Electrical Safety Authority

Ontario Electrical Safety Report

OESR 2022

Contents

A Message from the Electrical Safety Authority's Public Safety Officer

The Ontario Electrical Safety Report (OESR) is an annual report that compiles and publishes a collection of electrical safety data and analysis that helps to make Ontario a safer place to live, work and play free from electrical harm.

Electricity is involved in almost everything we do on a daily basis. Technology is changing at an incredible pace. We continue to see electrical incidents decrease, which is promising; however, we need to be mindful whether we are at work or play.

Incidents referred to in this report involve tragic circumstances in which people have been injured or killed. The least we can do is learn from these events. We can prevent these incidents from occurring in the future by analyzing and understanding what caused them, and taking meaningful steps towards change. The data collected and analyzed through the OESR helps the ESA focus on risk factors and guides efforts to reduce electrical harms in areas of highest risk.

Looking ahead, electrical safety is a crucial component in our provincial energy and electrification transformation. In addition, our ever-changing physical environment and the increase in storm activity we have seen recently, are opportunities for us to be conscious of all the ways that we are interacting with our electrical systems and products. Through enhanced stakeholder engagement and expanded education and awareness campaigns, we count on Ontarians to partner with us in identifying electrical risk areas and finding resolution that keeps everyone safe.

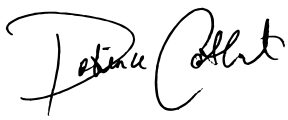
The OESR would not be possible without the collaboration of our safety partners. This report is compiled with the cooperation and participation from the Office of the Chief Coroner, the Ontario Ministry of Labour, Immigration, Training and Skills Development, the Office of the Fire Marshal and Emergency Management, the Canadian Institute of Health Information and the Workplace Safety and Insurance Board of Ontario.

Thank you to all of our partners for their contributions to the report and their dedication to improving electrical safety in Ontario.

I also recognize the safety organizations, electrical contractors, utility line crews, first responders, product manufacturers, electrical inspectors and extended ESA staff, who work every day to help keep Ontarians safe from electrical harm.

Finally, thank you to my colleagues at the ESA who have worked hard to consolidate, analyze and write this report, helping inform the safety community at large.

I am proud of this report and of our contribution to reducing electrical harm. It is an honour and a privilege to serve the people of Ontario.



Patience Cathcart
Public Safety Officer, Electrical Safety Authority

Electrical-related Fatalities and Incidents Over the Past Ten Years (2013-2022)

141 ELECTRICAL-RELATED FATALITIES

54 Electrocution Fatalities

87 Electrical Fire Fatalities*

Electrocution Fatalities

2013-2017 vs. 2018-2022 → **19%** decrease

Utility-related Deaths

Accounted for **48%** of all electrical-related fatalities in the past ten years

Deaths from Powerline Contact

2013-2017: **8**

2018-2022: **12**

Occupational Deaths

2013-2017: **18**

2018-2022: **9**

Non-occupational

The five-year rolling average rate of fatalities has increased from **0.12** per million (2013-2017) to **0.22** per million (2018-2022).

INCREASE OF **83%**

Fire Fatalities and Events

2013-2017 vs. 2018-2022 → **3%** decrease

Cooking Fires

Most common type of fire with electricity as the ignition source

Number of Cooking Fires

2017: **699**

2021: **563**

19% decrease

Electrical Distribution Fires

Number of Electrical Distribution Fires

2017: **422**

2021: **396**

6% decrease

PRIORITY ISSUES

The ESA's focus areas to reduce electrical injuries and fatalities fall in the following harm categories:

1. Occupational settings
2. Non-occupational settings
3. Powerline contact
4. Product safety
5. Aging infrastructure

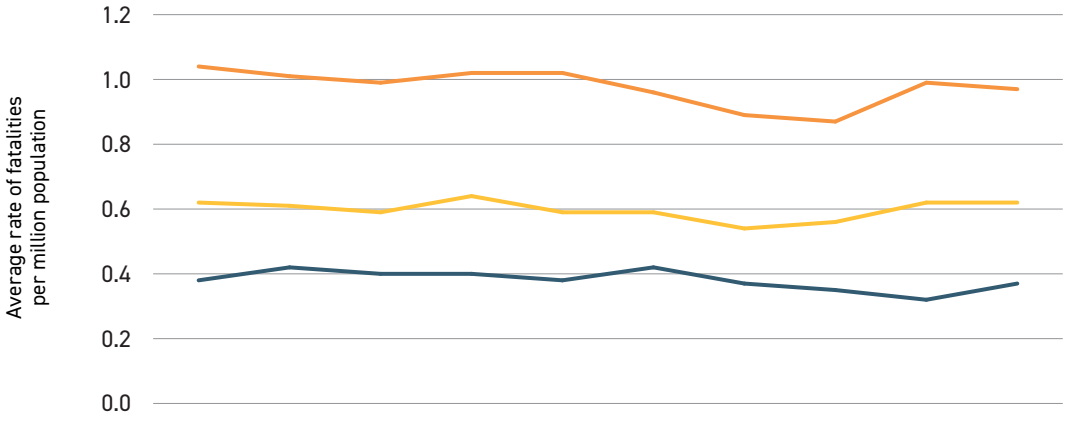
**Fire fatalities are those where the ignition source was reported as "electrical distribution equipment" or the fuel of the ignition source was reported as "electricity"*

Executive Summary

The Electrical Safety Authority's (ESA's) Ontario Electrical Safety Report (OESR) was created to provide a comprehensive perspective of electrical fatalities, injuries, and incidents in Ontario. Data presented in this report come from multiple sources, investigations, and root-cause analyses. Information is provided on potential electrical risks and high-risk sectors. This report is used by the ESA and others to better understand the dynamics of electrical safety and to encourage the development of initiatives to improve the status of electrical safety in the province.

Since 2014, the five-year average rate of electrocution and burn fatalities, and electrical fire fatalities (where the ignition source was identified to be electrical) have been less than one per million population. Progress has been made to reduce the number of fatalities and injuries, while the causes and context have shifted slightly over the time period. Concerted efforts remain essential for rates to continue to decrease.

FIVE-YEAR ROLLING AVERAGE OF ALL ELECTRICAL-RELATED FATALITIES IN ONTARIO, 2009–2022



Five-year period	2009-2013	2010-2014	2011-2015	2012-2016	2013-2017	2014-2018	2015-2019	2016-2020	2017-2021	2018-2022
Electrical fire fatalities	0.62	0.61	0.59	0.64	0.59	0.63	0.58	0.56	0.62	0.62*
Electrocution and burn fatalities	0.42	0.40	0.40	0.38	0.42	0.37	0.35	0.32	0.37	0.34*
Total electrical-related fatalities	1.04	1.01	0.99	1.02	1.02	1.00	0.93	0.88	0.99	0.97*

**Preliminary data subject to change*
Source: ESA, Coroner, and OFMEM records

Electrical-related Fatalities

In the past ten years, there were 141 electrical fatalities in Ontario. From 2013 to 2022, 54 people have died from electrocution (non-intentional death caused by contact with electricity) or by the effects of electrical burns, and 87 have died as a result of electrical fires (where the ignition fuel was identified as electricity and/or the ignition source was electrical distribution equipment). In comparison, the previous ten-year period from 2012 to 2021 reported 53 deaths from electrocutions and burns, and 89 fire deaths where the ignition source was identified as electrical. The trend rate of electrical-related fatalities continues to decrease.

Electrocutions and Electrical Burn Fatalities

Below are the five-year rolling average rates of electrocutions and electrical burn fatalities, comparing the two most recent five-year periods:

Five-year period	
2013–2017	• 29 electrical-related fatalities • Five-year rolling average of 0.42 per million population
2018–2022	• 25 electrical-related fatalities • Five-year rolling average of 0.34 per million population

Rate decrease of 19%

Utility-related electrocutions have accounted for 48% of all electrical-related fatalities in the past ten years:

Five-year period	
2013–2017	• 28% of all electrical-related fatalities (8/29) were from powerline contact • Five-year rolling average of 0.12 per million population
2018–2022	• 48% of all electrical-related fatalities (12/25) were from powerline contact • Five-year rolling average of 0.16 per million population

Rate increase of 33%

In the past ten years, the number of occupational electrical-related fatalities have equalled the number of non-occupational fatalities. However, the number of non-occupational electrical deaths have been greater than occupational deaths for four of the most recent five years.

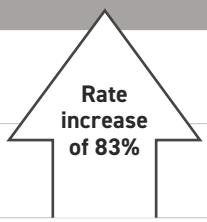
Five-year period	
2013–2017	• 62% of electrical-related fatalities (18/29) were occupational • Five-year rolling average of 0.48 per million labour force
2018–2022	• 36% of electrical-related fatalities (9/25) were occupational • Five-year rolling average of 0.23 per million labour force

Rate decrease of 52%

Electrical trade (electricians and apprentice electricians) accounted for 26% of occupational electrical-related fatalities between 2013 and 2022 as they were fatally injured on the job when working on energized equipment.

Between 2018 and 2022, there were 16 non-occupational electrical fatalities.

Five-year period	
2013–2017	38% of electrical fatalities were non-occupational (11/29) • Five-year rolling average of 0.12 per million population
2018–2022	64% of electrical fatalities were non-occupational (16/25) • Five-year rolling average of 0.22 per million population



Fire Fatalities and Events

The rate of electrical fire fatalities (where the ignition fuel was identified as electricity and/or the ignition source was electrical distribution equipment) has decreased by 3% when comparing the five-year rolling average in 2012–2016 and 2017–2021.

The number of structure-loss fires where electricity was identified as the fuel of the ignition source has decreased by 11% between 2017 and 2021.

Cooking-related fires continue to be the most common type of fire where electricity was the fuel of the ignition source:

- In 2017, there were 699 cooking equipment fires;
- In 2021, there were 563 cooking equipment fires, a decrease of 19%.

Electrical distribution equipment fires are fires from electrical wiring, devices, or equipment in which its primary function is to carry current from one location to another (e.g., wiring, extension cords, terminations, electrical panels, and appliance cords) with electricity as the fuel of the ignition source. This type of fire has decreased over the most recent five years:

- In 2017, there were 422 electrical distribution equipment fires;
- In 2021, there were 396 electrical distribution equipment fires, a decrease of 6%.

Priority Issues

The ESA uses incident data from the OESR to identify areas that present the greatest risk to Ontarians, to monitor changes in incidence, and to identify emerging risks and trends.

Based on the data collected in the past ten years, the ESA has identified that the majority of electrical injuries and fatalities occur in the following specific areas. These areas have been identified as priorities for reducing electrical fatalities, serious injuries, damage, and loss in Ontario:

- Powerline contact while working accounted for 30% of all occupational electrical fatalities between 2013 and 2022.
- Powerline contact while at home or in recreational settings has increased; between 2013 and 2017, 36% of non-occupational fatalities were due to powerline contact. More recently between 2018 and 2022, 50% of non-occupational fatalities were due to powerline contact.
- There was at least one critical injury to an electrical trade worker each year, in the past ten years. Safety incidents tend to be associated with unsafe work practices.
- From the most currently available data, non-occupational electrical injuries, identified from emergency department visits in Ontario, have decreased 11% from 2012 to 2021; however, the proportion of those with severe injuries has decreased by 1%.

- Misuse of electrical products and unapproved or counterfeit products account for a significant number of safety reports.
- The ESA defines electrical products as appliances, cooking equipment, lighting equipment, other electrical and mechanical equipment, and processing equipment. Data from the Office of the Fire Marshal and Emergency Management (OFMEM) show that the five-year average for electrical product structure-loss fires (where electricity was identified as the fuel source) between 2012–2016 and 2017–2021 has decreased by 17%.
- An average of 1,449 electrical loss fires (where ignition sources were fuelled by electricity) occurred in the past five years, with an average of eight fatalities per year.

ESA Initiatives

Based on the information collected from the OESR, the ESA's strategic plan (*Safely Powering Tomorrow*) in 2020 focuses on addressing those harms that represent the majority of incidents and fatalities. The ESA is working towards a goal of a 10% reduction in the electrical fatality and critical injury rate between 2020 and 2025. Harms within the following five categories are being considered for mitigation and prioritization:

- worker safety;
- powerline safety;
- non-occupational electrical interactions;
- electrical product fires; and
- aging infrastructure.

Additional details on the ESA's efforts can be found at **www.esasafe.com**.

To ensure that the ESA is optimizing its efforts to act as an effective and efficient regulator, the ESA has undertaken a risk-based prioritization of electrical harms for safety, and manages harms from a life cycle perspective. The harm life cycle (HLC) uses data from internal and external sources (including those from this safety report) to manage harm reduction action.

The ESA cannot reach its goal without the significant work and support of its partners and stakeholders within the electrical safety system. We would like to acknowledge:

- those who generate and distribute electricity;
- electrical equipment manufacturers;
- standards organizations;
- safety organizations;
- installers of electrical equipment;
- educators;
- facility owners;
- injury response and treatment providers;
- government;
- researchers;
- injury prevention specialists;
- safety regulators and worker safety advocates; and
- those who are end users of electricity.

Working together, we seek to reduce the number of electrical fatalities, injuries, and fires with the ultimate vision of "An Ontario where people can live, work, and play safe from electrical harm."

1.0 Purpose of This Report

This 22nd report on the state of electrical safety in Ontario summarizes electrical incidents, electrical-related fatalities identified by the Office of the Chief Coroner, and injuries of an electrical nature. It also provides information on deaths, injuries, and damage caused by fire incidents identified by the Office of the Fire Marshal and Emergency Management (OFMEM), as well as fires and fire fatalities identified by local fire departments where electricity was identified as the ignition fuel and/or electrical distribution equipment was identified as the ignition source.

The purpose of this report is to provide stakeholders within the broad electrical safety system with an update and a longitudinal perspective of electrical safety in Ontario.

Those stakeholders include:

- electrical utilities and those organizations that generate, transmit, and distribute electricity;
- organizations that design, manufacture, distribute, and supply electrical products;
- electrical contractors who install, repair, and maintain electrical wiring installations and products in our homes, workplaces, and public spaces;
- regulators and various levels of government that write policies and regulations to protect public safety;
- Canadian and international organizations which develop standards for electrical installation and products;
- academic and commercial organizations that focus on safety research and development;
- organizations, such as insurance companies, that create policies that drive organization and consumer behaviour to reduce risk;
- health care providers, workplace and community-based safety organizations, and education and training organizations that provide public communication and increase hazard-mitigation skills and awareness;
- people in homes, workplaces and public spaces;
- and more.

All of these organizations have an important role in contributing to and improving electrical safety in Ontario.

This report intends to educate and inform members of the electrical safety system by identifying key electrical safety risks. This information can be used to develop and improve standards, identify areas for continued safety research, influence the development of workplace and community-based safety programs, and lead to improved training, education, and communication programs.

1.1 Role of the Electrical Safety Authority

The Electrical Safety Authority (ESA) is an administrative authority acting on behalf of the Government of Ontario with specific responsibilities under Part VIII of the *Electricity Act, 1998*, and the *Safety and Consumer Statutes Administration Act, 1996*. As part of its mandate, the ESA is responsible for administering regulation in four key areas:

- Ontario Electrical Safety Code (Regulation 164/99);
- Licensing of Electrical Contractors and Master Electricians (Regulation 570/05);
- Distribution Safety (Regulation 22/04); and
- Product Safety (Regulation 438/07).

The ESA operates as a private, not-for-profit corporation. Funding derives from fees for electrical oversight, safety services, and licensing of electrical contractors and master electricians. Activities include:

- overseeing compliance with regulations;
- investigating fatalities, injuries, and fire losses associated with electricity;
- identifying and targeting leading causes of electrical risk, using a harm life cycle approach;
- promoting awareness, education, and training on electrical safety; and
- engaging with stakeholders to improve safety.

1.2 Focus Reports

Traditionally, the OESR has published case studies based on ESA root cause investigations. Instead, this year, the report will feature two focus reports that highlight the work the ESA has done in 2022 to address specific harms related to utilities and powerlines, and the emerging area of electrification, with a specific emphasis on electric vehicles and micromobility devices. These can be found at the end of Chapter 3 and Chapter 5, respectively.

2.1 Electrocutions and Electrical Burn Fatalities

Electrocution occurs when a person is exposed to a lethal amount of electrical energy.

It takes very little electrical current to seriously injure or to kill a person. Direct contact with a circuit that provides less than one amp of electricity (less than the current through a 100-Watt lightbulb) passing through a human body can cause a person to stop breathing (fibrillation). Direct contact with a live 15-amp circuit, the equivalent to a standard household outlet, can result in death (Canadian Centre for Occupational Health and Safety, 2023).

There were 54 electrical-related fatalities reported in Ontario in the ten-year span between 2013 and 2022, which is one death more than the time period between 2012 and 2021.

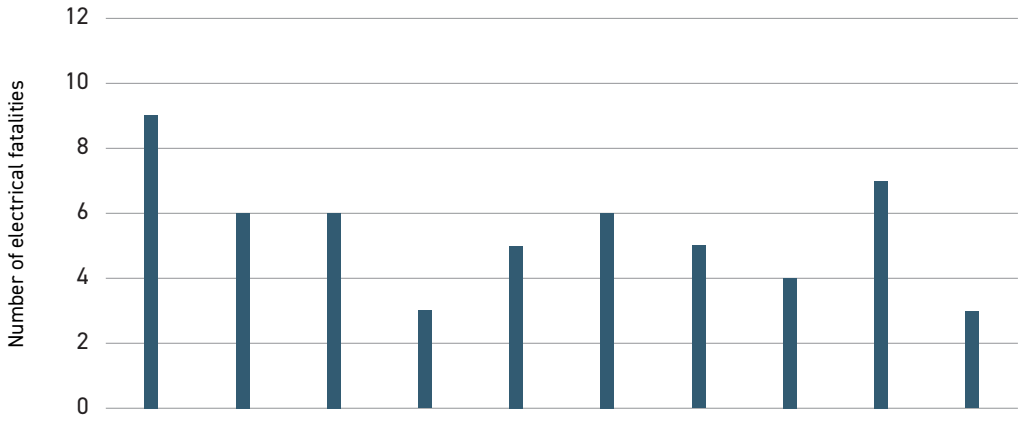
By age group, individuals aged 20 to 39 years accounted for the largest proportion of fatal injuries (48%), followed by individuals 40 to 59 years of age (31%). The majority of electrical fatalities occurred between the months of June and September (59%), with a peak of fatalities in August (20%).

The five-year rolling average rate of electrical fatalities has decreased by 19% when comparing 2013–2017 (0.42 per million population) and 2018–2022 (0.34 per million population). However, the rate of powerline fatalities has increased: when 2013–2017 (0.12 per million) and 2018–2022 (0.16 per million) were compared, there was a 33% increase in the five-year rolling average rate of powerline electrocutions.

Residential (28%), utility (12%), and commercial (12%) settings were the most common places for electrical-related fatalities between 2018 and 2022.

The five-year rolling average rate of occupational electrical-related fatalities per labour force has decreased 52% when comparing 2013–2017 (0.48 fatalities per million) to 2018–2022 (0.23 fatalities per million). The five-year rolling average rate of non-occupational electrical-related fatalities per million population has increased by 27% between the same time periods (0.16 fatalities per million to 0.22 fatalities per million).

1 NUMBER OF ELECTRICAL-RELATED FATALITIES IN ONTARIO, 2013–2022



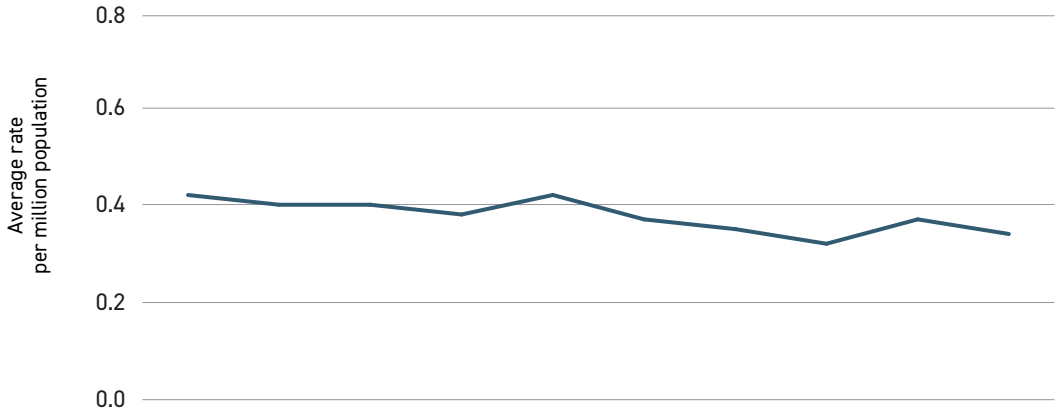
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of electrical fatalities	9	6	6	3	5	6	5	4	7	3

Source: ESA and Coroner records

Conclusion

The number of electrical-related fatalities in 2022 has decreased by four when compared to the previous year of 2021. 2022 has had the lowest number of electrical fatalities since 2016.

2 FIVE-YEAR ROLLING AVERAGE RATE OF ELECTRICAL-RELATED FATALITIES IN ONTARIO, 2009–2022



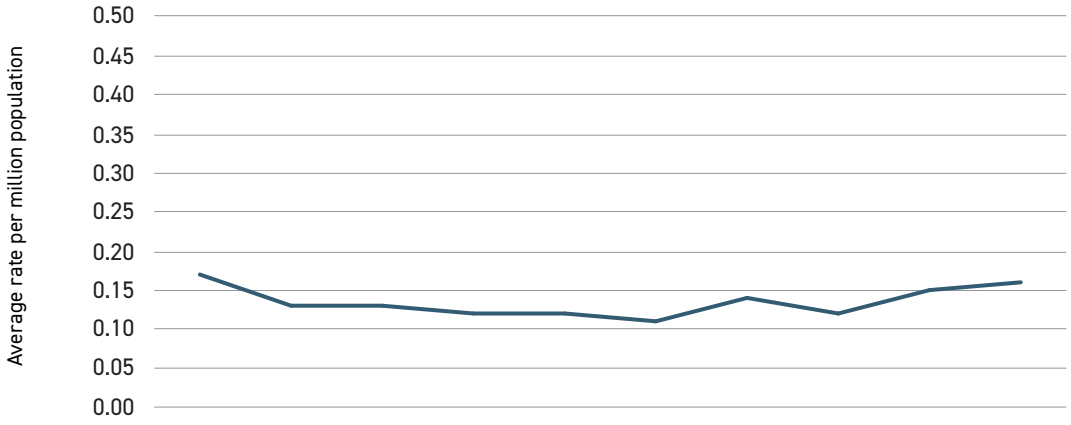
Five-year period	2009–2013	2010–2014	2011–2015	2012–2016	2013–2017	2014–2018	2015–2019	2016–2020	2017–2021	2018–2022
Rate of electrical-related fatalities (per million population)	0.42	0.40	0.40	0.38	0.42	0.37	0.35	0.32	0.37	0.34

Source: ESA and Coroner records

Conclusion

The rate of electrical-related fatalities has decreased when compared to the previous year of 2021. There has been a 19% decrease when comparing the average rate at 2013–2017 and 2018–2022.

3 FIVE-YEAR ROLLING AVERAGE RATE OF POWERLINE FATALITIES IN ONTARIO, 2009–2022



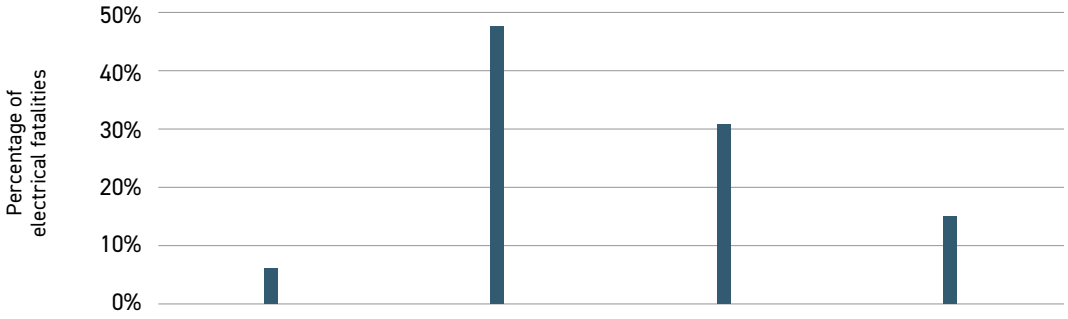
Five-year period	2009–2013	2010–2014	2011–2015	2012–2016	2013–2017	2014–2018	2015–2019	2016–2020	2017–2021	2018–2022
Rate of powerline fatalities (per million population)	0.17	0.13	0.13	0.12	0.12	0.11	0.14	0.12	0.15	0.16

Source: ESA and Coroner records

Conclusion

In 2022, there were three powerline fatalities. There has been a 33% increase when comparing the rate at 2013–2017 and 2018–2022.

