Construction Exposure Profiles:

Asbestos

PROVINCIAL BUILDING & CONSTRUCTION TRADES COUNCIL OF ONTARIO

Asbestos fibres are a strong and highly heat resistant material used extensively in insulation, building materials, and other products from the 1930s to 1980s. Asbestos was used as insulation of walls, pipes, boilers, and kilns. It was also used in roofing materials, ceiling tiles, floor tiles, and other building materials. Although asbestos was banned in Canada in 2018, it remains an important hazard in the construction trades, where many workers continue to be exposed during asbestos remediation and repair of buildings with asbestos-containing material (ACM).

CAREX Canada estimates that

53,000

Ontario construction workers are exposed to asbestos.

Health Effects

Asbestos causes mesothelioma and cancers of the lung, larynx, and ovaries. It is also strongly suspected of causing colorectal, pharyngeal, and stomach cancer. Asbestos also causes asbestosis, an incurable scarring of the lungs, and other lung diseases such as chronic obstructive pulmonary disease (COPD), and idiopathic pulmonary fibrosis.

Exposure Sources and Construction Trades

Workers in the construction trades are at risk for asbestos exposure when maintaining, renovating, or demolishing older buildings with ACM. Insulators may be in contact with the fibres when replacing insulation in old buildings. Pipefitters and plumbers can be exposed to asbestos when removing old piping and boilermakers can also be exposed when working with older boilers that were insulated with asbestos. Given the extensive use of asbestos in other building materials such as roofing, flooring, ceiling tiles, joint wall compound, and in cement, many building trades workers are still exposed to asbestos.

Occupational Disease Risks

The Occupational Cancer Research Centre's (OCRC) Burden of Occupational Cancer in Ontario report estimates workplace exposure to asbestos causes 160 lung cancers and 35 mesotheliomas each year among Ontario construction workers. The Future Burden of Cancer in Construction project estimates that asbestos will cause 5,960 lung cancer cases in the Ontario construction industry between 2030 and 2060.

Findings in the Table 1 show the percent increase for mesothelioma and asbestosis in specific construction occupations compared to all other workers in the Occupational Disease Surveillance System (ODSS).

Table 1. Increased risk of mesothelioma and asbestosis in specific construction trades occupations compared to all other workers in the ODSS.

	Mesothelioma	Asbestosis
Insulators and related	2482%*	3420%*
Pipefitters and plumbers	488%*	718%*
Boilermakers	236%*	845%*
Painters, paperhangers, and related	159%*	50%
Plasterers and related	131%*	458%*
Construction electricians and repairers	113%*	228%*
Brick and stone masons and tile setters	81%*	304%*
Carpenters and related	73%*	96%*
Welding and flame cutting	65%*	33%
Sheet metal workers	44%	164%*

**Statistically significant*

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Construction Exposure Profiles: **Asbestos**

In 1986, the Ontario Asbestos Workers Registry was developed to monitor workers who had been exposed to asbestos. The OCRC linked workers in this registry to provincial health records and identified very high risks of cancer and respiratory disease in these workers. They had a 40% increased risk of developing lung cancer, 10 times the risk of mesothelioma, 3 times the risk of COPD, 18 times the risk of asbestosis, and over 11 times the risk of other fibrosis.

Prevention

Asbestos management and disposal in Ontario are regulated. Specialized worker education and training are required before removing or disturbing any materials containing asbestos.

The Infrastructure Health and Safety Association and Government of Canada provide guidelines for risk assessment and control. Ontario Regulation 278/05 specifically covers asbestos on construction projects and in buildings and repair operations. Guidelines may change over time and it is important to consult the appropriate statutes and regulations to remain up to date on government regulations. These regulations also vary across jurisdictions and there is a growing need for a national asbestos management standard in Canada.

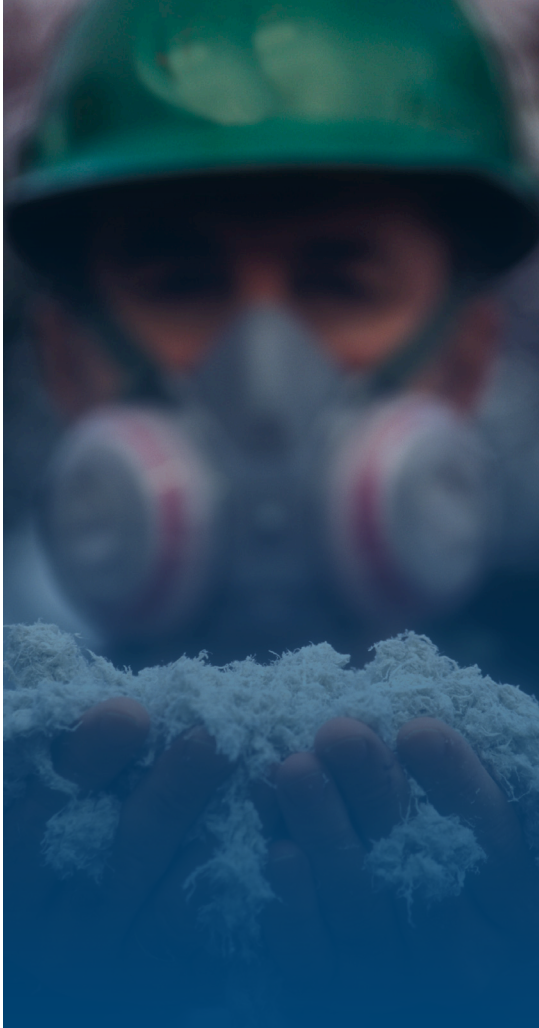
Work involving asbestos and ACM can be categorized into three types of asbestos activities: Type 1 (low), Type 2 (moderate) and Type 3 (high). Employers are required to complete an asbestos work report once a year for each worker that is involved in Type 2 or Type 3 activities, which is submitted to the Ontario Asbestos Workers Registry. When a worker has accumulated 2, 000 hours of asbestos exposure, the equivalent of one full year of employment, the worker is notified and will likely receive a medical examination.

