EPC Electronic Disaster Database and Its Characteristics

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Abstract

The purpose of this report is to explain the development and use of the Emergency Preparedness Canada Disaster Database and the Browser Program. The report includes a graphical presentation and analysis of the information contained within the database at the present time. The Emergency Preparedness Canada Disaster Database was created in 1990 and has since undergone several updates and revisions. Sections of this report are based on an earlier document EPC Disaster Database and Its Characteristics, Technical Report 92-1 (Provencher, 1992).

Disclaimer

Where there has been no finding of fact by a court of law in a criminal, civil, or administrative proceeding, the facts set out in this report are alleged facts.

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1.0 Background

In June 1990, Emergency Preparedness Canada initiated a project to create a database of Canadian disasters. The project was inspired by the international Disasters Database produced by the Centre for Research on the Epidemiology of Disaster (CRED), based at the Catholic University of Louvain, Belgium. The CRED database is sponsored by the International Federation of Red Cross and Red Crescent Societies, the World Health Organization, the United Nations Department for Humanitarian Affairs, the European Community Humanitarian Office and the International Decade for Natural Disaster Reduction. It contains approximately 10,500 records of disaster events from 1900 onward.

The Canadian version is the *Emergency Preparedness Canada (EPC) Disaster Database*, with the abbreviation *EPC Disaster Database*, a list of disasters which have occurred in Canada since 1900. The first draft of the Canadian database was similar to the CRED database in format; however, it has evolved through the years to become more reflective of the Canadian situation and needs.

The information contained within the database has also evolved to become more accurate, consistent and complete. In 1990, the Communications Directorate of EPC contracted the task of producing a list of disasters that have occurred in Canada within recorded history. The resulting list, entitled Significant Disasters in Canada (Anon., 1995), along with the information already contained in the CRED database, comprised the first draft of the Canadian database. Since then, the database has been revised by several employees of the Office of the Senior Scientific Advisor (OSSA) of EPC, with significant contributions from other government departments and the EPC regional offices. A software program called a Browser was developed simultaneously. It is a useful tool to filter through the hundreds of disaster records to find only those records of interest to the researcher.

The aim of OSSA in the spring of 1997 was to have an up-to-date and comprehensive database to provide to the public as soon as possible. The database, as embedded in the Browser program, will be made available to all interested parties by request to Emergency Preparedness Canada and will also be made accessible over the Internet through the Emergency Preparedness Canada site: **http://hoshi.cic.sfu.ca/epc/pub/en_publist.html**

2.0 Introduction

This document describes the electronic database of Canadian disasters that have occurred since 1900, and includes a discussion on Canada's disaster history as revealed by the data. The database information includes details of the time, location, type and severity of each disaster. The information in the database can be sorted and displayed through a user-friendly program called a Browser.

Sections 3.0 to 5.0 outline the technical aspects of the database. Here, the scope, structure and use of the EPC Disaster Database and Browser program are explained, beginning with the definition of a disaster. The aim of Section 6.0 is to discuss the challenges and observations of those who have worked to create a consistent and useful database. Section 7.0 is a summary and evaluation of the information currently contained within the database, including several graphs and discussion of the trends observed.

The author assumes that the reader has no prior knowledge of the database, though an understanding of the basic terms and functions of database software is useful.

2.1 Use of the Data

The EPC Disaster Database is easily accessible and is intended for a wide range of users. Some examples of its uses include the following:

- research on historic trends of events in Canada;
- comparison of the occurrence of different types of events;
- comparison of natural versus human-caused events;
- investigations of the geographical regions in which certain events occur; and
- as a link to further event-specific information via the references.

The focus of disaster management has shifted from response after the event to the mitigation of hazard vulnerability and reduction of loss through preparedness. The notion that catastrophes are "acts of God" and beyond the control of humans is changing. "New technologies in communications, information-gathering, processing, and monitoring of hazardous events now allow the conception of mitigation and management strategies previously not undertaken by public service agencies" (Comfort, 1988). It is intended that the database be useful both as an educational tool and resource to emergency planners in their attempts to reduce disasters.

3.0 Definition of a Disaster

For the purpose of a database, a clear definition of disaster is required to determine which events qualify for inclusion. Each entry must meet the criteria of the definition in order to maintain consistency. Various sources offer the following definitions:

"[A disaster is] a sudden calamitous event producing great material damage, loss, and distress."

-- Webster's Third New International Dictionary

"[A disaster is] a great or sudden misfortune."

-- The Concise Oxford Dictionary, 8th Edition

"A disaster, by definition, is an unscheduled, overwhelming event that causes death, injury, and extensive property damage."

-- Rubin *et al*. (1985)

"Very recently, the Dutch Parliament passed a new Disaster Act. It defines disaster as an event that endangers the life and health of many people or causes severe harm to material interests, and that requires coordinated efforts on the part of agencies and organizations from various fields of expertise."

-- Uriel Rosenthal *in* L. Comfort (1988)

"[Disasters are] sudden unplanned disruptions of the social order"

-- L. Comfort (1988)

For the purpose of the Canadian database, questions remain as to the specific limitations on the definition: How 'great' must the loss or damage be for the event to be considered a disaster? Is loss or damage measured in terms of dollars, lives, injuries, or human trauma? Can an event be a disaster when no one is killed? Is it possible that there be positive outcomes of a disaster? Should Canada attempt to declare a similar definition to those of other countries, even though the geographic, economic and political situations may be different?

These questions require significant reflection and have been debated throughout the development of the database. Opinions differ among natural scientists, sociologists, economists, and those who have been personally affected by a disaster. The criteria for entry into the CRED database is ten deaths, and/or 100 affected, and/or an appeal for assistance (The International Federation of Red Cross and Red Crescent Societies, 1996). The number of deaths seems arbitrary, and the meaning of 'affected' is unclear. Significant Disasters in Canada, EPC's initial attempt of creating a Canadian database, defined significant disaster as "an unforeseen mischance resulting in widespread dislocation affecting everyday life and/or of sufficient seriousness as to warrant present-day coverage by national media." However, this definition could give unwarranted credibility to the media in its ability to interpret or describe disasters. Ultimately, no definition will be satisfactory to all.

Disasters are human events, often deeply and permanently touching peoples' lives. It is difficult, if not impossible, to quantify the economic and sociological impacts on the people affected. It is not our intention to trivialize disasters by simplifying them to a list of numbers and brief statements. Rather, it is part of an on-going effort to educate and communicate with the public.

After much deliberation, the following definition was chosen:

A disaster is an interruption in time and space of normal processes causing death, injury or homelessness, economic or property loss, and/or significant environmental damage. The interruption is beyond the coping capacity of the community and/or is beyond the assumed risk factors of human activity. Assumed risk is inherent in most human activity such as transportation and handling of dangerous goods. The interruption precludes war.

