CSSP environmental scan 2013

Dr. Brian W. Greene

Defence Research and Development Canada

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Abstract

Environmental Scan 2013 provides an overview of the key drivers and trends defining the context in which the Canadian Safety and Security Program (CSSP) is anticipated to operate over the next three to five years. The scan's objective is to present a comprehensive and integrated picture of the public safety and security operating environment for the purpose of informing the development of CSSP priorities. After briefly outlining the broader safety and security and science and technology policy environments, the scan examines nine issues, threats, and hazards that constitute the problem space for CSSP activities.

Significance to defence and security

Environmental Scan 2013 is a key input to the priority-setting and policy-making process in Defence Research and Development Canada's Centre for Security Science, manager of the Canadian Safety and Security Program.

Résumé

L'analyse environnementale 2013 donne un aperçu des principaux facteurs et tendances qui définissent le contexte dans lequel on s'attend à ce que le Programme canadien pour la sûreté et la sécurité (PCSS) fonctionne au cours des trois à cinq prochaines années. L'objectif de l'analyse est de présenter un tableau complet et intégré du cadre de fonctionnement de la sûreté et la sécurité publiques aux fins de l'établissement des priorités du PCSS. Après avoir brièvement souligné les milieux généraux de la politique de sûreté et de sécurité et de la politique de science et technologie, on examine neuf enjeux, menaces et dangers qui constituent l'espace-problème pour les activités du PCSS.

Importance pour la défense et la sécurité

L'analyse environnementale 2013 est un élément clé du processus d'établissement des priorités et d'élaboration des politiques au Centre des sciences pour la sécurité de Recherche et développement pour la défense Canada, lequel gère le Programme canadien pour la sûreté et la sécurité.

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Acknowledgements

1   Introduction

Environmental Scan 2013 provides an overview of the key drivers and trends defining the context in which the Canadian Safety and Security Program (CSSP) is anticipated to operate over the next three to five years. The scan's objective is to present a comprehensive and integrated picture of the public safety and security operating environment for the purpose of informing the development of CSSP priorities. While the scan draws on many forward-looking analyses and reports, it is not a forecast or formal risk assessment; it neither attempts to predict the future nor utilize any formal modelling to appraise the risks discussed throughout.

The scan is informed by both internal (i.e., governmental) and external sources, with a focus on issues that contain an explicit knowledge or science and technology (S&T) dimension of relevance to the CSSP. The first section of the scan briefly discusses the broader policy environment. This is followed by an examination of the various issues, threats, and hazards that constitute the problem space for CSSP activities[1].

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[1] The information contained herein is current as of 31 October 2013.

2 Policy environment

2.1 Safety and security

The landscape of Canadian safety and security policy has expanded considerably over the last decade. Although the primary impetus for this expansion was the terrorist attacks of 11 September 2001, increasing awareness of the innate complexity of some issues, along with the interconnections between them, has also contributed to the transformation (e.g., cyber security, critical infrastructure protection, and emergency management).

These and other factors are expected to further alter the safety and security landscape over the coming years. As detailed below, the pace of change in the cyber domain continues to create new and ever more complex challenges in areas such as critical infrastructure protection, counterterrorism, and law enforcement. Climate change has emerged as a key driver of change across several domains as well, along with growing political and economic interest in the Arctic.

The safety and security policy agenda will also continue to be shaped by unforeseen developments like this year's devastating Alberta floods and the Lac Mégantic explosion, the latter subsequently focusing national attention on an issue that was previously well below the radar of public consciousness: the transportation of dangerous goods by rail. In combination, these events have also propelled the national political conversation surrounding the development of a National Disaster Mitigation Program, an initiative aimed at building community resilience which was recently endorsed by the Government of Canada in the Speech from the Throne [1].

2.2 Science and technology

In May 2013, the National Research Council (NRC) announced that it had transformed itself "into an industry-focused research and technology organization" that "will support Canadian industries by investing in large-scale research projects that are directed by and for Canadian business" [2]. That same month, the Science, Technology, and Innovation Council (STIC), the federal government's external scientific advisory body, released its biennial report on the country's science, technology, and innovation performance. According to the STIC, as of 2011 Canada ranked 23rd out of 41 countries assessed in terms of its overall expenditures on research and development when measured in relation to its gross domestic product, down from 16th place internationally in 2006. Although the report highlights several areas of strength, it also indicates that Canada risks an erosion of its economic well-being unless the current trajectory is reversed [3]. The NRC's transformation into an industry-focused organization represents an important part of the Government of Canada's strategy for addressing that problem.

