ENVIRONMENTAL CLEANUP; ENVIRONMENTAL REMEDIATION
(Contamination Clean-Up in Ontario)

We cleanup contaminants and pollutants from contaminated sites to redevelop or restore the contaminated sites in Ontario. We provide innovative cleanup solutions including solidification and stabilization, soil vapor extraction, permeable reactive barriers, monitored natural attenuation, bioremediation-phytoremediation, chemical oxidation, steam-enhanced extraction and thermal desorption. to cleanup complex contaminated sites with wide ranging contamination cleanup capabilities and extensive remediation experience at hundreds of contaminated sites in Ontario, including Barrie, Belleville, Brampton, Brant, Brantford, Brockville, Burlington, Cambridge, Cornwall, Elliot Lake, Sudbury, Guelph, Haldimand County, Hamilton, Kawartha Lakes, Kingston, Kitchener, London, Markham, Mississauga, Niagara Falls, Norfolk County, North Bay, Orillia, Oshawa, Ottawa, Owen Sound, Pembroke, Peterborough, Pickering, Port Colborne, Prince Edward County, Quinte West, Sarnia, Sault Ste. Marie, St. Catharines, St. Thomas, Stratford, Thorold, Timmins, Toronto, Vaughan, Waterloo, Welland, Windsor, Woodstock, Ajax, Amherstburg, Arnprior, Aurora, Aylmer, Bancroft, Bracebridge, Bradford, West Gwillimbury, Caledon, Carleton Place, Cobourg, Collingwood, East Gwillimbury, Erin, Espanola, Essex, Fort Erie, Gananoque, Georgina, Goderich, Grand Valley, Gravenhurst, Greater Napanee, Grimsby, Halton Hills, Hanover, Hawkesbury, Huntsville, Ingersoll, Innisfil, Kingsville, Lakeshore, LaSalle, Lincoln, Midland, Milton, Minto, Mississippi Mills, Mono, New Tecumseth, Newmarket, Niagara-on-the-Lake, Oakville, Orangeville, Parry Sound, Pelham, Penetanguishene, Perth, Petawawa, Petrolia, Plympton-Wyoming, Prescott, Renfrew, Richmond Hill, Saugeen Shores, Shelburne, Smiths Falls, South Bruce Peninsula, St. Marys, Tecumseh, Blue Mountains, Tillsonburg, Wasaga Beach, Whitby, and Whitchurch-Stouffville.

Accidental spills and careless waste disposal practices can result in soil and ground water contamination. Spills are common and can occur just about anywhere and anytime.

About 4,000 spills are reported each year in Ontario, amounting to over several millions liters of diesel, gasoline, and other chemicals. Officials estimate that the total number of unreported spills in Ontario could be as high as 20,000.

Gasoline, diesel, and heating oil comprise about 65% of the reported spills in Ontario. Chemicals spilled many years ago can linger in the soil and still be a problem today.

Site contamination is a complex problem that seldom goes away by itself and can persist for decades. The contamination may not be confined to the site itself, because contaminants often spread far beyond their original source. Toxic Contamination can seep through the soil to the groundwater, which then becomes unfit for drinking. Natural groundwater flow can spread the contamination over a wide area.

As a result, soil and ground water contaminations in Ontario are often found in properties near past or present industrial sites, such as refineries, steel plants, mines, scrap yards and chemical plants. Contamination of properties in Ontario is also often associated with smaller-scale operations such as gas stations, automobile vehicle repair garages, dry cleaning outlets, electrical contractors, print shops, waste processors and industrial waste disposal sites.

Leakage of diesel, gasoline, heating oil or other products from underground storage tanks is another common cause of soil and ground water contamination in Ontario. Contaminated sites in Ontario are very often found near operating gas stations, former gas stations and at other locations where gasoline and diesel have been stored in underground fuel storage tanks. Gas stations or dry cleaners can severely impact a property 500 meters away.

From 1,500 to 5,000 underground storage tanks across Ontario are thought to be leaking. As time passes, more of the older tanks will begin to leak due to problems such as corrosion. There are at least 2,000 landfill sites across Ontario and contaminants may be seeping out of many of these landfill sites.