The community is able to cope with an event if and only if

- ***there is no requirement for assistance from outside the community,***
- ***the community can assume the cost of the event, and***
- ***normal community activity is not disrupted because of the event.***

Note that with this definition, it is not essential that deaths occur in order that an event constitute a disaster. Also, there is no minimum economic loss to qualify the event as a disaster, as communities have different financial resources available for protection and recovery. The caveat of the community coping with an event is meant to override any preset dollar figures. The concept of community coping viz-a-viz emergencies is discussed in several sources (Anon., 1992; Anon., 1994). A. Mourey (Anon., 1996) describes an emergency as a situation in which "people who are caught up in the process depend on the will of others to help them." This criteria seems more reasonable than setting a dollar amount.

Certain human activities involve levels of risk acceptable to society, but with possible loss of life or injury as a consequence. This factor results in a bias in the choice of events included in the database, where natural phenomena causing death or destruction are always considered disasters, while human-caused events are more strictly judged. Although the loss of life in one type of disaster is no more or less tragic than in another, there is an element of surprise or helplessness in natural events. Thus, human-caused events causing death or injury, namely transportation, civil unrest, mining accidents, fires, and hazardous chemicals, are not included in the database unless they were significant enough to disrupt a community.

4.0 Structure of the Database

The software used to create the database is Microsoft Access, Version 2.0. The database consists of one table: *SIGDIS* (significant disasters) which currently contains 662 records.

Each disaster comprises one record of the table. The information describing each disaster is placed in the following fields: *NF, PE, NS, NB, QB, ON, MN, SK, NW, AB, YU, BC*. These fields refer to the provinces and territories as shown in Table 1; they were created in response to the problem of identifying the location of disasters which affected more than one province or territory. Each field is of type YES/NO, where "0" indicates that the province/territory is not affected by the disaster and "-1" indicates that it is affected.

Table 1: Province Codes

Code	Province
BC	British Columbia
AB	Alberta
SK	Saskatchewan
MN	Manitoba
ON	Ontario
QB	Quebec
NB	New Brunswick
NS	Nova Scotia
PE	Prince Edward Island
YU	Yukon
NF	Newfoundland
NW	Northwest Territories
SV	Several

MAGNITUDE
This field displays the magnitude of an earthquake on the Richter scale; for all other disasters, it is left as a zero.

CATEGORY
This field displays the disaster reference according to its source type, where the types are as listed in Table 2.

REFERENCE
This field contains the detailed reference information.

Table 2: Information Sources

Number	Type of Information Source
1	Emergency Preparedness Canada (EPC), including Regional Offices
2	Government of Canada, not including EPC
3	Provincial Governments
4	Non-governmental books, reports
5	Insurance Companies
6	Press
7	Other/Unknown

DISNO
This field contains the unique seven digit disaster number of each event which serves as the key of the database. The first four numbers are the year of the event, the last three are chosen to order the events chronologically and must be unique to the entry. A key field allows for advanced functions to be performed on the data, such as links and queries.

DSTRIKE
This field displays the date on which the disaster struck. Some entries show only the year, or month and year, due to the nature of the event. For example, droughts, floods and cold fronts may develop gradually and be associated with a season or period of time. In other circumstances, the reference material did not provide a specific starting date of the event.

PROVINCE
Table 1 shows the code assigned to each province and territory. When more than one province/territory is affected, the code SV, for several, is placed in this field, and the provinces affected are assigned "-1" in their corresponding individual field.

TYPE
The categories of disaster are shown in Table 3; the appropriate code is placed in this field.

DEAD
If the exact or estimated number of deaths is known, it is displayed in this box. Otherwise, the field contains a zero.

Table 3: Types of Disasters

Code	Disaster Type
AM	Accident-Mining
AO	Accident-Other
AT	Accident-Transportation
AV	Avalanche
CU	Civil Unrest - Terrorism
CW	Cold Wave
DR	Drought
EP	Epidemic
EQ	Earthquake
FF	Forest Fire
FI	Fire
FL	Flood
HC	Hazardous Chemicals
HU	Hurricane
HW	Heat Wave
LS	Landslide
OT	Other
ST	Storm
TO	Tornado
TS	Tsunami

EVACUATED
If the exact or estimated number of people evacuated from the area during a disaster is known, it is placed in this field. Otherwise, the field contains a zero.

DOLDAM
If the exact or estimated value of the damage in millions of dollars is known, it is placed in this field. Otherwise, the field contains a zero. Note that the values shown are estimates given in the dollar value at the time of the disaster, and inflation is not taken into account.

INJURED
If the exact or estimated number of injuries is known, it is placed in this field. Otherwise, the field contains a zero.

COMENG / COMFRA
These two fields allow for comments in English and French, respectively. Where possible, they include a brief outline of the disaster and a qualitative description of the resulting damage.

PLACE NAME / LAT / LONG
A location of the disaster is included to assign latitude and longitudinal coordinates to the disaster. For some records, this indicates a central or approximate location, as the disasters may cover large regions.

5.0 Browser

The Browser program was created by Stan Isbrandt, Directorate of Evaluation and Analysis (now OSSA), to make the database 'user-friendly' and accessible. The Browser provides a clear and simple interface to guide the user through queries on the data. The Filter command allows the user to choose location, time period and type of disaster. By clicking on the box labelled 'Filter,' the user is asked to indicate his or her choice of the three variables, and the Browser retrieves only those records of interest. The records are displayed one at a time, but the user may view several records on a page by selecting 'Preview and Print.' This function also shows how many records met the criteria specified by the Filter, and printing the results is optional.

Structure of the Browser Screen:

English / French choice box
The user has the choice of viewing the information in English or French.

Province Affected
Each province has its own box which contains a check-mark when the province is affected by the disaster being displayed at the time.

Province
This box displays the province in which the disaster occurred. When more than one province is affected, it displays Sev/Plus which denotes several provinces. To see which provinces are affected, refer to the Provinces Affected boxes.

Disaster Type
The Disaster Type box indicates the type of disaster being displayed. There are currently twenty different types of disasters in the database, as listed in Table 3.

Magnitude
For earthquakes only, the Magnitude box displays the value of the magnitude of an earthquake on the Richter scale. Note that the magnitude is also included in the comment box for convenience.

Date / Deaths / *Injured* / *Evacuated* / *M$ Damage* / *Disaster Number / Information Source*
These correspond to the descriptions in Section 4.0, where *Date* is analogous to DSTRIKE, *Disaster Number* to DISNO and *M$ Damage* to DOLDAM, and *Information Source* to

REFERENCE.

6.0 Complexities of Data Selection

Creating a database of this nature presents certain complexities regarding choice of categories and criteria for selecting data.

6.1 Identification of events by type

It was important that database categories be well-defined and clear, but not so constrictive that it would be difficult to classify events. Consequently, twenty distinct categories were chosen, under which events were classified according to their primary cause. For example, a hurricane that causes flooding and wind damage is only labelled as HU. However, some overlap was unavoidable, such as the Newfoundland earthquake/landslide/tsunami of 1929, included in all three categories.