4 PERCENTAGE OF ELECTRICAL-RELATED FATALITIES BY AGE GROUP IN ONTARIO, 2013–2022



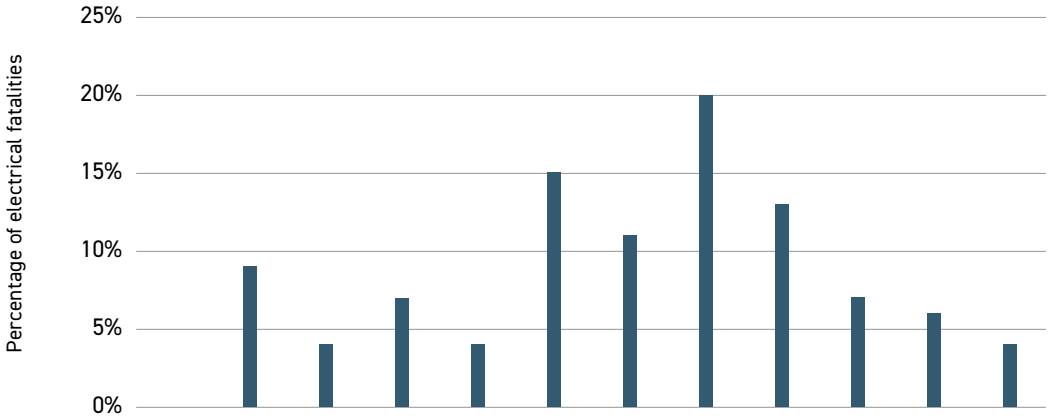
Age	0–19	20–39	40–59	60+
Percentage	6%	48%	31%	15%

Source: ESA and Coroner records

Conclusion

In the last ten years, 48% of electrical-related fatalities occurred among the 20–39 age group, followed by the 40–59 age group (31%).

5 PERCENTAGE OF ELECTRICAL-RELATED FATALITIES BY MONTH IN ONTARIO, 2013–2022



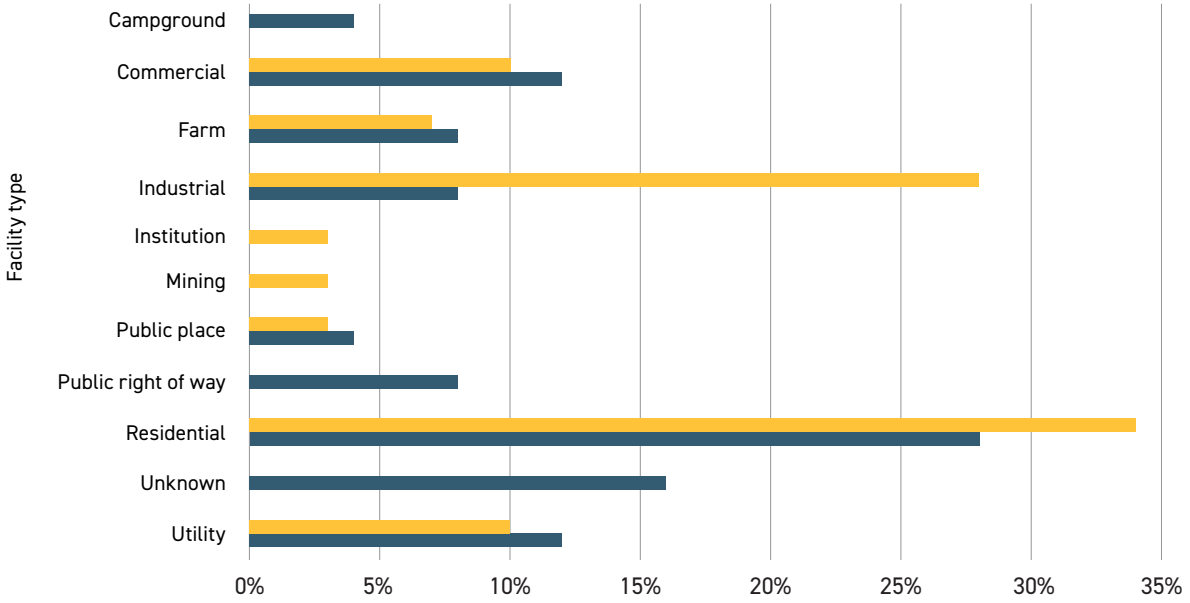
Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.
Percentage	0%	9%	4%	7%	4%	15%	11%	20%	13%	7%	6%	4%

Source: ESA and Coroner records

Conclusion

In the last ten years, August was the most common month for electrical fatalities to occur. No fatalities were reported for the month of January.

6 PERCENTAGE OF ELECTRICAL FATALITIES BY FACILITY TYPE IN ONTARIO, 2013–2017 AND 2018–2022



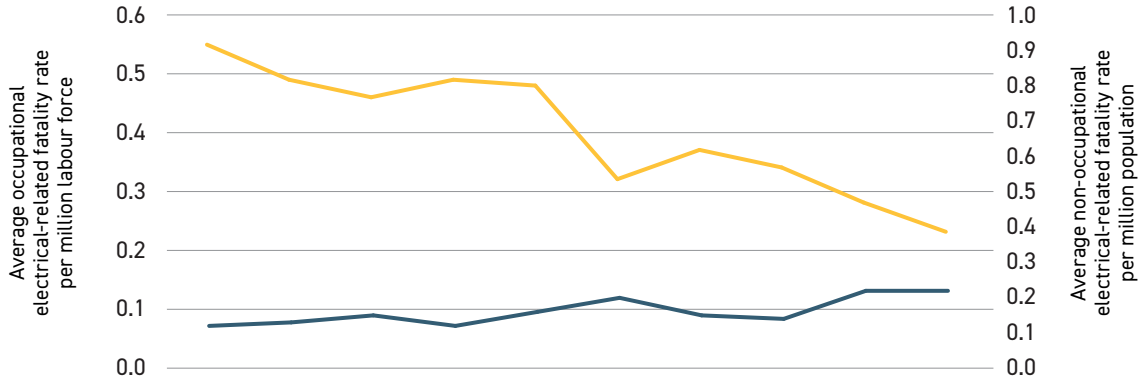
	Facility type	Campground	Commercial	Farm	Industrial	Institution	Mining	Public place	Public right of way	Residential	Unknown	Utility
Percentage of electrical fatalities	2013–2017	0%	10%	7%	28%	3%	3%	3%	0%	34%	0%	10%
	2018–2022	4%	12%	8%	8%	0%	0%	4%	8%	28%	16%	12%

Source: ESA and Coroner records

Conclusion

Residential settings were the most common settings where electrical-related fatalities occur.

7 FIVE-YEAR ROLLING AVERAGE RATE OF OCCUPATIONAL AND NON-OCCUPATIONAL ELECTRICAL-RELATED FATALITIES IN ONTARIO, 2009–2022



Five-year period	2009–2013	2010–2014	2011–2015	2012–2016	2013–2017	2014–2018	2015–2019	2016–2020	2017–2021	2018–2022
Occupational	0.55	0.49	0.46	0.49	0.48	0.32	0.37	0.34	0.28	0.23
Non-occupational	0.12	0.13	0.15	0.12	0.16	0.20	0.15	0.14	0.22	0.22

Source: ESA and Coroner records

Conclusion

The five-year rolling average rate of occupational electrical-related fatalities per labour force has decreased 52% when comparing 2013–2017 to 2018–2022. The five-year rolling average rate of non-occupational electrical-related fatalities per million population has increased by 38% between the same time periods.

2.2 Occupational Electrical-related Fatalities and Electrical Injuries

Occupational electrical-related fatalities are a particular hazard to those who routinely work near electrical sources. According to the U.S. Bureau of Labor Statistics, there were 126 fatal electrical injuries in the United States in 2020 (Campbell, 2022). The mining industry had the highest rate of fatal electrical injuries, followed by the construction industry. "Construction, repairing, cleaning" accounted for the leading worker activity for electrical fatalities at 64%, while "Using or operating tools, machinery" accounted for 22% of electrical fatalities (ESFI, 2022).

In Ontario, Kim et al. (2016) studied occupational fatalities among construction workers between 1997 and 2007 and found that electrical contact was responsible for 15% of fatalities; risk factors associated with occupational fatalities included direct contact with electrical sources, lower voltage sources, and working outdoors. The greatest proportion of electrocution deaths occur among electricians and electrical helpers, utility workers, and those working in construction and manufacturing industries. Electrical-related fatalities are more common among workers who are younger than the average age of occupational deaths overall. Contact with overhead powerlines is reportedly by far the most frequent cause of fatal occupational electrocution injury (Campbell, 2022).

For those who survive electrical injury, the immediate consequences are usually obvious and often require extensive medical intervention. But symptoms may not appear until days or years later and they may present as pervasive and less well-defined consequences. Long-term effects are particularly difficult to diagnose, as the link between the injury and the symptoms can often go unrecognized by patients and their physicians and worsen (Yiannopoulou et al., 2021). Substantial acute and long-term neuropsychological and social outcomes existed among patients after an electrical injury, and were similar between patients exposed to low- and high-voltage injuries (Radulovic et al., 2019).

Education and proper protection are essential in preventing electrical injuries at work. A survey of 600 people in 2020 who worked directly with electricity asked questions about their experience with electrical shock hazards. Seventy-eight percent of respondents said they have been shocked while on the job, where 37% were shocked by less than 221 V. This is in contrast with 85% of respondents, who felt they were highly confident in recognizing electrical hazards (Littelfuse, 2020). This highlights the need for ongoing and refresher training for those who work with electricity in an occupational setting.

Between 2013 and 2022, there were 27 occupational electrical-related fatalities in Ontario. In the previous time period (2012–2021), there were 29 occupational fatalities. In 2022, no occupational electrical-related fatalities were reported.

The five-year rolling average number of fatalities and critical injuries among workers (overall occupational safety) has increased by 21% when comparing between 2013–2017 and 2018–2022; this number is driven by the higher number of injuries being reported in the recent years. Meanwhile, the five year rolling average number of fatalities and critical injuries among electrical trade workers has stayed the same when comparing these two time periods.

When comparing the five-year rolling average rate, the occupational electrical-related fatalities have decreased from 0.48 per million labour force population in 2013–2017 to 0.23 per million labour force population in 2017–2021. This is a decrease of 52%.

In the 2018–2022 time period, industrial and farm settings (both at 22%) were the most common places for occupational electrical-related fatalities. Repair and maintenance was the most common type of work being done when these fatalities occurred. Between 2013 and 2022, the most commonly cited causes of death were due to improper procedure (30%) when excluding unknown causes.

Between 2013 and 2022, electrical tradespeople accounted for 26% of all occupational electrical-related fatalities. In the previous ten-year period (2012–2021), electrical tradespeople accounted for 28% of all occupational electrical-related fatalities.

A review of data provided by the WSIB from 2013 to 2022 shows that male workers continue to outnumber female workers with respect to occupational electrical injury. Workers in the construction and services sectors contribute to the highest number of WSIB lost time injury claims. Machine tools, electric parts, and other sources were the most common sources of injury. There is a 5% increase in the total number of electrical injury claims between 2013–2017 and 2018–2022; the number of claims for electrocution has increased by 15% between the time periods.

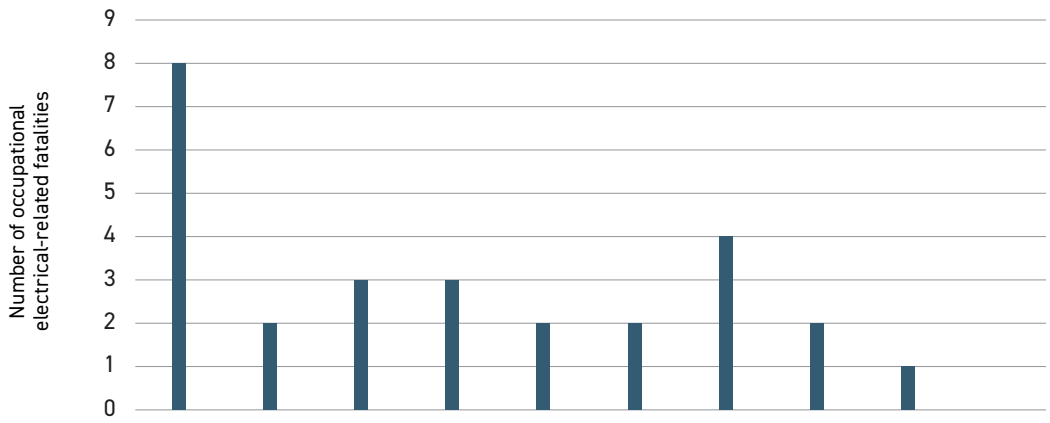
Statistics Directly Related to the ESA's Harm Reduction Priorities

WORKER SAFETY

Five-year Rolling Average Comparison

Number of worker-related electrical fatalities and critical injuries based on data reported by the Ministry of Labour, incidents investigated by the ESA and confirmed with the Office of the Chief Coroner. The worker safety five-year rolling average has increased by 21% between 2012–2016 and 2018–2022.

1 NUMBER OF OCCUPATIONAL ELECTRICAL-RELATED FATALITIES IN ONTARIO, 2013–2022



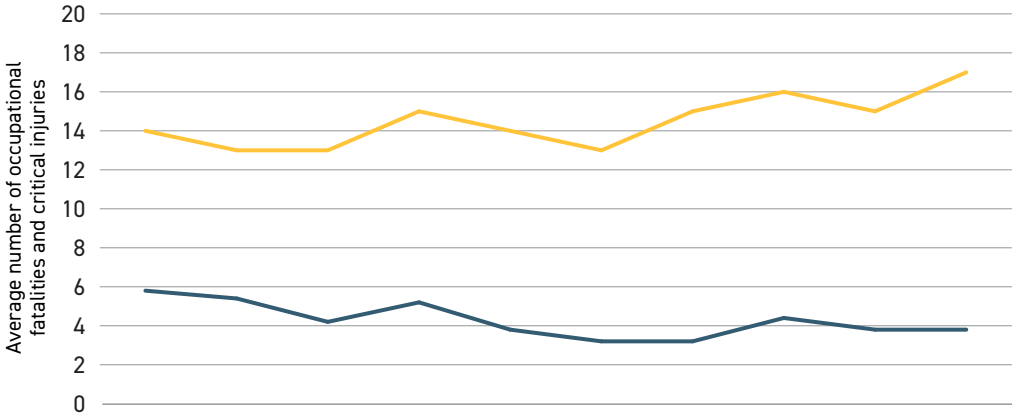
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of occupational electrical-related fatalities	8	2	3	3	2	2	4	2	1	0

Source: ESA and Coroner records

Conclusion

In 2022, no occupational electrical-related fatalities were reported in Ontario.

2 FIVE-YEAR ROLLING AVERAGE OF OCCUPATIONAL FATALITIES AND CRITICAL INJURIES IN ONTARIO, 2009–2022



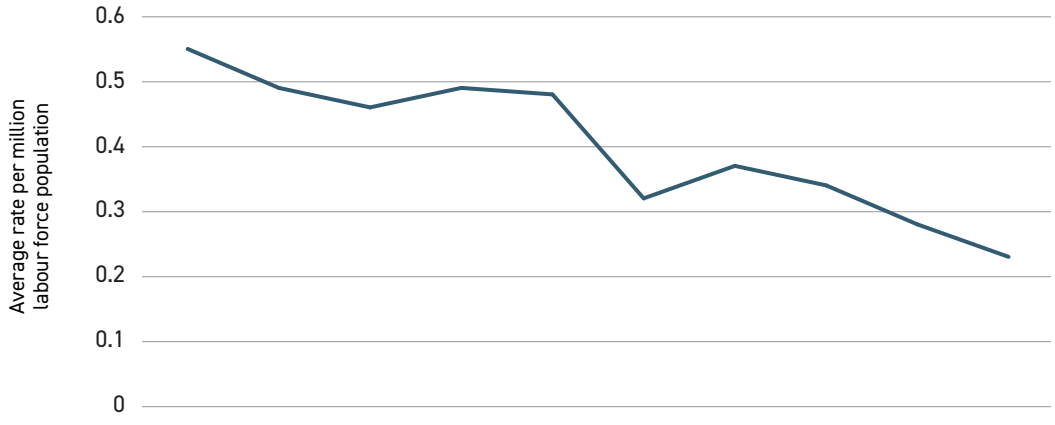
Five-year period	2009–2013	2010–2014	2011–2015	2012–2016	2013–2017	2014–2018	2015–2019	2016–2020	2017–2021	2018–2022
Occupational safety overall	14	13	13	15	14	13	15	16	15	17
Electrical trade	5.8	5.4	4.2	5.2	3.8	3.2	3.2	4.4	3.8	3.8

Source: ESA, Coroner, and MOLTSD records

Conclusion

The five-year rolling average number of occupational fatalities and critical injuries has increased among occupational safety overall. However, it has remained the same among electrical trade workers when comparing 2013–2017 and 2018–2022.

3 FIVE-YEAR ROLLING AVERAGE RATE OF OCCUPATIONAL ELECTRICAL-RELATED FATALITIES IN ONTARIO, 2009–2022



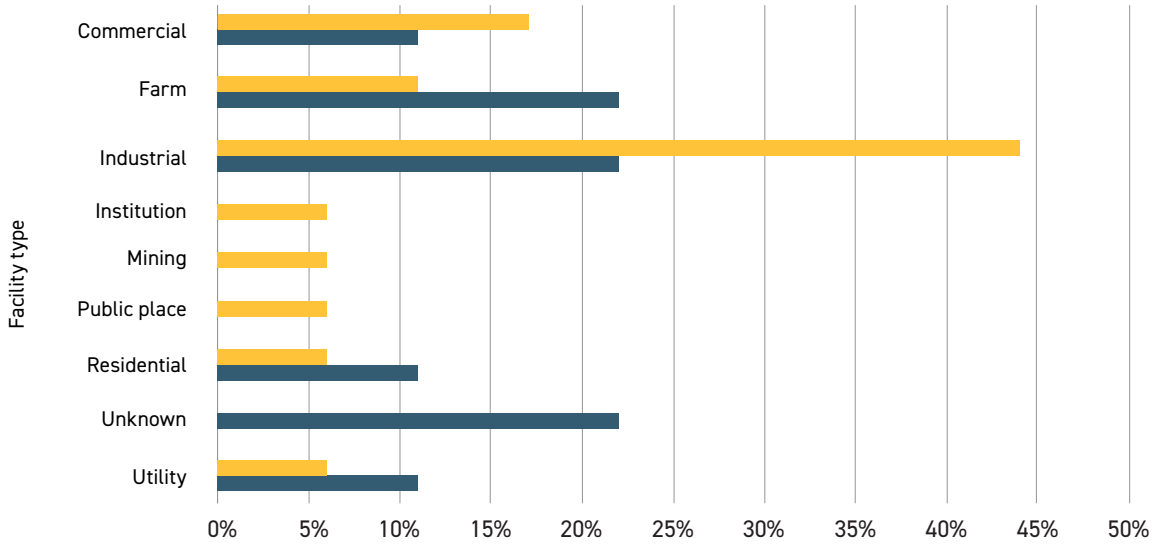
Five-year period	2009–2013	2010–2014	2011–2015	2012–2016	2013–2017	2014–2018	2015–2019	2016–2020	2017–2021	2018–2022
Occupational electrical-related fatality rate	0.55	0.49	0.46	0.49	0.48	0.32	0.37	0.34	0.28	0.23

Source: ESA and Coroner records

Conclusion

The rate of occupational electrical-related fatalities has decreased by 52% when comparing 2013–2017 and 2018–2022.

4 PERCENTAGE OF OCCUPATIONAL ELECTRICAL-RELATED FATALITIES BY FACILITY TYPE IN ONTARIO, 2013–2017 AND 2018–2022



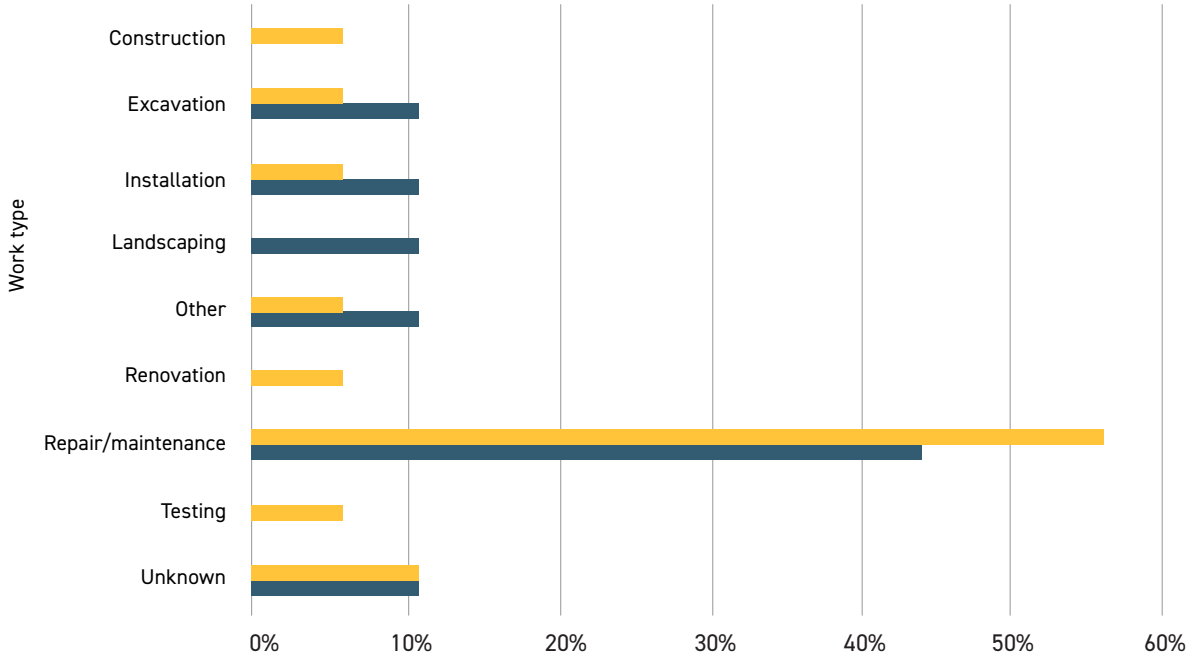
Facility type	Commercial	Farm	Industrial	Institution	Mining	Public place	Residential	Unknown	Utility
Percentage of occupational electrical-related fatalities 2013–2017	17%	11%	44%	6%	6%	6%	6%	0%	6%
2018–2022	11%	22%	22%	0%	0%	0%	11%	22%	11%

Source: ESA and Coroner records

Conclusion

In 2013–2017, the most commonly reported settings for occupational electrical-related fatalities were industrial and commercial settings. In 2018–2022, industrial and farm settings were most common.

5 PERCENTAGE OF OCCUPATIONAL ELECTRICAL-RELATED FATALITIES BY TYPE OF WORK IN ONTARIO, 2013–2017 AND 2018–2022



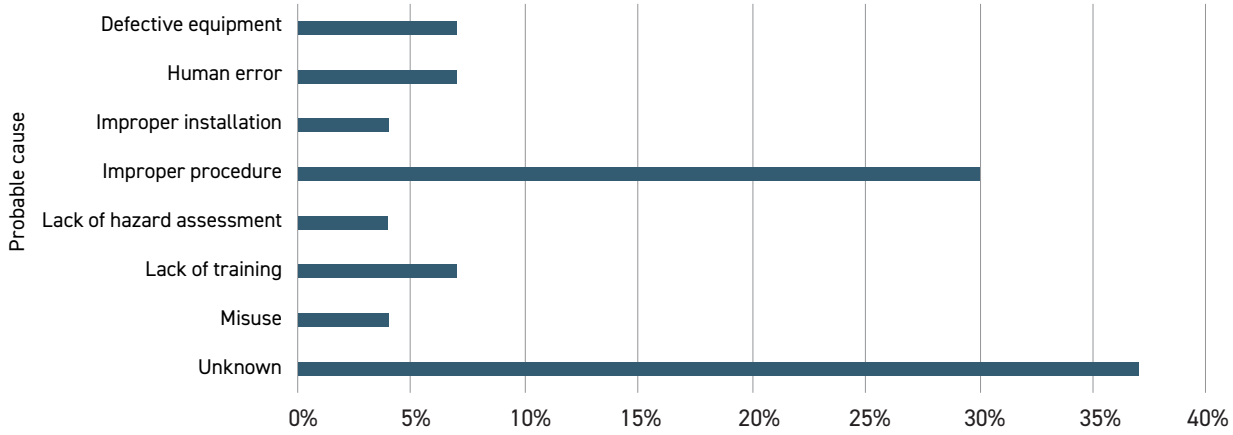
Work type	Construction	Excavation	Installation	Landscaping	Other	Renovation	Repair/ maintenance	Testing	Unknown
Percentage of occupational electrical-related fatalities 2012–2017	6%	6%	6%	0%	6%	6%	56%	6%	11%
Percentage of occupational electrical-related fatalities 2018–2022	0%	11%	11%	11%	11%	0%	44%	0%	11%

Source: ESA and Coroner records

Conclusion

In 2013–2017 and 2018–2022, repair/maintenance activities were the most common types of work for occupational electrical-related fatalities.