The soon-to-be-released update to the government's Science, Technology, and Innovation Strategy will further illuminate the government's plan for transforming the federal science business model. While generally consistent with the CSSP template, the growing expectation that federal science should also serve broader economic objectives [4] is, nevertheless, expected to influence how Defence Research and Development Canada carries out its mission in the years ahead.

Safety and Security – Key Policies, Strategies, and Actions Plans

Canada First Defence Strategy

Securing an Open Society: Canada's National Security Policy

Beyond the Border: A Shared Vision for Perimeter Security and Economic Competitiveness

Building Resilience Against Terrorism: Canada's Counter-Terrorism Strategy

Canada's Cyber Security Strategy

Action Plan 2010-2015 for Canada's Cyber Security Strategy

National Strategy and Action Plan for Critical Infrastructure

Canada-United States Action Plan for Critical Infrastructure

Chemical, Biological, Radiological, Nuclear, and Explosives Resilience Strategy and Action Plan

Communications Interoperability Strategy for Canada and Action Plan

An Emergency Management Framework for Canada

Federal Policy for Emergency Management

Emergency Management Act

Federal Emergency Response Plan

Canada's National Disaster Mitigation Strategy

3 Issues, threats, and hazards

3.1 Cyber security

Computerized and networked information systems underpin a rapidly increasing amount of economic, governmental, and social activity. As of 2010, 79% of Canadian households had internet access, with a majority of households (54%) using more than one type of device to go online [5]. Canadians now routinely use the internet for activities such as banking, filing their tax returns, purchasing goods and services (in 2010, Canadian online sales were estimated at $15.3 billion), and social networking [6]. With internet connectivity steadily on the rise, both in Canada and worldwide, and the emergence of cloud computing, Canadians' reliance on the internet to conduct a broad array of activities can only be expected to increase in the years ahead.

In this context, the wide range of actors – individuals, foreign governments, terrorist organizations, organized criminal networks, and other motivated actors – capable of disrupting these activities or, in the worst case scenarios, even causing devastating harm, has emerged as a pressing concern. As noted in the World Economic Forum's survey of global risks, "Terrorism, crime and war in the virtual world have, so far, been less deadly and disruptive than their equivalents in the physical world, but there is a growing fear that this could change" [7]. Reflecting that fear, cyber security has quickly come to be regarded as an important dimension of national security.

Growing awareness of how cyber-attacks may be used as a substitute for or in conjunction with traditional military operations have given rise to widespread discussion of the potential for cyberwar. While cyber-operations can be expected to be a part of future military campaigns, the term cyberwar is somewhat of a misnomer in terms of describing the nature of the cyber threat. In reality, the primary threats in the cyber domain are cyber-espionage and cyber-sabotage [8].

Cyber-sabotage is a particularly acute concern given the various critical infrastructure (CI) vulnerabilities that an adversary might attempt to exploit. The potential for such an attack to wreak havoc with any number of CI systems has become clearer as details surface about the serious physical damage caused by the sophisticated computer virus (nicknamed 'Stuxnet') inserted into the Siemens controllers used to run the nuclear centrifuges at the Natanz enrichment facility in Iran [9]. While a Stuxnet-like attack is probably still beyond the capabilities of all but a few states, the art of the possible is rapidly evolving.

Perhaps more significant than the direct consequences of the attack itself or even its impressive technical aspects is its potential impact on the still-evolving normative regime governing cyber-operations. As international security analyst Misha Glenny observes, "Stuxnet has effectively fired the starting gun in a new arms race that is very likely to lead to the spread of similar and still more powerful offensive cyberweaponry across the Internet" [10]. What is more, it is unlikely to be an arms race limited to a small number of states. Through cyber-operations, actors lacking the military capability to engage an adversary directly could conceivably employ cyber-attacks as an alternative. Cyber-space, in this sense, must be understood as a domain particularly well-suited to asymmetric and non-militarized conflict, with cyber-operations functioning as a potential strategic equalizer.