If, in the future, the database becomes much larger, or users request that it be more specific, the categories could be segregated further. For example, the category "accidents-transportation" could be broken down into marine, air and land transportation disasters; "hazardous chemicals" could be separated into oil spills, road spills and explosions, etc.

The category "storms" includes a variety of events. The types currently included are blizzards, hailstorms, snowstorms, freezing rain, thunderstorms, and wind storms. To segregate by type would be complicated, as many events are combinations of the above, i.e. rain and hail, freezing rain and wind. Suggestions include the segregation of blizzards and hailstorms, or division by winter and summer storms. At this time, it is not considered practical to break down storms by type, as most storms now include a description in the comments section.

There are currently only three entries which do not fit into any category and, hence, fall under the classification "other." These include the following events: radiation sickness from a fluorspar mine; the Thalidomide birth defect tragedy; and an army worm infestation on the prairies.

6.2 Criteria for data selection

Where no deaths, injuries or property losses are reported, it is difficult to determine whether the disaster, such as a storm, caused serious disruption to the community. Terms are often used to describe the damage, such as "severe" or "extensive," but it remains unclear whether or not the community was able to cope with the disaster without support. In these cases, a judgment call was made, and the benefit of the doubt was to include the event.

Although the disaster database precludes war, events falling under the category "civil unrest-terrorism" have been included, as they create a disruption to the community and often require outside help (eg. military assistance). Events which may have begun as peaceful civil protests can become disasters if they escalate into violence and threaten the safety of the surrounding community. The events in this category include bombings, massacres, hostage takings and strikes.

Although numerous strikes may occur each year in Canada, they are only included when they have caused death, injury, and/or significant property damage.

Earthquakes with a magnitude of 5.0 or higher on the Richter scale are included in the database regardless of death or damage. This size of earthquake in a populated area is felt by the public and may cause minor to serious damage to communities.

Some events occur over a large geographical area and/or interval of time. Floods are often described in terms of the period of time in which they affected a large area, such as southern Manitoba, Lower Fraser River Valley, or the Maritime provinces. The flood may have comprised several floods of different water bodies in a general region, but it is treated as a single event. When a flood severely affects more than one community, each location is assigned a record, and the comments describe how each was affected.

The information in the database is only as reliable as its source. The International Federation of Red Cross and Red Crescent Societies (1996) acknowledges that "...most reporting sources have vested interests, and figures may be affected by socio-political considerations." Petak and Atkisson (1982) state that "...media exaggerations of disaster impacts on a community apparently increase as a function of distance from the disaster site." Where contradicting information regarding a certain event was found in two or more references, government sources were used over private organizations or the press, when possible. Although effort was made to obtain the most accurate details for the database, it is possible that errors exist. Also, estimates are exactly that - an approximation of a figure.

The latitude and longitude coordinates are meant to depict approximate locations or focal points of the disaster. Cold waves, heat waves, floods, and droughts often affect large geographical areas, as reflected in the locations assigned to these types of disaster, such as "British Columbia to Quebec," or "across Canada." In these cases, focal points were chosen in order to be able to integrate the events into a geographical information system at a later date.

7.0 Data Analysis

The large number of disasters summarized in the database proves that Canada is not immune to disasters, natural or otherwise. Recent floods in southern Manitoba and the Saguenay region of Quebec have shown what devastating losses disasters can inflict on Canadian society. Tornadoes in Edmonton in 1987 and in Regina in 1912 resulted in great loss of life, injuries and property damage; landslides in Quebec, Alberta and British Columbia have devastated entire communities; blizzards occur in all parts of the country and can paralyse movement and communications; Hurricane Hazel reached Ontario in 1954 to cause serious destruction; earthquakes on the West Coast have the potential to wreak great destruction; and releases of hazardous chemicals have required the evacuation of thousands and serious clean-up operations (Anon., 1991).

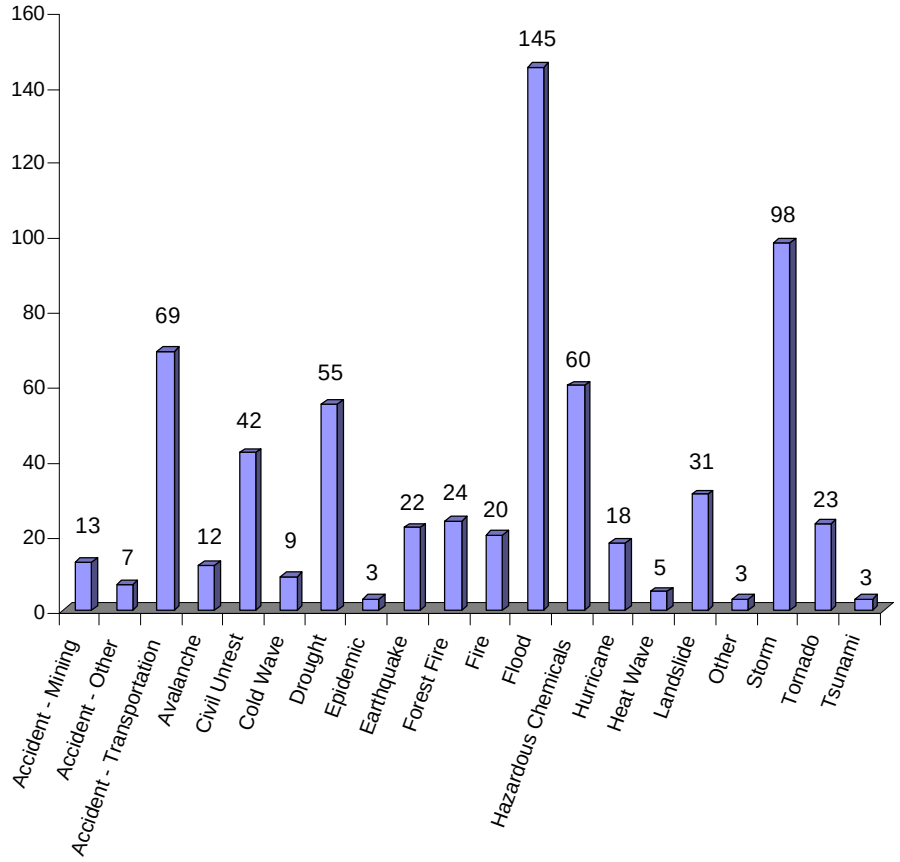
The following sections examine the data in an attempt to reveal trends of Canada's disaster history. The results are discussed, and possible gaps or inconsistencies in the data are identified.

7.1 Types of disasters

Figure 1 shows the number of each type of disaster reported in the database.

Figure 1: Number of Disasters according to Type

The most common type of disaster occurring in Canada this century is flooding, followed by storms. Transportation accidents, hazardous chemical disasters, and droughts follow with similar numbers of records.