6 PERCENTAGE OF OCCUPATIONAL ELECTRICAL-RELATED FATALITIES BY PROBABLE CAUSE IN ONTARIO, 2013–2022



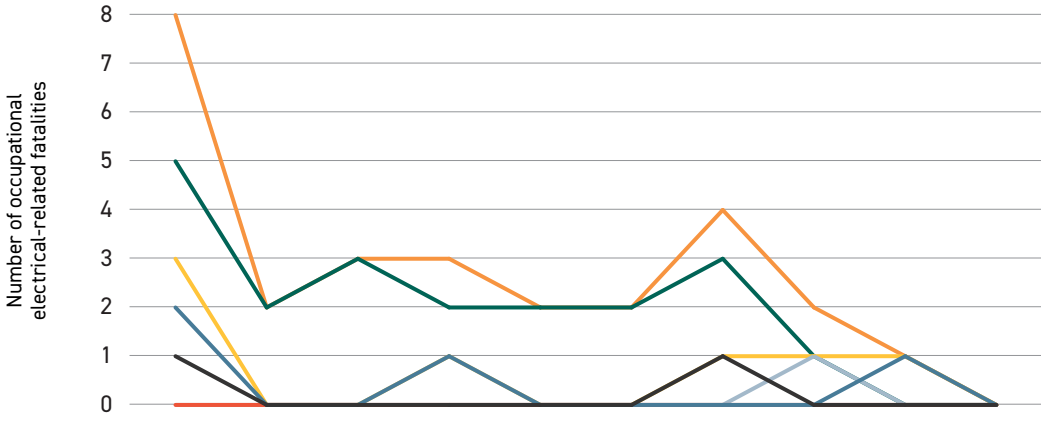
Probable cause	Defective equipment	Human error	Improper installation	Improper procedure	Lack of hazard assessment	Lack of training	Misuse	Unknown
Percentage of occupational electrical-related fatalities	7%	7%	4%	30%	4%	7%	4%	37%

Source: ESA and Coroner records

Conclusion

Aside from unknown cause, the most commonly cited cause of occupational electrical-related fatalities in the most recent ten-year period was improper procedure.

7 NUMBER OF OCCUPATIONAL ELECTRICAL-RELATED FATALITIES BY OCCUPATION IN ONTARIO, 2013–2022



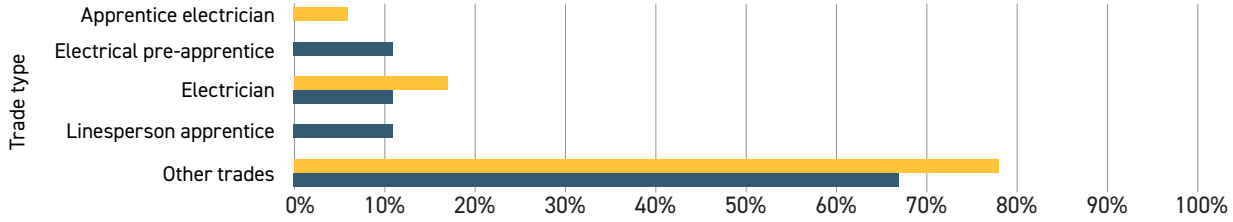
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Apprentice electrician	1	0	0	0	0	0	1	0	0	0
Electrician	2	0	0	1	0	0	0	0	1	0
Power linesperson	0	0	0	0	0	0	0	0	0	0
Linesperson apprentice	0	0	0	0	0	0	0	1	0	0
Total electrical	3	0	0	1	0	0	1	1	1	0
Other trades	5	2	3	2	2	2	3	1	0	0
All occupational fatalities	8	2	3	3	2	2	4	2	1	0

Source: ESA and Coroner records

Conclusion

Since 2013, on average, there has been less than one electrical trade fatality per year. In contrast, there has been an average of three occupational fatalities (all trades) per year.

8 PERCENTAGE OF OCCUPATIONAL ELECTRICAL-RELATED FATALITIES BY TRADE, 2013–2017 AND 2018–2022



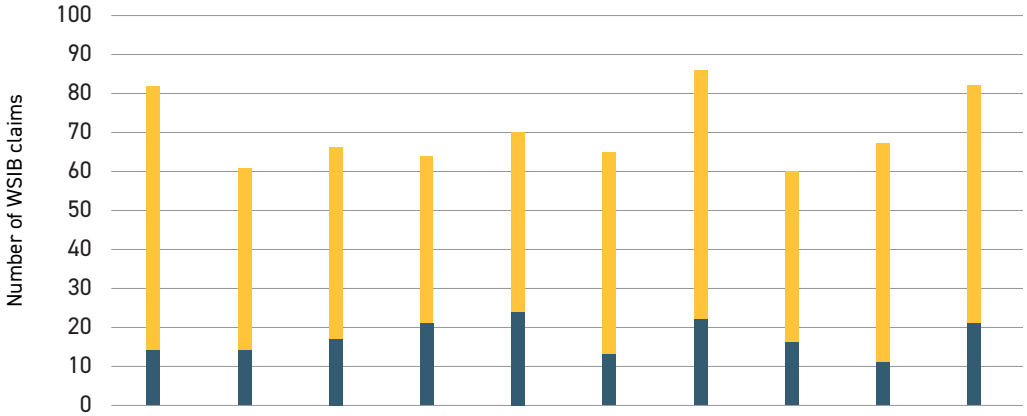
Trade type	Apprentice electrician	Electrical pre-apprentice	Electrician	Linesperson apprentice	Other trades
Percentage of occupational electrical-related fatalities: 2013–2017	6%	0%	17%	0%	78%
Percentage of occupational electrical-related fatalities: 2018–2022	0%	11%	11%	11%	67%

Source: ESA and Coroner records

Conclusion

In the most recent five-year period (2018–2022), the number of occupational electrical-related fatalities among other trades has decreased.

9 NUMBER OF ALLOWED WSIB LOST TIME ELECTRICAL INJURY CLAIMS BY SEX IN ONTARIO, 2013–2022



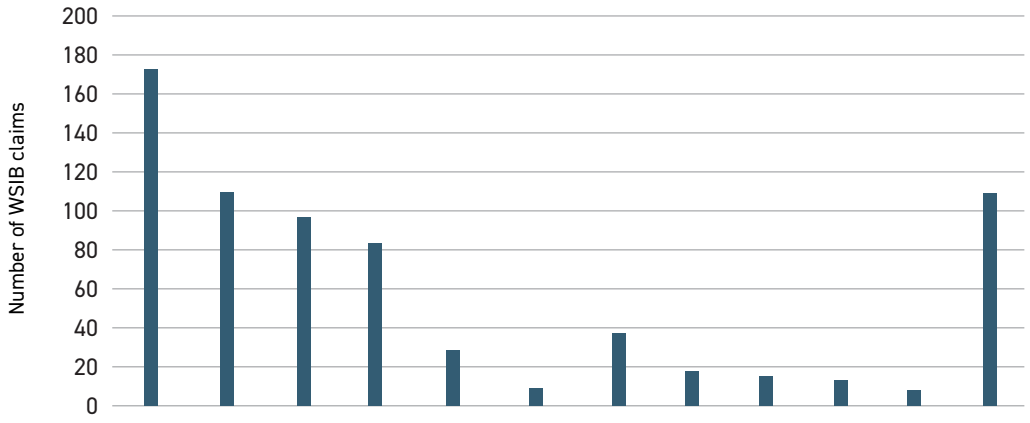
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Male	68	47	49	43	46	52	64	44	56	61
Female	14	14	17	21	24	13	22	16	11	21

Source: Workplace Safety and Insurance Board

Conclusion

Between 2013 and 2022, the number of WSIB claims related to electrical injury among males was three times greater than those among females.

10 NUMBER OF ALLOWED WSIB LOST TIME ELECTRICAL INJURY CLAIMS BY SECTOR IN ONTARIO, 2013–2022



Sector type	Construction	Services	Manufacturing	Schedule 2	Health care	Non-hospital healthcare and social assistance	Electrical	Transportation	Leisure and hospitality	Food	Retail	Other industry sectors
Number of WSIB claims	172	109	96	83	28	9	37	18	15	13	8	109

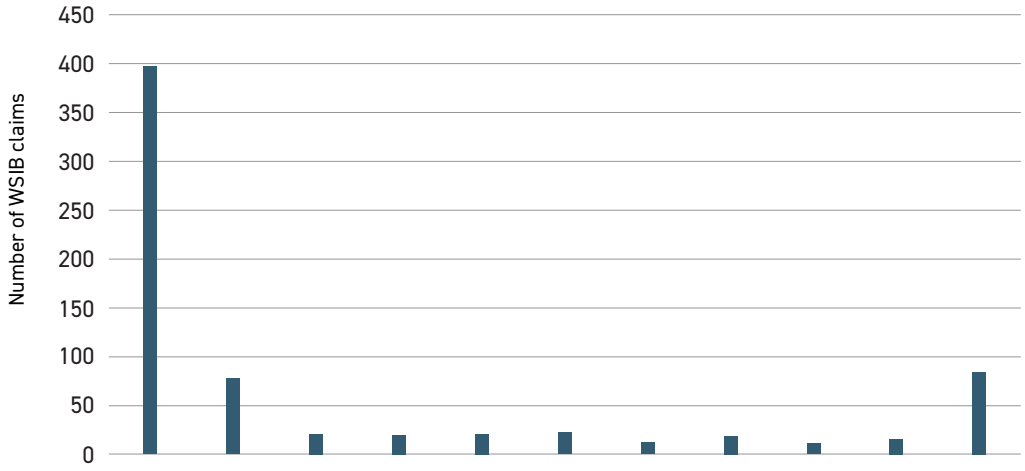
Source: Workplace Safety and Insurance Board

Conclusion

Between 2013 and 2022, WSIB lost time electrical injury claims were more commonly reported by workers from the construction and services sectors.

* Schedule 2 workers are those that work in firms funded by public funds (federal, provincial, and/or municipal governments), firms legislated by the province but self-funded, or firms that are privately owned but involved in federally regulated industries such as telephone, airline, shipping, and railway.

11 NUMBER OF ALLOWED WSIB LOST TIME ELECTRICAL INJURY CLAIMS BY THE TOP 10 SOURCES IN ONTARIO, 2013–2022



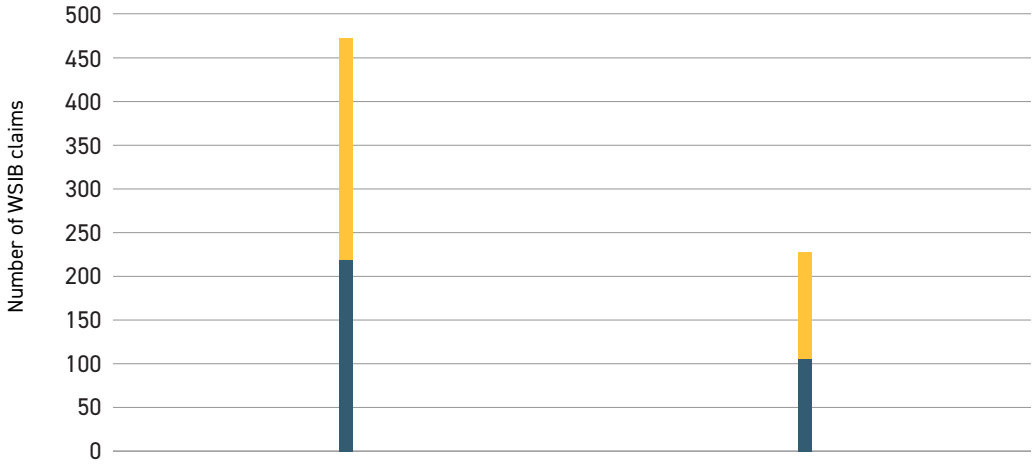
Source	Machine tool and electric parts	Heating, cooling, and cleaning machinery	Metal woodworking and plastic, rubber, concrete, and other processing	Misc. machinery (e.g., audio, video, televisions, telephones, snowblowers)	Hand tools, powered	Other tools, instruments, equipment, unspecified (not elsewhere classified)	Fire, flame, smoke	Special process machinery (e.g., food slicers, paper, printing, wrapping, sewing, pumps)	Furniture and fixtures	Office and business machines	Other sources
Number of WSIB claims	398	78	21	20	21	23	12	19	11	16	84

Source: Workplace Safety and Insurance Board

Conclusion

Machine tool, electric parts, and other sources were the most common sources of WSIB electrical injury claims between 2013 and 2022.

12 NUMBER OF ALLOWED WSIB LOST TIME ELECTRICAL INJURY CLAIMS BY NATURE OF INJURY IN ONTARIO, 2013–2017 AND 2018–2022



Nature of injury	Electrocutions, electric shock	Burns, electrical
2018–2022	254	106
2013–2017	220	123

Source: Workplace Safety and Insurance Board

Conclusion

There was a 5% increase in the total number of electrical injury claims between 2013–2017 and 2018–2022; the number of claims for electrocution has increased by 15% between the time periods.

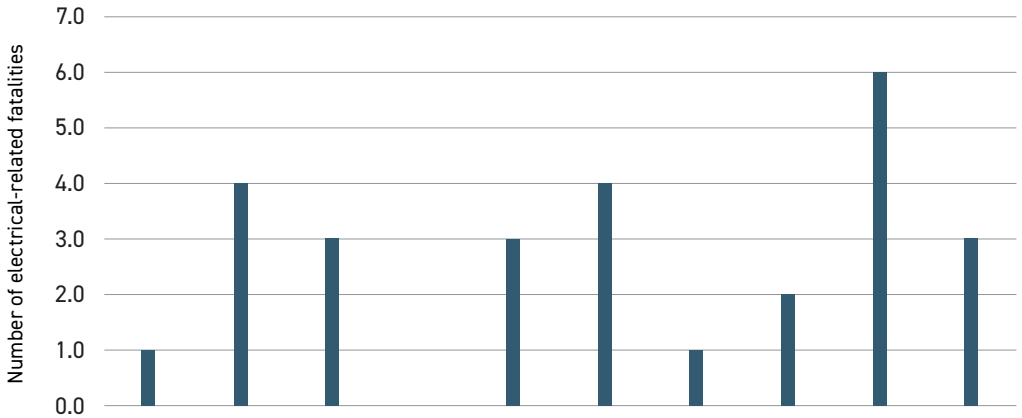
2.3 Non-occupational Electrical-related Fatalities and Injuries

Electrical injuries are a significant health problem. They are the leading cause of death for the young, and contribute substantially to the burden on the health care system. Many injuries are predictable and preventable.

In 2022, there were three non-occupational electrical-related fatalities. In the previous year, there were six non-occupational electrical-related fatalities. The five-year rolling average rate between 2013–2017 and 2018–2022 has increased by 38% from 0.16 per million population to 0.22 per million population.

In the past ten years, the residential setting was the most common place for non-occupational electrical-related fatalities. Human error, improper use/misuse, misadventure, and theft were the most common activities associated with fatalities.

1 NUMBER OF NON-OCCUPATIONAL ELECTRICAL-RELATED FATALITIES IN ONTARIO, 2013–2022



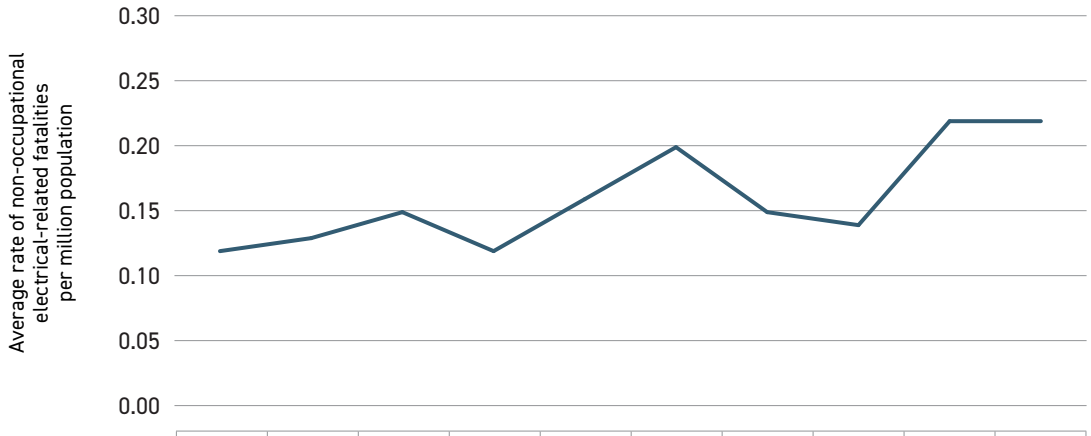
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of non-occupational electrical-related fatalities	1	4	3	0	3	4	1	2	6	3

Source: ESA and Coroner records

Conclusion

In 2022, three non-occupational fatalities occurred.

2 FIVE-YEAR ROLLING AVERAGE RATE OF NON-OCCUPATIONAL ELECTRICAL-RELATED FATALITIES IN ONTARIO, 2009–2022



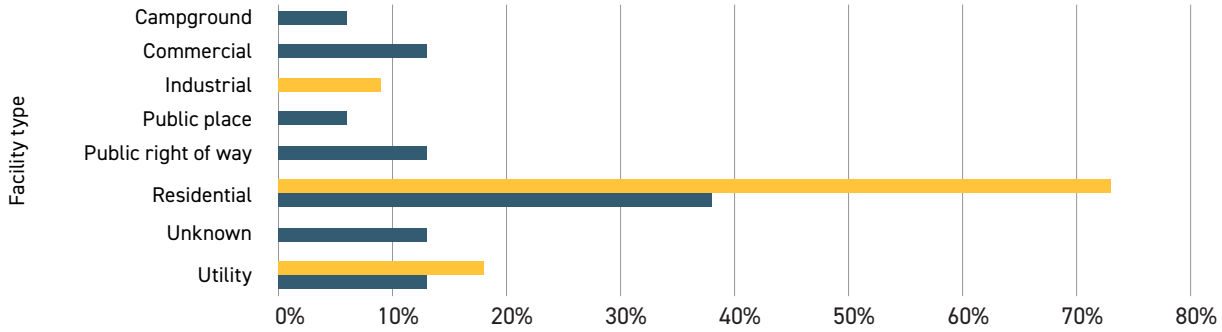
Five-year period	2009–2013	2010–2014	2011–2015	2012–2016	2013–2017	2014–2018	2015–2019	2016–2020	2017–2021	2018–2022
Rate of non-occupational electrical-related fatalities per million population	0.12	0.13	0.15	0.12	0.16	0.20	0.15	0.14	0.22	0.22

Source: ESA and Coroner records

Conclusion

The five-year rolling average rate of non-occupational electrical-related fatalities has increased by 38% when comparing 2013–2017 and 2018–2022.

3 PERCENTAGE OF NON-OCCUPATIONAL ELECTRICAL-RELATED FATALITIES BY FACILITY TYPE IN ONTARIO, 2013–2022



Percentage of non-occupational electrical-related fatalities

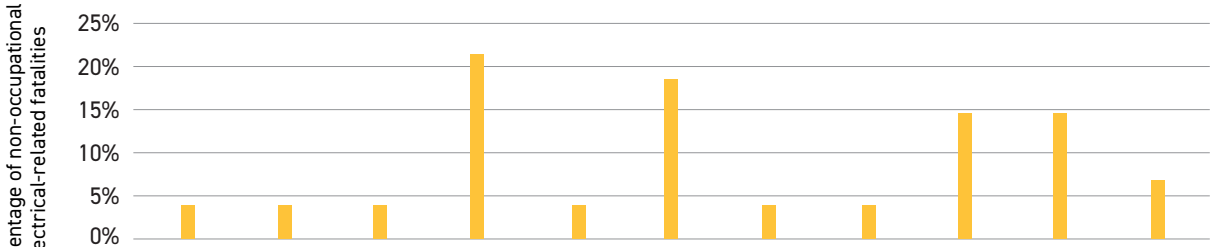
Facility type	Campground	Commercial	Industrial	Public place	Public right of way	Residential	Unknown	Utility
2013–2017	0%	0%	9%	0%	0%	73%	0%	18%
2018–2022	6%	13%	0%	6%	13%	38%	13%	13%

Source: ESA and Coroner records

Conclusion

In the past ten years, the residential setting has been the most common place for non-occupational electrical-related fatalities.

4 PERCENTAGE OF NON-OCCUPATIONAL ELECTRICAL-RELATED FATALITIES BY POTENTIAL CAUSE IN ONTARIO, 2013–2022



Activity type	Act of God/ force majeure	Damaged equipment	Equipment failure	Human error	Improper installation	Improper use/ misuse	Lack of awareness of hazard	Lack of maintenance	Misadventure	Theft	Unknown
Percentage of non-occupational electrical-related fatalities	4%	4%	4%	22%	4%	19%	4%	4%	15%	15%	7%

Source: ESA and Coroner records

Conclusion

Human error (22%), improper use/misuse (19%), misadventure (15%), and theft (15%) were the most common activities associated with non-occupational electrical-related fatalities.

2.4 Electrical Injury and Emergency Department Visits in Ontario, 2012–2021

Electrical injuries can occur as a result of lightning, low-voltage, or high-voltage injury, and are often associated with high morbidity and mortality. Almost all electrical injuries are accidental and preventable (Zemaitis et al., 2023).

Exposure to electricity can result in four main types of injuries: flash, flame, lightning, and true injuries. Flash injuries are caused by an arc flash and are typically associated with superficial burns. Flame injuries occur when an arc flash ignites an individual's clothing, and electrical current may or may not pass the skin. Lightning injuries are associated with an electrical current flowing through the individual's entire body. True electrical injuries involve an individual becoming part of an electrical circuit, where an entrance and exit site can be found (Zemaitis et al, 2023).

Small or minor burns may be managed in an emergency department, but patients with severe burns may be transferred to regional burn centres for additional management (Koyfman and Long, 2020).

In the United States, approximately 10,000 patients present in emergency departments with electrical burns or electric shock. An estimated 4% of burn centre admissions are due to electrical burns. Most electrical injuries are due to household or occupational exposures. Young children are affected most by household current, adolescent males by high-risk behaviour, and adult males by occupational exposure (Gentges and Schleche, 2018).

From 2012 to 2021, 8,726 visits to Ontario hospitals' emergency departments (ED) were due to electrical injury. The trend of males outnumbering females in electrical injuries is also observed in ED visits with 70% of ED visits from males. The age group with the largest number of ED visits was 25–30 years for males and 20–24 for females.

Using the Canadian Triage and Acuity Scale (CTAS), the severity of electrical injury was assessed upon each ED visit. Between 2012 and 2021, 86% of ED visits were classified as the most severe — that is, requiring resuscitation, conditions that are a potential threat to life, limb, or function requiring medical intervention or delegated acts, or conditions that could potentially progress to a serious problem requiring emergency intervention (Canadian Triage and Acuity Scale between 1 and 3).

In 65% of all ED visits, the principal diagnosis was identified as electrical current, while burns were the principal diagnosis in 18% of cases.

When excluding unspecified place of occurrence, the most common locations for electrical injury were the home, followed by trade and service areas, and industrial and construction locations.

Statistics Directly Related to the ESA's Harm Reduction Priorities

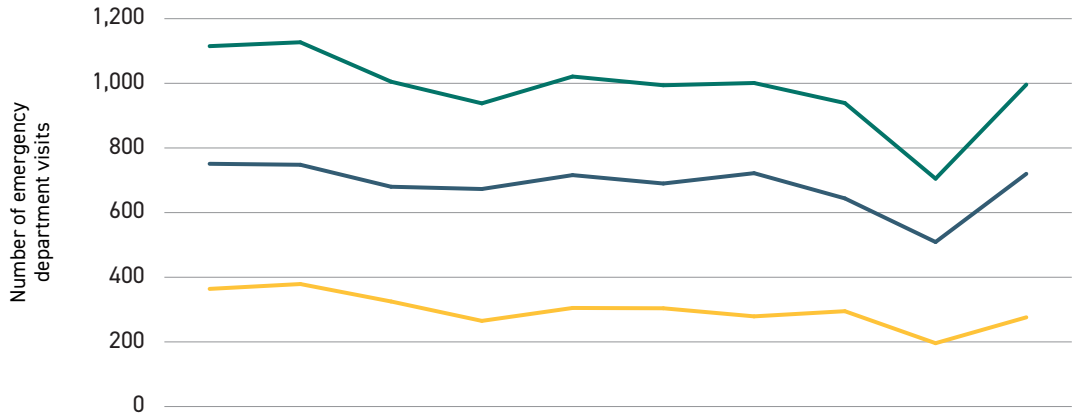
NON-OCCUPATIONAL ELECTRICAL SAFETY

Five-year Rolling Average Comparison

Number of emergency department visits due to critical electrical injuries (Canadian Triage and Acuity Scale levels 1–3) reported to the Canadian Institute of Health Information.

