



Defence Research and
Development Canada

Recherche et développement
pour la défense Canada



Scenario Mission Task Analysis Report

Scenario and Mission Objectives Research Report

Curtis Coates

Robert Kobierski

Esterline | CMC Electronics

Scientific Authority

Lynne Genik

DRDC Centre for Security Science

The scientific or technical validity of this Contract Report is entirely the responsibility of the Contractor and the contents do not necessarily have the approval or endorsement of Defence R&D Canada.

Defence R&D Canada – Centre for Security Science

Contract Report

DRDC CSS 2013-008

July 2013

Canada

Scenario Mission Task Analysis Report

Scenario and Mission Objectives Research Report

Curtis Coates

Robert Kobierski

Esterline | CMC Electronics

Scientific Authority

Lynne Genik

DRDC Centre for Security Science

The scientific or technical validity of this Contract Report is entirely the responsibility of the Contractor and the contents do not necessarily have the approval or endorsement of Defence R&D Canada.

Defence R&D Canada – Centre for Security Science

Contract Report

DRDC CSS 2013-008

July 2013

Principal Author

Original signed by Curtis Coates

Curtis Coates

Project Engineer

Approved by

Original signed by Lynne Genik

Lynne Genik, MSc

Decision Support Section

Approved by

Original signed by Denis Bergeron

Dr. Denis Bergeron

Manager, Decision Support Section

Approved for release by

Original signed by Andrew Vallerand

Dr. Andrew Vallerand

A/ DRDC Centre for Security Science DRP Chairman

© Her Majesty the Queen in Right of Canada, as represented by the Minister of National Defence, 2013

© Sa Majesté la Reine (en droit du Canada), telle que représentée par le ministre de la Défense nationale, 2013

Abstract

The Centre for Security Science (CSS) of Defence Research & Development Canada (DRDC) has a collaborative project with Emergency Management British Columbia (EMBC) Integrated Public Safety (IPS) to demonstrate the value of a science and technology (S&T) structured approach for improving emergency management capabilities. The objective of this EMBC-DRDC collaborative project is to evaluate options at the municipal and regional levels as applied to their risk assessment and Critical Infrastructure (CI) programs. Specifically, this work looks at the identification of the overarching shared objective of risk treatment for a scenario (i.e., the collective "mission"); and decomposition of that mission into key tasks that are sufficiently specific that a given task could be undertaken by individual stakeholders with minimal direction.

Résumé

Le Centre des sciences pour la sécurité (CSS) de Recherche et développement pour la défense Canada (RDDC) a entrepris un projet en collaboration avec l'Unité intégrée de la sécurité publique de la Gestion des interventions d'urgence de la Colombie Britannique (EMBC) dans le but de démontrer la valeur d'une approche structurée en sciences et technologie (S & T) pour améliorer les capacités de gestion des urgences. L'objectif du projet concerté EMBC-RDDC consiste à évaluer les options aux échelles municipale et régionale en fonction des programmes d'infrastructures essentielles (IE) et d'évaluation des risques. De façon plus précise, la présente vise à déterminer l'objectif commun global de traitement des risques d'un scénario (c. à d., la « mission » collective) et à décomposer cette mission en tâches principales suffisamment précises pour qu'une tâche donnée puisse être entreprise par un intervenant avec un minimum de directives.

Executive summary

Scenario Mission Task Analysis Report: Scenario and Mission Objectives Research Report

Curtis Coates; Robert Kobierski; DRDC CSS CR 2013-008; Defence R&D Canada –Centre for Security Science; July 2013

Background: Defence Research & Development Canada and Emergency Management British Columbia Integrated Public Safety are working together to demonstrate the use of a Science and Technology structured approach to improving British Columbia's emergency management capabilities. The objective of this collaborative effort is to study techniques that would support municipal and regional level development of emergency response plans through the use of an effective risk management framework for treating priority risks.

A gap was found in the development of response plans in that while many municipalities were using a Hazard Risk Vulnerability Assessment Tool Kit to determine community risks, there was uneven exploitation of the risk assessments as part of a holistic risk management framework. Defence Research & Development Canada has proposed that using scenarios can aid harmonized planning by providing a shared focus for the community stakeholders.

Results: Within this, the initial portion, of the Scenario Mission-to-Task Analysis Project two scenarios were developed for the British Columbia municipalities of Nanaimo and Parksville. Work in this phase of the project also developed objectives associated with each of the four scenarios. Interaction with community domain experts was required to ensure the scenarios and objectives were representative of the two separate municipalities.

Significance: It was concluded that the scenarios and objectives contained herein are suitable for the continuation of the mission to task analysis.

Future plans: This document is the first in a series of reports that will, in total, provide the complete examination of hazard scenarios and clearly demonstrate the value of the mission to task analysis methodology to support the development of community risk mitigation plans.

Sommaire

Scenario Mission Task Analysis Report: Scenario and Mission Objectives Research Report

Curtis Coates; Robert Kobierski; DRDC CSS CR 2013-008; Defence R&D Canada – Centre for Security Science; Juillet 2013

Contexte : Recherche et développement pour la défense Canada et la Gestion des interventions d'urgence de la Colombie-Britannique travaillent ensemble à démontrer comment l'utilisation d'une approche structurée en sciences et technologie peut améliorer les capacités de gestion des urgences en Colombie-Britannique. L'objectif de ce travail de collaboration consiste à étudier des techniques susceptibles d'appuyer l'élaboration, aux échelles municipale et régionale, de plans d'intervention d'urgence grâce à l'utilisation d'un cadre de gestion efficace des risques pour le traitement des risques prioritaires.