As explained in Section 6.2, it is often difficult to determine whether or not an event should be considered a disaster, and floods are no exception. The information sources frequently use descriptions such as “significant damage,” and some records are included regardless of the

uncertainty. However, even if the ambiguous records were removed, flooding would still be the most common disaster. The fact that detailed flood records exist, underlines the significance of flooding in Canada.

Figure 2 compares the number of natural with human-caused disasters. Human-caused disasters, including all accidents, hazardous chemicals, civil unrest, fire, and "other" categories, comprise 32% of the total disasters.

Figure 2: Natural versus Human-Caused Disasters

7.2 Location of events

Figure 3 displays the number of disasters which have occurred in each province and territory. The total number of disasters indicated on this graph exceeds the total number in the database, as disasters which affected more than one province are depicted for each affected province.

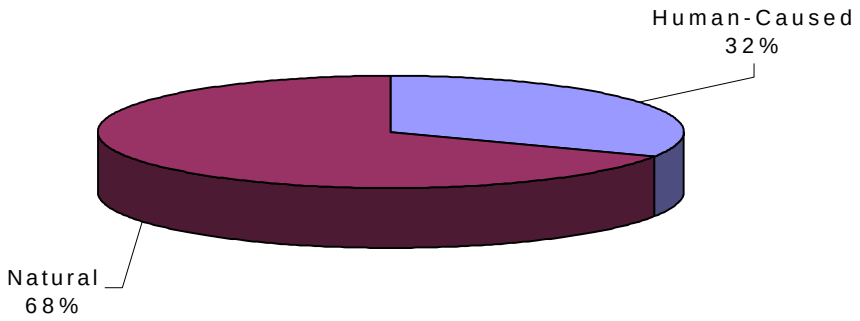
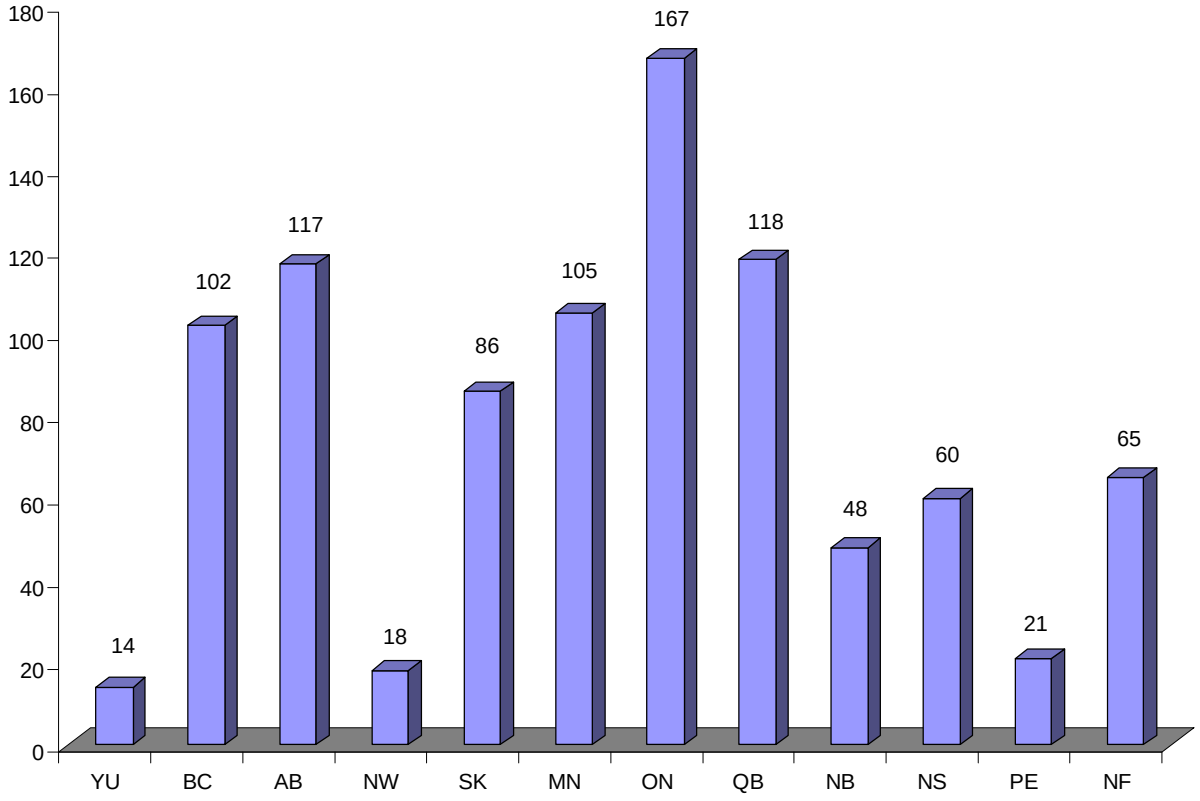


Figure 3: Disasters by Province



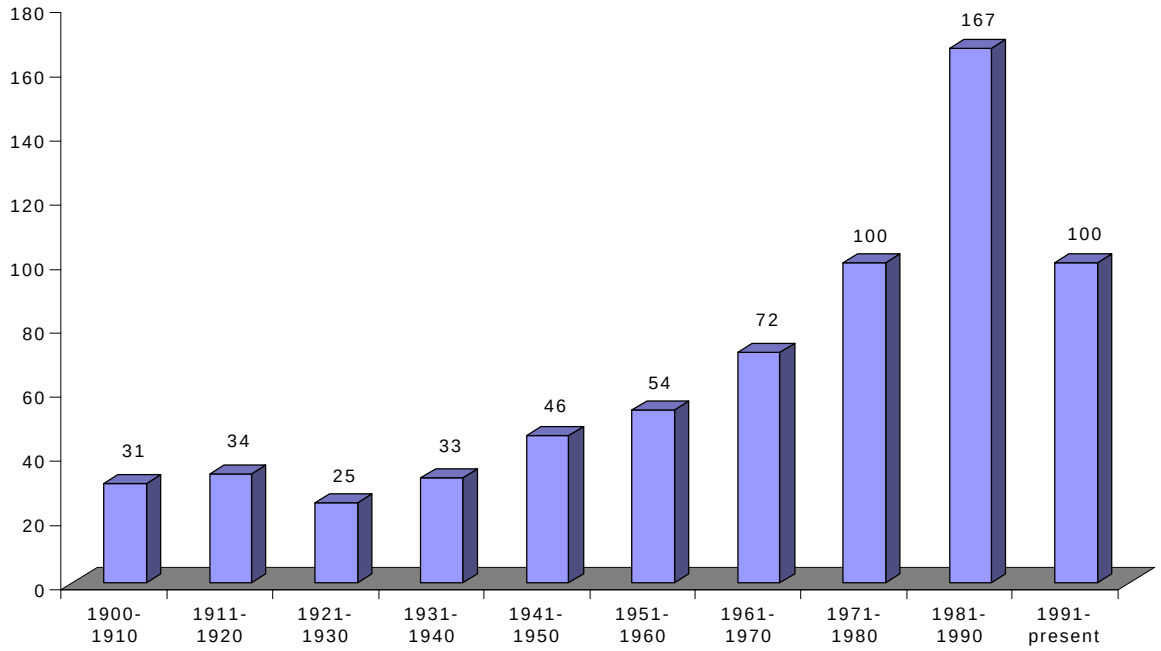
Canada's vast land area exposes Canadians to geophysical hazards and a wide variety of weather events (Anon., 1991), but in order for a natural phenomenon to become a disaster, it must impact a population. Human-caused disasters will obviously occur more frequently in highly and densely populated regions. It is no surprise, then, that the provinces with the highest population and population density also experience the greatest number of disasters.