To reduce exposure to asbestos, the most effective methods are through the use of engineering controls, such as local exhaust ventilation equipped with high-efficiency particulate air (HEPA) filters, water and wetting agent spray systems, and sealing off work areas. Administrative controls, such as cleaning policies for the workplace equipment and clothing, training, and exposure monitoring, can also be effective. Personal protective equipment (PPE), which may include fit-tested respirators, protective suits, goggles, boots, and gloves, must be used appropriately. PPE should be clean, disinfected, and correctly disposed as per manufacturer's instructions. For a more complete set of control measures see the resources section.

Although there are controls in place, past asbestos exposure and prevention of new exposure in workers from pre-existing ACM will remain a challenge for many years to come. Diseases such as mesothelioma and asbestosis take a long time to develop from initial exposure to asbestos and can vary based on many factors, further highlighting the importance of monitoring and reporting worker asbestos exposure.

This profile was prepared by the Occupational Cancer Research Centre in collaboration with the Ontario Building Trades Council with funding from the Ontario Ministry of Labour, Immigration, Training and Skills Development.

OCRC Occupational Cancer Research Centre



Resources

Ontario Ministry of Labour, Immigration, Training and Skills Development - Guide to the Regulation respecting Asbestos on Construction Projects and in Buildings and Repair Operations:
https://www.ontario.ca/document/guide-regulation-respecting-asbestos-construction-projects-and-buildings-and-repair

Infrastructure Health & Safety Association - Asbestos Controls for Construction, Renovation, and Demolition:
https://www.ihsa.ca/PDFs/Products/Id/DS037.pdf

Occupational Health and Safety Act. O. Reg. 278/05: Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations:
https://www.ontario.ca/laws/regulation/050278

Canadian Centre for Occupational Health and Safety. Asbestos – control strategies for workplaces:
https://www.ccohs.ca/oshanswers/chemicals/asbestos/control.html

Government of Canada - technical guide to asbestos exposure management programs:
https://www.canada.ca/en/employment-social-development/services/health-safety/reports/asbestos-exposure-management-programs.html

To access this fact sheet and other health and safety and prevention information please visit:
www.obtworkplaceresource.com/health-safety

Construction Exposure Profiles:

Crystalline Silica

PROVINCIAL BUILDING & CONSTRUCTION TRADES COUNCIL OF ONTARIO

Crystalline silica is a component of soil, sand, and rocks and most commonly occurs in the form of quartz. It is found in building materials such as stone, asphalt, brick, concrete, granite, and mortar. Crystalline silica is a very common hazard at construction work sites.

CAREX Canada estimates that

105,000

Ontario construction workers are exposed to silica.

Health Effects

Inhalation of silica dust can cause lung cancer and silicosis, an irreversible lung disease caused when silica damages and scars lung tissue. Symptoms such as shortness of breath, severe coughing, and body weakness may become more noticeable the longer workers are exposed to crystalline silica. Silica dust exposure is also a possible risk factor for chronic obstructive pulmonary disease (COPD) and idiopathic pulmonary fibrosis.

Exposure Sources and Construction Trades

CAREX Canada has identified construction as the single largest industry with exposure to silica. Some large construction trades exposed to silica are labourers, heavy equipment operators, plasterers, and drywallers, but many more are potentially exposed.

There are many activities in construction that produce dust from silica-containing materials. Examples include:

- Chipping, sawing, grinding, hammering, or drilling
- Crushing, loading, hauling, or dumping
- Mixing and cutting concrete
- Abrasive blasting
- Dry sweeping or pressurized air blowing
- Tunneling, excavating, earth moving, or blasting

Occupational Disease Risks

According to the Occupational Cancer Research Centre (OCRC) burden of cancer in Ontario report, occupational exposure to crystalline silica causes 102 lung cancers annually in the construction sector. Without intervention, this exposure will cause an estimated 3,350 lung cancer cases in the Ontario construction industry from 2030-2060.

Below are the results from the Occupational Disease Surveillance System (ODSS) in construction trades most likely to be exposed to crystalline silica. The following Table 1 shows the percent increase for lung cancer and COPD, the two most common lung diseases, in construction occupations compared to all other workers in the ODSS.

Table 1. Increased risk of lung cancer and COPD in specific construction trades occupations compared to all other workers in the ODSS.

	Lung Cancer	COPD
Excavating, grading and related	37%*	38%*
Paving, surfacing and related	22%	33%
Labouring and other elemental work in excavating, grading and paving	55%*	75%*
Excavating, grading, paving and related not elsewhere classified	35%*	32%*
Brick and stone masons and tile setters	-	16%
Concrete finishing and related	-	38%*
Plasterers and related	20%	7%
Glaziers	28%	22%
Labouring and other elemental work in other construction trades	8%*	45%*

**Statistically significant*

- No increased risk observed or case numbers too small to report any increased risk

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Construction Exposure Profiles: **Crystalline Silica**

Prevention

The occupational exposure limit for crystalline silica is 0.1 mg/m^3 in Ontario. There are many effective and proactive methods that can be implemented to reduce crystalline silica exposure in the workplace.

Eliminating silica may not always be feasible but sometimes safer alternatives such as garnet for sand blasting can be used as a substitute or another process that produces less silica dust. Engineering controls could involve local exhaust ventilation, wet processing, and enclosing areas to control dust levels. Worker exposure monitoring and providing hand washing facilities on site are examples of administrative controls. Finally, personal protective equipment (PPE) may include fit-tested respirators, eye wear, and protective clothing. A study by the Institute for Work and Health and the OCRC estimated that a combination of wet method, local exhaust ventilation, and PPE use could prevent approximately 110 lung cancers in Ontario construction workers in the coming years.