The number of emergency department visits that were classified as critical visits has decreased by 4% in the five-year rolling average between 2012–2016 and 2017–2021.

1 NUMBER OF EMERGENCY DEPARTMENT (ED) VISITS FOR ELECTRICAL INJURY BY SEX IN ONTARIO, 2012–2021



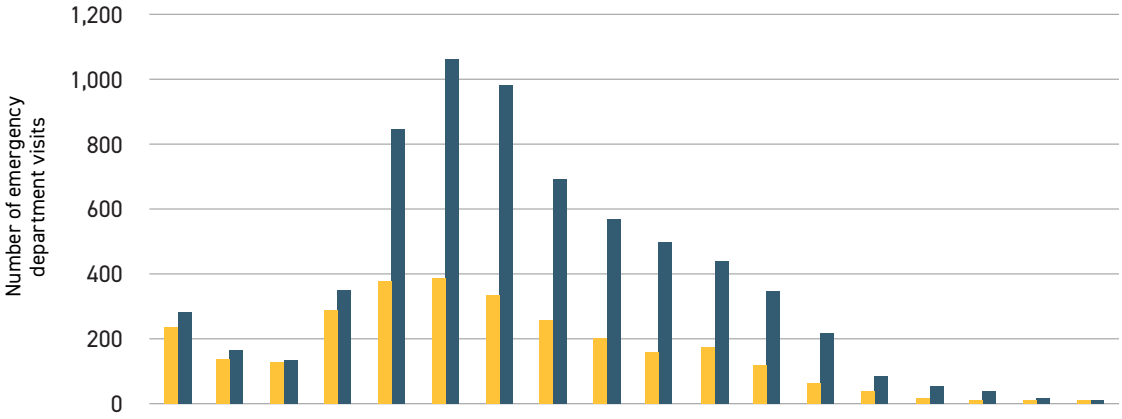
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Female	364	379	325	265	305	304	279	295	196	276
Male	751	748	680	673	716	690	722	644	509	720
Total	1,115	1,127	1,005	938	1,021	994	1,001	939	705	996

Source: ED All Visit Main Table (CIHI), IntelliHEALTH, Ministry of Health and Long-Term Care (MOHLTC)

Conclusion

The total number of ED visits for electrical injury has decreased by 11% in the past ten years.

2 NUMBER OF EMERGENCY DEPARTMENT (ED) VISITS FOR ELECTRICAL INJURY BY AGE AND SEX IN ONTARIO, 2012–2021



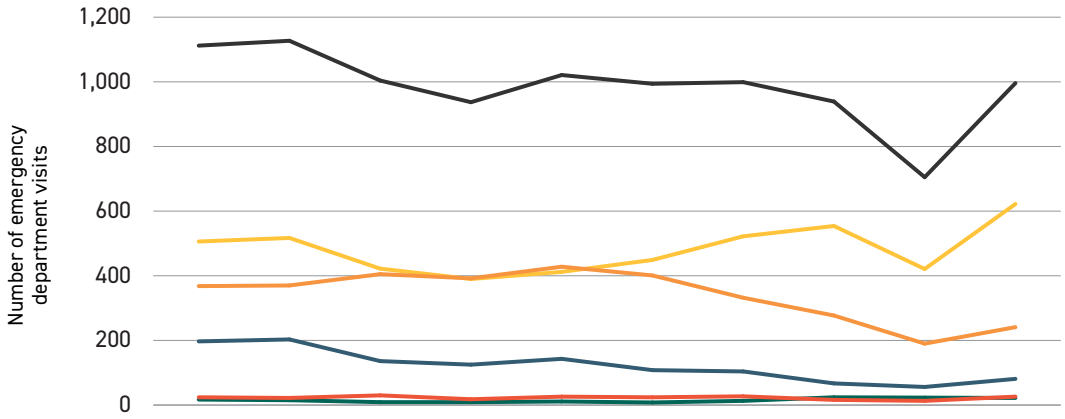
Age	0–4	5–9	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85+
Female	239	140	130	291	382	391	339	259	203	160	177	121	65	39	18	12	10	12
Male	284	166	136	352	854	1,074	991	699	573	502	443	351	221	87	503	39	16	10

Source: ED All Visit Main Table (CIHI), IntelliHEALTH, MOHLTC

Conclusion

The number of males seen at the ED for electrical injury is greater than the number of females in all age groups in the past ten years. The age group with the largest number of ED visits was 25–30 years for males and females.

3 NUMBER OF ED VISITS FOR ELECTRICAL INJURY BY CANADIAN TRIAGE AND ACUITY SCALE (CTAS) IN ONTARIO, 2012–2021



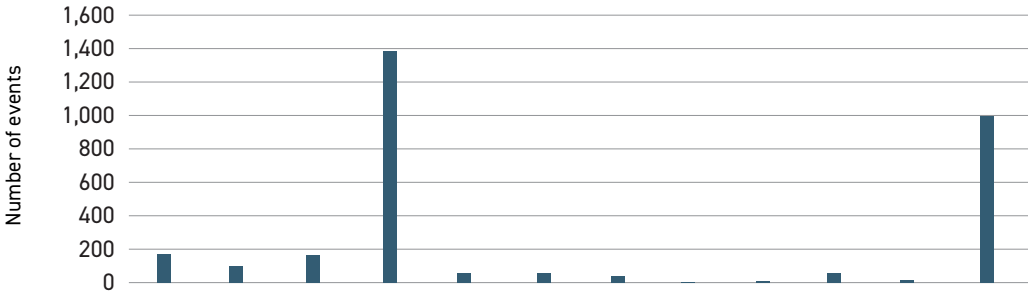
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Resuscitation/ life threatening (level 1)	24	22	30	18	26	24	27	16	13	26
Emergent/potentially life threatening (level 2)	368	370	405	392	428	401	332	277	190	241
Urgent/potentially serious (level 3)	506	517	422	390	412	449	522	554	421	622
Less-urgent/ semi-urgent (level 4)	197	203	136	125	143	108	104	67	56	81
Non-urgent (level 5)	17	15	9	9	11	8	13	24	23	22
Total	1,112	1,127	1,004	937	1,021	994	999	939	705	996

Source: ED All Visit Main Table (CIHI), IntelliHEALTH, MOHLTC

Conclusion

Eighty-six percent of ED visits for electrical injury were classified on the Canadian Triage and Acuity Scale (CTAS) at levels 1-3 (Resuscitation, Emergent, Urgent).

4 LOCATION OF BURNS ASSOCIATED WITH ELECTRICAL INJURY IN ONTARIO, 2012–2021



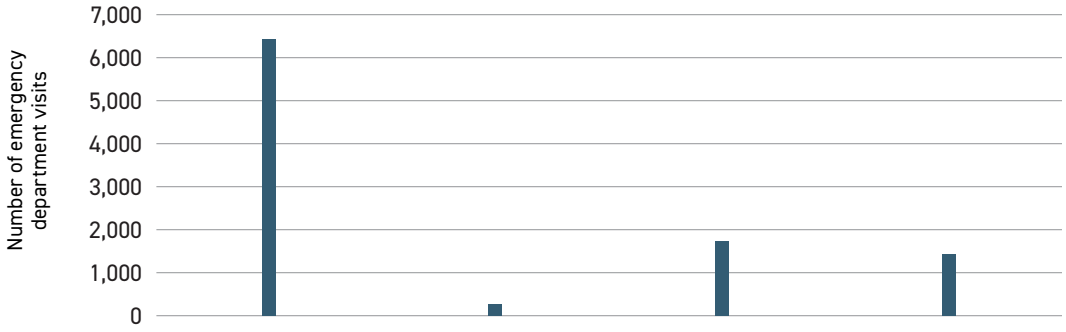
Location of burns	Head and neck	Trunk	Shoulder and upper limb, except wrist and hand	Wrist and hand	Hip and lower limb, except ankle and foot	Ankle and foot	Eye and adnexa	Respiratory tract	Other internal organs	Multiple body regions	Unspecified body areas	Unknown
Total	172	86	164	1,385	57	56	38	1	11	54	12	996

Source: ED All Visit Main Table (CIHI), IntelliHEALTH, MOHLTC

Conclusion

Of the ED visits from an electrical injury that resulted in a burn, the majority of injuries were found on the wrist and hand.

5 PRIMARY DIAGNOSIS OF EMERGENCY DEPARTMENT (ED) VISITS FOR ELECTRICAL INJURY IN ONTARIO, 2012–2021



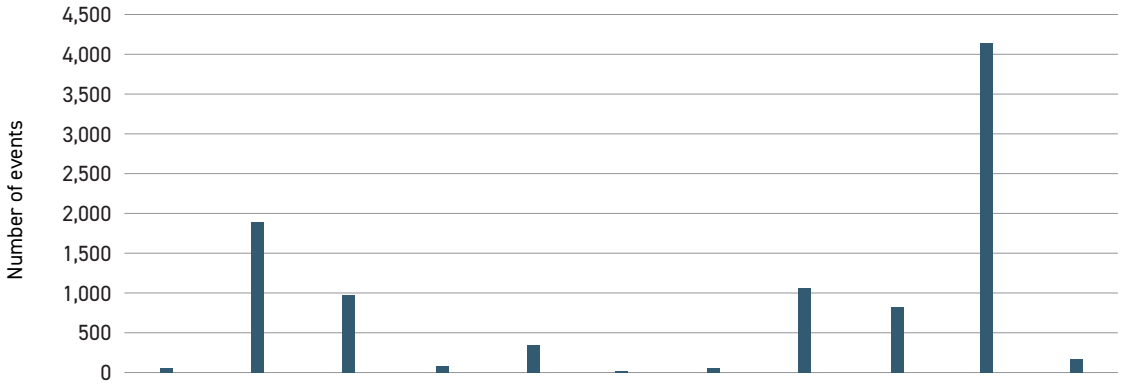
Primary diagnosis	Effects of electric current (T75.4)	Effects of lightning (T75.0)	Burns (T20–T31)	Other diagnoses
Number of ED visits	6,421	274	1,726	1,420

Source: ED All Visit Main Table (CIHI), IntelliHEALTH, MOHLTC

Conclusion

The majority of ED visits for electrical injury had a principal diagnosis of electric current (65%), followed by burns (18%).

6 PLACE WHERE ELECTRICAL INJURY OCCURRED IN ONTARIO, 2012–2021



Place	Farm	Home	Industrial and construction area	Residential institution	School, other institution, and public area	Sports and athletics area	Street and highway	Trade and service area	Other specified place of occurrence	Unspecified place of occurrence	Unknown
Total	5,758	1,892	979	81	342	25	58	1,065	819	4,141	169

Source: ED All Visit Main Table (CIHI), IntelliHEALTH, MOHLTC

Conclusion

While many ED visits from electrical injury were from unspecified places of occurrence, the most commonly reported places of injury were the home, trade and service areas, and industrial and construction areas.

3.0 Utility-related Equipment

Utility-related equipment includes electrical equipment and devices used by Local Distribution Companies (LDCs), privately owned companies, or property owners that distribute electricity to customers' facilities or buildings. Examples of such equipment include overhead and underground powerlines (including most equipment on utility poles), substations, electrical chambers (vaults), high-voltage switchgear, and transformers. Utility-related equipment carries dangerous amounts of energy or power, and if barriers are breached, can be fatal. Overhead and underground equipment barriers are typically clearances above and below the ground, while substation barriers typically include fences and walls. Each barrier is designed to prevent public access and exposure to electric shock hazards.

From 2013 to 2022, there were 26 electrical-related fatalities associated with utility-related equipment, which made up 48% of the total electrical fatalities in Ontario. This number is similar when compared to the previous ten-year period of 2012–2021 at 47%.

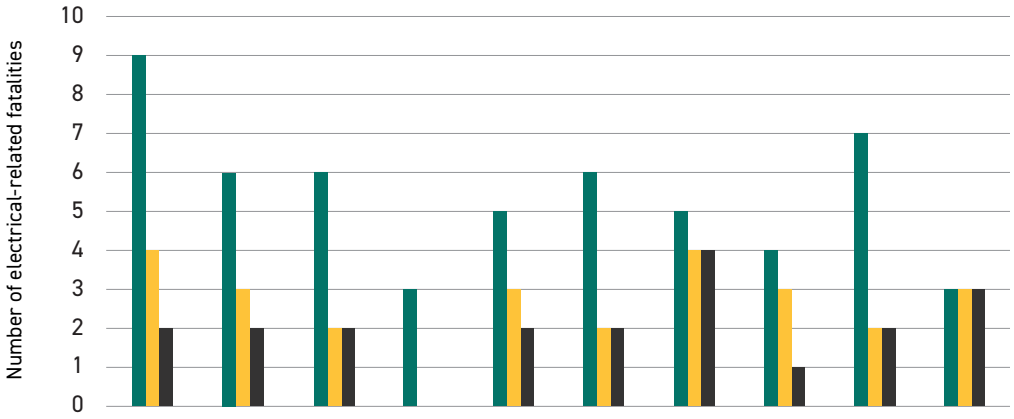
Contact specifically with powerlines accounted for 20 of the electrical-related fatalities in the most recent ten-year period, which contributed to 77% of utility-related equipment fatalities. The five-year rolling average rate for powerline electrocutions has increased by 33% when comparing 2013–2017 and 2018–2022.

The five-year average number of utility-related electrical fatalities has increased by 17% when comparing 2013–2017 and 2018–2022. Overhead powerline contact remains the leading cause of utility-related electrical incidents every year. In 2022, there were fewer than five reported incidents related to overhead powerlines among LDC workers (as a subset of the utility sector).

Under-reporting and missing information is especially prevalent with utility contact incidents, and this information should be interpreted with caution. Reported injuries because of utility-related equipment have decreased over the past ten years, although property damage has been increasingly reported in the most recent five years.

Section 3.1 provides a focused report that highlights some of the ESA's recent work involving utilities and powerlines. This includes information from two coroner's inquests, powerline awareness results from a general public survey, and copper theft research.

1 NUMBER OF UTILITY-RELATED EQUIPMENT ELECTRICAL-RELATED FATALITIES IN ONTARIO, 2013–2022



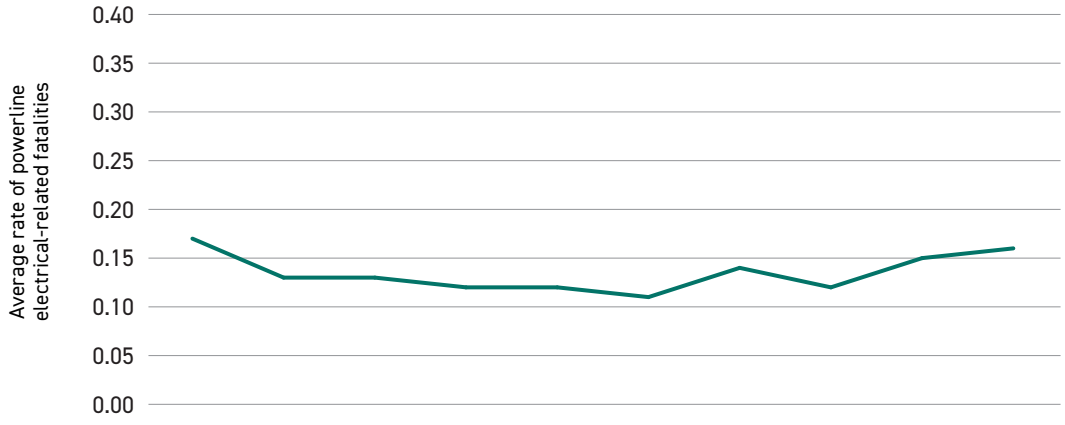
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Electrical-related fatalities	9	6	6	3	5	6	5	4	7	3
Utility equipment electrical fatalities	4	3	2	0	3	2	4	3	2	3
Powerline electrical-related fatalities	2	2	2	0	2	2	4	1	2	3

Source: ESA and Coroner records

Conclusion

The number of utility-related equipment fatalities has been within a range of zero to four fatalities reported per year. In 2022, there were three utility equipment fatalities reported, all of which were from powerline contact.

2 FIVE-YEAR ROLLING AVERAGE OF POWERLINE ELECTRICAL-RELATED FATALITIES IN ONTARIO, 2009–2022



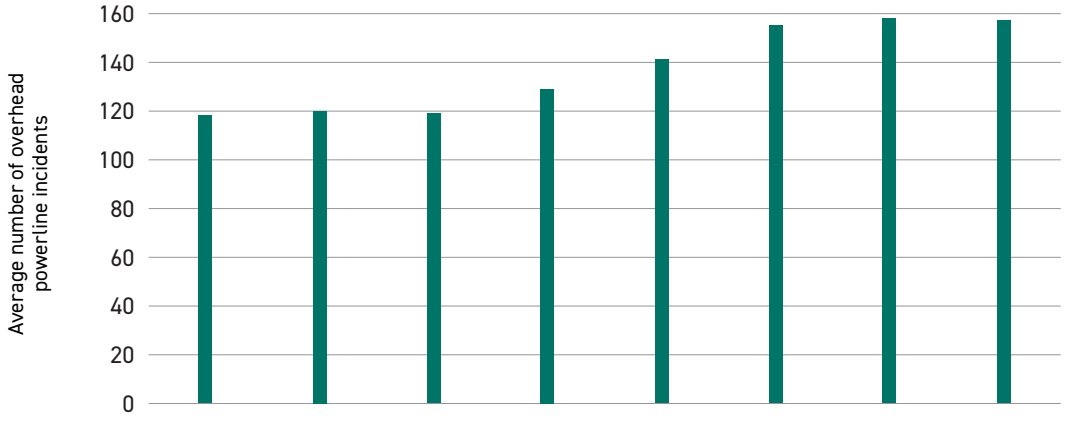
Five-year period	2009–2013	2010–2014	2011–2015	2012–2016	2013–2017	2014–2018	2015–2019	2016–2020	2017–2021	2018–2022
Rate of powerline electrical-related fatalities	0.17	0.13	0.13	0.12	0.12	0.11	0.14	0.12	0.15	0.16

Source: ESA and Coroner records

Conclusion

The rate of powerline electrical-related fatalities has increased by 33% when comparing 2013–2017 and 2018–2022. The 2018–2022 rate has increased by 7% when compared to the previous five-year period of 2017–2021.

3 FIVE-YEAR ROLLING AVERAGE NUMBER OF OVERHEAD POWERLINE INCIDENTS IN ONTARIO, 2011–2022



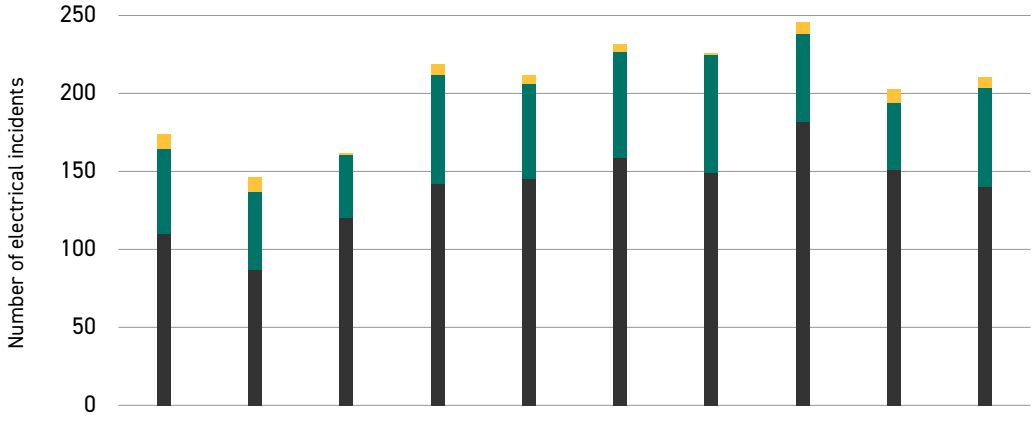
Five-year period	2011–2015	2012–2016	2013–2017	2014–2018	2015–2019	2016–2020	2017-2021	2018–2022
Number of overhead powerline incidents	118	120	119	129	141	155	158	157

Source: ESA records

Conclusion

The five-year rolling average number of overhead powerline incidents has increased by 32% when comparing 2013–2017 and 2018–2022.

4 NUMBER OF UTILITY-RELATED ELECTRICAL INCIDENTS BY CONTACT TYPE IN ONTARIO, 2013–2022



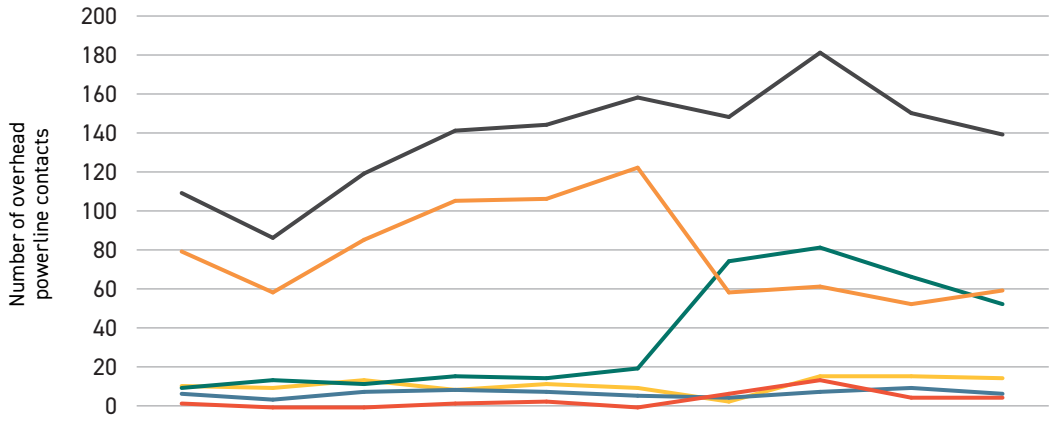
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Vaults, substations, and padmounts	9	10	1	7	6	5	1	8	9	7
Underground powerline contact	55	50	41	70	61	68	76	56	43	64
Overhead powerline contact	110	87	120	142	145	159	149	182	151	140

Source: ESA records

Conclusion

Overhead powerline contact remains the leading cause in utility-related electrical incidents between 2013 and 2022. The total number of utility-related electrical incidents has increased by 21% when comparing 2013 and 2022.

5 NUMBER OF OVERHEAD POWERLINE CONTACTS BY SECTOR IN ONTARIO, 2013–2022



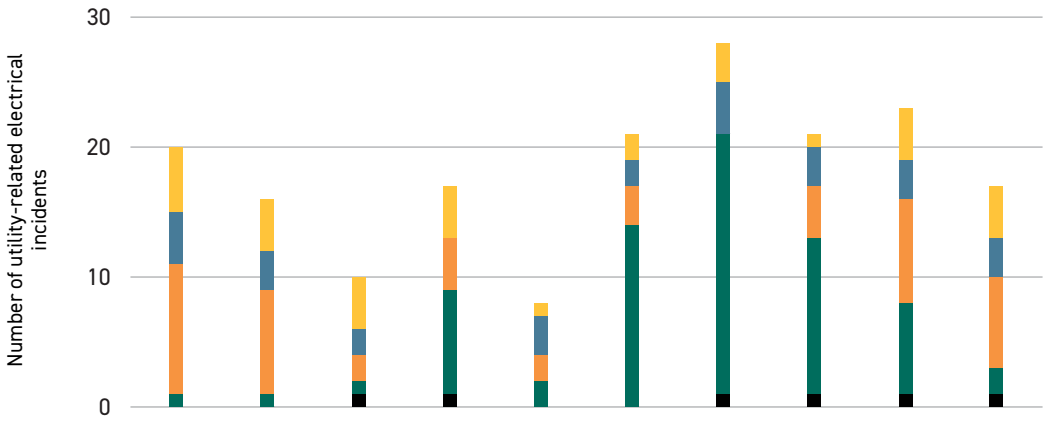
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Construction	80	59	86	106	107	123	59	62	53	60
Farm	2	0	0	2	3	0	7	14	5	5
Public	10	14	12	16	15	20	75	82	67	53
Transport	7	4	8	9	8	6	5	8	10	7
Utility	11	10	14	9	12	10	3	16	16	15
Total	**110**	**87**	**120**	**142**	**145**	**159**	**149**	**182**	**151**	**140**
LDC worker as a subset of utility sector	0	0	<5	0	0	0	0	<5	<5	<5

Source: ESA records

Conclusion

Construction has been the leading sector in overhead powerline contacts in the past ten years, although incidents reported in public settings have increased in the recent three years. In 2022, there have been fewer than five reported incidents involving LDC workers and overhead powerline contact.