Ontario has experienced the greatest number of disasters, with Quebec and Alberta following. For further detail, Appendix A contains graphs of the types of disaster which have occurred in the individual provinces and territories.

7.3 Disasters over time

Figure 4 displays the number of disasters which occurred in each decade of the century. The final time period includes disasters from 1991 to the time of this report, July 1997, approximately half a decade.

Figure 4: Number of Events per Decade



The differences in the types and frequency of disasters throughout history are, in part, a reflection of a changing society. Increases in transportation, urbanization and industry, i.e. the built environment, all contribute to the rise of disasters in Canada.

As Perry and Mushkatel (1984) explain:

> "With industrialization and the growth of technology, the presence of man-made disasters is increasingly felt. The quest for energy has brought, for example, coal mine disasters, risks from the transportation of volatile chemicals such as liquid natural gas, gasoline, and liquid petroleum gas, and finally the growth of the nuclear power industry with the promise of a clean, renewable energy source and the potential of devastation. In creating dams and reservoirs for agriculture, we introduce new sources of flood threat."

However, the growth of technology also provides humankind with the ability to predict disasters and minimize losses. Canada has one of the most highly developed communications systems in the world, and is a leader in space-based communications. These may prove to be of crucial importance in disaster situations. Canada is also a leader in satellite and remote sensing technology, used to assess regional susceptibility to natural disasters such as floods, erosion, mud and rock instabilities, and to monitor forest fires. New developments in materials and construction methods have improved the strength and safety of buildings during disasters such as earthquakes and hurricanes. However, full use is not yet being made of these advances to improve warning and protection for people and their property in areas at risk (Anon., 1991). In addition, many safety features are mandatory in certain areas through building codes and by-laws, though it is unclear as to how well these are being enforced. The under-application and lack of

enforcement of preventative technologies may partially explain the rise observed in Figure 4.

Another factor explaining the trend in Figure 4 is that events have been more carefully recorded in recent times, while the actual number of disasters has not drastically increased. Historic information on smaller events, such as flooding, is difficult to obtain. No mechanism was in place to document the events of the time and throughout the country, nor was it required that accidents such as the release of hazardous materials be reported to authorities, as it is now.

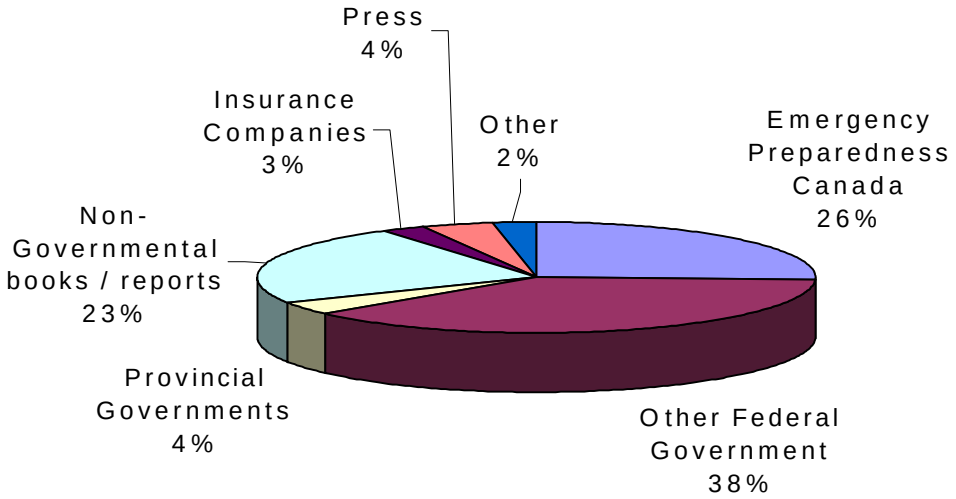
The information from 1991 to the present is not complete, as there is a lag time between the occurrence of some types of events and their entry in the database. For example, a large number of disasters in the 1980s are smaller flood events, many in remote areas, which were recorded locally and published in reports two to three years later. The corresponding information on smaller flooding and storm events in the mid-1990s was not available at the time of this report.

7.4 Information sources

Figure 5 shows the distribution of the sources of information used in the compilation of the database. It can be seen that the majority of information is obtained from federal government departments. Along with EPC, the most important are Environment Canada for floods and storms, the Environmental Emergencies Branch of Environment Canada for hazardous material disasters, and the Geological Survey of Canada of Natural Resources Canada, which provides the National Atlas of Canada with information on landslides and earthquakes.

Figure 5: Sources of Information (see Table 2)

The information from EPC was gathered from both the national and regional offices. A substantial amount of information had been compiled previously in a report called Significant Disasters in



Canada, (Anon., 1995). The remainder of the information was gathered through communication between national and regional offices at the time of the disaster.

Non-governmental books and reports contributed nearly a quarter of the information in the database. The most important of these include Canadian Disasters - An Historical Survey, by Robert L. Jones; A Report on Ontario Flood History by The Water Network of the University of Waterloo; the Canadian National Report for the International Decade for Natural Disaster Reduction, produced by the Royal Society of Canada and the Canadian Academy of Engineering, 1994; and Canadian Disasters, by René Schmidt, 1985.

7.5 Most significant events

The disaster which caused by far the largest number of deaths was the epidemic of Spanish Influenza. From 1918 to 1925, the disease affected all regions of the country, killing over 50,000 Canadians. The second worst disaster, in terms of loss of life, was the Halifax harbour explosion in 1917. It is etched in Canadian history books as a terrible tragedy which claimed 1,963 lives and devastated more than 300 acres of residential and business property in Halifax and Dartmouth. The explosion was caused by the collision of two ships, one carrying a large amount of munition and supplies for World War I. It was the largest human-made explosion ever to occur prior to the first nuclear explosion, and appears in the Guinness Book of Records (Jones, 1992).

Two ocean vessel sinkings in 1914 and 1917 each claimed over 1000 lives. Since 1990, the disasters which have claimed the most lives were, again, ocean vessel sinkings. Three ships sank off the east coast, each claiming over 30 lives; none of the ships were Canadian owned. By way of comparison, the Westray mine explosion in Nova Scotia, 1992, killed 26 miners.