Crystalline silica is a workplace hazard present in many building and construction trades. Improved control measures and comprehensive workplaces safety plans will help reduce future exposures in construction workers.

This profile was prepared by the Occupational Cancer Research Centre in collaboration with the Ontario Building Trades Council with funding from the Ontario Ministry of Labour, Immigration, Training and Skills Development

Resources

CAREX Canada - Silica (Crystalline) Profile:
https://www.carexcanada.ca/profile/silica_crystalline/

Canadian Centre for Occupational Health and Safety - Respirable Crystalline Silica: Breathe Easier:
https://www.ccohs.ca/newsletters/hsreport/issues/2017/05/ezine.html#hsreport-ontopic

Canadian Centre for Occupational Health & Safety - OSH Answers Fact Sheet - Silicosis:
https://www.ccohs.ca/oshanswers/diseases/silicosis.html

Ontario Ministry of Labour, Immigration, Training and Skills Development - Silica on Construction Projects:
https://www.labour.gov.on.ca/english/hs/pubs/silica/

Ontario Occupational Disease Statistics - Silica:
https://www.occdiseasestats.ca/#/exposure?id=1&locale=en

Occupational Health Clinics for Ontario Workers Inc - Silica Control Tool Pilot Program:
https://www.ohcow.on.ca/occupational-illness/silica-control-tool-pilot-program-ontario/

Occupational Cancer Research Centre - Burden of occupational cancer in Ontario:
https://www.cancercareontario.ca/sites/ccocancercare/files/assets/OCRCBurdenofOccupationalCancerReport.pdf

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Construction Exposure Profiles:

Diesel Engine Exhaust

PROVINCIAL BUILDING & CONSTRUCTION TRADES COUNCIL OF ONTARIO

Diesel engine exhaust is a complex mixture of soot particles, ash, sulfates, silicates, nitrogen oxides, carbon monoxide, polycyclic aromatic hydrocarbons (PAHs) and other toxic substances produced when diesel burns in an engine. The composition of the exhaust can vary depending on the type of machinery due to different types of engines, fuels, loads, and emission control systems. It is a significant health hazard in the building and construction trades.

CAREX Canada estimates that

36,000

Ontario construction workers are exposed to diesel engine exhaust.

Health Effects

Diesel engine exhaust causes lung cancer and may cause bladder cancer. Short term acute effects include light-headedness, nausea, and respiratory symptoms as well as irritation of the eyes, throat, and bronchi. Diesel exhaust may also initiate allergic reactions, cause asthma, and may increase the risk of cardiovascular diseases such as heart attacks (acute myocardial infarction (AMI)).

Exposure Sources and Construction Trades

Workers can be at risk for diesel engine exhaust exposure when diesel powered machines are being used, repaired, and tested. It can accumulate to higher levels in enclosed spaces. Workers in the building and construction trades can be exposed when operating or working near diesel construction equipment such as:

- Heavy equipment
- Trucks
- Generators
- Compressors
- Pumps
- Heaters
- Air conditioners
- Cranes
- Compacters
- Concrete mixers

OCRC conducted a study to measure the levels of diesel engine exhaust exposure in Ontario construction workers and found the highest average exposure in those working underground, operating equipment in unenclosed cabins and enclosures. Diesel engine exhaust exposure levels observed in construction settings can sometimes be as high as in some mining operations. Many exposures in this study exceeded health-based limits that have been proposed for diesel engine exhaust based on the most recent studies of lung cancer.

Occupational Disease Risks

OCRC's Burden of Occupational Cancer in Ontario report estimates workplace exposure to diesel engine exhaust causes 12 lung and bladder cancers among Ontario construction workers each year. According to the Future Burden of Cancer in Construction Project, 400 lung cancers in Ontario construction workers will be caused by diesel engine exhaust between 2030 and 2060 if strong prevention actions are not taken. Workers in excavating, grading, and paving were identified as having high exposure to diesel engine exhaust in the Occupational Disease Surveillance System (ODSS). The following Table 1 shows the percent increase for selected diseases in specific construction trades occupations compared to all other workers in the ODSS.

Table 1. Increased risk of lung cancer, bladder cancer, and AMI in specific construction trades occupations compared to all other workers in the ODSS.

	Lung Cancer	Bladder Cancer	AMI
Excavating, grading and related	37%*	13%	31%*
Paving, surfacing and related	22%	-	75%
Labouring and other elemental work in excavating, grading and paving	55%*	5%	41%*
Excavating, grading, paving and related, not elsewhere classified.	35%*	29%	19%

**Statistically significant*
- no increased risk observed or case numbers too small to report any increased risk

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Construction Exposure Profiles: **Diesel Engine Exhaust**

Prevention

There is currently no occupational exposure limit for diesel engine exhaust in construction, although a new limit of 160 µg/m³ (total carbon) has been proposed. However, the OCRC recommends that exposures be kept below 20 µg/m³ (elemental carbon) and kept as low as possible to prevent health effects. Recent research indicates that levels above 1 µg/m³ (elemental carbon) increase the risk of lung cancer.

Elimination would involve the use of alternative energies like electric which do not produce diesel engine exhaust. Rebuilding or using newer engines with stricter emissions regulations are a form of substitution. Engineering controls such as local exhaust ventilation or enclosed cabs can help to isolate the worker from the hazard. Preventative maintenance of diesel engines, limiting idling, and operator training are administrative controls. Use of personal protective equipment, such as respirators, should be used if no other controls are possible.

Diesel engine exhaust continues to be a common occupational hazard for workers in the construction trades. Workplace exposure data is likely underestimating diesel engine exhaust exposure in workers. Better controls and prevention strategies are necessary to reduce exposure in construction workers.

This profile was prepared by the Occupational Cancer Research Centre in collaboration with the Ontario Building Trades Council with funding from the Ontario Ministry of Labour, Immigration, Training and Skills Development.