3.2   Terrorism

According to the Canadian Security Intelligence Service (CSIS), terrorism is "the greatest threat to the national security of Canada," with Islamist extremism presenting the "most salient threat" [11]. In February 2013, then director of CSIS Richard Fadden told the Senate's Standing Committee on National Security and Defence that the nature of the terrorist threat has, nevertheless, changed. "Five years ago, we were not as worried about domestic terrorism as we are now," said Fadden in noting Al Qaeda's efforts to encourage so-called 'lone-wolf' attacks by individuals sympathetic to their cause [12].

The activities of several Al Qaeda-affiliated groups in Afghanistan and Pakistan, the Middle East, and Africa are an ongoing concern. For example, according to CSIS, "Numerous young Somali-Canadians have travelled to Somalia for terrorist training" under the tutelage of Al Shabaab, the militant Islamist group that controls significant parts of the country. In 2011 the group released a videotape calling for attacks on Canada and other Western countries. As CSIS notes, "The recruitment of Western citizens to participate in terrorist acts is a priority for these groups, because such operatives have easy access to Europe and North America" [13].

Although conventional explosives still pose the primary threat, potential terrorist acquisition and use of a chemical, biological, radiological, or nuclear weapon remains a concern as well, as does the threat of an attack on one of the country's nuclear facilities. Due to the proliferation of advanced technologies, the tactics and weapons employed by terrorists are also likely to change in coming years. According to the U.S. National Intelligence Council, "Individuals and small groups will have greater access to lethal and disruptive technologies (particularly precision-strike capabilities, cyber instruments, and bioterror weaponry), enabling them to perpetrate large-scale violence – a capability formerly the monopoly of states" [14].

Over the last five years, terrorists have also grown more adept at using the internet to communicate, spread their message, and plan and coordinate attacks [15], adding another layer of complexity to the counter-terrorism effort. Complicating matters further is the large volume of structured and unstructured text, data, images, and video that the intelligence collection process now generates. The range of challenges facing intelligence and law enforcement agencies in their fight against terrorism are thus expected to expand over the next two decades.

3.3   Border security

Although border security is a multifaceted issue that is both constitutive and derivative of Canada's standing as a sovereign state, it is Canada's relationship with the United States – particularly the enormous volume of trade between the two countries – that largely contextualizes the issue for Canadians, the reality of which is reflected in the Beyond the Border Declaration issued by Prime Minister Harper and President Obama in February 2011 [16]. The key drivers in this area for Canada are thus both generic (e.g., terrorism, human smuggling, the importation of illicit drugs and firearms, etc.) and specific (i.e., U.S. political and security priorities).

Insofar as it establishes a framework for dealing with these and other related issues, the Beyond the Border Action Plan is a key component of Canada's strategy for managing the problem of border security. The plan identifies four key areas of cooperation: addressing threats early; trade

facilitation, economic growth and jobs; cross-border law enforcement; and critical infrastructure and cyber-security [17]. From an operational standpoint, these tasks are complicated by the fact that the border is divided between official ports of entry - airports, harbours, and land crossings – and the vast expanse of largely undefended and unmonitored territory that remains.

With the longest coastline of any country in the world, maritime and port security comprises an important part of the border security picture for Canada. The challenges in the maritime domain are both extensive and diverse. At one end of the spectrum is the challenge of providing persistent wide-area surveillance of Canada's Exclusive Economic Zone (EEZ) and its approaches, a task that will only grow more difficult as global warming makes Canada's Arctic waterways more accessible to maritime traffic. At the opposite end of the spectrum is the challenge of policing the Great Lakes and other inland waterways, where thousands of small vessels traverse the maritime boundary between Canada and the U.S. every day.

Consistent with developments elsewhere, the maritime domain is also increasingly reliant on computerized and networked information systems. As a recent report on the issue notes, such systems are now "…used to enable essential maritime operations, from navigation to propulsion, from freight management to traffic control communications." Unfortunately, "The awareness on cyber security needs and challenges in the maritime sector is currently low to non-existent" [18], such that the nature and extent of the vulnerabilities are unclear.