6 NUMBER OF UTILITY-RELATED ELECTRICAL INCIDENTS BY OUTCOME IN ONTARIO, 2013–2022



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Critical injury	5	4	4	4	1	2	3	1	4	4
Fatality	4	3	2	0	3	2	4	3	3	3
Non-critical injury	10	8	2	4	2	3	0	4	8	7
Property damage	1	1	1	8	2	14	20	12	7	2
Unknown	0	0	1	1	0	0	1	1	1	1

Source: ESA records

Conclusion

The number of reported utility-related incidents that resulted in property damage has increased since 2018. The number of critical injuries and the number of fatalities reported from utility-related incidents have remained between zero and five between 2013 and 2022. Please note that outcome information for utility incidents contains missing information and/or under reporting.

3.1 Focus Report: Powerline Safety

The ESA's Recent Work in Utilities and Powerlines

Historically, contact with powerlines has been the leading cause of fatalities. The recent five-year rolling average rate of powerline fatalities (0.16 per million population) indicates that despite the small number, the trend has been slowly increasing when compared to previous time periods. The five-year rolling average for overhead powerline contacts has also been increasing since 2016. The number of incidents reported in public settings has more than doubled since 2018, whereas those in the construction sector decreased by 49% when comparing the same time period.

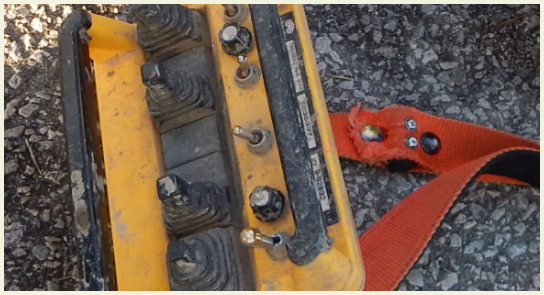
OCCUPATIONAL POWERLINE CONTACTS

Fatal powerline contact while at work continues to be the highest risk. When comparing 2013–2017 and 2018–2022, the fatalities for each period (four deaths) has remained the same. In 2021 and 2022, the Ontario Office of the Chief Coroner (OCC) held two inquests for powerline fatalities that occurred in 2012 and 2015, respectively. Both of these incidents involved hydrovac workers that were working in proximity to powerlines. These incidents resulted in fines from the Ontario Ministry of Labour, Immigration, Training and Skills Development (MLITSD) directed at the contractor and subcontractors involved in the incidents.

The 2012 incident resulted in 11 recommendations that were directed to the MLITSD, Infrastructure Health and Safety Association (IHSA), Hydro Ottawa, and similar electrical companies. These recommendations were about specific content provided in safety courses for construction workers, exploring additional protective equipment for hydrovac workers, and improved oversight of contractors and subcontractors doing the work for electrical companies. The specific recommendations can be found in Appendix A of this report.

The 2015 incident resulted in ten recommendations that were directed to MLITSD, IHSA, and the Provincial Labour-Management Health and Safety Committee for Construction (PLMHSC). These recommendations included issuing a Hazard Alert for remote-control devices for booms and cranes, and research into technology that could protect workers whose equipment may be in proximity to overhead powerlines. The recommendations went further, suggesting amendments to the Act that would require new protective measures, public education, and increased frequency of training for constructors, employers, supervisors, and workers who work near overhead powerlines. The recommendations can be found in Appendix B of this report.

3.1 Focus Report: Powerline Safety (Continued)



While ESA staff attended and completed a root cause analysis for both incidents, the ESA did not participate in either inquest. The inquest recommendations provided additional insights on the ESA's approach to safety awareness campaigns for educating those who work in proximity to powerlines. The ESA continues to work with MLITSD and IHSA as a collaborative partner and as the subject matter expert in assisting with other powerline incident investigations and developing safety guidelines.

NON-OCCUPATIONAL POWERLINE CONTACT

Overhead powerline contact and fatalities while at home or in a recreational setting are on the rise. When comparing 2013–2017 and 2018–2022, the number of fatalities for each period (four deaths and eight deaths, respectively) have doubled. Maintaining vegetation, individuals performing in recreational activities and copper thefts were the types of activity that were associated with these fatalities.

Powerline contacts in the public domain have increased. Many of these incidents occurred while tree maintenance was being conducted. In most situations, the trees being maintained were in contact with overhead powerlines. Increased storm activity in Ontario has also resulted in increased powerline contacts being reported to the ESA. These contacts occur while individuals are attempting to manage fallen tree limbs and trees.

Anecdotally, between 2020 and 2021, the COVID-19 lockdowns provided an environment where Ontarians were at home and spent time performing projects around the house that they otherwise would not have had the time to complete. Rather than hiring experienced businesses and workers to do the work, many completed "do it yourself" projects and maintenance. In 2023, the ESA conducted an online survey to assess Ontarians' knowledge, attitudes, and beliefs on powerline safety. In a representative sample from the general public, 38% of respondents indicated that they did more outdoor chores and maintenance in the past year when compared to years past.

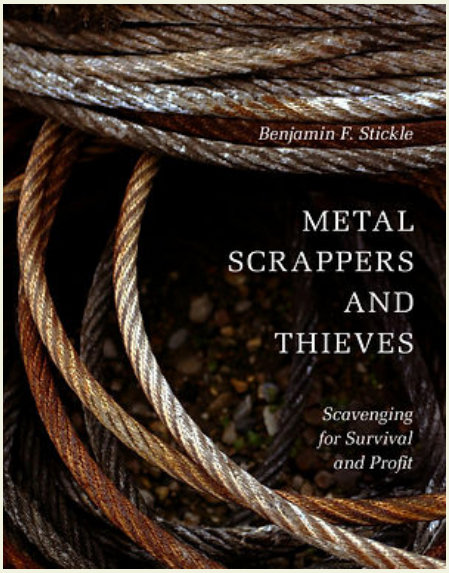
In the same survey, respondents were asked about their knowledge of keeping safe distances around powerlines. Sixty-four percent of respondents indicated that they should stay a distance of three metres or more away from an overhead powerlines; however, 79% of these respondents guessed this response. Forty-five percent of respondents to the same question answered that they should be 10 metres or more from a downed powerline; 80% of these respondents guessed this response. This is a concern for the ESA as it demonstrates knowledge gaps regarding

3.1 Focus Report: Powerline Safety (Continued)

powerlines among the public. There are additional opportunities for the ESA to work with safety partners to bring forward awareness and education to Ontarians on the dangers of powerlines, particularly to homeowners doing work around their homes.

Further, there has been an increase in fatalities where individuals are performing recreational activities in proximity to overhead powerlines and inadvertently making contact. While the activities are not similar in nature, they are occurring while individuals may be distracted or less alert, given they are performing a leisure activity. The ESA continues to observe the circumstances around these deaths to better understand how to create awareness for Ontarians in the future, on always being aware of one's surroundings and the ever present danger of energized powerlines.

COPPER THEFT



Between 2017 and 2022, six of 19 non-occupational electrical fatalities occurred as a result of copper theft. Many of these individuals had no fixed address. Theft locations were a mix of local distribution company (LDC) property and customer-owned electrical equipment. Despite the fact that most electrical fatalities involve powerlines, only one copper theft fatality involved a powerline. Each year since 2020, at least one electrical fatality from copper theft has been reported. For LDCs, copper theft activity lends to several concerns. Not only is it a safety concern when the copper is part of an energized system, but it can have other implications. These thefts often cause service outages which can put locations that house or service vulnerable populations, at risk. Additionally, impacts to the operations of LDCs and the costs to replace that copper over time, drive up costs to electricity consumers.

To gain insight into why copper theft occurs, the ESA reached out to Dr. Benjamin Stickle, Professor of Criminal Justice Administration at Middle Tennessee State University, who is an expert on metal theft. His research and experience indicated that as the value of copper and other metals continues to increase, metal theft has become one of the fastest-growing crimes in the United States (Stickle, 2017).

3.1 Focus Report: Powerline Safety (Continued)

Dr. Stickle defines metal thieves as individuals who take metal which they have no legal right to possess and recycle it for personal gain. His research indicates that many metal thieves work in teams, and at one time, were employed full-time as electricians, HVAC workers, general maintenance workers, or contracting workers. Their employment background provided these individuals with the technical skills and tools necessary to carry out large and challenging amounts of metal theft, with access to areas where high quantities of valuable metal were often unguarded. He explains they have the ability to use their employment as a cover for their conduct while they are taking the copper, or serving as a convenient excuse to be in possession of large amounts of metal. Many metal thieves initially scrapped legally before making the decision to steal. Ease of theft, significant financial incentive, low risk, and perceived financial need were the reasons for moving into theft. Metal thieves are distinct from metal scrappers, who are individuals who regularly collect fragmented, damaged, or discarded metal items, which are no longer useful or have not maintained their original value, to recycle them for financial profit.

In conversations with Dr. Stickle, the ESA came to learn that geographically, copper thefts are commonly seen in areas of urban decay. Generally this is to mean that in locations where industry was once prominent but has since degraded or moved out of the area, copper theft tends to be more common. There are typically more abandoned locations where desperate individuals may pillage to collect copper wiring and sadly some of those locations may still be energized. Although Dr. Stickle's research was done in the United States, his insights are valuable for the ESA to gain more understanding of the population that carries out copper theft.

In February 2023, the ESA administered an online survey to all Ontario LDCs. Of the 33 LDC respondents, 54% were concerned about copper theft and 42% of organizations place copper theft as a high priority. The level of detail collected by the organizations who participated in our survey, ranged from enumerating incidents to full reporting. The copper theft impact to LDCs across Ontario is not unanimous in terms of all LDCs experiencing the same extent of loss.

An engagement with LDCs was held with the ESA's Utility Advisory Council, following the survey, to discuss copper theft and share potential solutions. These included suggestions such as using alternatives to copper where possible and exploring other alternative materials. Additionally, they offered that it may help if copper parts were more difficult to access by moving them indoors, or installing additional locks or barbed wires, and/or increasing inspection and security in yards or storage. For next steps, members were to explore the idea of an awareness campaign, although copper theft is considered a "crime of desperation" and additional awareness and education may facilitate additional theft, giving the idea to those who may not have already considered it. The ESA continues to work with LDCs who collect and are willing to share data, so that copper theft information can be routinely and systematically collected to gain better insight.

4.0 Overview of Fires in Ontario

Fire remains a significant threat to life and property in urban and rural areas. Structural fires, especially residential fires, remain a critical concern. The high number of electrical incidents and the associated dollar loss, as well as the number of "deliberate" fires and their associated dollar loss, are the two other areas of major concern (Asgary et al., 2010).

Ontario reported 34,327 structure-loss fires (fires resulting in an injury, fatality, or property lost) between 2017 and 2021. Residential-loss fires (25,292) account for 74% of structure-loss fires in the same time period. Stove-top fires (with electricity fuel only) account for 6% of structure-loss fires and 8% of residential-loss fires. Since 2017, there has been a 4% increase in total-loss fires, a 6% increase in structure-loss fires, and a 10% increase in residential-loss fires.

For the period between 2012 and 2021, the OFMEM identified the following as the most common ignition sources for structure-loss fires:

- cooking (17%);
- electrical distribution equipment – wiring (9%);
- heating and cooling equipment (8%);
- miscellaneous (includes fires – natural causes and chemical reactions) (8%);
- cigarettes (7%);
- appliances (5%); and
- other electrical, mechanical (5%).

When comparing 2012–2016 and 2017–2021, the average number of structure-loss fires per year by ignition source decreased 12% for cooking, 7% for electrical wiring, 13% for heating/cooling equipment, and 8% for appliances.

Among structures that follow the Ontario Building Code (OBC), when structure-loss fires were limited to those where electricity was identified as the fuel of the ignition source (but not necessarily the primary fuel energy source), the most common electrical-related products involved were:

- cooking equipment (40%);
- electrical distribution equipment (27%); and
- appliances (12%).

Electrical Products

The ESA defines electrical products as appliances, cooking equipment, lighting equipment, other electrical and mechanical equipment, and processing equipment. Data from the OFMEM shows that the five-year average for electrical product fires (where electricity was identified as the fuel of the ignition source) between 2012–2016 and 2017–2021 has decreased by 17%.

Statistics Directly Related to the ESA's Harm Reduction Priorities

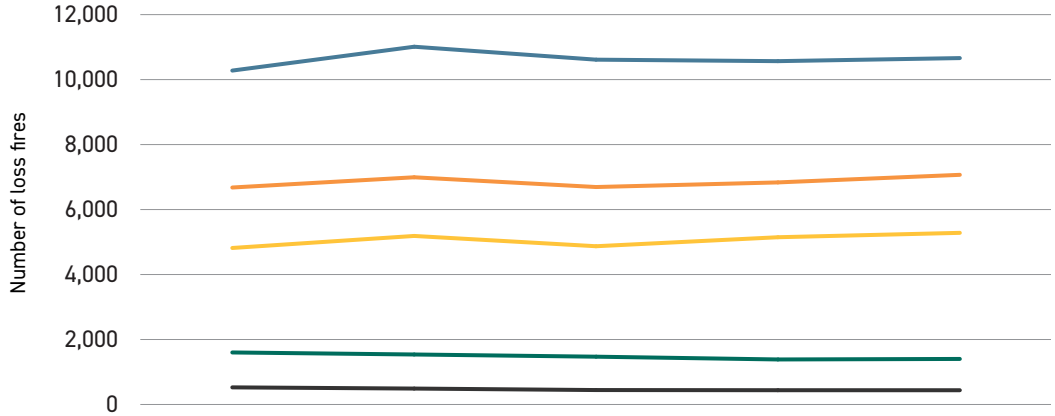
PRODUCT SAFETY

Five-year Rolling Average Comparison

Number of electrical product-related fires: a product fire is defined as one involving appliances, cooking equipment, lighting equipment, and other electrical, mechanical, or processing equipment as classified by the Office of the Fire Marshal and Emergency Management data.

The product safety five-year rolling average has decreased by 17% between 2012–2016 and 2017–2021.

1 NUMBER OF LOSS FIRES IN ONTARIO, 2017–2021



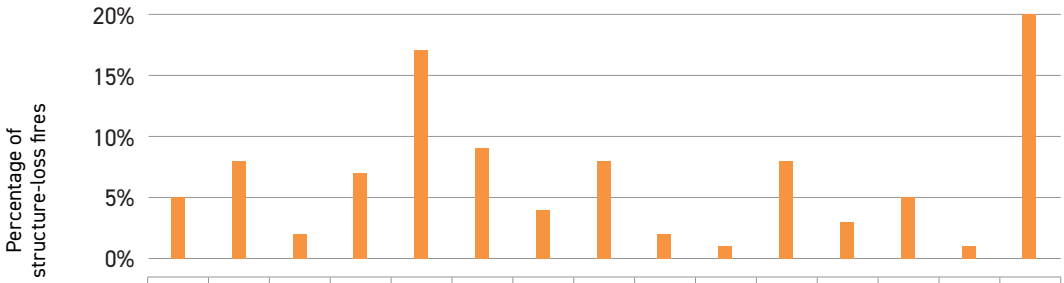
Year	2017	2018	2019	2020	2021
Total number of loss fires	10,307	11,067	10,672	10,599	10,694
Structure-loss fires	6,683	7,012	6,715	6,841	7,076
Residential-loss fires	4,809	5,189	4,874	5,142	5,278
Structure-loss fires where electricity fuelled the ignition source	1,571	1,508	1,440	1,354	1,370
Stove-top structure-loss fires	489	452	406	401	400

Source: OFMEM records

Conclusion

The number of total-loss fires has decreased between 2017 and 2021. Structure-loss fires and residential-loss fires, however, have increased in that same period. The number of fires where electricity fuelled the ignition source has decreased by 13% when comparing 2017 and 2021.

2 PERCENTAGE OF STRUCTURE-LOSS FIRES BY IGNITION SOURCE IN ONTARIO, 2012–2021



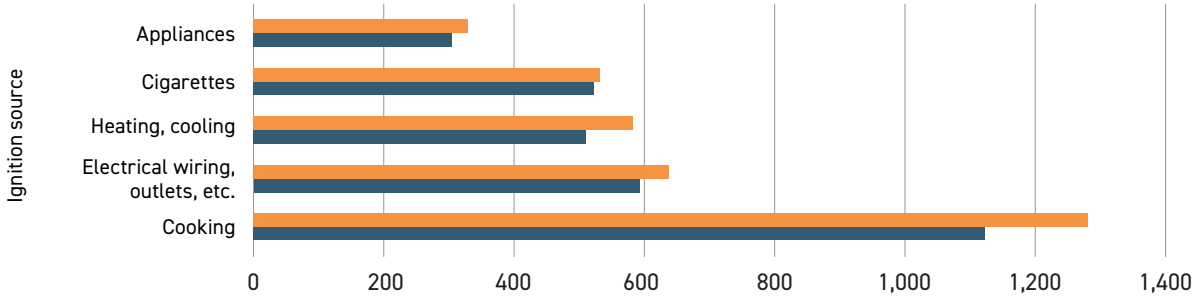
Ignition source	Appliances	Arson	Candles	Cigarettes	Cooking	Electrical wiring	Exposure	Heating, cooling	Lighting	Matches, lighters	Miscellaneous	Other open flame tools	Other electrical, mechanical	Processing equipment	Undetermined
2012–2021	5%	8%	2%	7%	17%	9%	4%	8%	2%	1%	8%	3%	5%	1%	20%

Source: OFMEM records

Conclusion

When excluding undetermined and miscellaneous sources, cooking (17%) and electrical wiring (9%) were the most common ignition sources for structure-loss fires between 2012 and 2021.

3 FIVE-YEAR AVERAGE NUMBER OF STRUCTURE-LOSS FIRES BY IGNITION SOURCE IN ONTARIO, 2012–2016 AND 2017–2021



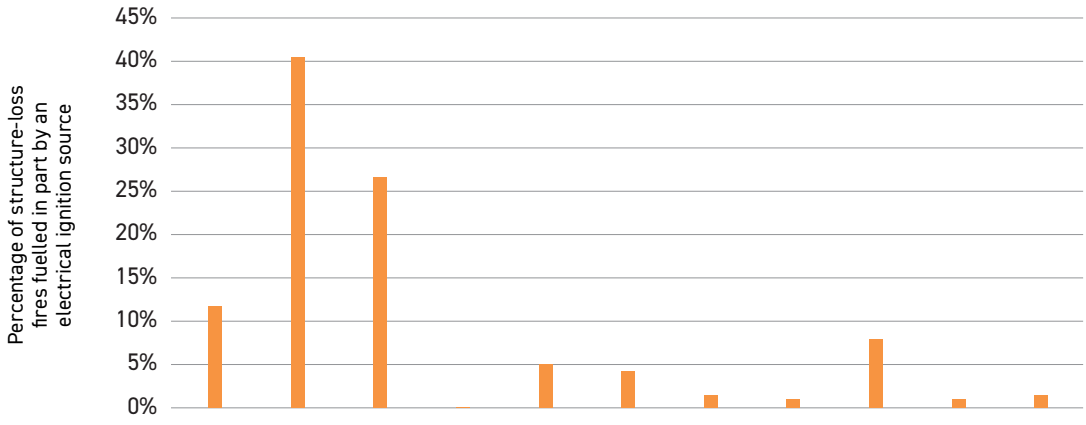
Ignition source		Cooking	Electrical wiring, outlets, etc.	Heating, cooling	Cigarettes	Appliances
Average number of structure-loss fires	2012–2016	1,281	636	583	533	329
	2017–2021	1,123	591	510	523	304

Source: OFMEM records

Conclusion

Cooking equipment remained the most common ignition source in 2012–2016 and 2017–2021, although the average number of structure-loss fires among cooking equipment, heating/cooling, electrical wiring, and appliances has decreased in the most recent time period.

4 PERCENTAGE OF STRUCTURE-LOSS FIRES FUELLED IN PART BY AN ELECTRICAL IGNITION SOURCE IN ONTARIO, 2012–2021 (OBC STRUCTURES ONLY)



Electrical ignition source	Appliances	Cooking	Electrical distribution equipment	Exposure	Heating, chimney	Lighting	Miscellaneous	Open flame	Other electrical, mechanical	Processing equipment	Undetermined
Percentage of structure-loss fires	11.6%	40.4%	26.5%	0.1%	5.0%	4.1%	1.4%	0.9%	7.8%	0.9%	1.4%

Source: OFMEM records

Conclusion

When the fire is from ignition sources that use electricity, cooking equipment (40%), electrical distribution equipment (27%), and appliances (12%) were the most common ignition sources between 2017 and 2021.

5 PERCENTAGE OF ELECTRICAL STRUCTURE-LOSS FIRES IN ONTARIO BY TIME OF DAY, 2012–2021 (OBC STRUCTURES ONLY)

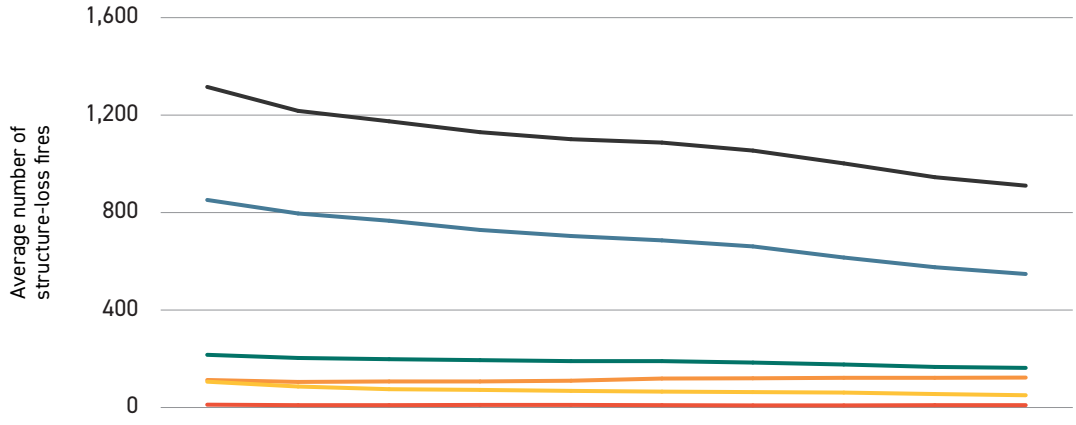
Time	Midnight – 8 a.m.	8 a.m. – 4 p.m.	4 p.m. – Midnight
Percentage	19%	38%	43%

Source: OFMEM records

Conclusion

Between 2012 and 2021, most of the electrical-related structure-loss fires occurred in the period from 4 p.m. to midnight.

6 FIVE-YEAR ROLLING AVERAGE NUMBER OF ELECTRICAL STRUCTURE-LOSS FIRES BY PRODUCTS IN ONTARIO, 2008–2021 (OBC STRUCTURES ONLY)



Five-year period	2008–2012	2009–2013	2010–2014	2011–2015	2012–2016	2013–2017	2014–2018	2015–2019	2016–2020	2017–2021
Appliances	222	209	204	200	196	196	190	182	172	168
Cooking equipment	862	806	776	738	713	695	670	624	584	556
Lighting	111	91	80	77	73	70	68	66	60	55
Other electrical, mechanical	118	110	112	112	115	124	125	127	127	128
Processing equipment	16	14	14	15	15	14	13	13	14	14
Product safety overall	1,329	1,230	1,187	1,142	1,113	1,099	1,066	1,012	956	921

Source: OFMEM records

Conclusion

Between 2012–2016 and 2017–2021, the five-year rolling average number of fires related to product safety has decreased by 17%.

4.1 Fires Resulting in Fatalities

Beaulieu et al. (2020) studied the geographic and demographic distribution of residential fires and related casualties in Canadian provinces. Between 2005 and 2015, 145,252 residential fires were reported from the provinces of British Columbia, Alberta, Manitoba and Ontario, in which 5.5% resulted in casualties. Death rates per population decreased significantly between 2005 and 2015, while casualties per 1,000 house fires did not change. Death rates per house fire incidents were generally higher in urban than in remote areas, but tended to increase as distance from city centres increased and moved closer to suburban areas. Fire-related deaths were more likely to involve males, and older residents were much more likely to have died in fires (Clare et al., 2017). The vast majority of fire-related deaths are classified as unintentional (accidents) (Statistics Canada, 2022).