Occupational Cancer Research Centre

Resources

Canadian Centre for Occupational Health and Safety - OSH Answers Fact Sheets - Diesel Exhaust:
https://www.ccohs.ca/oshanswers/chemicals/diesel_exhaust.html

CAREX Canada - Diesel Engine Exhaust Profile:
https://www.carexcanada.ca/profile/diesel_engine_exhaust/

Government of Canada - Control measures for diesel engine exhaust emission in the work place:
https://www.canada.ca/en/employment-social-development/services/health-safety/reports/control-diesel-emissions.html

Workers Health & Safety Centre - Diesel Exhaust:
https://www.whsc.on.ca/files/resources/hazard-resource-lines/diesel-exhaust-whsc-resource-line.aspx

Ontario Occupational Disease Statistics - Diesel engine exhaust:
https://www.occdiseasestats.ca/#/exposure?id=2&locale=en

Occupational Cancer Research Centre - Burden of occupational cancer in Ontario:
https://www.cancercareontario.ca/sites/ccocancercare/files/assets/OCRCBurdenofOccupationalCancerReport.pdf

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Construction Exposure Profiles:

Lead

PROVINCIAL BUILDING & CONSTRUCTION TRADES COUNCIL OF ONTARIO

Lead is a useful but very toxic metal. It is primarily used in lead-acid batteries, as well as in lead sheets, pipes, and pigments. Until the 1980s, lead was also used in paints due to its durability. There has been a decline in the use of lead over the past decades, however, construction materials containing lead may still exist in older buildings.

CAREX Canada estimates that

20,000

construction workers are exposed to lead in Ontario.

Health Effects

Workers can be exposed to lead by breathing in or ingesting lead dust, fumes, or mist. The health effects are the same regardless of method of exposure, but the body absorbs higher levels of lead when it is breathed in.

A worker can experience lead poisoning when exposed to high levels of lead over a short period of time, but low levels of exposure over time can also have serious health effects.

Symptoms from low level exposure may include:

- Abdominal pain
- Constipation
- Tiredness
- Headache
- Irritability
- Loss of appetite
- Memory loss
- Weakness
- Pain or tingling in hand and/or feet

And in some cases of severe lead poisoning:

- Peripheral neuropathy (damage to the peripheral nervous system)
- Cerebral edema (brain swelling)
- Encephalopathy (brain disorder, disease, or damage) leading to possible seizures, coma, and death

Other long-term symptoms of lead poisoning include:

- Depression
- Distraction, forgetfulness, irritability
- Nausea, vomiting, diarrhea, and/or constipation
- Kidney disease
- High blood pressure
- Atherosclerosis (thickening or hardening of the arteries)
- Heart disease
- Brain damage
- Weakened immune system
- Reproductive damage
  - Males: decreased fertility, changes in sperm quality, damage to the testes
  - Females: decreased fertility, miscarriage, premature birth, earlier age at the onset of menopause
- Damage to blood cells causing anemia
- Decreased lung function
- Asthma
- Obstructive lung disease
- Enlarged liver
- Altered thyroid hormone levels
- Macular degeneration (blurred or loss of central vision)
- Some evidence for stomach, lung, kidney, brain, and nervous system cancers

Exposure Sources and Construction Trades

In construction trades, lead can be found in the form of lead metal, lead coatings, and old lead paint. Construction occupations primarily exposed to lead in Canada include welders, plumbers, pipefitters, steel welders, and cutters.

Lead can be found in the following construction materials:

- Additive in brass and other alloys
- Cable and wire casing
- Cast iron pipes, gaskets, and connections
- Solder
- Flashing
- Lead glass and stained glass
- Paint, surface coatings, glazing and structural steel primer
- Some late 19th and early 20th century tinted mortar

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Construction Exposure Profiles: **Lead**

The following are examples of activities that can release lead and potentially expose workers:

- Abrasive blasting of surfaces containing lead
- Welding, cutting, soldering, or cleaning structures with lead coatings
- Demolishing materials containing lead
- Lead burning
- Dry sanding, scraping, grinding, or buffing surfaces containing lead
- Using power tools to remove lead coatings
- Repairing, renovating, or removing pre-existing structures that contain lead
- Removing, repointing, or disturbing lead-containing mortar

Prevention

The occupational exposure limit for lead in Ontario is 0.05 mg/m^3 (milligrams per metre cubed) in air. However, over-exposure to lead is almost always measured in blood. In Ontario, new surveillance guidelines came into effect in 2020. Workers must be medically removed if their blood lead level measured twice one month apart is 1.0 µmol/L (micromole per litre) or if they have a single measure above 1.4 µmol/L.

There are also various prevention strategies that can be used in the workplace to reduce lead exposure in workers. Engineering controls such as barriers/enclosures, local exhaust ventilations, wet methods to reduce dust generation, and dust collection systems can reduce lead being released into the work environment. Appropriate education and training for workers, proper use of washing/decontamination facilities, and good housekeeping practices are examples of administrative controls. Finally, personal protective equipment such as eye protection, gloves, footwear, disposable protective clothing, and fit-tested respirators can also provide protection against lead exposure.

Work involving lead can be categorized into three types of activities: Type 1 (low), Type 2 (moderate) and Type 3 (high). The Ministry of Labour, Training and Skills Development provides guidelines for respirator requirements depending on the type of lead operation.

Use of these proper controls, work practices, and medical surveillance of workers can help to reduce the risk of possible adverse health effects and future exposure to lead.

This profile was prepared by the Occupational Cancer Research Centre in collaboration with the Ontario Building Trades Council with funding from the Ontario Ministry of Labour, Immigration, Training and Skills Development.