3.4   Natural hazards and disasters

Canada is susceptible to a variety of natural hazards, from relatively common occurrences like seasonal flooding, wildfires, severe storms, and drought, to less frequent but potentially more devastating events such as earthquakes and hurricanes. Although the latter typically occupy the 'worst-case' scenario space in emergency management planning, the former actually account for most of the annual material losses attributed to natural hazards. According to the Insurance Bureau of Canada (IBC), natural disasters cost the country approximately $1 billion a year ($1.6 billion in 2011), with most of the losses coming as a result of extreme weather events [19]. The wildfires that ravaged the Slave Lake region of northern Alberta in 2011, for example, resulted in an estimated $700 million in insured losses[2] [20]. This year's flooding in Calgary and southern Alberta has been even more costly. According to the IBC, the bill for insured property damage from the floods already exceeds $1.7 billion [21].

The potential for more consequential natural disasters is far from negligible, however. On average, Canada experiences approximately 4,000 earthquakes each year, of which perhaps fifty are strong enough to be felt by humans[3]. The risk of experiencing a severe and damaging earthquake is greatest in British Columbia, where several tectonic plates intersect[4]. The strongest

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[2] Although the fire is believed to have been the result of arson, abnormally dry conditions likely served as an aggravating factor.
[3] Unless otherwise noted, all information in this section is drawn from Natural Resources Canada, "Frequently Asked Questions About Earthquakes." Accessed online at http://www.earthquakescanada.nrcan.gc.ca/info-gen/faq-eng.php#can_largest.
[4] Canada's other major earthquake zones are the northern Cordillera (southwest Yukon, Richardson Mountains, and Mackenzie Valley) and arctic margins (including Nunavut and northern Quebec). The

earthquake ever recorded in Canada occurred just off the Haida Gwaii in 1949 (a magnitude 8.1 event) and was felt over most of the province and beyond. An even stronger earthquake (9.0 magnitude), what seismologists refer to as a megathrust earthquake, is believed to have occurred off the coast of B.C. in 1700, collapsing houses on Vancouver Island and producing a tsunami that wiped out an entire coastal village. The total economic cost of an earthquake of similar magnitude today was recently estimated at upwards of $74 billion [22].

Although the megathrust earthquake and resulting tsunami that devastated a portion of northern Japan in 2011 presents a terrifying picture of the aftermath of such earthquakes, the greater danger for Canada lies in the possibility of an inland earthquake closer to Vancouver or another major urban area. While inland earthquakes tend to be much weaker than megathrust earthquakes, they nevertheless represent a substantial hazard. The magnitude 6.9 earthquake that struck close to Kobe, Japan in 1995 killed more than 5,000 people and damaged or destroyed more than 200,000 buildings [23]. With southwest B.C. and northern Washington having experienced four magnitude 7+ earthquakes over the past 130 years, the potential for a disaster on the scale of the 1995 Kobe earthquake is significant [24].

An earthquake of similar or even weaker magnitude along the Ottawa-Quebec City corridor potentially poses an even greater risk given the comparative lack of earthquake preparedness in the region [25]. Residents of Ottawa and the surrounding region were reminded of their vulnerability in June 2010, when a 5.0 magnitude earthquake occurred near Val-des-Bois, Quebec, approximately 60 kilometres north of Ottawa [26]. The shaking damaged several buildings and collapsed a section of a highway close to the epicentre.

In the Atlantic region, tropical storms and hurricanes represent a serious and growing threat to both life and property. According to the Canadian Disaster Database, the region was hit by eleven named storms between 2001 and 2011 (including five hurricanes), a sharp rise in frequency when compared to the fifteen named storms that made landfall between 1927 and 2000 [27]. The deadliest and most costly of these storms was Hurricane Juan, which struck the Halifax region in September 2003, killing eight people and causing more than $200 million in damage [28].

Complicating the natural hazards picture is global warming. As stated by the Intergovernmental Panel on Climate Change (IPCC), "Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level" [29]. For Canada, this has meant "…rising temperatures, shifting rainfall patterns, and increases in certain types of hazardous weather, such as heat waves" [30]. According to Environment Canada, the national average temperature in 2011 was 1.5°C above normal (1961-1990 average), making 2011 the eighth warmest year on record since nationwide record-keeping began in 1948 (at 3.0°C above normal, 2010 ranks as the warmest). Moreover, annual temperatures have been at or above normal every year since 1993 [31], with the ten warmest years on record globally all occurring since 1998 [32].