The health and safety of people who live or work at or very near a contaminated site are directly at risk. The local natural environment is also at risk. The immediate concern is the potential contamination cleanup cost.

A phase 2 environmental site assessment involves sampling and testing of soil and ground water etc., considered by the outcome of a phase 1 environmental site assessment or other investigation to be possible instances of environmental contamination. If contamination is identified, the phase 2 environmental site assessment findings are used to develop options for dealing with the contamination including removing the contamination from the soil and/or ground water, managing the contamination in-place and or monitoring soil and groundwater conditions to ensure the contamination doesn’t worsen.

Phase 3 environmental site assessment is an investigation involving cleanup of a property. When a phase 2 environmental site assessment confirms an environmental contamination, a phase 3 environmental site remediation may be initiated based on the type, degree, and extent of contamination and subsurface conditions at the site. Phase 3 environmental site investigations aim to delineate the physical extent of contamination based on recommendations made in Phase 2 environmental site assessments.

Phase 3 environmental site investigations may involve intensive testing, sampling, and monitoring, “fate and transport” studies and other modeling, and the design of feasibility studies for cleanup and remedial plans.

This study normally involves assessment of alternative cleanup methods, costs and logistics. Depending on the subsurface conditions, type of contaminant, and other variables, various methods such as excavate and haul of contaminated soil, pump and treatment of groundwater, bioremediation (supply oxygen and nutrients to a contaminated site so that naturally occurring bacteria that degrade hydrocarbons can flourish and breakdown the hydrocarbons), soil vapor extraction (force air through contaminated soil to drive contaminant particles into the air), neutralization in-place, may be used to remove or neutralize the contamination.

The storage and the dispensing of petroleum products at gas stations pose a risk of subsurface soil and groundwater contamination. The contamination may not be confined to the site itself, because contaminants often spread far beyond their original source. Leaking storage tanks at gas stations are a major source of environmental contamination. And it is not just the property that the gas station is located on that is at risk. Depending on the type of soil, presence of groundwater etc. the contamination can literally spread for many city blocks.

If you find a leak in your tank system or a component of the system, you must immediately withdraw the system or component from service until the leak is repaired. In the case of a component, you may continue to operate the system only if that component can be isolated from the system. Systems that do not have double walls or secondary containment pose a higher risk to the environment because, in the event of a leak or spill, product is released directly into soil and water. Once there, it can migrate over a considerable distance and cause extensive and long-term damage to the environment.

There are an estimated 2,500 dry cleaning facilities in Ontario. After World War I, dry cleaners began using chlorinated solvents. These solvents were much less flammable than petroleum solvents and had improved cleaning power.

By the mid-1930s, the dry cleaning industry had adopted tetrachloroethylene (perchloroethylene – “PERC”) as the ideal solvent. It has excellent cleaning power and is stable, nonflammable, and gentle to most garments. . In the early days of dry cleaning, large amounts of perchlorethylene were vented to the atmosphere because it was regarded as cheap and believed to be harmless.

Dry cleaning accounts for between one-third and one-half of all the perc used in Canada. Perc has been designated under the Canadian Environmental Protection Act as a persistent, bio-accumulative chemical that is toxic to the environment. Modern dry cleaning machines use a closed-loop system in which the chilled air is reheated and recirculated. This results in high solvent recovery rates and reduced air pollution.

Many solvents and inks used in the printing industry emit a volatile organic compound as atmospheric vapour. Emissions can be direct through stacks and vents, or fugitive. volatile organic compounds are photo-reactive and when they combine with nitrous oxide emissions and particulate from cars, trucks and industry and are synthesized by ultra violet rays in sunlight, they produce “smog”, as a dirty yellow pollutant.

Printing operations could pose some environmental concerns due to potential spills leaks or migration of chlorinated solvents through natural and/or preferential pathways. The stricter pollution regulations including requirements to comply with the pollution prevention waste water bylaw in Toronto, avoidance, elimination, reduction and/or substitution of the use of chlorinated solvents, re-use and/or recycling of chlorinated solvents, proper waste, spill and contamination programs have reduced the potential spills leaks or migration of chlorinated solvents from printing industry in the last decade.

The purpose of the Environmental Protection Act is to provide for the protection and conservation of the natural environment. To ensure this, the Minister of Environment and Climate Change is empowered to administer and enforce the province's environmental legislation.

