Hazard Identification and Risk Assessment Program

Hazard Identification Report 2019

Office of the Fire Marshal
and Emergency Management

Ontario

Contents

Version Control

Version

This is version **3.0** of the HIRA report (issue 3, no revisions).

There have been two previous issues of the HIRA report published in 2003 and 2012, respectively.

Publication of New Versions

The Ontario Hazard Identification and Risk Assessment Report will be published every 5 years. The formal update process begins 1-2 years prior to each publication, to allow time for comprehensive engagement and review of content. A new version is published at the conclusion of this process.

Revision List

Revisions to the current version can occur at any time. The version number should be updated with each revision, by changing the number after the decimal point, and recorded using the table below:

Revision Number (3.X)	Description of change	Date of Revision	Revision Made By (Name)	Approved By (Name)
3.0	original version	2019-05-01	Sarah Thompson	Jon Pegg, Mario Di Tommaso

Publications Management

Copies of the HIRA Report are to be widely distributed among the emergency management stakeholder community, and are to be posted to emergency management stakeholders' websites. This includes the Ministry of the Solicitor General and websites of Emergency Management Ontario (EMO), shown below.

This publication is subject to review and amendments. This process is the responsibility of the office of the Chief, Emergency Management. Stakeholders are encouraged to review and evaluate the HIRA Report as they use it and to submit comments and suggestions.

Until a new Report supersedes this version, amendments may be published from time to time. The amendment form in this section will be used to keep a record of approved amendments.

Comments and suggestions relating to the HIRA Report should be directed to:

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> Ref: Hazard Identification and Risk Assessment Report, 2019
> 25 Morton Shulman Ave, Toronto, ON, M3M 0B1, Canada

E-mail via: AskOFMEM@ontario.ca

Web sites:
- https://www.emergencymanagementontario.ca/english/home.html
- http://www.mcscs.jus.gov.on.ca/english/default.html

Management Review

The original version (3.0) of this report was approved in March 2019, as follows:

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Office of the Deputy Solicitor General Community Safety, and

Office of the Chief, Emergency Management,

Ministry of the Solicitor General

APPROVAL
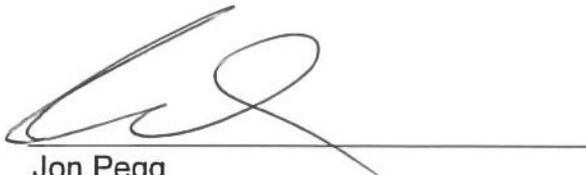
Hazard Identification Report 2019

Ontario Provincial Hazard Identification and Risk Assessment Program

By affixing our signatures below, we hereby approve this document:

Mario Di Tommaso
Deputy Solicitor General Community Safety

Jon Pegg
Chief, Emergency Management

Emergency Management in Ontario

While Ontario is a safe place to live and work, emergencies can happen anywhere and at any time. Emergency management in Ontario consists of a system of mutually supportive partnerships coordinated by the Office of the Chief, Emergency Management. These partnerships and relationships encompass municipal, regional, unincorporated and First Nation communities, as well as Non-profit Organizations across Ontario.

The emergency management office falls within the Ministry of the Solicitor General. Its role is to monitor, co-ordinate and assist in the development and implementation of prevention, mitigation, preparedness, response and recovery strategies to maximise the safety, security and resiliency of Ontario through effective partnerships with diverse communities.

Disclaimer

This document was developed by Office of the Fire Marshal and Emergency Management to provide information to support municipalities and Provincial ministries in the fulfilment of the Emergency Management and Civil Protection Act, Sections 2.1 (3) and 5.1 (2).

The Office of the Fire Marshal and Emergency Management's work is guided by the current best available evidence. The Emergency Management Branch assumes no responsibility for the results of the use of this document by anyone.

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Acknowledgments

Academic and Expert Advisers

Emergency Management Ontario would like to express its appreciation to the following for their expert contribution to the production of the 2019 Ontario Provincial HIRA Report:

- Cody Anderson, Public Safety Canada
- David Etkin, York University
- Matthew Godsoe, Public Safety Canada
- Melanie Goodchild, The Waterloo Institute for Social Innovation and Resilience
- Trina Gorr, City of Ottawa
- Tara Hamilton, Ontario Office of the Fire Marshal
- Sgt. Ray Kalia, Royal Canadian Mounted Police
- Daryl Mahoney, Alberta Emergency Management Agency
- Adam McAllister, Ontario Ministry of Natural Resources and Forestry
- Caroline Nolan, The Ottawa Hospital
- Laurie Pierce, Royal Roads University
- Elizabeth Scambler, Emergency Management British Columbia
- Jennifer Smysnuik, City of Toronto
- Lori Thompson, Alberta Emergency Management Agency