Although it is impossible to draw a direct link between global warming and any specific weather-related event, climate scientists are increasingly confident that the phenomenon is likely to influence the frequency and severity of extreme weather events such as drought, floods, and

Ottawa and St. Lawrence Valleys, New Brunswick, and the offshore region south of Newfoundland experience frequent earthquakes as well.

storms. According to the IPCC, "It is very likely that the length, frequency, and/or intensity of warm spells or heat waves will increase over most land areas," during the next century. The IPCC is also predicting a marked increase in the frequency of heavy precipitation and the average tropical cyclone maximum wind speed [33].

For Canada, the impact will be significant. While Western and Atlantic Canada will likely experience a decline in seasonal average precipitation during the summer over the next three to four decades (likely leading to more droughts), the frequency of severe precipitation events across the country is expected to increase [34]. Events similar to this year's record rainfalls that caused extensive flooding in Calgary and southern Alberta and Toronto are thus likely to become more common. Hurricane intensity is also anticipated to increase over the next several decades [35], as is wildfire activity, which is expected to rise dramatically over the course of the century, with one study forecasting a 25% increase in overall fire occurrence by 2030 and a 75% increase by 2100 [36].

3.5   Non-natural disasters

As evidenced by the Deep Water Horizons oil spill in the Gulf of Mexico in 2010 and the nuclear meltdown at the Fukushima power plant in Japan in 2011, large-scale industrial accidents have the potential to create major non-natural disasters. For Canada, there are several areas of critical concern, including nuclear safety. At present, Canada has five nuclear sites, which includes 18 operating power reactors, 3 decommissioned reactors, and a large research reactor[5]. Despite Canada's good nuclear safety record, the nature of nuclear energy is such that the potential for a serious incident remains.

The range of conceivable radiological or nuclear emergencies extends well beyond the possibility of an accident at one of the country's nuclear facilities. Canada could also be affected by a major nuclear accident in another country or aboard a nuclear-powered vessel sailing in Canadian waters or visiting a Canadian port. The transportation of radioactive material presents another potential risk [37].

Canada's chemical industry, including its large and growing oil and gas sector, is another area of concern. An accident at a major chemical production or storage facility, for example, would likely have both public health and environmental consequences. The transportation by rail of dangerous goods such as ammonia, chlorine, and crude oil presents another risk, as was tragically demonstrated by the derailment and explosion of a train transporting oil in Lac-Mégantic on 6 July.

In the wake of the Deep Water Horizons oil spill, the potential for an accident of similar magnitude involving some element of Canada's rapidly expanding oil and gas industry (e.g., drilling platform, pipeline, tanker, etc.) has received increased attention. The concern is particularly acute in relation to growing industry interest in the Arctic, where the operating environment is significantly more challenging than that which exists in other parts of the country. As a recent analysis noted, "Worst-case scenarios may be worse in the Arctic because the ability

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[5] For a detailed list of all nuclear facilities in Canada see Canadian Nuclear Safety Commission, "Maps of Nuclear Facilities." Accessed online at http://www.nuclearsafety.gc.ca/eng/readingroom/maps/index.cfm.

to manage evolving situations is limited by environmental conditions and the lack of appropriate infrastructure" [38].

Catastrophic events like the Exxon Valdez accident in 1989 or the Deep Water Horizons spill are not the only risk. As the scope of oil-related operations increases in northern Alberta and other parts of the country, localized spills like the ones that released 3,000 barrels of oil into the Red Deer River near Sundre, Alberta in June 2012 and 575 barrels near Jansen, Saskatchewan in May 2013 are an increasing risk [39]. Although rail safety has dominated the news since the Lac Mégantic explosion, pipeline safety is a growing concern as well. According to National Energy Board data, the number of pipeline safety-related incidents doubled between the years 2000 and 2011 [40].