The two most deadly tornadoes occurred in Regina, 1912, which claimed 28 lives, and Edmonton, 1987, which claimed 27 lives.

Canada's most destructive landslide, which took 76 lives, occurred in the town of Frank, Alberta in 1903. The best known modern landslide in Canada occurred at St. Jean Vianney, 10 km west of Chicoutimi, Quebec, in 1971; it destroyed 43 homes and took 31 lives.

The largest earthquake in Canadian territory registered 8.1 on the Richter scale; it occurred off the Queen Charlotte Islands, B.C., in 1949. However, a larger earthquake in Alaska, measuring 8.5, caused a 3.6m tsunami which damaged the coast of British Columbia to an estimated cost of $4.7 million in 1964.

The single mine disaster which claimed the most lives occurred at a coal mine in Hillcrest, Alberta in 1914, where a dust explosion killed 189 miners. However, the Springhill mine, Nova Scotia, claimed 235 lives throughout its lifetime in three separate disasters occurring in 1891, 1956 and 1958. The first disaster, which claimed 121 lives, is not included in the database, as it occurred before 1900.

The worst aircraft disaster in Canadian history was the crash of a chartered Arrow Air DC-8 at

Gander, Newfoundland, 1985, with the loss of 256 lives. The most deadly train accident was a derailment of a CPR passenger train en route to Minneapolis in 1910; 63 died and 20 were injured when the back end of the train left the tracks near Spanish River, Ontario.

An air disaster which could be considered as civil unrest is the Quebec Airways DC-3 crash near Saint-Joachim, Quebec on September 9, 1949. A saboteur named J.A. Guay and two accomplices, presumably Canadian citizens, set a bomb on a plane which subsequently crashed and killed 32 people. Authorities believe that the bomb caused the crash.

8.0 Conclusions

During the last six years, the EPC Disaster Database has evolved to meet the needs of Emergency Preparedness Canada. The database has become more complete and consistent, and detailed references have been included to make the database more useful to researchers. It is hoped that the database becomes well known and well used. Not only will it serve as an educational and research tool for others, but with attention from a variety of parties, it will receive constructive feedback and criticism. It is important that the information in the database remain current, and it is EPC's intention that, time and resources permitting, updates of the database will occur on a regular basis.

9.0 Bibliography

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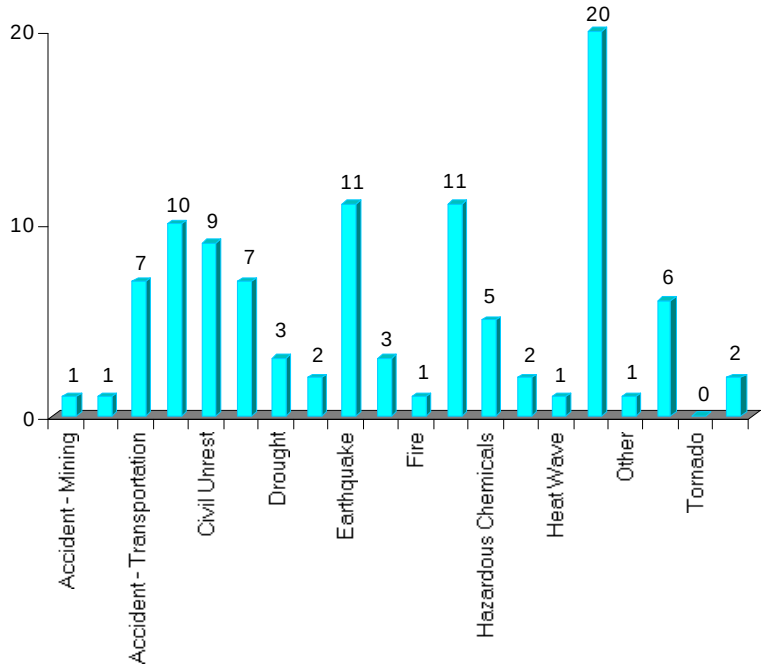
Appendix A: Disasters by Province and Territory