OCRC Occupational Cancer Research Centre

Resources

Ontario Ministry of Labour, Immigration, Training and Skills Development - Lead on Construction Projects:
https://www.labour.gov.on.ca/english/hs/pubs/lead/

Ontario Ministry of Labour, Immigration, Training and Skills Development - Part II: Medical surveillance program requirements for individual designated substances:
https://www.ontario.ca/document/code-medical-surveillance-designated-substances/part-ii-medical-surveillance-program-requirements-individual-designated-substances

CAREX Canada - Lead Profile:
https://www.carexcanada.ca/profile/lead/

Canadian Centre for Occupational Health and Safety - Lead on Construction Projects:
https://www.ccohs.ca/oshanswers/chemicals/lead_construction.html

WorkSafeBC - Lead:
https://www.worksafebc.com/en/health-safety/hazards-exposures/lead

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Construction Exposure Profiles:

Paints

PROVINCIAL BUILDING & CONSTRUCTION TRADES COUNCIL OF ONTARIO

Paints can either be solvent or water-based and contain pigments, binders (resins) and other additives. Pigments are used as colouring agents and increase durability and provide corrosion protection. Modern paints use resins and drying oils as binders. Resins can provide corrosion resistance, waterproofing, and other weather resistant coatings that can coat steel, wood, concrete structures, and facades.

Additives give special properties to paints, such as preventing bacterial growth, speeding up the drying process, or inhibition of corrosion. Nanoparticle additives, which were more recently added to paints, have a variety of properties like scratch resistance, hardness, gloss, and stability but there is limited research on the safety of paints containing nanoparticles.

Paints can contain harmful chemicals such as alcohols, cadmium compounds, chromium compounds, coal-tar and asphalt, isocyanates, lead compounds, nickel, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), silica and various volatile organic compounds (VOCs) such as formaldehyde, benzene, and glycol ethers. In the past, asbestos was used as a filler and arsenic was used as an anti-fouling agent in paint which may still exist in older buildings.

Waterborne paints contain lower levels of toxic chemicals and low-VOC and have been widely used in the construction industry. Over the years, solvent content in other paints has been reduced to an extent that VOC emission levels are similar to that of waterborne paints. Powder coatings are applied to surfaces by spraying and are cured with heat or ultraviolet light. They do not contain solvents but contain all other paint elements (pigments, binders, and additives) in a powdered form.

Health Effects

Workers are primarily exposed when they breathe in paint vapours or when paint comes in contact with skin or eyes. Paint can also be unintentionally ingested when workers have traces of paint left on their hands.

Painters are at an increased risk of bladder and lung cancer. It is difficult to determine if the increased risks of cancer are due to the contents in paint, other hazards in the work environment, or a combination of the two factors. Individually, many chemical additives and solvents in paint can cause cancer. Painters may be at increased risk of mesothelioma from asbestos exposure through paint or other sources in their work environment.

Some chemicals in paints can cause dermatitis, asthma, fertility problems, and liver, kidney, or neurological diseases. Temporary acute effects may include coughing, wheezing, headaches, nausea, and irritation of the eye, skin, and respiratory system.

Examples of materials commonly found in paint are shown in Table 1 on the following page. Many other chemicals used as surfactants, driers, thickeners, preservatives, plasticizers, biocides, anti-skinning agents, corrosion inhibitors, and light stabilizers may also be present in paint. It is important to review the material safety data sheet to understand the ingredients and health effects of each paint.

Construction Exposure Profiles: **Paints**

PROVINCIAL BUILDING & CONSTRUCTION TRADES COUNCIL OF ONTARIO

Table 1. Selected materials in paints and their health effects

Material	Use in paint	Known health effects
Alcohols, aliphatic	Solvents	Eye, nose, and skin irritation Headache, nausea, vomiting, unconsciousness
Aromatic hydrocarbons (e.g. benzene, toluene, xylene)	Solvents	Eye, nose, and skin irritation (including dermatitis) Kidney and liver damage, dizziness, headaches, memory loss, and other neurological effects Benzene causes acute myeloid leukemia and some evidence for chronic lymphocytic leukemia, multiple myeloma, and lung cancer
Cadmium compounds, chromium and chromium compounds	Pigments	Cadmium has a negative effect on the kidneys and bones. Inhalation can cause lung cancer and possibly prostate, kidney and bladder cancers Hexavalent chromium can cause shortness of breath, coughing, bronchitis and other respiratory effects. Hexavalent chromium causes lung cancer
Coal tar and asphalt	Special waterproof coatings in ships, tanks, pipes	Eye, respiratory tract, and skin irritation Skin and scrotal cancer with some evidence for leukemia, kidney, bladder, and digestive tract cancers
Formaldehyde	Amino resin varnishes, biocide (water-based paints)	Eye, nose, skin, and airway irritation Long-term exposure linked to nose and throat cancers and leukemia
Glycols (e.g. ethylene glycol)	Polyester resins, water-based paints	Narcosis, pulmonary edema, severe liver and kidney damage Long-term exposure can cause neurological and blood effects such as fatigue, nausea, tremor, and anemia
Isocyanates	Two-component polyurethane resins	Eye, nose, throat, and skin irritation Occupational asthma and is a potential carcinogen
Lead compounds	Primers, pigments, driers	Abdominal pain, headache, tiredness, memory loss Long-term symptoms may affect kidneys, heart, brain, immune system, reproductive system, lungs, liver, and eyes
Nickel	Pigment	Contact dermatitis, asthma, chronic bronchitis, decreased lung function, immunological and renal effects May cause lung cancer
Polychlorinated biphenyls	Plasticizers	Skin irritation and high exposure levels can lead to liver damage Melanoma (a type of skin cancer) and may cause non-Hodgkin lymphoma and breast cancer
Silica, crystalline	Filler, sand-blasting operation	Chronic obstructive pulmonary disease and rheumatoid arthritis Silicosis and lung cancer
Styrene	Polyester resins	Eye, skin, and throat irritation Central and peripheral nervous system effects, hearing problems, and dermatitis May cause cancer with some evidence for increased risk of blood cancers (e.g., myeloid leukemia)
Titanium dioxide	Pigment	Eye, nose, throat, and skin irritation May cause cancer

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Construction Exposure Profiles: **Paints**

Exposure Sources and Construction Trades

Exterior house paints, interior paints, masonry paints, and waterproof paints are examples of types of paints used in construction trades. While exposure to paint is highest in painters, other building trades workers can also be exposed when working near painters such as during surface preparation (ex. sanding and paint stripping), paint application, and drying.