This can take the form of monitoring, recommending appropriate abatement action, or prosecuting polluters in Ontario. Many times all three are undertaken in the ministry's efforts to get tough with polluters. The Province of Ontario - Environmental Protection Act states that no person shall discharge into the natural environment any contaminant, and no person responsible for a source of contaminant shall permit the discharge into the natural environment of any contaminant from the source of contaminant, in an amount, concentration or level in excess of that prescribed by the regulations. R.S.O. 1990, c.E.19, s.6(l).

We have managed contamination cleanup using soil excavation and disposal with groundwater pump and treat, and in-situ technologies at hundreds of industrial, commercial, institutional and multi-residential sites in Ontario, including in Ontario, including Barrie, Belleville, Brampton, Brant, Brantford, Brockville, Burlington, Cambridge, Cornwall, Elliot Lake, Sudbury, Guelph, Haldimand County, Hamilton, Kawartha Lakes, Kingston, Kitchener, London, Markham, Mississauga, Niagara Falls, Norfolk County, North Bay, Orillia, Oshawa, Ottawa, Owen Sound, Pembroke, Peterborough, Pickering, Port Colborne, Prince Edward County, Quinte West, Sarnia, Sault Ste. Marie, St. Catharines, St. Thomas, Stratford, Thorold, Timmins, Toronto, Vaughan, Waterloo, Welland, Windsor, Woodstock, Ajax, Amherstburg, Arnprior, Aurora, Aylmer, Bancroft, Bracebridge, Bradford, West Gwillimbury, Caledon, Carleton Place, Cobourg, Collingwood, East Gwillimbury, Erin, Espanola, Essex, Fort Erie, Gananoque, Georgina, Goderich, Grand Valley, Gravenhurst, Greater Napanee, Grimsby, Halton Hills, Hanover, Hawkesbury, Huntsville, Ingersoll, Innisfil, Kingsville, Lakeshore, LaSalle, Lincoln, Midland, Milton, Minto, Mississippi Mills, Mono, New Tecumseth, Newmarket, Niagara-on-the-Lake, Oakville, Orangeville, Parry Sound, Pelham, Penetanguishene, Perth, Petawawa, Petrolia, Plympton-Wyoming, Prescott, Renfrew, Richmond Hill, Saugeen Shores, Shelburne, Smiths Falls, South Bruce Peninsula, St. Marys, Tecumseh, Blue Mountains, Tillsonburg, Wasaga Beach, Whitby, and Whitchurch-Stouffville.

Environmental cleanup deals with the removal of pollution or contaminants from environmental media such as soil and groundwater. Environmental cleanup technologies are many and varied but can generally be categorized into ex-situ and in-situ methods.

Ex-situ methods involve excavation of affected soils and subsequent treatment at the surface as well as extraction of contaminated groundwater and treatment at the surface. In-situ methods seek to treat the contamination without removing the soils or groundwater. Various technologies have been developed for cleanup of oil-contaminated soil/sediments.

Our traditional cleanup approaches consist of soil excavation and disposal to landfill and groundwater "pump and treat". In-situ technologies include but are not limited to: solidification and stabilization, soil vapor extraction, permeable reactive barriers, monitored natural attenuation, bioremediation-phytoremediation, chemical oxidation, steam-enhanced extraction and in situ thermal desorption.

Thermal desorption is a technology for soil cleanup. During the process a desorber volatilizes the contaminants (e.g. oil, mercury or hydrocarbon) to separate them from especially soil or sludge. After that the contaminants can either be collected or destroyed in an offgas treatment system.

Excavation processes can be as simple as hauling the contaminated soil to a regulated landfill, but can also involve aerating the excavated material in the case of volatile organic compounds. Recent advancements in bioaugmentation and biostimulation of the excavated material have also proven to be able to cleanup semi-volatile organic compounds onsite. If the contamination affects a river or bay bottom, then dredging of bay mud or other silty clays containing contaminants (including sewage sludge with harmful microorganisms) may be conducted.

Recently, ExSitu Chemical Oxidation has also been utilized in the cleanup of contaminated soils in Ontario. This process involves the excavation of the contaminated area into large bermed areas where they are treated using chemical oxidation methods.