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Ontario Ministries and Responsibility Areas

- Health and Long Term Care
- Agriculture, Food and Rural Affairs
- Attorney General
- Children, Community & Social Services
- Community Safety & Correctional Services
- Economic Development, Job Creation & Trade
- Energy, Northern Development & Mines
- Transportation

- Environment, Conservation & Parks
- Finance
- Government & Consumer Services
- Indigenous Affairs
- Infrastructure
- Intergovernmental Affairs
- Labour
- Municipal Affairs and Housing
- Natural Resources & Forestry
- Tourism, Culture & Sport
- Treasury Board Secretariat
- Francophone Affairs

Federal Government Agencies

- Royal Canadian Mounted Police
- Environment and Climate Change Canada
- Public Safety Canada
- Natural Resources Canada

Special thanks

Special thanks to the many representatives of municipal, regional, Indigenous, and unincorporated communities across the province, for their engagement with and commitment to this project.

Emergency Management Ontario acknowledges its presence on lands traditionally occupied by Indigenous Peoples. You can search the specific treaty area for addresses across Ontario on the digital map of Ontario treaties and reserves: https://www.ontario.ca/page/map-ontario-treaties-and-reserves.

Executive Summary

Purpose

The 2019 Hazard Report provides a comprehensive overview of hazard information relevant to Ontario.

This provides municipal and provincial emergency management coordinators with a baseline and common understanding of hazards. This supports creation of HIRA and fulfilment of the Emergency Management and Civil Protection Act.

Hazard Inclusion

Hazards were included based on specific criteria. First, hazards must meet the following definition:

> *"A phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage."*
> - *English-French Glossary of Terms, Emergency Management Ontario*

The hazard must also have the potential to meet one or more of the following criteria:

- People could be effected beyond the community's capacity to respond.
- There could be significant damage or interruption of normal processes, such that affected communities must use extraordinary or emergency resources.
- A declaration of emergency or activation of the community Emergency Control Group is possible.

Hazard Triggers

Hazards can be triggered in a variety of ways, though generally as one of the following:

- **Ecological:** Situations caused by the interaction of soil, water, climate, or land forms with human social, economic, industrial or other processes.
- **Accident:** situations where reasonable care is taken, and conduct follows or exceeds standards, but human action or error results in damage or harm.
- **Malfunction:** failure of equipment or machinery) to function normally or satisfactorily, resulting in damage, destruction or harm
- **Planned Outage:** a period when a service is not available or when equipment is closed down, resulting in damage, destruction or harm
- **Intentional attack:** Intentional damage, destruction or harm.
- **Negligence:** failure to use reasonable care, or conduct that falls below established standards, resulting in damage, destruction or harm

Hazards themselves can also trigger secondary hazards and cascading effects.

Hazards

The Hazard Report 2019 contains information profiles for hazards. Organized into 9 sub-sections labelled A-I:

A. Agricultural & Food Emergency
Farm Animal Disease
Food Contamination
Plant Disease or Infestation

B. Environmental
Avalanche
Drought or Low Water
Earthquake
Erosion
Extreme Cold
Extreme Heat
Flood
Fog
High Wind
Hurricane
Land Subsidence
Landslide
Lightning
Thunderstorm
Storm Surge
Tornado
Wildland Fire
Winter Weather

C. Extraterrestrial
Space Object Crash (Any)
Space Weather

D. Hazardous Materials
(Fixed site or in transport)
Chemical Release
Nuclear (Facility)
Oil or Natural Gas Release
Radiological Emergency

E. Health
Water Quality
Infectious Disease
Substance Use & Overdose

F. Public Safety
Active Threat
Civil Disorder
Crowd Disaster
Geopolitical Pressures
Sabotage
CBRNE
Cyber Attack
Electromagnetic Pulse (EMP)

G. Structural
Dam Failure
Fire/Explosion
Mine Emergency
Structure Failure

H. Supply & Distribution
Communications Failure
Electrical Energy Failure
Food Shortage
Medical Drug, Blood Product or Supplies Shortage
Petroleum Product Shortage
Water or Wastewater Disruption

I. Transportation
Aviation
Marine
Public Transit Systems
Rail, Light Rail, Subway
Road and Highway

Foreword

Numerous and interconnected personal, social, political, economic, and environmental factors influence vulnerability and exposure to hazards, and therefore risk.