Occupational Disease Risks

Painters, paperhangers and related occupations had a 39% increased risk of lung cancer and 14% increased risk of bladder cancer compared to all other workers in the Occupational Disease Surveillance System. These workers also had a 12% increased risk of asthma and 13% increased risk of dermatitis compared to all other workers.

Prevention

There is no general occupational exposure limit for paint in Canada, however there are limits for specific chemicals that may be in paint, such as formaldehyde or benzene, which can help reduce exposure. As paint content can vary greatly between type of paint and brand, it is important to read each material safety data sheet carefully to understand the contents of the paint and potential health effects. Workers should be aware that paint purchased through retail outlets lack material safety data sheets.

Although elimination of paint is generally not feasible, less hazardous types such as waterborne paints or isocyanate-free alternatives can be used. Other methods such as use of a brush or roller instead of spraying the paint could also reduce the amount of paint particles and solvents released into the air. Engineering controls may include using enclosed barriers to prevent other workers from being exposed and improving ventilation inside the work area to remove fumes/dusts and introduce fresh air. There are administrative controls that can also help reduce exposure, such as ensuring that there are warning signs specifying paint work is underway, policies to keep paints in tightly closed containers when not in use to reduce unnecessary solvent evaporation, appropriate handwashing facilities and policies, and scheduling shift work so that there are fewer workers exposed to tasks involving painting. Finally, personal protective equipment like properly fit-tested respirators, eye protection, gloves, and coveralls can provide protection for workers.

As there are various chemicals in paint that can be hazardous to workers, it is important to be aware of the composition of new paint and of existing hazards in old paint. This can help guide workplaces to reduce paint exposure and better protect workers.

This profile was prepared by the Occupational Cancer Research Centre in collaboration with the Ontario Building Trades Council with funding from the Ontario Ministry of Labour, Immigration, Training and Skills Development.

OCRC Occupational Cancer Research Centre

Resources

Infrastructure Health & Safety Association - Occupational Health Risks - Painters & Decorators:
https://www.ihsa.ca/pdfs/products/id/W116.pdf

Health and Safety Executive - Construction hazardous substances: Solvents:
https://www.hse.gov.uk/construction/healthrisks/hazardous-substances/solvents.htm

Health and Safety Executive - Painting by Brush/Roller:
https://www.hse.gov.uk/pubns/guidance/oce2.pdf

The National Institute for Occupational Safety & Health - Epoxies and Resins - Reproductive Health:
https://www.cdc.gov/niosh/topics/repro/epoxiesresins.html

WorkSafeBC - Paints & coatings:
https://www.worksafebc.com/en/health-safety/hazards-exposures/paints-coatings

The National Institute for Occupational Safety & Health - Isocyanates:
https://www.cdc.gov/niosh/topics/isocyanates/default.html

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Construction Exposure Profiles:

Solar Radiation

PROVINCIAL BUILDING & CONSTRUCTION TRADES COUNCIL OF ONTARIO

Sun exposure at work is a hazard for those in the building and construction trades. The sun emits ultra-violet radiation, which can harm the skin and eyes. Workers are exposed when performing job tasks outdoors during working hours. The intensity of this exposure can vary depending on factors like the season, geography, time of day, reflection from surfaces, cloud coverage, air pollution, and time spent under the sun.

CAREX Canada estimates that

141,000

Ontario construction workers are exposed to solar radiation.

Health Effects

Solar radiation causes skin cancer (both melanoma and non-melanoma) and may cause lip and eye cancer. A common and immediate effect of ultraviolet radiation is a sunburn. With repeated exposure over time, skin will age faster, losing elasticity and developing blemishes and wrinkles. Other health effects include heat stress, eye injury and cataracts.

Exposure Sources and Construction Trades

Any worker who spends time performing tasks outside is exposed to solar radiation. The highest risk is for workers who spend prolonged time outdoors under direct sunlight. Examples of tasks in construction with high levels of exposure include:

- Building or repairing outdoor structures
- Installing walls and roofs
- Repairing or replacing shingles
- Outdoor electrical work
- Excavating, grading, and paving
- Loading/unloading material
- Operating heavy equipment outdoors, if not in a covered cab

Occupational Disease Risks

OCRC's Burden of Occupational Cancer in Ontario report estimates workplace exposure to solar radiation causes 378 non-melanoma skin cancers each year among Ontario construction workers. Non-melanoma skin cancers include basal and squamous cell cancers that are less deadly than skin melanomas, but still require treatment and can kill if not treated. Without intervention, exposure to solar UV radiation will cause an estimated 27, 650 skin cancers from 2030-2060 in the Ontario construction industry.

The Occupational Disease Surveillance System (ODSS) looked at many cancers, including melanomas and lip cancers, in the Ontario construction trades compared to all other workers followed in the ODSS (skin cancers, other than melanomas, are not identified by the Ontario Cancer Registry due to under-reporting).

Electrical power, lighting and wire communications equipment erecting, installing and repairing occupations had 21% significant increased risk of melanomas and 28% increased risk for lip cancers. Excavating, grading, paving and related occupations had a 105% significant increased risk for lip cancer.

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Construction Exposure Profiles: **Solar Radiation**

Prevention

There are currently no occupational exposure limits for solar UV radiation in Canada, however they do exist for UV radiation from artificial sources (ex. Arc welding). These limits are easily exceeded in outdoor work so workplaces should build/update their workplace safety programs to reduce sun exposure.