The surfactant enhanced aquifer remediation process (solubilization and recovery) involves the injection of hydrocarbon mitigation agents or specialty surfactants into the subsurface to enhance desorption and recovery of bound up otherwise recalcitrant non aqueous phase liquid. In geologic formations that allow delivery of hydrocarbon mitigation agents or specialty surfactants, this approach provides a cost effective and permanent solution to sites that have been previously unsuccessful utilizing other cleanup approaches. This technology is also successful when utilized as the initial step in a multi-faceted cleanup approach utilizing surfactant enhanced aquifer remediation then In situ oxidation, bioremediation enhancement or soil vapor extraction.

Pump and treat involves pumping out contaminated groundwater with the use of a submersible or vacuum pump, and allowing the extracted groundwater to be purified by slowly proceeding through a series of vessels that contain materials designed to adsorb the contaminants from the groundwater.

For petroleum-contaminated sites this material is usually activated carbon in granular form. Chemical reagents such as flocculants followed by sand filters may also be used to decrease the contamination of groundwater. Air stripping is a method that can be effective for volatile pollutants such as BTEX compounds found in gasoline.

For most biodegradable materials like BTEX, MTBE and most hydrocarbons, bioreactors can be used to clean the contaminated water to non-detectable levels. With fluidized bed bioreactors it is possible to achieve very low discharge concentrations which will meet or exceed discharge requirements for most pollutants.

Depending on geology and soil type, pump and treat may be a good method to quickly reduce high concentrations of pollutants. It is more difficult to reach sufficiently low concentrations to satisfy remediation standards, due to the equilibrium of absorption/desorption processes in the soil. However, pump and treat is typically not the best form of cleanup. It is expensive to treat the groundwater, and typically is a very slow process to clean up a release with pump and treat. It is best suited to control the hydraulic gradient and keep a release from spreading further.

Better options of in-situ treatment often include air sparge / soil vapor extraction or dual phase extraction / multiphase extraction.

Other methods include trying to increase the dissolved oxygen content of the groundwater to support microbial degradation of the compound (especially petroleum) by direct injection of oxygen into the subsurface, or the direct injection of a slurry that slowly releases oxygen over time (typically magnesium peroxide or calcium oxy-hydroxide).

Solidification and stabilization work has a reasonably good track record but also a set of serious deficiencies related to durability of solutions and potential long-term effects. In addition CO_2 emissions due to the use of cement are also becoming a major obstacle to its widespread use in solidification/stabilization projects. Stabilization/solidification is a remediation and treatment technology that relies on the reaction between a binder and soil to stop/prevent or reduce the mobility of contaminants. Stabilization involves the addition of reagents to a contaminated material (e.g. soil or sludge) to produce more chemically stable constituents; and Solidification involves the addition of reagents to a contaminated material to impart physical/dimensional stability to contain contaminants in a solid product and reduce access by external agents (e.g. air, rainfall). Conventional stabilization/solidification is an established cleanup technology for contaminated soils and treatment technology for hazardous wastes.

However, the uptake of stabilization/solidification technologies has been relatively modest, and a number of barriers have been identified including:

the relatively low cost and widespread use of disposal to landfill;
the lack of authoritative technical guidance on stabilization / solidification;
uncertainty over the durability and rate of contaminant release from stabilization/solidification treated material;
experiences of past poor practice in the application of cement stabilization processes used in waste disposal in the 1980s and early 1990s; and
residual liability associated with immobilized contaminants remaining on-site, rather than their removal or destruction.

New in situ oxidation technologies have become popular for cleanup of a wide range of soil and groundwater contaminants. Remediation by chemical oxidation involves the injection of strong oxidants such as hydrogen peroxide, ozone gas, potassium permanganate or persulfates.

Oxygen gas or ambient air can also be injected to promote growth of aerobic bacteria which accelerate natural attenuation of organic contaminants. One disadvantage of this approach is the possibility of decreasing anaerobic contaminant destruction natural attenuation where existing conditions enhance anaerobic bacteria which normally live in the soil prefer a reducing environment. In general though, aerobic activity is much faster than anaerobic and overall destruction rates are typically greater when aerobic activity can be successfully promoted.