There are also more specific concerns about the potential environmental consequences of any spill involving oil sands crude (bitumen). Because it is heavier than conventional crude, bitumen is more difficult to clean up in the event of a spill, a challenge first identified after an Enbridge pipeline carrying diluted bitumen (bitumen must be diluted for transport by pipeline) ruptured near Michigan's Kalamazoo River in July 2010. The cleanup, which is still ongoing, has thus far cost more than $800 million (Enbridge estimates the final tally will be more than $1 billion), making it the costliest onshore oil spill in U.S. history [41].

3.6   Critical infrastructure

Critical infrastructure (CI) encompasses the "processes, systems, facilities, technologies, networks, assets and services essential to the health, safety, security or economic well-being of Canadians and the effective functioning of government" [42]. In line with that definition, the National Strategy for Critical Infrastructure identifies ten critical infrastructure sectors: energy and utilities, finance, food, transportation, government, information and communication technology, health, water, safety, and manufacturing [41].

Although the National Strategy emphasizes the importance of developing partnerships among federal, provincial, and territorial governments and critical infrastructure sectors, the recent Auditor General's report on protecting Canadian infrastructure against cyber threats found that, "progress toward building partnerships and monitoring threats has been limited" [43]. The Auditor General also identified shortcomings with the sector networks responsible for coordinating these activities [42]. Overall, the Auditor General found that progress in achieving the Government's commitment to address cyber threats to CI has been slow [42].

The problems identified by the Auditor General are the result of a transformative development in critical infrastructure more broadly: the increasing prevalence of complex and interdependent systems; the consequence of which is a critical infrastructure system of systems that is more fragile in some respects than that which existed previously.

The potential negative externalities of complexity and interdependence extend well beyond the first order effects identified by the Auditor General. As the 2011 Japanese earthquake vividly demonstrated, global supply chains and 'just in time' inventory processes increase the risk that certain types of local market and industrial disruptions will have cascading systemic/global effects [44]. Indeed, such 'system effects' are almost to be expected. As a recent Chatham House

study observes, "In an increasingly connected global economy and society more people are (and will continue to be) affected by shocks, irrespective of whether 'high-impact events' are actually becoming more frequent or not" [45].

Critical infrastructure protection is further complicated by the fact that most of the country's CI is owned and operated by the private sector and governed by multiple federal and provincial/territorial mandates. Building the partnerships that lie at the heart of the National Strategy must therefore first overcome a large number of inherent coordination problems, including a lack of trust amongst some of the key actors. As the Auditor General noted, "In some cases, stakeholders are reluctant to share information that is sensitive or of a competitive nature" [46].

3.7   Emergency management

The difficult job of planning for and responding to many of the threats and hazards discussed in this scan primarily falls on the responder community and other emergency management practitioners. In practice, that means being prepared for a wide range of contingencies, from the relatively routine tasks of policing and firefighting, to the multitude of complex safety and security challenges that accompany major public security events like the G8/G20 summit and the Vancouver Olympics, to coping with a worst-case scenario terrorist attack, natural disaster, or industrial accident. Compounding the challenges associated with these tasks is the nature of the jurisdictional construct for emergency management in Canada, which divides responsibility for emergency management across three levels of government.

Beyond the various severe weather effects detailed above, global warming is also expected to transform the Arctic landscape, the implications of which are likely to create new emergency management problems. In addition to spurring more economic interest in the region's resources (oil, gas, minerals, fisheries), climate change is leading to increased shipping activity and tourism as well. As the pace of all forms of activity increases, so too will the demand for emergency management services, albeit in an environment with its own unique challenges. For example, "Magnetic and solar phenomena, interference and geostationary satellite geometry all mean that high-frequency radio and GPS are degraded above 70°-72° North, a major issue for communications, navigation, and search and rescue" [47]. Technological solutions will have to be found to address this type of problem. The grounding of an Arctic expedition ship in 2010 highlighted the need for even more basic services; in this case, passenger rescue and salvage. Another known challenge is the dearth of navigational charts [46].

Along with developing new solutions for new problems, there is also the imperative of improving existing protocols. A recent analysis of the respective national responses to Hurricane Katrina and the 2011 Japanese earthquake and associated disasters highlights several significant weaknesses in this regard. According to the report, both the American and Japanese responses were hindered by inadequate situational awareness. As the authors note, "Both events obliterated much of the existing information collection equipment, emergency response centers and processes on which disaster management systems depended" [48].