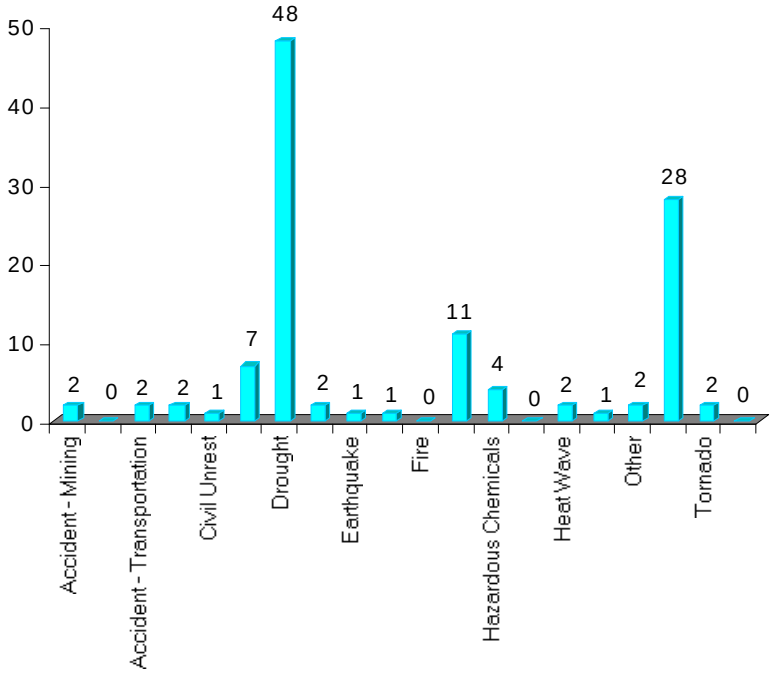
British Columbia

Total Disasters = 103



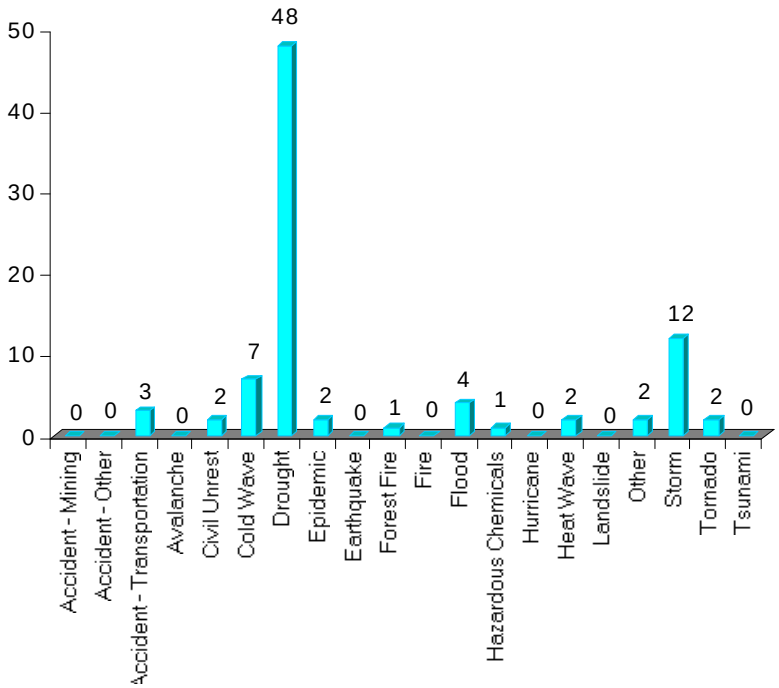
Alberta

Total Disasters = 116



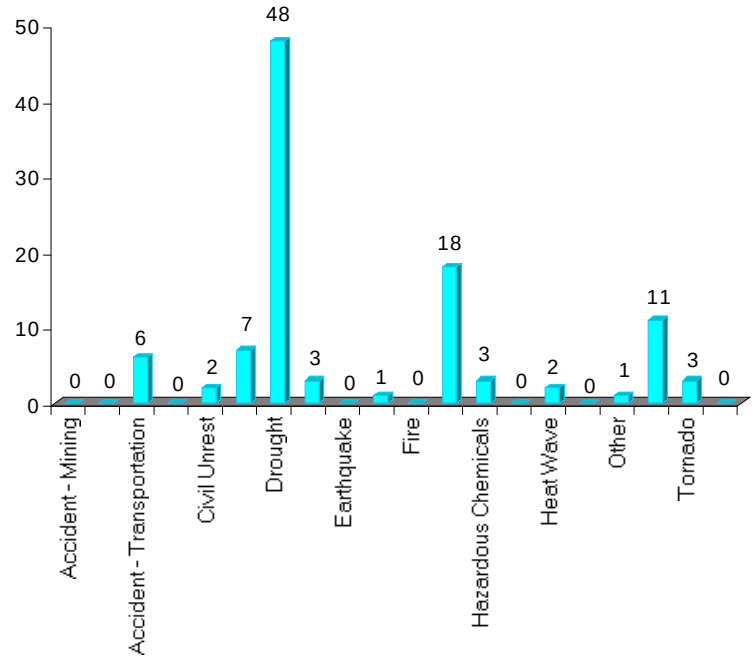
Saskatchewan

Total Disasters = 86



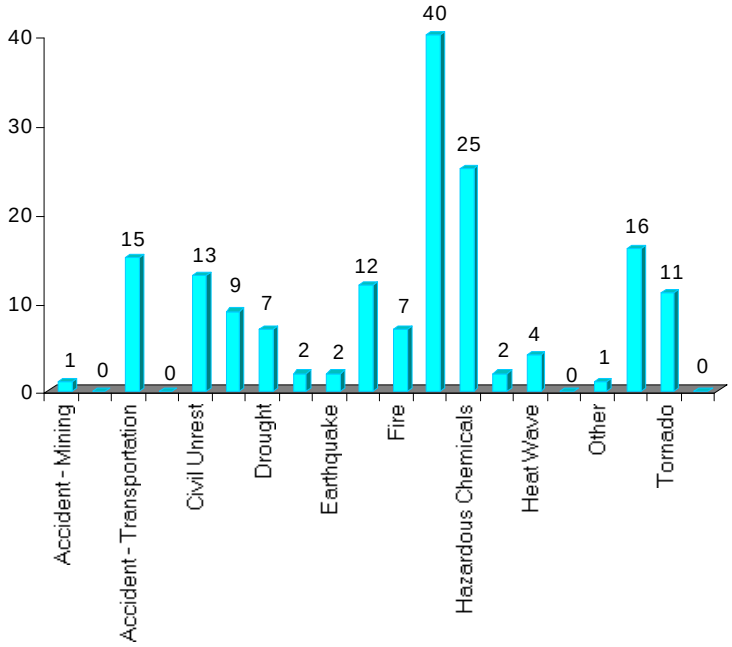
Manitoba

Total Disasters = 105



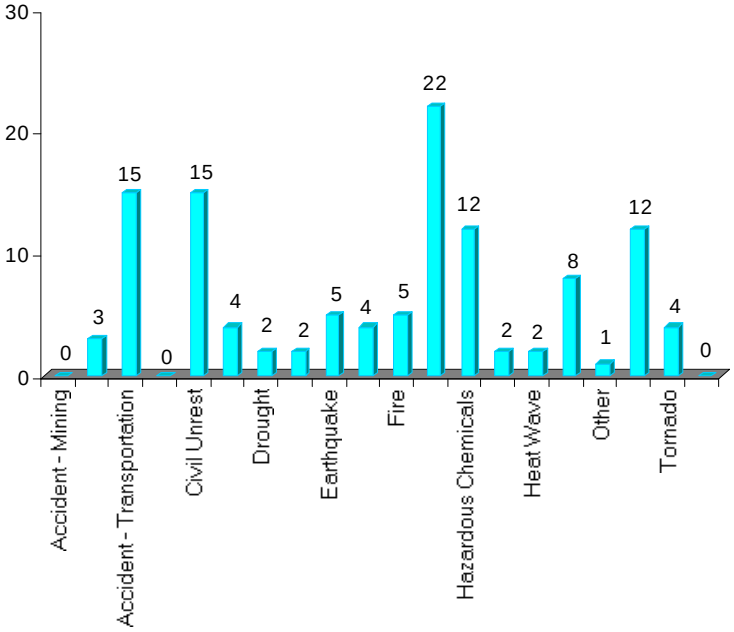
Ontario

Total Disasters = 167



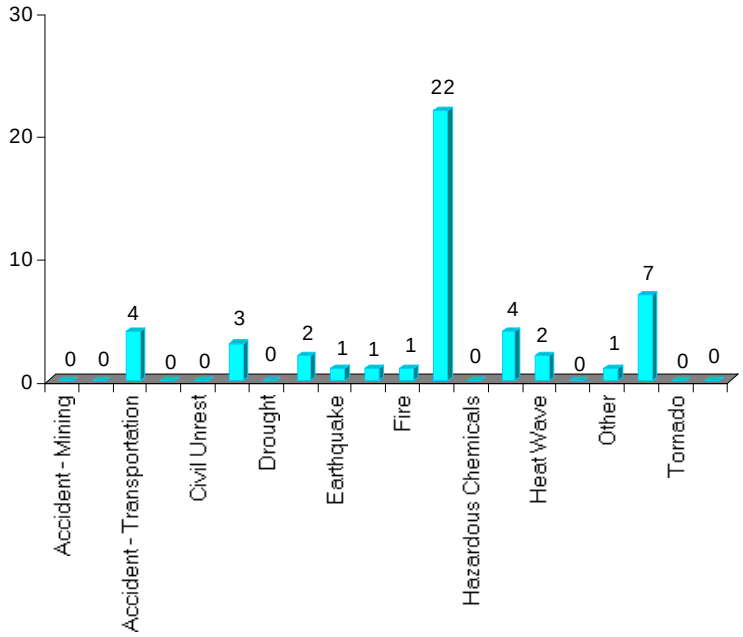
Québec