The injection of gases into the groundwater may also cause contamination to spread faster than normal depending on the site's hydrogeology. In these cases, injections downgradient of groundwater flow may provide adequate microbial destruction of contaminants prior to exposure to surface waters or drinking water supply wells.

Migration of metal contaminants must also be considered whenever modifying subsurface oxidation-reduction potential. Certain metals are more soluble in oxidizing environments while others are more mobile in reducing environments.

Soil vapor extraction is an effective cleanup technology for soil. Multi-Phase Extraction is also an effective cleanup technology when soil and groundwater are to be remediated coincidentally. Soil vapor extraction and Multi Phase Extraction utilize different technologies to treat the off-gas volatile organic compounds generated after vacuum removal of air and volatile organic compounds from the subsurface and include granular activated carbon (most commonly used historically), thermal and/or catalytic oxidation and vapor condensation.

Generally, carbon is used for low (below 500 ppmV) volatile organic compounds concentration vapor streams, oxidation is used for moderate (up to 4,000 ppmV) volatile organic compounds concentration streams, and vapor condensation is used for high (over 4,000 ppmV) volatile organic compounds concentration vapor streams.

Granular activated carbon is used as a filter for air or water and commonly used to filter tap water in household sinks. Granular activated carbon is a highly porous adsorbent material, produced by heating organic matter, such as coal, wood and coconut shell, in the absence of air, which is then crushed into granules. Activated carbon is positively charged and therefore able to remove negative ions from the water such as organic ions, ozone, chlorine, fluorides and dissolved organic solutes by adsorption onto the activated carbon. The activated carbon must be replaced periodically as it may become saturated and unable to adsorb (i.e. reduced absorption efficiency with loading). Activated carbon is not effective in removing heavy metals.

Thermal oxidation (or incineration) can also be an effective cleanup technology.

This approach is somewhat controversial because of the risks of dioxins released in the atmosphere through the exhaust gases or effluent off-gas. Controlled, high temperature incineration with filtering of exhaust gases however should not pose any risks.

Two different technologies can be employed to oxidize the contaminants of an extracted vapor stream. The selection of either thermal or catalytic depends on the type and concentration in parts per million by volume of constituent in the vapor stream. Thermal oxidation is more useful for higher concentration (~4,000 ppmV) influent vapor streams (which require less natural gas usage) than catalytic oxidation at ~2,000 ppmV.

Thermal oxidation uses a system that acts as a furnace and maintains temperatures ranging from 730 to 820°C. Catalytic oxidation which uses a catalyst on a support to facilitate a lower temperature oxidation. This system usually maintains temperatures ranging from 315 to 425°C.

Vapor condensation is the most effective off-gas treatment technology for high (over 4,000 ppmV) VOC concentration vapor streams. The process involves cryogenically cooling the vapor stream to below 40°C such that the VOCs condensate out of the vapor stream and into liquid form where it is collected in steel containers.

The liquid form of the VOCs is referred to as dense non-aqueous phase liquids (DNAPL) when the source of the liquid consists predominantly of solvents or light non-aqueous phase liquids (LNAPL) when the source of the liquid consists predominantly of petroleum or fuel products. This recovered chemical can then be reused or recycled in a more environmentally sustainable or green manner than the alternatives described above. This technology is also known as cryogenic cooling and compression.

Using nano-sized reactive agents to degrade or immobilize contaminants is termed nanoremediation. In soil or groundwater nanoremediation, nanoparticles are brought into contact with the contaminant through either in situ injection or a pump-and-treat process.

The nanomaterials then degrade organic contaminants through redox reactions or adsorb to and immobilize metals such as lead or arsenic.

In commercial settings, this technology has been dominantly applied to groundwater remediation, with research into wastewater treatment. Research is also investigating how nanoparticles may be applied to cleanup of soil and gases.

Nanomaterials are highly reactive because of their high surface area per unit mass, and due to this reactivity nanomaterials may react with target contaminants at a faster rate than would larger particles. Most field applications of nanoremediation have used nano zero-valent iron (nZVI), which may be emulsified or mixed with another metal to enhance dispersion.