Fire fatalities in Ontario

Ontario reported 884 deaths due to fires between 2012 and 2021. This number excludes fire deaths in vehicle collisions, fire fatalities among emergency response, or any fire deaths on federal or First Nations property. This number is more than what was reported between 2010 and 2019, where 849 deaths were reported. The OFMEM reported that in 2021, the fire death rate was 8.5 deaths per million population, which is a 67% increase when compared to the fire death rate in 2012, which was 5.1 deaths per million population.

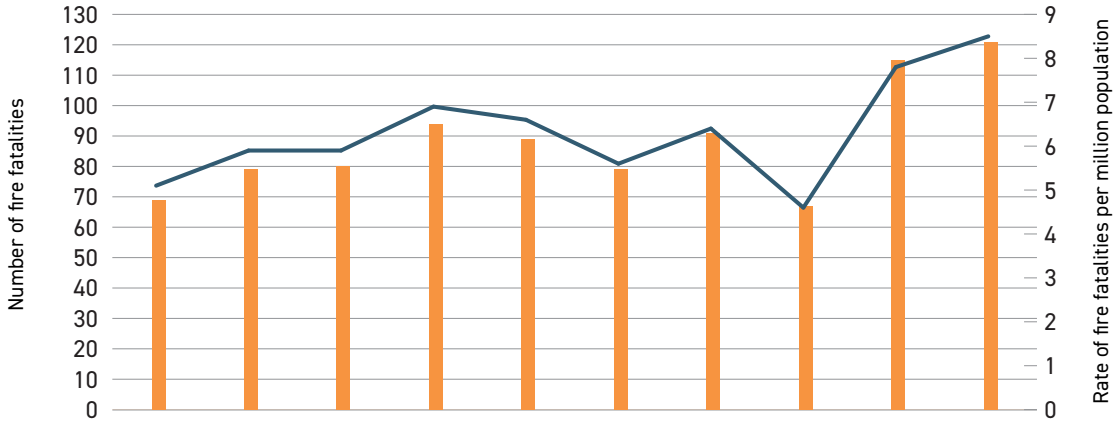
Structure-loss fires are fires that result in an injury, fatality, and/or financial loss that occur in structures (as opposed to vehicles or the outdoors). In Ontario, there were 801 fire fatalities from structure-loss fires from 2012 to 2021. The OFMEM reported that in 2021, the structure-loss fire death rate was 7.5 per million population, which is a 63% increase when compared to the structure-loss fire death rate in 2012, which was 4.6 deaths per million population.

Electrical fire fatalities in Ontario

The OFMEM data identified 87 deaths in fires for which electricity was the fuel of the ignition source or were from electrical distribution equipment between 2012 and 2021. Since 2012, the death rate from this type of fire has decreased 19% from 0.52 deaths per million population to 0.42 deaths per million population.

In these types of fires in which the investigations were considered closed, 97% were considered accidental between 2012 and 2021. Stove or range-top burners accounted for 39% of fire fatalities fuelled by electricity in the last ten years.

1 NUMBER AND RATE OF ALL FIRE FATALITIES IN ONTARIO, 2012–2021



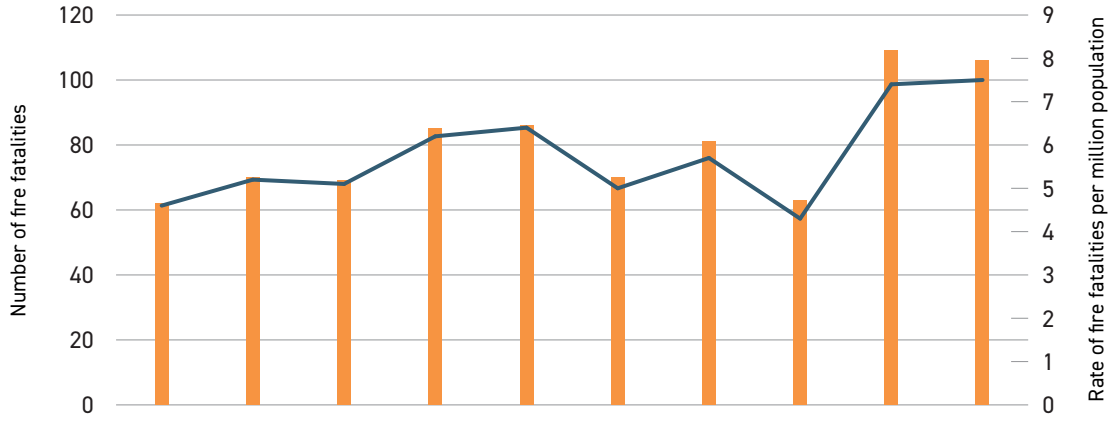
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
All fire fatalities in Ontario	69	79	80	94	89	79	91	67	115	121
Ontario population in millions	13.4	13.5	13.6	13.8	13.4	14.1	14.3	14.5	14.7	14.2
Fire death rate in Ontario	5.1	5.9	5.9	6.9	6.6	5.6	6.3	4.6	7.8	8.5

Source: OFMEM records

Conclusion

The number and rate of fire fatalities have increased when comparing 2012 and 2021.

2 NUMBER AND RATE OF FIRE FATALITIES IN STRUCTURE FIRES IN ONTARIO, 2012–2021



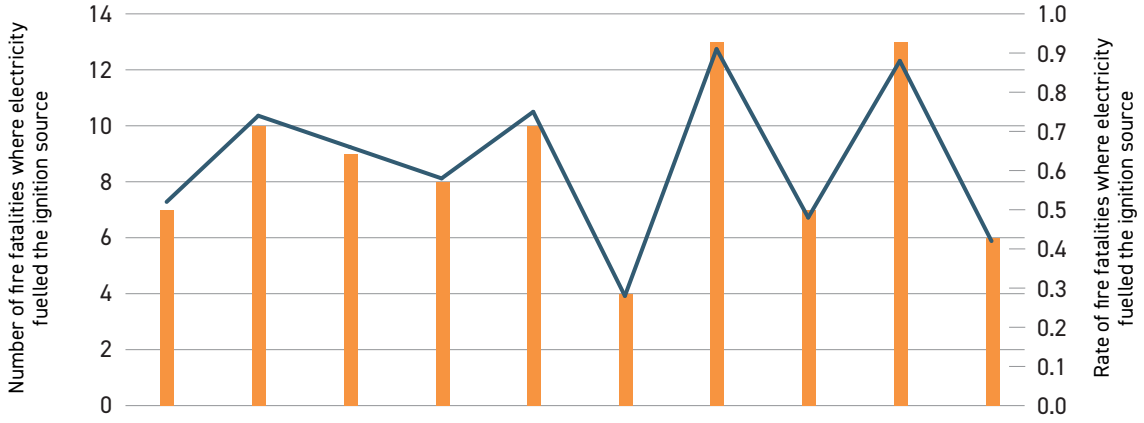
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Number of fire fatalities from structure fires	62	70	69	85	86	70	81	63	109	106
Ontario population in millions	13.4	13.5	13.6	13.7	13.4	14.1	14.3	14.5	14.7	14.2
Rate of fire fatalities from structure fires	4.6	5.2	5.1	6.2	6.4	5	5.7	4.3	7.4	7.5

Source: OFMEM records

Conclusion

The number and rate of fire fatalities in structure fires have increased when comparing 2012 to 2021. It should be noted that these fatalities are for all structure fires , and includes more than electrical fire fatalities.

3 NUMBER AND RATE OF STRUCTURE FIRE FATALITIES WHERE ELECTRICITY WAS THE FUEL OF THE IGNITION SOURCE IN ONTARIO, 2012–2021



Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Number of fatalities where electricity fuelled the ignition source	7	10	9	8	10	4	13	7	13	6
Ontario population in millions	13.4	13.5	13.6	13.7	13.4	14.1	14.3	14.5	14.7	14.2
Rate of fatalities where electricity fuelled the ignition source	0.52	0.74	0.66	0.58	0.75	0.28	0.91	0.48	0.88	0.42

Source: OFMEM records

Conclusion

The rate of structure fire fatalities where electricity fuelled the ignition source or where fires were from electrical distribution equipment has decreased 19% when comparing 2012 to 2021.

4 PERCENTAGE OF STRUCTURE FIRE FATALITIES WHERE ELECTRICITY IS THE FUEL OF THE IGNITION SOURCE BY CAUSE CLASSIFICATION IN ONTARIO, 2012–2021 (CLOSED FIRE INVESTIGATIONS ONLY)

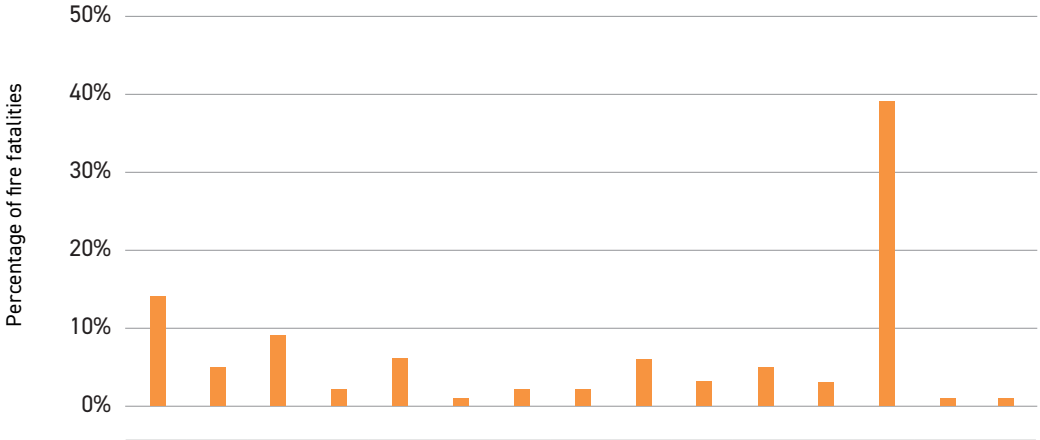
Cause classification	Accidental	Undetermined	Intentional
2012–2021	97%	2%	1%

Source: OFMEM records

Conclusion

Almost all structure fire fatalities (97%) where electricity fuelled the ignition source or where the fires were from electrical distribution equipment were accidental.

5 PERCENTAGE OF STRUCTURE FIRE FATALITIES WHERE ELECTRICITY WAS THE FUEL OF THE IGNITION SOURCE BY IGNITION SOURCE IN ONTARIO, 2012–2021 (CLOSED FIRE INVESTIGATIONS ONLY)



Ignition source	Circuit wiring – copper	Clothes dryer	Cord, cable for appliance, electrical articles	Electric blanket, heating pad	Extension cord, temporary wiring	Incandescent lamp	Multiple competent ignition sources	Other cooking items (e.g., toaster, kettle)	Other electrical	Other electrical distribution items	Oven	Space heater – portable	Stove, range-top burner	Christmas lights, decorative lighting	Undetermined
Percentage	13%	5%	9%	3%	5%	1%	1%	5%	6%	4%	5%	3%	40%	1%	1%

Source: OFMEM records

Conclusion

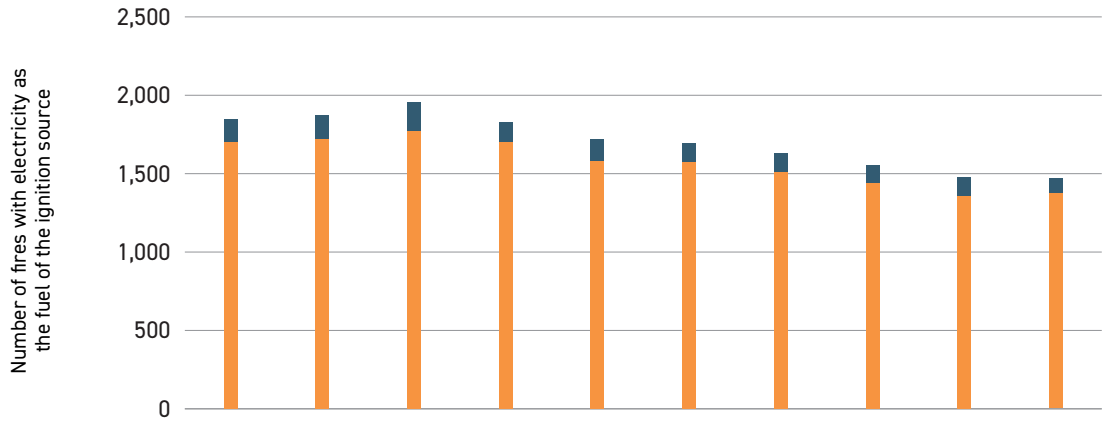
The stove (40%) remains the most common ignition source when examining structure fire fatalities where electricity fuelled the ignition source or where the fires were from electrical distribution equipment in the most recent ten-year period.

4.2 Fire Incidents with Electricity as the Fuel of the Ignition Source of the Fire

Among OBC structures, where electricity was the fuel of the ignition source of the fires, there were 15,698 loss fires and 1,315 no-loss fires for a total of 17,013 structure fires from 2012 to 2021. Over the same time period, there was a 19% decrease in structure-loss fires and a 20% decrease in total structure fires.

Between 2012 and 2021, 82% of structure fires occurred in the residential setting. Cooking equipment (41%), electrical distribution equipment (26%), and appliances (11%) remained the most common ignition sources in these fires.

1 NUMBER OF STRUCTURE FIRES WITH ELECTRICITY AS THE FUEL OF THE IGNITION SOURCE IN ONTARIO, 2012–2021 (OBC STRUCTURES ONLY)



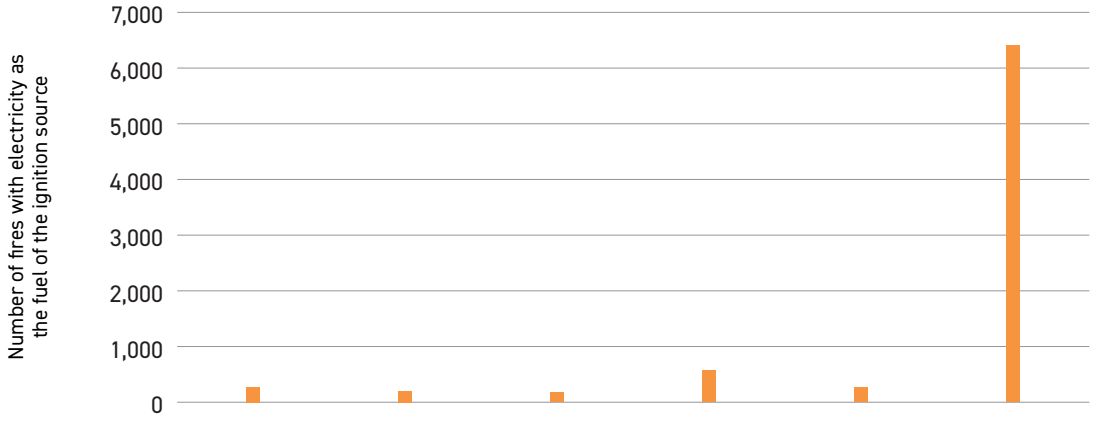
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Number of fires with no loss	146	155	182	129	137	124	120	108	118	96
Number of fires with loss	1,697	1,716	1,768	1,696	1,578	1,571	1,508	1,440	1,354	1,370
Total fires with electricity as the fuel	1,843	1,871	1,950	1,825	1,715	1,695	1,628	1,548	1,472	1,466

Source: OFMEM records

Conclusion

In 2021, the total number of structure fires where electricity was the fuel of the ignition source decreased by <1% when compared to 2020.

2 NUMBER OF FIRES WITH ELECTRICITY AS THE FUEL OF THE IGNITION SOURCE BY STRUCTURE CLASSIFICATION IN ONTARIO, 2017–2021 (OBC STRUCTURES ONLY)



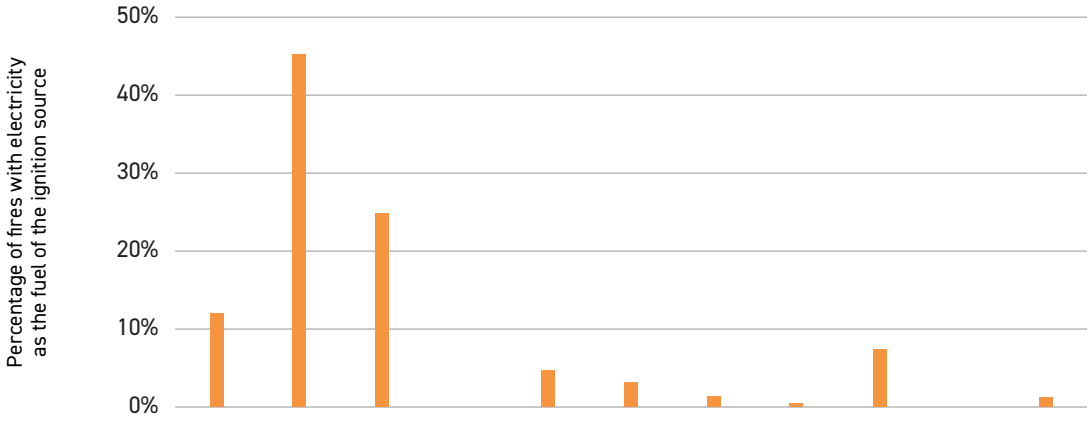
Structure classification	Assembly	Business and personal services	Care and detention	Industrial	Mercantile	Residential
Number of fires	266	188	168	551	245	6,391

Source: OFMEM records

Conclusion

Residential structures were the most common structures (82%) for fires where electricity was the fuel of the ignition source between 2017 and 2021.

3 PERCENTAGE OF RESIDENTIAL FIRES WITH ELECTRICITY AS THE FUEL OF THE IGNITION SOURCE BY IGNITION SOURCE IN ONTARIO, 2017–2021



Ignition source	Appliances	Cooking equipment	Electrical distribution equipment	Exposure	Heating equipment, chimney, etc.	Lighting	Miscellaneous	Open flame tools, smokers' articles	Other electrical, mechanical	Processing equipment	Undetermined
Percentage	11.9%	45.2%	24.8%	0.1%	4.7%	3.1%	1.3%	0.4%	7.3%	0.1%	1.2%

Source: OFMEM records

Conclusion

Cooking equipment and electrical distribution equipment were the leading sources in residential fires when electricity fuelled the ignition source.

4.3 Cooking Fires with Electricity as the Fuel of the Ignition Source of the Fire

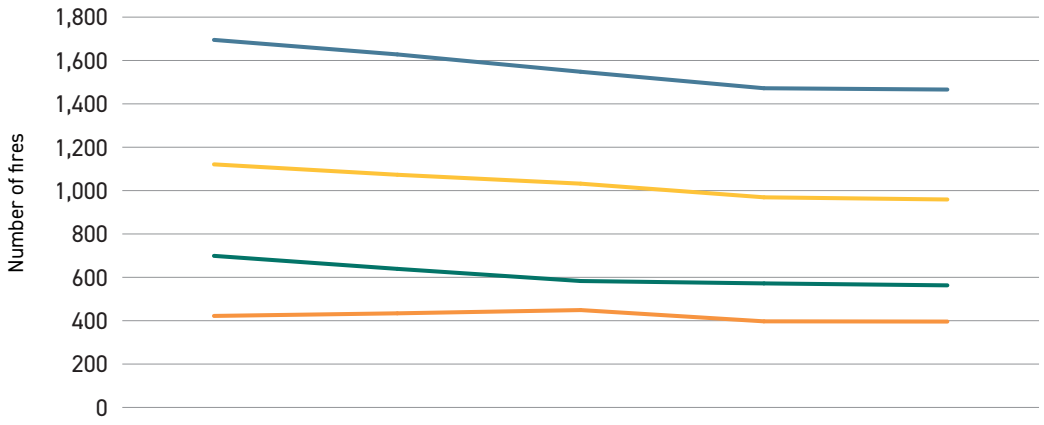
The National Fire Protection Association found that households that used electric ranges had a higher risk of cooking fires and associated losses than those using gas ranges. Their research also showed that a disproportionate share of home cooking fires were reported in apartments or other multi-family homes (Ahrens, 2017).

The most common cause of residential fires is cooking fires. Cooking fires have led to major injuries and fatalities, as well as significant financial losses. In most cooking fires, the ignition occurred due to the presence of cooking oil, which is highly ignitable, and could contribute to its spread (Hamida et al., 2019). Electricity is used in many stoves as the method to ignite these stoves.

From 2017 to 2021, there were 3,056 structure fires in Ontario, where the ignition source was cooking equipment fuelled by electricity. Of those, 95% occurred in homes, and there has been an 18% decrease in this type of residential fire since 2017. Stove and range-top burners were the leading ignition source, followed by the oven and other cooking items. The overwhelmingly cited possible cause to these cooking fires was leaving the stove or range-top burner unattended.

The OFMEM fire-loss reporting system identified cooking equipment as one of the leading ignition sources associated with preventable home injuries. Structure fires that were ignited from cooking equipment that used electricity accounted for an annual average of 90 injuries among civilians and an average of four fatalities between 2017 and 2021. In this time period, cooking equipment was the leading ignition source in fires from electrical products or where electricity fuelled the ignition source.

1 NUMBER OF COOKING EQUIPMENT AND ELECTRICAL DISTRIBUTION EQUIPMENT FIRES IN ONTARIO, 2017–2021 (OBC STRUCTURES ONLY)



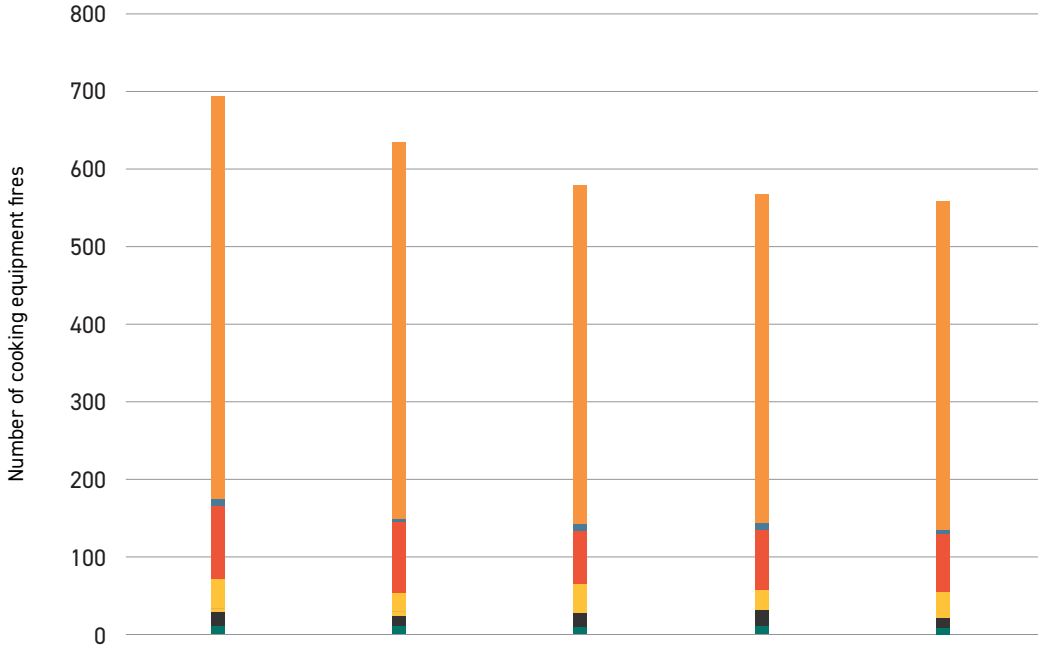
Year	2017	2018	2019	2020	2021
Cooking equipment	699	639	583	572	563
Electrical distribution equipment	422	434	449	397	396
Total cooking equipment and electrical distribution equipment fires	1,121	1,073	1,032	969	959
Total fires with electricity as the fuel	1,695	1,628	1,548	1,472	1,466

Source: OFMEM records

Conclusion

The number of structure fires from cooking equipment (where electricity fuelled the ignition source) and electrical distribution equipment (where electricity fuelled the ignition source) in 2021 has decreased by 14% when compared to 2017.