It is hard to eliminate or substitute work that needs to be done under the sun. Engineering controls such as shade structures, cabs for heavy equipment, films on vehicle windows to reduce UV exposure, and covering reflective surfaces can all help protect workers from solar radiation. Administrative controls like scheduling work before 11am and after 3pm to avoid the sunniest times of the day can minimize UV exposure. Finally, if it is not possible to reduce sun exposure, hats, sunglasses, clothing made of fabrics with high UV protection factor, and broad-spectrum sunscreens are examples of personal protective equipment that can be provided to workers.

A study by the OCRC estimated that non-melanoma skin cancers in Ontario construction workers will double by 2060. PPE use and shade structures alone can reduce skin cancer cases by 6, 034 and 2, 945 respectively between 2030 to 2060.

Solar radiation can impact almost all the building and construction trades. Even with controls, it is difficult to avoid the sun, and this could put tens of thousands of workers at risk for skin cancers. Education and training are key to informing workers of their risk and encouraging them to report their work-related diagnoses to better understand the scope of the issue in Ontario.

This profile was prepared by the Occupational Cancer Research Centre in collaboration with the Ontario Building Trades Council with funding from the Ontario Ministry of Labour, Immigration, Training and Skills Development

Resources

Canadian Centre for Occupational Health and Safety - Skin Cancer and Sunlight:
https://www.ccohs.ca/oshanswers/diseases/skin_cancer.html

WorkSafeBC - Sun & UV radiation:
https://www.worksafebc.com/en/health-safety/hazards-exposures/sun-uv-radiation

Ontario Ministry of Labour, Immigration, Training and Skills Development - Ultraviolet Radiation in the Workplace - 2. Health Effects of UV Exposure:
https://www.labour.gov.on.ca/english/hs/pubs/uvradiation/gl_uvrad_2.php

CAREX Canada - Solar UV Radiation Profile:
https://www.carexcanada.ca/profile/uv_radiation_solar/

Sun Safety at Work - Enhancing sun safety in Canadian workplaces:
https://sunsafetyatwork.ca/

Ontario Occupational Disease Statistics - UV radiation:
https://www.occdiseasestats.ca/#/exposure?id=3&locale=en

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Construction Exposure Profiles:

Welding Fumes

PROVINCIAL BUILDING & CONSTRUCTION TRADES COUNCIL OF ONTARIO

Welding fumes are a mixture of fine particles and gases produced through welding, a process that uses heat to fuse metals together. Coating and residues on the metal can also affect the composition and health effects of welding fumes. They can include metal working fluids, cadmium plating, chromates, vapours, lead oxide from primer paints, and plastic coatings.

CAREX Canada estimates that

31,000

Ontario construction workers are exposed to welding fumes.

Health Effects

Welding fumes cause lung cancer and may cause kidney cancer.

There are many health effects from inhaling welding fumes, including symptoms of nausea, dizziness, and irritation of the nose, throat, and eyes. Continuous long-term exposure to welding fumes could potentially lead to lung irritation, bronchitis, pneumonia, heart disease, and neurological problems.

Exposure Sources and Construction Trades

By occupation, the top two most exposed groups in Canada identified by CAREX Canada are welders and related machine operators and construction trades helpers and labourers.

Sheet metal workers may be exposed when welding together sheet metal parts, flame-cutting sheet metal or polishing welds. Boilermakers may be exposed when installing, fusing, or separating components. Other construction trades are also exposed when working with metal products, welding or working in close proximity to welders. Welding processes are performed by many industries that span across construction and building trades occupations and it is important to highlight their potential exposure to welding fumes. The International Agency for Research on Cancer estimated that people exposed to welding fumes may be 10 times higher than the number of people who have the job title of welder.

Occupational Disease Risks

According to the Occupational Cancer Research Centre burden of occupational cancer in Ontario report, workplace exposure to welding fumes causes 13 lung cancers annually in the construction sector.

Findings in the Table 1 below show the percent increase for lung cancer in specific construction occupations compared to all other workers in the Occupational Disease Surveillance System (ODSS).

Table 1. Increased risk of lung cancer in specific construction trades occupations compared to all other workers in the ODSS.

	Lung Cancer
Boilermakers, platers, and structural metal workers	42%*
Structural metal erectors	37%*
Roofing, waterproofing, related	25%*
Sheet metal workers	15%*
Other construction trades occupations	14%*
Welding and flame cutting	13%*
Pipefitting, plumbing and related	8%

**Statistically significant*

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Construction Exposure Profiles: **Welding Fumes**

Prevention

Although welding fumes have been classified as carcinogenic, no Canadian jurisdictions, including Ontario, have an exposure limit for overall welding fumes. However, occupational limits are in place for specific metals and metal oxides, such as chromium and nickel, identified in welding fumes to reduce exposure.

Although it would be difficult to eliminate welding fumes without eliminating welding, replacing working materials with less hazardous metals and cleaning surfaces to remove solvents, degreasers, and other hazardous substances may help to reduce the risk to workers. Engineering controls such as improved ventilation and local exhaust ventilation systems can remove fumes before they can be inhaled. Administrative controls can involve worker training and workplace monitoring/sampling to keep track of exposure levels. Workers should also wear appropriate respiratory protection and other personal protective equipment such as eye protection.

As there is limited evidence on levels of exposure to welding fumes specifically in construction trades, further research is needed to understand the risks and prevention of exposure among construction workers.

This profile was prepared by the Occupational Cancer Research Centre in collaboration with the Ontario Building Trades Council with funding from the Ontario Ministry of Labour, Immigration, Training and Skills Development.