Total Disasters = 118



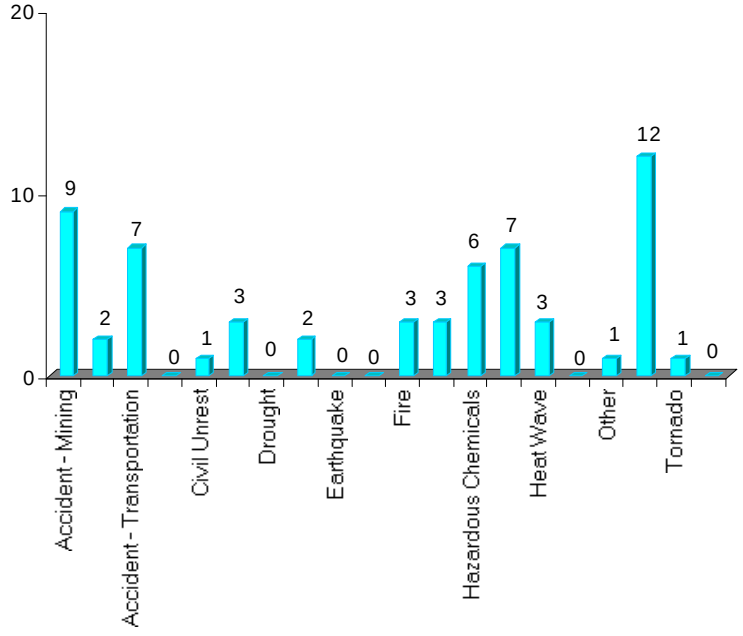
New Brunswick

Total Disasters = 48



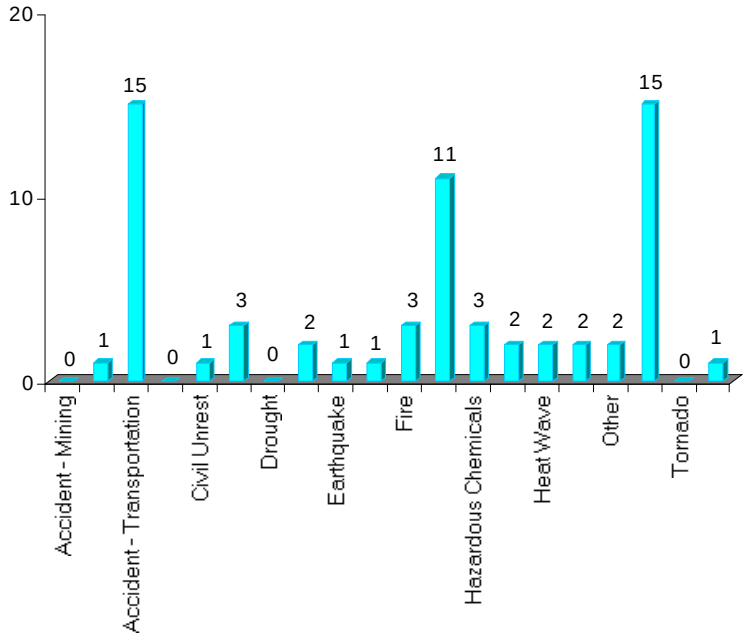
Nova Scotia

Total Disasters = 60



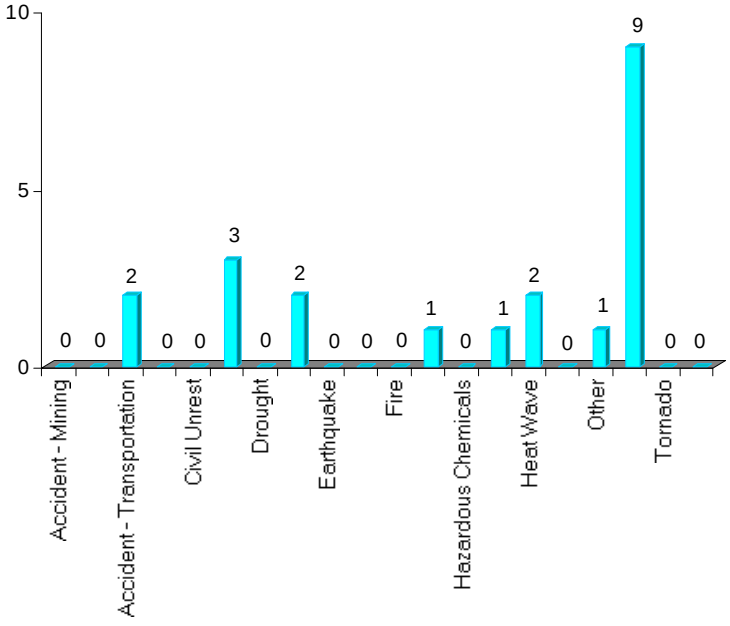
Newfoundland

Total Disasters = 65



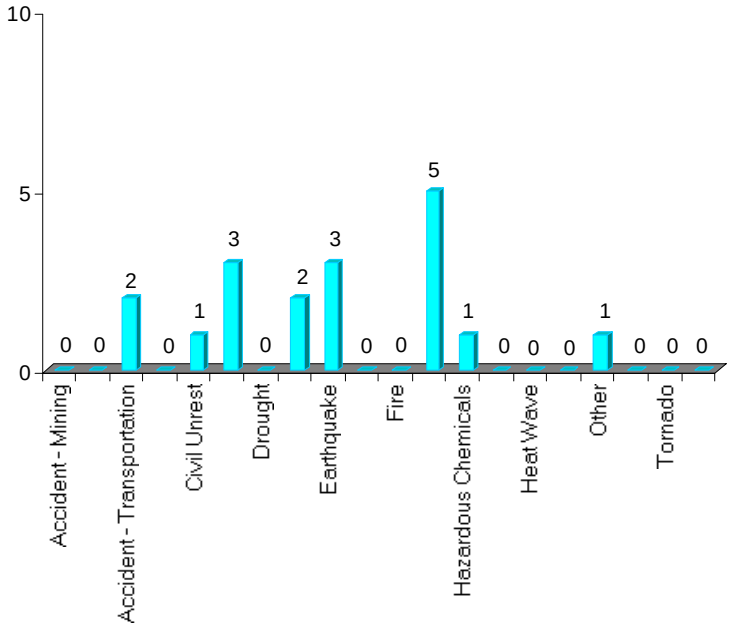
Prince Edward Island

Total Disasters = 21



Northwest Territories

Total Disasters = 18



Yukon Territory

Total Disasters = 14