That nanoparticles are highly reactive can mean that they rapidly clump together or react with soil particles or other material in the environment, limiting their dispersal to target contaminants. Some of the important challenges currently limiting nanoremediation technologies include identifying coatings or other formulations that increase dispersal of the nanoparticle agents to better reach target contaminants while limiting any potential toxicity to bioremediation agents, wildlife, or people.

Bioremediation is a process that treats a polluted area either by altering environmental conditions to stimulate growth of microorganisms or through natural microorganism activity, resulting in the degradation of the target pollutants. Broad categories of bioremediation include bio-stimulation, bio-augmentation, and natural recovery (natural attenuation). Bioremediation is either done on the contaminated site (in situ) or after the removal of contaminated soils at another more controlled site (ex situ). In the past, it has been difficult to turn to bioremediation as an implemented policy solution, as lack of adequate production of remediating microbes led to little options for implementation.

Those that manufacture microbes for bioremediation must be approved; however, the authorities are traditionally have been more cautious about negative externalities that may or may not arise from the introduction of these species.

One of their concerns is that the toxic chemicals would lead to the microbe's gene degradation, which would then be passed on to other harmful bacteria, creating more issues, if the pathogens evolve the ability to feed off of pollutants.

Cleaning of oil contaminated sediments with self-collapsing air microbubbles have been recently explored as a chemical free technology. Air microbubbles generated in water without adding any surfactant could be used to clean oil contaminated sediments. This technology holds promise over the use of chemicals (mainly surfactant) for traditional washing of oil contaminated sediments.

Fortunately, today's property owners have learned from yesterday's mistakes, and are eager to cleanup contaminations confirmed in their properties. Since no two contaminated sites are alike, phase 3 environmental site remediation is customized for every site, and can vary in cost and length of remediation.

The cost to of contamination cleanup is based on the location and size of the site; type, extent, and degree of contamination; depth to groundwater; subsurface conditions etc. We're an employee owned Canadian firm and take pride in our cleanup and remediation management.

WE ARE YOUR CONTAMINATION CLEANUP EXPERTS

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We cleanup contaminated sites with bioremediation using combination of microbes, dissolved oxygen and nutrients to degrade hydrocarbons, BTEX and chlorinated solvents, spraying augmented microbial hydrocarbon solution, injecting surfactants and chemical oxidants like hydrogen peroxide, ozone gas, potassium permanganate and persulfates in the contaminant plume, extracting groundwater, filter through an activated carbon filter and then reintroduced into the contaminant plume, in Ontario, including Barrie, Belleville, Brampton, Brant, Brantford, Brockville, Burlington, Cambridge, Cornwall, Elliot Lake, Sudbury, Guelph, Haldimand County, Hamilton, Kawartha Lakes, Kingston, Kitchener, London, Markham, Mississauga, Niagara Falls, Norfolk County, North Bay, Orillia, Oshawa, Ottawa, Owen Sound, Pembroke, Peterborough, Pickering, Port Colborne, Prince Edward County, Quinte West, Sarnia, Sault Ste. Marie, St. Catharines, St. Thomas, Stratford, Thorold, Timmins, Toronto, Vaughan, Waterloo, Welland, Windsor, Woodstock, Ajax, Amherstburg, Arnprior, Aurora, Aylmer, Bancroft, Bracebridge, Bradford, West Gwillimbury, Caledon, Carleton Place, Cobourg, Collingwood, East Gwillimbury, Erin, Espanola, Essex, Fort Erie, Gananoque, Georgina, Goderich, Grand Valley, Gravenhurst, Napanee, Grimsby, Halton Hills, Hanover, Hawkesbury, Huntsville, Ingersoll, Innisfil, Kingsville, Lakeshore, LaSalle, Lincoln, Midland, Milton, Minto, Mississippi Mills, Mono, New Tecumseth, Newmarket, Niagara-on-the-Lake, Oakville, Orangeville, Parry Sound, Pelham, Penetanguishene, Perth, Petawawa, Petrolia, Plympton-Wyoming, Prescott, Renfrew, Richmond Hill, Saugeen Shores, Shelburne, Smiths Falls, South Bruce Peninsula, St. Marys, Tecumseh, Blue Mountains, Tillsonburg, Wasaga Beach, Whitby, and Whitchurch-Stouffville.