2 NUMBER OF COOKING EQUIPMENT FIRES WITH ELECTRICITY AS THE FUEL OF THE IGNITION SOURCE BY SOURCE IN ONTARIO, 2017–2021 (OBC STRUCTURES ONLY)



Year	2017	2018	2019	2020	2021
Stove, range-top burner	524	490	441	428	428
Range hood	9	4	8	9	5
Oven	95	92	69	78	76
Other cooking items	42	29	38	26	34
Open fired barbeque - fixed or portable	0	1	0	1	0
Microwave	19	13	18	20	12
Deep fat fryer	10	10	9	10	8

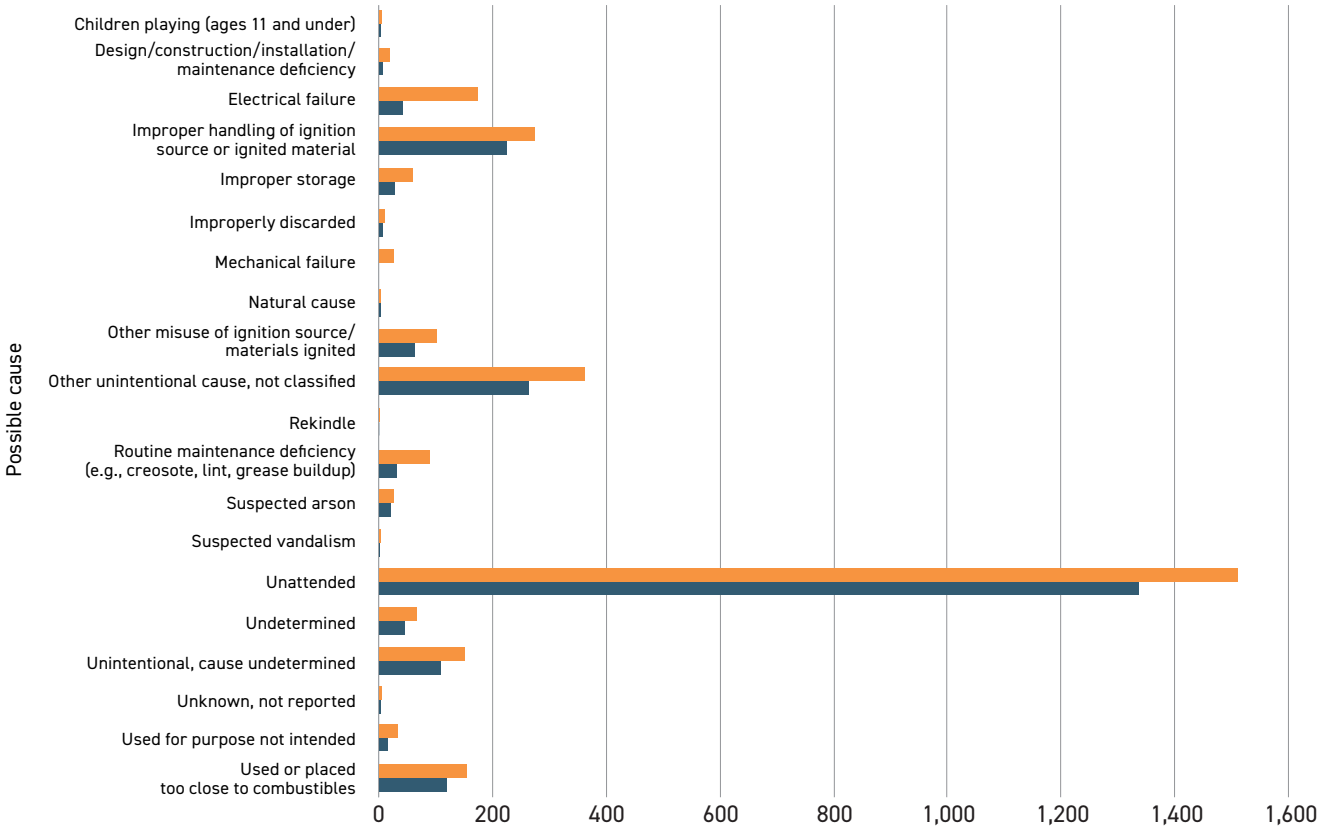
Source: OFMEM records

Conclusion

Stoves and range-top burners were the leading sources (76%) of cooking equipment fires between 2017 and 2021.

Other cooking items include toasters, kettles, electric frying pans, etc.

3 NUMBER OF STOVE-TOP FIRES VS. COOKING EQUIPMENT FIRES BY POSSIBLE CAUSE IN ONTARIO, 2017–2021 (OBC STRUCTURES ONLY)



Possible cause	Children playing (ages 11 and under)	Design/construction/installation/ maintenance deficiency	Electrical failure	Improper handling of ignition source or ignited material	Improper storage	Improperly discarded	Mechanical failure	Natural cause	Other misuse of ignition source/ materials ignited	Other unintentional cause, not classified	Rekindle	Routine maintenance deficiency (e.g., creosote, lint, grease buildup)	Suspected arson	Suspected vandalism	Unattended	Undetermined	Unintentional, cause undetermined	Unknown, not reported	Used for purpose not intended	Used or placed too close to combustibles
Cooking equipment fires	5	18	172	273	59	10	25	3	100	360	1	89	26	2	1,506	66	150	5	33	153
Stove-top fires	3	7	42	224	28	7	0	3	63	262	0	30	20	1	1,332	44	108	3	15	119

Source: OFMEM records

Conclusion

Leaving fires unattended was the most common cause of stove-top (58%) and cooking equipment fires (49%) between 2017 and 2021.

4.4 Electrical Distribution Equipment Fires with Electricity as the Fuel of the Ignition Source of the Fire

The OFMEM defines electrical distribution equipment as electrical wiring, devices, or equipment where the primary function is to carry current from one location to another. Thus, wiring, extension cords, terminations, electrical panels, and cords on appliances are considered electrical distribution equipment. This is not to be confused with utility equipment from Local Distribution Companies.

Among OBC structures, in the five-year period between 2017 and 2021, the OFMEM identified 2,098 fires as electrical distribution equipment fires with electricity as the fuel of the ignition source, in which 94% were identified as loss fires. The five-year rolling average of electrical distribution equipment loss structure fires has decreased by 9% between 2012–2016 and 2017–2021.

The most common ignition source of electrical distribution equipment fires was circuit wiring (aluminum and copper), and the number of fires from this source has decreased by 14% when comparing 2012–2016 and 2017–2021. Electrical failure is the most common possible cause in these types of fires.

Between 2012 and 2016, there was an estimated average of 35,150 home fires involving electrical distribution and lighting equipment in the U.S. This caused an estimated average of 490 deaths, 1,200 injuries each year in 2012–2016, as well as an estimated $1.3 billion in direct property damage per year (Campbell, 2019).

Electrical distribution and lighting equipment remain one of the leading causes for home fire and fire casualties in the United States (Hall, 2023). It is also the leading cause of home fire property damage. Electrical wiring and cable insulation accounted for 5% of all the home fires and 4% of all the home fire deaths. Cords or plugs were involved in only 1% of fires, but 6% of deaths. Extension cords dominated the cord or plug category. Electrical failures or malfunctions can occur in any type of equipment powered by electricity. Between 2016 and 2020, Hall (2023) reported that half of these fires involved electrical distribution or lighting equipment.

Statistics Directly Related to the ESA's Harm Reduction Priorities

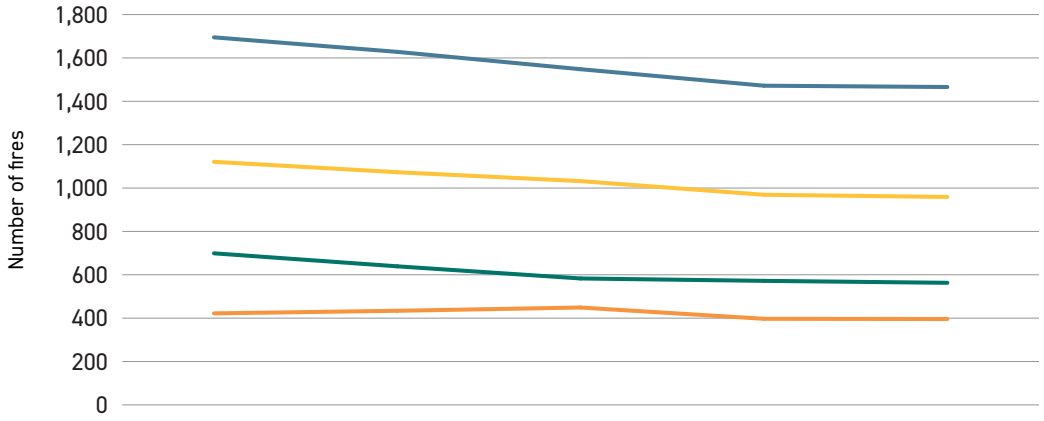
AGING INFRASTRUCTURE AND DISTRIBUTION EQUIPMENT FIRES

Five-year Rolling Average Comparison

Number of electrical wiring-related fires: this includes fires from copper and aluminum wiring, extension cords, appliance cords, terminations, and electrical panels — electrical devices categorized by the OFMEM as electrical distribution equipment.

The five-year rolling average for electrical distribution equipment structure loss fires related to aging infrastructure has decreased by 9% between 2012–2016 and 2017–2021.

1 NUMBER OF COOKING EQUIPMENT AND ELECTRICAL DISTRIBUTION EQUIPMENT FIRES IN ONTARIO, 2017–2021 (OBC STRUCTURES ONLY)



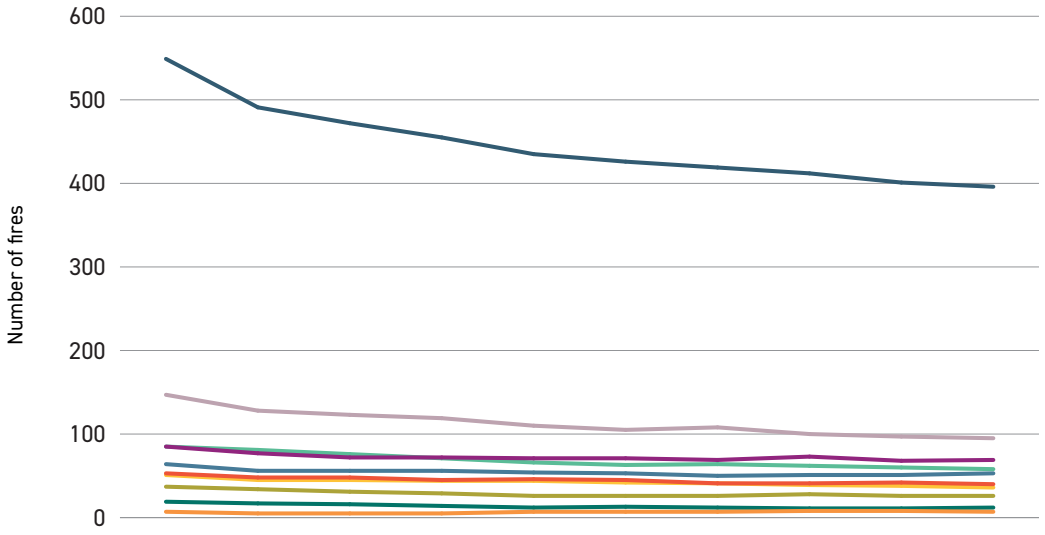
Year	2017	2018	2019	2020	2021
Cooking equipment	699	639	583	572	563
Electrical distribution equipment	422	434	449	397	396
Total cooking equipment and electrical distribution equipment fires	1,121	1,073	1,032	969	959
Total fires with electricity as the fuel	1,695	1,628	1,548	1,472	1,466

Source: OFMEM records

Conclusion

The number of electrical distribution equipment structure fires has decreased 6% since 2017.

2 FIVE-YEAR AVERAGE NUMBER OF ELECTRICAL DISTRIBUTION EQUIPMENT STRUCTURE-LOSS FIRES BY IGNITION SOURCE IN ONTARIO, 2008–2021 (OBC STRUCTURES ONLY)



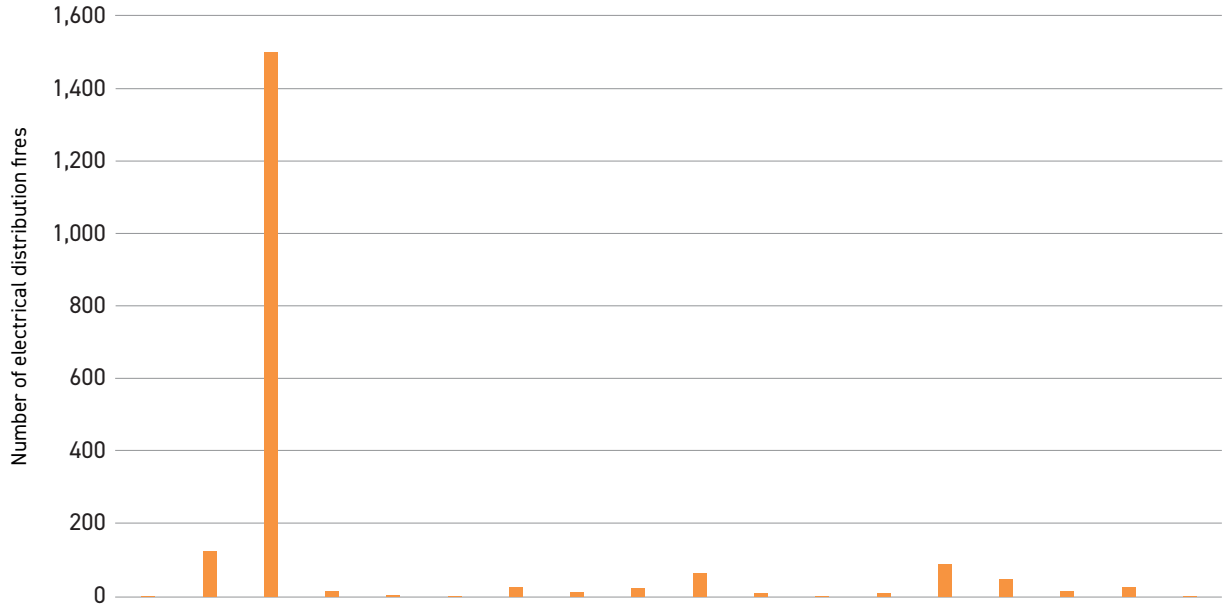
Five-year period	2008–2012	2009–2013	2010–2014	2011–2015	2012–2016	2013–2017	2014–2018	2015–2019	2016–2020	2017–2021
Circuit wiring – Al, Cu (includes conductors)	147	128	123	119	110	105	108	100	97	95
Cord, cable for appliance, electrical articles	85	77	72	72	71	71	69	73	68	69
Distribution equipment (includes panel boards, fuses, circuits)	85	81	76	71	66	63	64	62	60	58
Extension cord, temporary wiring	53	48	48	45	46	45	41	41	42	40
Metre	7	5	5	5	7	7	7	8	8	7
Other electrical distribution item	64	56	56	56	54	53	50	51	51	53
Service/utility lines (includes power/hydro transmission lines)	37	34	31	29	26	26	26	28	26	26
Terminations – Al, Cu (includes receptacles, switches, lights)	51	45	45	44	44	42	41	39	38	36
Transformer	19	17	16	14	12	13	12	11	11	12
Total	549	491	472	455	435	426	419	412	401	396

Source: OFMEM records

Conclusion

Circuit wiring — aluminum and copper remained the leading ignition source in electrical distribution equipment fires between 2008 and 2021. The five-year rolling average of electrical distribution equipment loss structure fires shows a 9% decrease between 2012–2016 and 2017–2021.

3 NUMBER OF ELECTRICAL DISTRIBUTION EQUIPMENT FIRES BY POSSIBLE CAUSE IN ONTARIO, 2017–2021



Possible cause	Children playing (ages 11 and under)	Design/construction/installation/ maintenance deficiency	Electrical failure	Improper handling of ignition source or ignited material	Improper storage	Improperly discarded	Mechanical failure	Natural cause	Other misuse of ignition source/ material ignited	Other unintentional cause, not classified	Routine maintenance deficiency (e.g., creosote, lint, grease buildup)	Suspected vandalism	Unattended	Undetermined	Unintentional, cause undetermined	Used for purpose not intended	Used or placed too close to combustibles	Vehicle collision
Number of electrical distribution fires	2	126	1,504	14	5	1	26	11	22	65	10	1	10	88	50	15	26	3

Source: OFMEM records

Conclusion

Electrical failure was the leading cause of electrical distribution structure fires between 2017 and 2021.

5.0 Product Safety

Ontario Regulation 438/07, *Product Safety,* enables the ESA to address the safety of electrical products and equipment offered for sale, sold, and used in Ontario.

O. Reg 438/07 authorizes the ESA to protect the public against potentially unsafe electrical products in the marketplace by:

1. Responding to product safety reports;
2. Removing potentially unsafe, counterfeit, and unapproved electrical products from the marketplace;
3. Requiring manufacturers to notify the public of potentially unsafe products; and
4. Implementing prevention-based and proactive detection activities.

The ESA has developed targeted response strategies for various potentially unsafe products.

The *Canada Consumer Product Act* in 2011 created concurrent product safety systems for consumer electrical products in Ontario, including mandatory reporting obligations to the ESA and Health Canada.

In 2021, Health Canada received 2,738 product reports, of which 167 reports were about electric ranges or ovens, where the top hazards included excessive heat/overheating, fire, and sharp edges or points. None of these reports was associated with deaths, although 38% mentioned injuries. Electrical injuries, such as shock and burns, were reported from products including ranges or ovens, telephones or accessories, and refrigerators (Health Canada, 2022).

Since 2013, there has been a 19% decrease in the number of product incidents reported to the ESA. In 2022, there were 458 reports. Compared to the previous year of 2021, this is a 5% decrease.

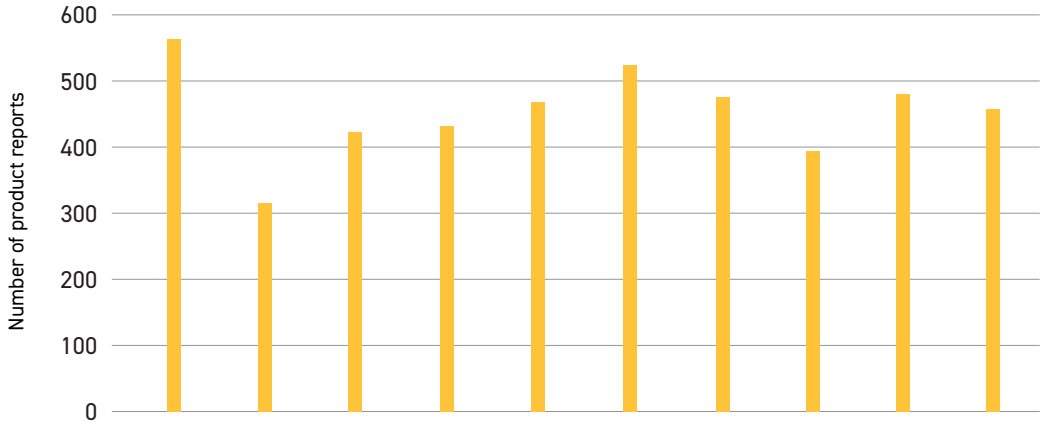
At the ESA, product safety reports are deemed high, medium or low risk by a risk assessment tool based on specific parameters. Some of these parameters include but are not limited to:

- Estimating the likelihood of the product being or becoming defective by evaluating factors such as product certification, use environment, history of compliance or previous product issues, ability to detect defect prior to product use and pattern of incidents;
- Estimating the likelihood of the serious negative effect materializing by evaluating factors such as exposure characteristics, human device interaction, undetected overheating, and impact of warnings; and
- Assessing severity of the potential impact by evaluating the loss severity: major, moderate, minor, or significant.

In 2022, all product safety investigations initiated by the ESA were a result of voluntary reporting and each report is assigned a priority based on its risk profile. Sixty-four percent (293 reports) were assigned as medium risk.

In 2022, 86% of product incident reports were concerned with unapproved products (products that have not been tested and evaluated to the applicable Canadian Safety Standards and may not be safe to use). A smaller percentage of reports dealt with certified products (products that were properly certified but reported to have a safety problem or a perceived safety problem) or products with a suspected counterfeit label.

1 NUMBER OF PRODUCT INCIDENT REPORTS SUBMITTED TO THE ESA IN ONTARIO, 2013–2022



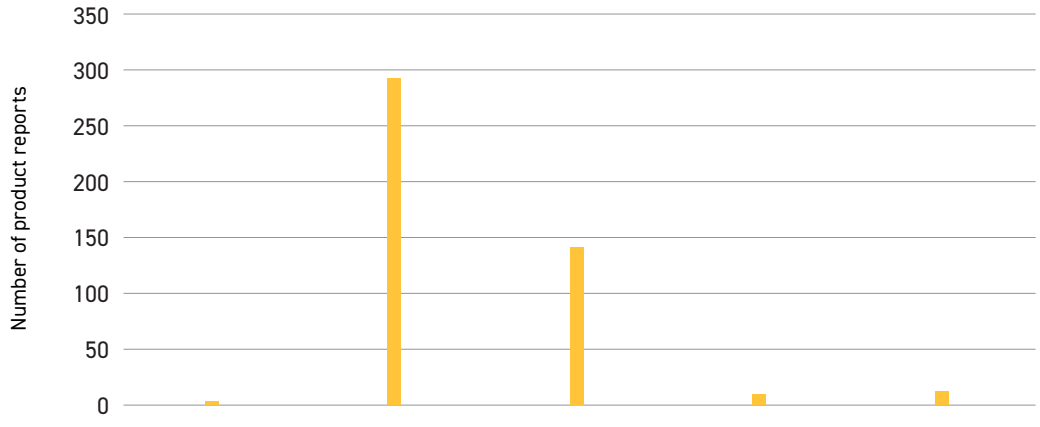
Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of product reports	564	316	423	432	468	524	475	394	481	458

Source: ESA records

Conclusion

Mandatory reporting to the ESA was introduced in 2008 with the introduction of Ontario Regulation 438/07. In 2011, the *Canada Consumer Product Act* was introduced which included mandatory reporting to Health Canada as well. In 2013, mandatory reporting to the ESA was removed as a result of amendments in the Regulation; as a result, a 54% decrease of reports between 2012 and 2013 was observed. Between 2013 and 2022, there has been a 19% decrease in product incident reports.

2 NUMBER OF PRODUCT INCIDENT REPORTS BY PRIORITY LEVEL IN ONTARIO, 2022



Priority level	High risk (most important)	Medium risk	Low risk	Priority 4 (least important)	Triaged by Health Canada
Number of product reports	2	293	142	9	12

Source: ESA records

Conclusion

In 2022, 64% of electrical incident reports to the ESA were classified as Priority 2.

3 PERCENTAGE OF PRODUCT INCIDENT REPORTS BY TYPE IN ONTARIO, 2022

Investigation type	Certified	With suspected counterfeit label	Unapproved
Percentage of product reports	14%	1%	86%

Source: ESA records

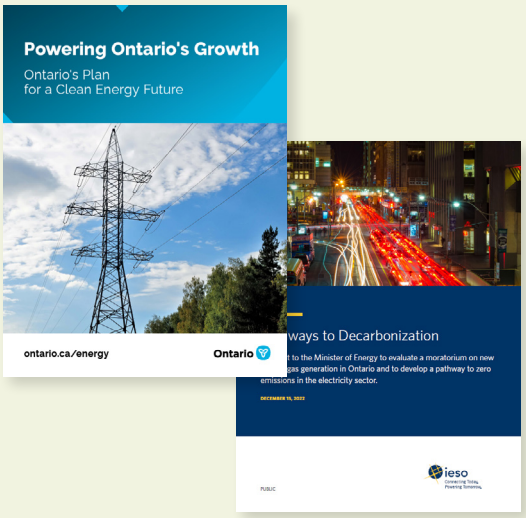
Conclusion

In 2022, 86% of electrical incident reports were from unapproved electrical products.

5.1 Focus Report: Electrification in Ontario

Electrification is the process of replacing technologies that use fossil fuels with technologies that use electricity as a source of energy. In efforts to reduce greenhouse gas emissions, replacing fossil fuels is seen to be critical in decarbonizing the economy and mitigating the impacts of climate change.

Alongside electrification efforts, the demand for electricity is expected to increase as Ontario anticipates unprecedented housing and infrastructure growth over the next two decades. This growing population capacity and energy gap is currently driving economy-wide electrification, and affects all sectors including industrial, building, transportation, and consumer goods.



In July 2023, the Ontario Ministry of Energy released its plan, *Powering Ontario's Growth*, an official response to the Independent Electricity System Operator's (IESO) *Pathways to Decarbonization* report published in 2022. The report forecasted the province's energy demands for the future and outlined the priorities being made to the generation, storage, and transmission of energy types such as solar, wind, hydroelectric, and biogas. An Electrification and Energy Transition Panel has been established for the province to advise the government on the highest value short-, medium- and long-term opportunities for the energy sector to help Ontario's economy prepare for electrification and energy transition.