The assistance required to deal with each disaster was also poorly defined and uncoordinated. "Requests for assistance were conveyed through whatever channels came to hand and, in the first

days, were not effectively prioritized either among local officials or between local and national authorities. Supply rather than demand drove aid decisions. Resources – some useful, some irrelevant and some even burdensome – were forced into a constricted system with little ability to match aid to need." Moreover, "Many anticipated rescue resources were within the disaster zone and therefore unavailable" [47].

The relationships between national and local authorities and between government and private entities proved problematic as well. In some cases, roles were not well delineated; in others, they were too rigid. "Distrust, contention, and competition proliferated. Ad hoc 'workarounds' were invented, and these undermined response until some trusted personalities could be designated and procedures were idiosyncratically constructed" [47].

The report additionally highlights the fact that evacuation plans and procedures were inadequate given the scale of the problems that arose. In light of this and the many other deficiencies noted above, public confidence in government unsurprisingly declined in the wake of each disaster. In Japan, "Lack of timely disclosure and contradictory statements during the first days of the crisis fed confusion and the consequent perception that officials did not have, or withheld, information required to advise the public accurately." In New Orleans during Hurricane Katrina, by contrast, "Lack of communication before the crisis about risk preparedness and mitigation exacerbated public distrust." In the authors' view, "Risk communications and interaction with the public before the incidents could have helped both the government and the public to communicate more effectively after the events" [47]. Looking beyond the immediate impact of each disaster, the report also draws attention to the fact that "Longer-term issues of environmental restoration and health rehabilitation (including mental health rehabilitation)" were not adequately addressed by either American or Japanese officials in their respective responses [47].

3.8   Serious and organized crime

According to a 2012 report by the House of Commons Standing Committee on Justice and Human Rights, "Organized crime poses a serious long-term threat to Canada's institutions, society, economy, and to our individual quality of life" [49]. As of 2011, there were 729 known organized crime groups in Canada. Of that number, twenty-four were classified as category one threats (the most serious threat level), with another 262 groups designated as category two threats[6] [48].

The main hubs of organized criminal activity in Canada are the lower mainland of British Columbia, Southern Ontario, and Greater Montreal [48]. Despite the geographic concentration, national and international operations are increasingly the norm in organized crime [48]. In terms of activities, the illicit drugs trade continues to dominate the criminal marketplace in Canada, with cocaine, cannabis, and synthetic drugs (e.g., bath salts, synthetic cannabis) accounting for the vast majority of the trade. With new synthetic drugs appearing almost weekly, detection and regulation have become ever more difficult. Canada has also emerged as a source country for synthetic drugs like ecstasy and crystal meth. The other primary areas of criminal interest are financial crime, theft, alcohol and tobacco smuggling, the sex trade, and human trafficking [48].

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[6] All of the groups classified as category one and category two threats are distinguished by the fact that they operate either inter-provincially or internationally

As is the case with many of the safety and security issues addressed in this scan, technological advances, particularly in the online realm, are also having a transformative effect on organized crime. According to Criminal Intelligence Service Canada's (CISC) most recent public report, technology is "…enabling organized crime to commit old crimes like theft and fraud in new ways and also undertake relatively new activities, such as hacking and 'spoofing'" [50]. The law enforcement challenge is more complex than simply grappling with a range of new methods and activities, however. As CISC notes, "Some organized criminal networks are exclusively virtual with illicit activities and communications occurring entirely online" [49].

3.9　Infectious disease

Compendia of the various threats and hazards that may present the world with an atypically severe or catastrophic challenge almost always include an infectious disease pandemic[7]. Whereas most of the scenarios that animate this genre of analysis are either extremely rare (e.g., a large asteroid impact) or hypothetical (e.g., a particle accelerator accident), pandemics constitute a known danger, with several having occurred in recent history.

