastewater treatment plants; manufacture of pesticides, rubber tires, alkylamines and dyes; automobile exhaust; natural emissions from air, water and soil
Nonylphenol and its ethoxylates	numerous	Yes	Detergents, emulsifiers, wetting agents and dispersing agents; textile processing; pulp and paper processing; pest control products
Oxidic, sulphidic and soluble inorganic nickel compounds	numerous	Yes	Mining; smelting; refining; alloy processing; scrap metal reprocessing; fuel combustion and waste incineration

Name	Chemical Abstract Service (CAS) Registry Number	Currently Used or Produced in Canada?	Potential Sources** and Uses
Oxirane, (Chloromethyl)-	9009-12-5	Yes	Chemical intermediate in the production of epoxy resins
Ozone	10028-15-6	Yes	From chemical reaction involving nitrogen oxides and volatile organic compounds generally emitted from combustion processes and solvent use
Particulate matter containing metals	not applicable	Yes	Smelting; mining; refining
Pentachlorobenzene (QCB)	608-93-5	Yes	Impurity in pesticides and in pentachlorophenol (wood treatment agent); natural emission from burning of organic compounds in presence of chlorine (e.g. waste incineration); transformer oil (now phased out)
Perfluorocarbons (PFCs)	numerous	Yes	Replaced CFCs; solvents; refrigerants; by-product of aluminum production
Perfluorocarboxylic Acids (PFCAs)	numerous	Yes	Industrial chemicals
Perfluorococtane Sulfonate (PFOS)	not applicable	No - 2008*	Fume suppressants for metal plating industry; surfactant in electroplating sector; fire suppressant
Phenol 4,4' -(1-methylethylidene) bis-(Bisphenol A)	80-05-7	Yes	Used in the production of polycarbonates for epoxies, lubricants, oils, resins, curing agents and plasticizers
(Bisphenol A)	80-05-7	Yes	Used in the production of polycarbonates for epoxies, lubricants, oils, resins, curing agents and plasticizers
Polybrominated Biphenyls	numerous	No - 1989*	Industrial and consumer products
Polybrominated Diphenyl Ethers (PBDEs)	numerous	Imported only	Flame retardants in products (furniture, computers, electrical components, appliances)
Polychlorinated biphenyls (PCBs)	numerous	Yes	Manufacturing of electrical equipment, heat exchangers, hydraulic systems
Polychlorinated dibenzodioxins (dioxins)	numerous	Yes	Commercial chemicals; incineration; pulp and paper mills that use chlorine bleaching; files and spills involving PCBs; burning in the metallurgical sectors

Name	Chemical Abstract Service (CAS) Registry Number	Currently Used or Produced in Canada?	Potential Sources** and Uses
Polychlorinated Dibenzofurans (furans)	numerous	Yes	Commercial chemicals; incineration; pulp and paper mills that use chlorine bleaching; files and spills involving PCBs; burning in the metallurgical sectors
Polychlorinated Terphenyls	61788-33-8	Imported only	PCB substitute in applications such as electric transformers, lubricating and cutting oils
Polycyclic Aromatic Hydrocarbons (PAHs)	numerous	Yes	Forest fires; wood heating; aluminum smelters; creosote-treated products; petroleum spills; metallurgical and coking plant
Propane, 2-nitro-	79-46-9	Yes	Used as a solvent and in the production of paints, inks, adhesives.
Quinoline	91-22-5	Yes	Used as a catalyst in metallurgical processes; corrosion inhibitor; dye manufacturing; cigarette smoke
Refractory ceramic fibres (RCFs)	not applicable	Yes	Insulation and reinforcing agent; fire protection material for furnaces, heaters, metal launders; tank cars; used in steel, petrochemical, ceramic, automotive and primary metal industries
Respirable particulate matter <10 microns	not applicable	Yes	Vehicle emissions; industrial processes; vegetative burning
Sulphur dioxide	7446-09-5	Yes	Smelting; burning of fossil fuels; coal-fired power generators; natural gas processing
Sulphur hexafluoride	2551-62-4	Yes	Insulating gas in electricity industry; cover gas in magnesium industry to prevent oxidation
Sulphuric Acid, Diethyl/dimethyl ester	77-78-1	Yes	Reagent
Tetrabutyltins	1461-25-2	Yes	Starting material in the synthesis of PVC
Tetrachlorobenzenes (TeCBs)	numerous	No*	Formerly found in dielectric fluids used to top up PCB transformers; dyestuff carriers

Name	Chemical Abstract Service (CAS) Registry Number	Currently Used or Produced in Canada?	Potential Sources** and Uses
Tetrachloroethylene	127-18-4	Imported only	Chemical feedstock; dry-cleaning solvent; metal-cleaning industry; degreasing facilities
Tetrachloromethane, Carbon Tetrachloride	56-23-5	No - 1995*	Chemical feedstock in the syntheses of CFCs, HCFCs and HFCs
Thiourea	62-56-6	Yes	Metal finishing; etching; used in pulp and paper processes; reactant in copper refining; accelerant in rubber production; tarnish remover
Toluene diisocyanates	Numerous	Yes	Polyurethane and foam industries
Tributyltetradecylphosphonium Chloride	81741-28-8	Yes	Limited use - produced by one Canadian company for export only
Trichloroethylene	79-01-6	Yes	Solvent in vapour-degreasing and cold-cleaning of fabricated metal parts; dry-cleaning; paints and paint removers
Vanadium pentoxide	1314-62-1	Yes	Production of sulphuric acid
Vinyl Chloride	75-01-4	Yes	Refrigerant; PVC production; plastics industry
Volatile organic compounds (VOCs)	numerous	Yes	Transportation sector; solvents; wood combustion

*** some exceptions may apply (such as essential uses, as an analytical standard, etc.)**
**** as cited by Environment Canada**



7 Margaret Street, Garson, ON P3L 1E1 | p. 705.693.1121 | f. 705.693.1124
100 Wilson Avenue, Suite 102, Timmins, ON P4N 2S9 | p. 705.531.1121 | f. 705.531.1125
1470 Government Road W, Kirkland Lake, ON P2N 3J1 | p. 705.642.3361 | f. 705.642.3222
6820 Kitimat Road, Unit 4, Mississauga, ON L5N 5M3 | p. 905.821.1112 | f. 905.821.2095

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