E-MOBILITY PRODUCTS AND SAFETY IMPLICATIONS

Electrical vehicles (EVs) are a key driver of electricity demand growth, one of the areas that have seen rapid innovation and consumer demand growth. By 2030, one out of every three automobiles sold will be electric, and there are expected to be over one million EVs on the road in Ontario. With an increasing demand for EVs, work will need to be done to ensure that electricity is being used safely by using licensed electrical contractors (LECs) to install EV chargers, and to ensure the home or building's electrical system has the capacity to supply this increased electrical demand.

Electric scooters and e-bikes (micromobility devices) have also become more popular. Many of these products are powered by lithium-ion batteries, and fire departments locally and internationally have seen a rise in lithium-ion battery explosions and fires. Although there is no reliable or systematic data that report on the sale of micromobility devices, the Light Electric Vehicle Association estimates that 880,000 e-bikes were imported to the US in 2021, which is double the number imported in 2020 (NPR, 2023).

5.1 Focus Report: Electrification in Ontario (Continued)

Locally, Toronto Fire Service has reported 33 fires related to batteries from electric bikes, scooters, vehicles, and household devices between January and June 2023. This is compared to 29 incidents reported during the entire calendar year of 2022 (Ceolin and Bond, 2023). Vancouver Fire and Rescue Services report that city firefighters respond to more than 50 calls a year for exploding rechargeable batteries in e-bikes and other devices, and of the ten fire deaths last year in the city, half were caused by rechargeable batteries (Lazaruk and Grochowski, 2023).

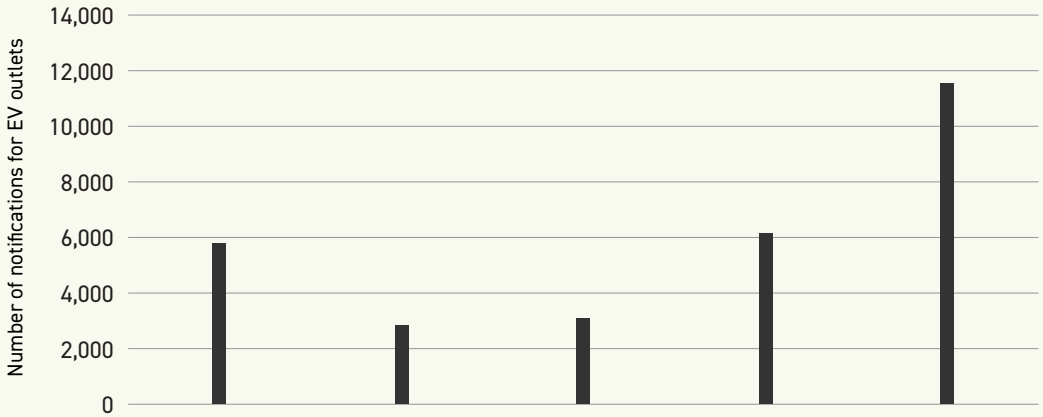
THE ESA'S CURRENT WORK ON EVs AND MICROMOBILITY DEVICES

Since 2021, four separate electric fire incidents related to lithium battery storage and batteries for e-bikes or EV chargers have been reported to the ESA. In these incidents, the ESA's operational staff had the opportunity to review the incident to address electrical safety. No electrical injuries or fatalities have been identified with EVs or micromobility devices.

Compliance with the Ontario Electrical Safety Code

The registration, operation and sale of EVs and microbility devices such as e-scooters or e-bikes is overseen by a number of regulatory authorities. With respect to electrical safety, the ESA has oversight over the requirement for product approval of EV charging devices in Ontario as well as the installation of these EV charging devices and outlets under the Ontario Electrical Safety Code. Ontarians are expected to file a notification (electrical permit) with the ESA for its installation, and the work must be done by an LEC if it is not a homeowner installing in their own home.

NUMBER OF ESA NOTIFICATIONS FOR EV OUTLETS, 2018–2022



2018	2019	2020	2021	2022
5,791	2,835	3,068	6,117	11,543

5.1 Focus Report: Electrification in Ontario (Continued)

Between 2018 and 2022, the number of EV outlets have continued to increase. Notifications peaked in September and November 2021 and 2022. Notifications were highest for Toronto, Ottawa, Mississauga, Brampton, and Oakville. Most of these notifications (78%) were considered changes to existing residential buildings, followed by commercial renovation work (9%). While life and/or property defects for EV outlet notifications were rare (<0.1%), the most common technical defects related to EV outlets were:

- Maximum continuous load;
- Receptacle ratings; and
- Load calculation required.

Improving Knowledge and Awareness on EVs

The ESA administered a survey in February 2023 to a representative sample of the general population to understand the awareness and behaviours around electrical products. Of the respondents who had purchased EV charging equipment in the past 12 months, 76% hired someone to install the EV charging equipment, and 21% hired an LEC. Of the respondents who purchased EV charging receptacles (EV outlets) in the past 12 months, 87% hired someone to install the EV receptacle, and 26% hired an LEC.

Using this information, the ESA has been addressing the awareness and knowledge gaps by creating a communication campaign about EVs that are directed to homeowners and property managers of condominium and multi-residential buildings. This includes:

- Guides and checklists for EV charger installations.
- Fact sheets for homeowners that highlight the factors for a proper installation of EV chargers.
- An episode on the ESA's Grounded in Ontario podcast on electric vehicle supply equipment, which also provides additional information about LECs.

Collaborative Work with Partners

The ESA has been working with the OFMEM to improve data collection on EV fires, and more specifically, fires related to charging equipment and infrastructure. ESA staff are also participating in working groups with local fire departments to discuss and identify potential collaborative work to reduce lithium-ion battery fires, and to promote safety messages regarding their handling and storage.

5.1 Focus Report: Electrification in Ontario (Continued)

Future Work for the ESA

Proper installation and consumer safety for EV connections will continue to be a priority for the ESA, as the number of EVs is expected to grow exponentially in the next few years. To mitigate safety risks, the ESA will expand awareness and education with other partners such as auto dealerships, while continuing traditional and social media messaging to LECs, homeowners, and the general public. For Ontarians installing EV outlets and charging equipment, this means engaging licensed electrical contractors, notifying the ESA about those installations, using approved products and – where appropriate – installing a dedicated circuit or upgrading the electrical panel to accommodate the additional electrical demand. Product safety with micromobility devices will continue to be monitored with the ESA's risk-based approach to harms (Harm Life Cycle).

In 2022, Canada announced that it would take in 500,000 immigrants a year by 2025, bringing in 1.5 million new immigrants in to the country. This population increase will put additional demand on infrastructure and electricity supply in Ontario, as it is anticipated that many will come to the province. Skilled Trades Ontario (STO) anticipates that Ontario will be short approximately 350,000 trade workers by 2025, therefore the demand for skilled trades, such as electricians, will increase. E-mobility is the first wave of electrification that is now refocusing ESA's ongoing efforts toward consumer and public safety. As electrification continues, and extends to distributed generation, increased storage, and efficiency efforts, it will involve a nimble risk-based approach to harms. ESA will also explore further working relationships with local fire departments, skilled trades organizations, and regulatory bodies to improve incident reporting, data collection and safety initiatives that prioritize the safety of workers, and the general public. Through training, ongoing public education, and swift decision making about harms, ESA will maintain focus on building a province where Ontarians can work and play safe from electrical harm.

6.0 Electrical Incident Review

Information about electrical incidents that are reported to the ESA is collected so that a trend analysis can be made. This allows the ESA to understand the current and potential electrical risks, and to assess compliance with applicable legislative and regulatory requirements. An incident review is conducted for all known incidents that are electrical in nature, or have the potential to be electrical in nature, which involve equipment/tools/devices that fall under the jurisdiction of the ESA, and meets one or more of the following criteria:

1. The incident review has the potential to provide the ESA, or the Authority Having Jurisdiction requesting the review, the opportunity to gain a better understanding of the potential harm;
2. Conducting the incident investigation may potentially address key electrical safety concerns in a proactive manner; and/or
3. When the circumstances of the current electrical incident warrant greater surveillance including, but not limited to, situations where newer technology is involved, or the electrical incident fits within the scope of a high-risk harm.

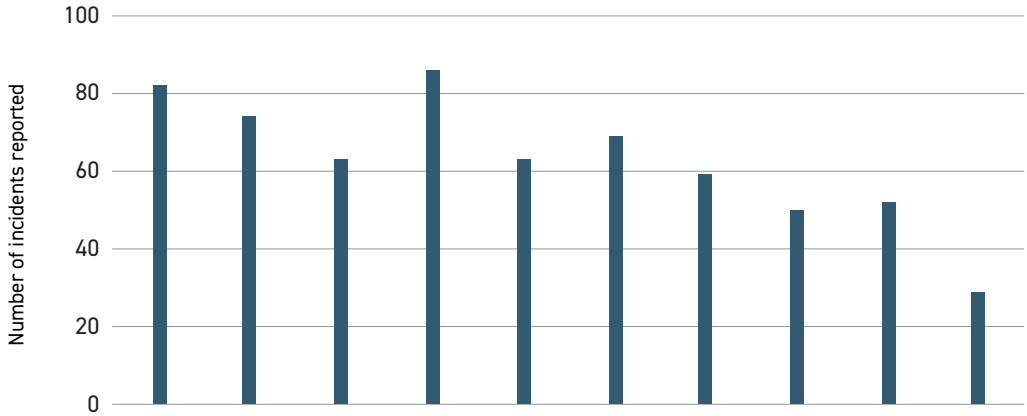
The following information is a summary of what is reported to the ESA's electrical incident database. This includes:

1. General incidents that are serious or non-serious electrical incidents, where the cause and conditions leading to the incident are apparent and straightforward and do not require an in-depth fact-finding inquiry; and
2. Root cause incidents, which are conducted for serious or non-serious electrical incidents where the cause and conditions leading to the incident are complex in that there are multiple causes and/or many conditions present that could contribute to the incident, and the incident requires an in-depth fact-finding inquiry.

Between 2013 and 2022, 627 electrical incidents were reported and reviewed by the ESA. Seven fatalities and 11 injuries related to unapproved consumer electrical products were reported during this time period.

In 2022, 29 incidents were reported to and reviewed by the ESA. This is a 44% decrease from 2021. Thirty-four percent of these incidents involved utility infrastructure, and 31% of these incidents involved powerlines. Fifty-five percent of reported incidents were occupational. Aside from unknown (38%), the most common cause of these incidents was damaged equipment (10%). A list of incidents reviewed from 2013 to 2022 can be found in Appendix C of this report.

1 NUMBER OF INCIDENTS REPORTED TO AND REVIEWED BY THE ESA



Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of incidents reported	82	74	63	86	63	69	59	50	52	29

Source: ESA records

Conclusion

In 2022, 29 incidents were reported and reviewed by the ESA; this is a 44% decrease from 2021.

Acknowledgements

The ESA acknowledges and thanks the Ministry of Labour, Immigration, Training and Skills Development of Ontario (MOLTSD) for providing information, notifying the ESA of occupational electrical injuries, and co-operating with the ESA in the investigation of these incidents.

The ESA thanks the Office of the Fire Marshal and Emergency Management (OFMEM) for its continuing support in providing information on fire-related electrical incidents, partnering with the ESA on stove-top fire initiatives, and notifying the ESA of electrical fire incidents.

The ESA also thanks the following organizations for their support:

- The Office of the Chief Coroner for Ontario for sharing coroners' information on electrical-related fatalities and other deaths in Ontario;
- The Workplace Safety and Insurance Board of Ontario (WSIB) for providing occupational injury information; and
- The Canadian Institute of Health Information (CIHI) for providing information on emergency department visits for electrical injury.

Development of this report was led by a team from the ESA, including Freda Lam, Anna Turkalj, Patrick Falzon, Sean Burger, and Patience Cathcart with assistance from staff of the ESA's Utility Regulations, Product Safety, and Communications departments.

Methodology

The ESA receives data from various resources to compile this report. These include the Office of the Chief Coroner, the MLITSD, the OFMEM, and the WSIB. The ESA then cross-references these data with the coroners' reports, OFMEM's reports, and the ESA's incident review data to ensure accuracy and understanding of the incidents. Data on non-serious incidents are taken as provided.

The Electrical Safety Authority's Data

The ESA uses Ontario population estimates and projections from Ontario's Ministry of Finance (Population Projections Scenarios for Ontario by Age and Sex, 2022–2046) to determine electrocution and death by fire as rate per population, and Statistics Canada labour force characteristics (Table 14-10-0017-01) to determine occupational injury rates.

The 2013 to 2022 electrocution statistics are based on Ontario coroners' reports, ESA records, and MLITSD reports. At time of writing, OFMEM fire fatality information is only partially completed due to pending investigations and confirmations.

Data provided by the Office of the Chief Coroner takes precedence over other data in the event of discrepancies.

The electrocution and electrical burn fatality cases in the report are unintentional in nature. Suicide and deliberate attempts to injure are excluded, as well as deaths by lightning strikes. Electrocution from criminal activities such as theft of power, vandalism, pranks, or vehicles hitting a utility pole are counted as part of the statistics but are not included as part of preventable deaths. Death resulting from a fall but initiated by an electrical contact to a worker would not be recorded as an electrical-related fatality and therefore would not be accounted for in electrical injury data.

This report separates occupational and non-occupational (the general public) incidents for reasons of stakeholder interest and to aid in identifying strategies to reduce harm.

Workplace Safety Insurance Board Data

The WSIB defines lost time injuries (LTIs) as all allowed claims by workers who have lost wages as a result of a temporary or permanent impairment. LTI counts include fatalities. This data is provided by WSIB Enterprise Information Warehouse, as of May 16, 2020, for all injury years.

Allowed LTIs for electrical burns and electrical-related fatalities are based on the following CSA Z795-96 nature of injury codes:

- 05200 Electrical burns;
- 05201 First-degree electrical burns;
- 05202 Second-degree electrical burns;
- 05203 Third-degree electrical burns;
- 05290 Electrical burns, N.E.C.; and
- 09300 Electrocutions, electric shocks.

Emergency Department Visits

Separations data from the National Ambulatory Care Reporting System were provided by the Canadian Institute for Health Information (CIHI). Emergency department separation data used in this report are classified according to the Canadian Modification of the 10th revision of the International Classification of Diseases (ICD-10-CA). The inclusion criterion for the report was the presence of T75.4, T75.0, W85, W86, W87, or X33 codes indicating an electrical injury, including being a victim of lightning, among any of the diagnosis or external cause codes assigned to a record.

Reliability of Data

The numbers and figures in this report are based on current information provided to the ESA as of August 1, 2023. Parts of this material are based on data and information provided by the Canadian Institute for Health Information, and are current as of October 2022. However, the analyses, conclusions, opinions, and statements expressed herein are those of the author, and not necessarily those of the Canadian Institute for Health Information. These numbers may change in subsequent reports due to additional information received after the publication of the report. These changes and explanations will be noted in future reports.

While the information is considered to be true and correct at the time of publication, the author does not warrant that it is free from errors or omission. The ESA prepares this report and makes it available on the understanding that the ESA and its employees and agents shall bear no liability of any kind to users of this report for any loss, damage, costs of expense incurred or arising from the use or reliance on the report, whether caused by any error, negligence, omission, or misrepresentation in the report or otherwise.

Fire Source Data

The OFMEM reports its data by calendar year. Data collection and verification for the year has a one-year lag in reporting in the OESR. The OFMEM does not publish Ontario statistics until all fire departments have reported. The larger departments – Toronto and Hamilton – generally do not finish their filing until June of the following year. At the time of writing, some OFMEM data for 2022 is unavailable and data for 2021 is presented instead. The number of fire incidents and fire fatalities are current as of June 6, 2023, and are considered to be the most accurate at this point in time.

The OFMEM provides information on all fire incidents except for those on federal or First Nations properties. Likewise, information on fire fatalities does not include those on federal or First Nations properties, nor fire deaths in vehicle accidents.

The ESA reports fire incidents based on data provided by the OFMEM to the ESA on:

- All fires where the ignition source was reported as “electrical distribution equipment” or the fuel of the ignition source was reported as “electricity”; and
- Fire incidents and fire fatalities investigated by the OFMEM where the ignition source was reported as “electrical distribution equipment” or the fuel of the ignition source was reported as “electricity”.

In addition, the ESA conducts its own investigation of fires when called by the local fire department to assist or when jointly investigating fire incidents with the OFMEM. The ESA presents data that are consistent with the reporting convention of the OFMEM. Fires are reported by ignition source where the fuel of the ignition source was reported as electricity. It is worth noting that with the exception of fires with distribution equipment and fires identified as electricity as the ignition source by the fire departments or the OFMEM, electricity was not the primary fuel associated with the fire. These situations are illustrated below.

In the OESR, these fires will be categorized into two types of fires. These are:

1. Fires caused by the ignition of combustibles (liquids and solids) around an electrical device, equipment, appliance, or installation, but which were not the direct result of a failure of electrical equipment, devices, electrical current, or arc flash coming into contact with the object. When the primary fuel associated with the fire is not electricity (such as leaving a stove unattended with the oil catching fire), the OFMEM labels these fires as cooking fires rather than electrical fires. In addition, the OFMEM does not recommend using numbers of fire deaths to identify trends and key issues.

   Typically, these types of fires were the direct result of misuse of the equipment, device, or appliance. Some examples of these types of fires are:

   - grease fires on an electrical stove top as a result of cooking left unattended;
   - clothing catching fire while cooking;
   - clothes dryer catching fire caused by the appliance overheating due to improper cleaning of the lint cache; and,
   - combustibles catching fire around heaters or electronics when they are placed too close to the heat source.

2. Fires caused by the ignition of combustibles around an electrical device, equipment, appliance, or installation and were the direct result of the failure of the device, equipment, or installation. In these cases, typical fires are caused by insulation surrounding electrical wiring failing and igniting a combustible in close proximity, or equipment or devices failing, causing them to overheat and later start a fire. Insulation failure could be caused by natural aging, premature aging resulting from overloading, or by mechanical breakdown of the insulation. Fires related to wiring and wiring devices are classified by the OFMEM as distribution equipment. Please note that the definition of distribution equipment in the fire section is quite different than the distribution equipment in the powerline section of the report.

   Examples of these fires are:

   - Carpet igniting caused by heat build-up of an extension cord placed under a carpet. Over time the insulation of the extension cord fails due to foot traffic on the cord, which leads to mechanical breakdown of the insulation.
   - Electrical wires poorly terminated and an installation performed without using any protective enclosure. Arcing occurs over time, resulting in a fire of combustibles around the wires.
   - Fire caused by a failure of a seized motor powered by electricity.

When fire fatality rates are calculated, the ESA displays data as it is calculated by the OFMEM, which uses Statistics Canada population estimates as the denominator. When fire fatality data is added to electrical-related death data, Ministry of Finance population estimates are used as the denominator.

References

Ahrens, M. (2017). Home structure fires. Quincy MA: National Fire Protection Association.

Asgary, A., Rezvani, H., Nosedal-Sanchez, J., and Primiani, J. (2018). Fire and Disasters: Examining Fire Incidents During Major Disasters and Emergencies in Canada. Accessed online at https://ufv.ca/media/assets/criminology/York-University---Examining-Fire-Incidents-During-Major-Disasters-in-Canada.pdf.

Beaulieu, A. Smith, J. Zeng., A., and Pike, A. (2020). The geographic and demographic distribution of residential fires, related injuries, and deaths in four Canadian provinces. Canadian Journal of Public Health, 111, 107-116.

Campbell, R. (2019). Home Electrical Fires. Quincy MA: National Fire Protection Association.

Campbell, R. (2022). Fatal Work Injuries Caused by Exposure to Electricity in 2020. Quincy MA: National Fire Protection Association.

Canadian Centre for Occupational Health and Safety (2023). Electrical hazards shouldn't come as a shock. Health and Safety Report, 16, 10. Accessed online at https://www.ccohs.ca/newsletters/hsreport/issues/2018/10/ezine.html#hsreport-ontopic. Downloaded on August 2, 2023.

Ceolin, C. and Bond, M. (2023). Fires connected to e-bike batteries spike in Toronto amid increased use. CityNews Toronto. Accessed online at https://toronto.citynews.ca/2023/07/04/fires-connected-to-e-bike-batteries-spike-in-toronto-amid-increased-use/#:~:text=Batteries%20from%20electric%20bikes%2C%20scooters,questionable%20safety%20off%20the%20market. Downloaded on August 4, 2023.

Clare, J. and Kelly, H. (2017). Fire and at risk populations in Canada: Analysis of the Canadian National Fire Information Database. Accessed online at http://cjr.ufv.ca/wp-content/uploads/2018/04/Murdoch-University-Fire-and-at-Risk-Populations.pdf. Downloaded on August 1, 2023.

Electrical Safety Foundation International (2022). Workplace Injury & Fatality Statistics. Accessed online at https://www.esfi.org/workplace-injury-and-fatality-statistics. Downloaded on August 2, 2023.

Gentges, JG. and Schleche, C. (2018). Electrical injuries in the emergency department: an evidence-based review. Emergency Medicine Practice, 20, 11, 1-20.

Hall, S. (2023). Home Structure Fires. National Fire Protection Association. Accessed online at https://www.nfpa.org/News%20and%20Research/Data%20research%20and%20tools/Building%20and%20Life%20Safety/Home%20Structure%20Fires. Downloaded on August 1, 2023.

Hamida, MB. and Hassanain, M.A. (2019). Fire safety in the built-environment: a case study in a residential facility. Architecture Civil Engineering Environment, 2, 27-34.

Health Canada (2022). Consumer Product Safety Program Annual Surveillance Report: 2021. Accessed online at https://www.canada.ca/en/health-canada/services/publications/product-safety/consumer-product-safety-surveillance-report/2021.html. Downloaded on August 2, 2023.

Kim, H., Lewko, J., Garritano, E., Moody, J., and Colontonio, A. (2016). Construction Fatality Due to Electrical Contact in Ontario, Canada, 1997–2007. Work, 54(3), 639-46.

Koyfman, A. and Long, B. (2020). The Emergency Medicine Trauma Handbook. New York: Cambridge University Press.

Lazaruk, S. and Grochowsk,i S. (2023). E-battery explosions cause rising concerns in Vancouver and across BC. Vancouver Sun. Available online at: **https://vancouversun.com/news/local-news/e-battery-explosions-causing-rising-concerns-in-vancouver-across-bc**. Downloaded on August 4, 2023.

Littelfuse (2020). Shock: Electrical's Deadliest Act. Available online at **https://m.littelfuse.com/~/media/protection-relays/reports/littelfuse-shock-electricals-deadliest-act-safety-report.pdf**. Downloaded on July 27, 2020.

Ontario Ministry of Finance. (2023). Population Projection Scenarios for Ontario by Age and Sex, 2022–2046. Queen's Printer for Ontario.

NPR (2023). What's driving the battery fires with e-bikes and scooters? Available online at **https://www.npr.org/2023/03/11/1162732820/e-bike-scooter-lithium-ion-battery-fires**. Downloaded on August 4, 2023.

Radulovic, N., Mason, S.A., Rehou S., Godleski, M., and Jeschke, M.G. (2019). Acute and Long-Term Clinical, Neuropsychological and Return-to-Work Sequelae Following Electrical Injury: A Retrospective Cohort Study. BMJ Open, 9:e025990.

Statistics Canada. (2022). Circumstances surrounding unintentional fire-related deaths, 2011 to 2020. Available online at **https://www150.statcan.gc.ca/n1/daily-quotidien/220616/dq220616b-eng.htm**. Downloaded on August 1, 2023.

Statistics Canada. Table 14-10-0017-01 Labour Force Characteristics, by sex and detailed age group, monthly, unadjusted for seasonality (x1,000) 12. Accessed August 1, 2023.

Stickle, B.F. (2017). Metal Scrappers and Thieves Scavenging for Survival and Profit. Palgrave Macmillan [e-book].

Taylor, A.J., McGwin, G., Valent, F., and Rue, L.W. (2002). Fatal occupational electrocutions in the United States. Injury Prevention, 8(4), 306-12.

Yiannopoulou, K.G., Papagiannis, .GI., Triantafyllou, A.I. et al. (2021). Neurological and neurourological complications of electrical injuries. Polish Journal of Neurology and Neurosurgery, 55, 1, 12-23.

Zemaitis, M.R., Foris, L.A., Lopez, R.A. et al. (2023). Electrical Injuries. StatsPearls. Treasure Island FL: StatPearls Publishing, Treasure Island (FL).

This document was prepared by the Regulatory Centre of Excellence of the Electrical Safety Authority.

For queries and additional information, please contact the ESA at:
freda.lam@electricalsafety.on.ca

Electrical Safety Authority

ISSN 2369-4572 (Print)
ISSN 2369-4580 (Online)