For Canada, pandemic influenza remains the primary infectious disease concern. On average, approximately 20,000 Canadians are hospitalized each year as a result of seasonal influenza and its complications, with between 2,000 and 8,000 eventually succumbing to the illness. Periodically, new highly virulent strains of the virus appear, thereby creating the necessary conditions for the onset of a pandemic (most recently in 2009) [51]. Avian influenza, commonly known as 'bird flu,' is another area of acute concern. Although it has not yet developed into a significant public health problem, a new strain of the virus (H5N1) has been circulating since 2003, with 633 reported human cases and 377 fatalities according to the World Health Organization (WHO) [52]. Another particularly deadly strain of influenza (H7N9) appeared in China earlier this year. As of 20 July 2013, the WHO had confirmed 134 human cases of the virus, including 43 deaths [53]. An ongoing fear is that one of these strains will mutate into a form more easily transmissible to and amongst humans, at which point the likelihood of a pandemic would be elevated.

As the Severe Acute Respiratory Syndrome (SARS) epidemic of 2002-2003 demonstrated, public health authorities must also be prepared to contend with new pathogens. A viral respiratory illness originating in China, SARS ultimately claimed the lives of 774 people worldwide, including 44 in Canada. [54] Public health officials are currently monitoring a SARS-like virus – Middle East Respiratory Syndrome Coronavirus (MERS-CoV) – that emerged in late 2012, with 91 laboratory-confirmed cases and 46 deaths as of 29 July 2013 [55].

Just as new infectious diseases like SARS are certain to appear, the re-emergence of more familiar diseases also poses a challenge. Over the last 25 years, tuberculosis (TB) has re-surfaced as one of the primary infectious causes of death in the world (1.4 million people died as a result of TB in 2011). According to the WHO, 8.7 million new cases of TB were diagnosed in 2011, a slight reduction from the year before and consistent with the overall downward trend in recent

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[7] For illustrative examples see Richard Posner, *Catastrophe: Risk and Response* (New York: Oxford University Press, 2004); Nick Bostrom and Milan M. Cirkovic, eds., *Global Catastrophic Risks* (Oxford: Oxford University Press, 2008); and Marq de Villiers, *Dangerous World: Natural Disasters, Manmade Catastrophes, and the Future of Human Survival* (Toronto: Penguin, 2009).

years. The number of multidrug resistant (MDR) cases continues to rise, however [56]. Even more troubling, researchers recently identified several cases of "totally drug-resistant" TB in South Africa [57].

The challenge of combatting both new and established infectious diseases is further complicated by the reality of globalization, whereby pathogens can be quickly spread around the world thanks to modern air travel. As with natural disasters, climate change portends to be an influence on infectious disease as well. According to a study commissioned by the WHO, "higher ambient air temperatures, along with changes in precipitation and humidity, can affect the biology and ecology of disease vectors and intermediate hosts, the pathogens that they transmit, and consequentially the risk of transmission" [58]. Climate change is thus likely to increase both the incidence and territorial reach of diseases as varied as malaria, dengue fever, Lyme disease, and West Nile virus [59].

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13. ABSTRACT (A brief and factual summary of the document. It may also appear elsewhere in the body of the document itself. It is highly desirable that the abstract of classified documents be unclassified. Each paragraph of the abstract shall begin with an indication of the security classification of the information in the paragraph (unless the document itself is unclassified) represented as (S), (C), (R), or (U). It is not necessary to include here abstracts in both official languages unless the text is bilingual.)

Environmental Scan 2013 provides an overview of the key drivers and trends defining the context in which the Canadian Safety and Security Program (CSSP) is anticipated to operate over the next three to five years. The scan's objective is to present a comprehensive and integrated picture of the public safety and security operating environment for the purpose of informing the development of CSSP priorities. After briefly outlining the broader safety and security and science and technology policy environments, the scan examines nine issues, threats, and hazards that constitute the problem space for CSSP activities.

L'analyse environnementale 2013 donne un aperçu des principaux facteurs et tendances qui définissent le contexte dans lequel on s'attend à ce que le Programme canadien pour la sûreté et la sécurité (PCSS) fonctionne au cours des trois à cinq prochaines années. L'objectif de l'analyse est de présenter un tableau complet et intégré du cadre de fonctionnement de la sûreté et la sécurité publiques aux fins de l'établissement des priorités du PCSS. Après avoir brièvement souligné les milieux généraux de la politique de sûreté et de sécurité et de la politique de science et technologie, on examine neuf enjeux, menaces et dangers qui constituent l'espace-problème pour les activités du PCSS.

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