Assessment of this risk attempts to discover if people and assets are able to withstand the negative consequences of a hazard, and for how long.[1]

This foreword contains a summary of some key factors to consider in relation to all hazards described in this report. While these themes are not the specific responsibility or purview of Emergency Management professionals, they help to underscore those people and assets at greatest risk from hazards.

Anyone or any community asset can be vulnerable or exposed to risk, and risk can shift and change over time. Understanding these themes therefore provides important insight into hazards and their outcomes.

Inter-Jurisdictional Crises

Any hazard could require joint management and response efforts between and across jurisdictional borders.

Most hazards cross boundaries of one type or another, including physical land barriers, political boundaries, or boundaries of responsibility or mandate. Four main types of cross-jurisdictional situation are:

- **International Emergency:** an emergency that affects Canada and at least one other country that requires joint management and response efforts between the countries.
- **Provincial/Territorial Emergency:** an emergency that originates in another province or territory but affects Ontario, and that requires joint management and response efforts between the affected Provinces/Territories.
- **Ontario inter-provincial Emergency:** an emergency that originates in Ontario but affects other provinces or territories. This requires joint management and response efforts between the affected Provinces/Territories.
- **Ontario intra-provincial emergency:** An emergency that crosses jurisdictional boundaries (perhaps political or other) but is physically contained within the province.

Challenges to planning across borders are often time-consuming to coordinate between multiple jurisdictions. They can result from physical distance, issues of jurisdictional

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[1] Humanitarian Coalition of Canada, 2019. https://www.humanitariancoalition.ca/what-is-a-humanitarian-emergency

overlap or gaps, conflicting policies or legislation, presence of divergent agendas, and language barriers.

Some challenges of cross-jurisdictional emergencies include:

- Notification and Reporting
- Cross-Border Movement of Equipment and Materials
- Cross-Border Movement of Personnel in support of the emergency
- Cross-Border evacuations and patient transfers
- Responder Training and Qualification/Certification Requirements
- Liability and Insurance Issues
- Occupational Health and Safety Legislation
- Language Considerations
- Security Provisions
- Inadmissibility (international borders)
- Mutual assistance plans

Ontario may be asked to provide mutual assistance via the Operational Framework for Mutual Aid Requests (OFMAR) if a crisis were to occur in another Canadian province or territory and exceed that jurisdiction's ability to respond.

International emergencies affecting Ontario are most likely to occur between Canada and the United States, given their proximity and the relative isolation of North America. Cooperation between Canada and the United States on emergency management was first formalized in 1986 by signing the agreement between Canada and the Government of the United States of America on Cooperation in Comprehensive Civil Emergency Planning and Management[2]. This original agreement was superseded in 2009 by the U.S.-Canada Memorandum of Agreement on Emergency Management Cooperation. This agreement was ratified by Congressional Joint Resolution (S.J. RES. 44) in early 2013. Central and Prairie regions of the United States and Canada entered into this agreement to facilitate cross border emergency management assistance through mutual aid. At a meeting of stakeholders in July 2013, the agreement was adopted and transitioned into the Northern Emergency Assistance Compact (NEMAC).

Social risk factors

An important consideration for emergency managers is to recognize the deeply rooted social risk factors within our society. The goal of the emergency manager should not be to solve the issue, but to acknowledge its existence and connect with those in the community who are already immersed in a given population.

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[2] Compendium of U.S.-Canada Emergency Management Assistance Mechanisms, 2016

Safe and affordable housing, employment, physical and mental well-being, and social inclusiveness are just some of the fundamental human needs that contribute to the health of individuals, families, and communities.

There are numerous social risk factors, such as poverty, homelessness, unemployment, substance abuse, and mental health issues that are pertinent to understanding human vulnerability to hazards in Ontario. More importantly, these issues can affect specific groups of people disproportionately and exacerbate their vulnerability levels. These groups include, but are not limited to, those who are homeless, unemployed, the elderly, Indigenous peoples, ethnic minorities, and others.

Engagement with local social services agencies, community outreach organizations, and non-profit organizations (including schools and faith-based organizations) to establish a network of services that can be provided to support these and other vulnerable groups is vital.

More information about how social risk factors can be included in risk assessment is contained within Annex 'B' of the companion document to this report, 'HIRA Methodology Guidelines 2019'.

Critical infrastructure

It is vital for emergency planners to understand the complex web of critical infrastructure owners, operators, providers and other stakeholders in and around their communities to reducing and/or mitigate hazard risk.