Resources

Canadian Centre for Occupational Health and Safety - Welding – Fumes and Gases:
https://www.ccohs.ca/oshanswers/safety_haz/welding/fumes.html

CAREX Canada - Welding Fumes Profile:
https://www.carexcanada.ca/profile/welding-fumes/

Government of Canada - Welding and allied processes - A guide to health hazards and hazard control measures:
https://www.canada.ca/en/employment-social-development/services/health-safety/reports/guide-welding.html

Infrastructure Health & Safety Association - Welding and Cutting:
https://www.ihsa.ca/rtf/health_safety_manual/pdfs/tools_and_techniques/Welding_and_Cutting.pdf

Canadian Centre of Occupational Health and Safety - OSH Answers Fact Sheets - Welding:
https://www.ccohs.ca/oshanswers/safety_haz/welding/

Occupational Cancer Research Centre - Burden of occupational cancer in Ontario:
https://www.cancercareontario.ca/sites/ccocancercare/files/assets/OCRCBurdenofOccupationalCancerReport.pdf

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Construction Exposure Profiles:

Wood Dust

PROVINCIAL BUILDING & CONSTRUCTION TRADES COUNCIL OF ONTARIO

Wood is made of cellulose fibers, water, and naturally occurring chemicals. It can also contain wood preservatives and biological agents such as bacteria, moulds, and fungi. Wood composition also varies depending on the type of tree. Trees are classified into three types: hardwoods (like beech, maple, and oak), softwoods (like spruce, pine, and cedar), and tropical or exotic woods (like mahogany, obeche, and iroko).

Wood dusts are created during the processing of wood and wood products. Inhalation and skin contact with wood dust can lead to negative health effects.

CAREX Canada estimates that

55,000

Ontario construction workers are exposed to wood dust.

Health Effects

Wood dust from all tree species can cause health effects, but the types of health effects may vary. High levels of wood dust exposure, particularly from hardwoods and tropical species, can cause sinonasal and nasopharyngeal cancer. Research has identified some specific tree species, such as oak, beech, mahogany, teak, and walnut as having a higher risk of causing cancer.

Short-term symptoms of wood dust inhalation include dry or sore throat, runny nose, and eye irritation. Over time, skin irritation may occur and develop into allergic dermatitis. Inhalation of wood dust, particularly from allergenic tree species, including cedar, oak, and some tropical tree species, can cause occupational asthma. Hypersensitivity pneumonitis, particularly from mouldy wood dust, can develop within hours or days of exposure and result in breathlessness, nausea, and other flu symptoms.

Exposure Sources and Construction Trades

According to CAREX Canada, the top exposed group by occupation in Canada to wood dust are carpenters but many building trades may be exposed.

There are many tasks in the construction trades that can generate wood dust such as:

- Sawing
- Cutting
- Sanding
- Milling
- Routing

Workers can also be exposed when disturbing wood dust that has settled by using compressed air or sweeping. Some tasks, such as sanding and using compressed air can generate high levels of fine wood dust and are particularly hazardous.

Occupational Disease Risks

According to the Occupational Cancer Research Centre's burden of occupational cancer in Ontario report, about half of occupational exposure to wood dust is in the construction industry. Sinonasal and nasopharyngeal cancer are rare, and it is estimated that only 2-3 cases are caused by wood dust each year in construction. However, short-term effects, allergic dermatitis and asthma are more common. Carpenters had a 30% increased risk of sinonasal cancer compared to all other workers in the Occupational Disease Surveillance System.

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Construction Exposure Profiles: **Wood Dust**

Prevention

The current occupational exposure limit in Ontario for hardwood dusts is 1mg/m^3 and 5 mg/m^3 for softwoods. However, the American Conference of Governmental Industrial Hygienists (ACGIH) recommends that all wood dust exposure be kept below 1 mg/m^3 and that dust from Western red cedar, the most allergenic Canadian tree species, be kept below 0.5 mg/m^3. A list of very allergenic tree species is below, but many more species may be allergenic to some individuals.

- African maple
- Ash
- Eastern white cedars
- Oak
- Obeche
- Ebony
- Iroko
- Jacaranda
- Mahogany
- Pine
- Ramin
- Redwood
- Walnut
- Western red cedar

Complete elimination of wood dusts may not be feasible but depending on the situation, it may be possible to substitute with another type of wood with fewer known health effects. Engineering controls like local ventilation exhaust and use of high-efficiency particulate filters can greatly reduce workers' exposure to wood dust. Wet or vacuum clean-up methods and appropriate education and training on safe work procedures are examples of administrative controls. Finally, personal protective equipment such as properly fitted respirators and protective clothing can help to reduce inhalation and skin exposure respectively.

Wood dusts are a hazard present in many work environments in the construction trades. Effective use of controls and prevention strategies are key to preventing future exposure and negative health effects in the construction industry.

This profile was prepared by the Occupational Cancer Research Centre in collaboration with the Ontario Building Trades Council with funding from the Ontario Ministry of Labour, Immigration, Training and Skills Development.

Resources

Canadian Centre for Occupational Health and Safety - Wood Dust - Health Effects:
https://www.ccohs.ca/oshanswers/chemicals/wood_dust.html

CAREX Canada - Wood Dust Profile:
https://www.carexcanada.ca/profile/wood_dust/

Work Safe Alberta - Workplace Health and Safety Bulletin - Health effects from Exposure to Wood Dust:
https://open.alberta.ca/dataset/05877598-3055-4740-82a1-1db7595f3a23/resource/1245a403-4b14-498a-8bab-ec4b896e373a/download/whs-pub-ch045.pdf

WorkSafeBC - Combustible Wood Dust Mitigation and Control Checklist:
https://www.worksafebc.com/en/resources/health-safety/checklist/combustible-wood-dust-mitigation-and-control-checklist?lang=en

Ontario Occupational Disease Statistics - Wood dust:
https://www.occdiseasestats.ca/#/exposure?id=4&locale=en

Occupational Cancer Research Centre - Burden of occupational cancer in Ontario:
https://www.cancercareontario.ca/sites/ccocancercare/files/assets/OCRCBurdenofOccupationalCancerReport.pdf

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