Aging infrastructure and historic underinvestment have led to some gaps between actual and needed infrastructure in Ontario and Canada, which puts pressure on this infrastructure to meet the growing needs of the population. Aging and poorly maintained infrastructure can expose owners, operators and those living or working in the vicinity of the infrastructure to risk.

The disruption of critical infrastructure and other community assets is often a key threshold or criteria for emergencies. The provision of key services from wastewater treatment to healthcare are crucial to the ability of the community to support its' residents, to withstand the effects of hazards, and to respond effectively. This is especially true in the case of essential services such as the provision of potable water, as well key dependencies such as electrical power.

There are three distinct key components of Critical Infrastructure, as follows:

- **Asset at Risk:** The people, property, operations, relationships or environments, which could be damaged in the event of a disaster or emergency. E.g. a Dam structure.

- **Hazard:** A process, phenomenon or human activity that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage. E.g. Full or partial collapse of a structure, such as a dam.
- **Impact:** The damage and effects resulting from an emergency or disaster events. E.g. human life lost or injury.

An 'asset at risk' is not the same as a hazard. For example, a dam does not pose a threat to people or property. However, a damaged or out of service asset can pose a threat either directly or indirectly. Scenarios ranging from physical damage to service disruption can create hazardous conditions.

Digital networks

Highly complex digital networks have produced highly connected critical infrastructure, which can result in effects that extend beyond the typical limits of one structure or system. For example, domestic Canadian internet communication passes through the United States before returning to Canada, which can expose the data to legal and constitutional issues and expose the network to outages originating beyond Canadian borders.

The two largest and more pervasive digital networks are the internet and cellular communication networks, respectively. The Internet carries a vast range of information resources and services along cables. These data routes are connected by high-capacity network centers that exchange traffic between the countries and continents. Wireless communication network, also known as the 'cellular' or 'mobile' network, is a digital connection where the last link is wireless.

An outage of these essential services can be disruptive even if down for a short time. While these preparedness, response and recovery initiatives are encouraged and often regulated, this is not a guarantee that digital systems will be unaffected by an emergency. Interdependency between digital networks and the power supply as well as other critical infrastructure sectors can further compound the risk. Almost every sector depends on telecommunications in order to provide essential services, and in turn, digital networks require power.

In light of the interconnected nature of Canada's critical infrastructure, partnerships are required among government and critical infrastructure stakeholders, including owners and operators, law enforcement and the research and development community.

Having a strong understanding of digital networks and the potential impacts of outages, as well as the effects of a local emergency on the wider digital network, are important aspects of emergency planning and preparedness.

Climate change

Our climate is changing, with more frequent and extreme events like flooding, forest fires, ice and wind storms, dry land and warming winters. The effects of climate change increase the risks to our health and personal safety, costs to homes and businesses, economy and society.

Regardless of the cause, changes in weather patterns already impose risks to life, property, and the natural environment in Ontario that cannot be ignored. We need to understand current and future vulnerabilities and risks in order to prioritize our actions because some risks will be greater than others. Hazard identification and risk assessment can help us set priorities and direct our efforts towards areas where they will be most needed.

Climate change has already caused damage to Ontario's people, environment, industry and business.. Emergency management programs ideally integrate climate change adaptation measures to ensure integrated programs, appropriate response mechanisms, suitable tools and governance structures.

Ecosystem disruption

An ecosystem is a dynamic complex of plant, animal, and microorganism communities and the nonliving environment interacting as a functional unit. As elements of the ecosystem are degraded, those functions can be lost.

People are part of, and receive substantial benefits from, ecosystems. These benefits are often termed 'ecosystem services'. Such systems and services are closely linked with social and economic wellbeing. The government of describes ecosystem services as 'the basis of human lives and economies' because people depend on a healthy environment for life (e.g., by providing air, water, food, raw materials, medicines), security (e.g., by mitigating extreme weather events, spread of vector-borne diseases), and quality of life (e.g., by supporting mental and physical health, cultural identity, recreation), among many others.

Many of the defining characteristics of plants and animals, including where they live, seasonal behaviors, potential for coexistence with other species, and relative risk to disease and extinction, are changing in response to climatic conditions. Often these responses are complex, making it difficult to predict large-scale, long-term impacts[3].

With ever-increasing demand for natural resources and food supply, and given ongoing human modification of the environment, such factors will continue to put extreme pressure on the environment and the ecosystems it contains.

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[3] National Center for Ecological Analysis and Synthesis (NCEAS), 2017