Une lacune a été relevée dans l'élaboration de plans d'intervention, notamment que même si de nombreuses municipalités utilisent la trousse d'outils pour l'analyse des dangers, du risque et de la vulnérabilité (ADRV) pour déterminer les risques d'une collectivité, l'exploitation des évaluations des risques n'est pas uniformisée par un cadre de gestion des risques holistique. Recherche et développement pour la défense Canada a suggéré que l'utilisation de scénarios contribue à harmoniser la planification en offrant une orientation commune aux intervenants communautaires.

Résultats : dans le cadre de la partie initiale du projet de l'analyse des tâches propres à la mission basée sur un scénario, deux scénarios ont été élaborés pour les municipalités de Nanaimo et de Parksville en Colombie-Britannique. Au cours de cette étape du projet, on a également précisé des objectifs associés à chacun des quatre scénarios. L'interaction avec des spécialistes du domaine communautaire s'est avérée nécessaire afin de faire en sorte que les scénarios et les objectifs soient représentatifs de chacune des deux municipalités.

Importance : on a conclu que les scénarios et les objectifs contenus dans la présente conviennent à la poursuite de l'analyse des tâches propres à la mission.

Plans futurs : le présent document est le premier d'une série de rapports qui fourniront un examen complet des scénarios de danger et qui démontreront clairement la valeur de la méthode d'analyse des tâches propres à la mission pour appuyer l'élaboration de plans d'atténuation des risques de la collectivité.

Table of contents

Abstract	i
Résumé	i
Executive summary	ii
Sommaire	iii
Table of contents	iv
List of figures	viii
List of tables	ix
Acknowledgements	x
1 Introduction.....	1
1.1 Background.....	1
1.2 Aim.....	2
1.3 Objectives.....	2
1.3.1 General Objectives.....	2
1.3.2 Specific Requirements.....	2
1.4 Document Outline	3
2 Methodology.....	4
2.1 General	4
2.2 Community Research	4
2.3 Scenario Development.....	4
2.4 Mission Statement	4
2.5 Objectives.....	5
2.6 Community Involvement.....	6
3 Results.....	11
3.1 General	11
3.2 Community Research	11
3.3 Candidate Scenarios	11
3.3.1 General.....	11
3.3.2 Scenario Selection	12
3.4 Community Scenario Narratives	13
3.5 Scenario Review Feedback.....	14
3.5.1 Nanaimo Scenario Review Results.....	14
3.5.1.1 Scenario 1 – Hazardous Material – Propane Rail Accident	14
3.5.1.2 Scenario 2 – Earthquake.....	15
3.5.2 Parksville Scenario Review Results	16
3.5.2.1 Scenario 1 – Wildland Urban Interface Fire	16
3.5.2.2 Scenario 2 – Earthquake.....	17
3.6 Mission Statements and Mission Objectives	18

3.6.1	General.....	18
3.6.2	BCERMS Response Goals (Community Goals)	18
3.6.3	The Four Pillars of Emergency Management	19
3.6.4	Mission Statements	20
3.6.5	Mission Objectives	21
3.6.6	Analysis Team Observations	21
4	Discussion of Results.....	23
4.1	General	23
4.2	Development of a Suitable Scenario	23
4.2.1	Scenario Selection	23
4.2.2	Scenario Detail.....	23
4.3	Creation of a Mission Statement	24
4.4	Development of Mission Objectives	25
4.5	Analysis Team Observations	27
5	Conclusions and Future Work	28
5.1	General	28
5.2	Conclusions	28
5.3	Future Work.....	29
	References	30
Annex A	Nanaimo Scenario 1 – Hazardous Material (HAZMAT) Propane Rail Accident	31
A.1	Introduction	31
A.2	Scenario Overview	31
A.2.1	General Description.....	31
A.2.2	Detailed Description	32
A.3	Scenario Assumptions	32
A.3.1	Timeline.....	32
A.4	Planning Considerations.....	35
A.4.1	Variables.....	35
A.5	Implications.....	36
A.5.1	Secondary Hazards/Events	36
A.5.2	Fatalities/Injuries	36
A.5.3	Property Damage	36
A.5.4	Service Disruption	36
A.5.5	Economic Impact.....	36
A.5.6	Long-Term Health Issues	37
Annex B	Nanaimo Scenario 1 – Propane Rail Accident Mission Statement and Mission Objectives	38
B.1	General	38
B.2	Nanaimo Scenario 1 Mission Statement.....	38
B.3	Nanaimo Scenario 1 Mission Objectives.....	38
B.3.1	Mitigation/Prevention.....	39

B.3.2	Preparedness	39
B.3.3	Response	43
B.3.4	Recovery	44
Annex C	Nanaimo Scenario 2 – Off-Shore Earthquake	45
C.1	Introduction	45
C.2	Scenario Overview	45
C.2.1	General Description	45
C.2.2	Detailed Description	46
C.3	Scenario Assumptions	46
C.3.1	Timeline	46
C.4	Planning Considerations	47
C.4.1	Variables	47
C.5	Implications	48
C.5.1	Secondary Hazards/Events	48
C.5.2	Fatalities/Injuries	48
C.5.3	Search and Rescue	48
C.5.4	Property Damage	49
C.5.5	Service Disruption	49
C.5.6	Economic Impact	49
C.5.7	Long-Term Health Issues	49
Annex D	Nanaimo Scenario 2 – Off-Shore Earthquake Mission Statement and Mission Objectives	50
D.1	General	50
D.2	Nanaimo Scenario 2 Mission Statement	50
D.3	Nanaimo Scenario 2 Mission Objectives	50
D.3.1	Mitigation/Prevention	50
D.3.2	Preparedness	51
D.3.3	Response	54
D.3.4	Recovery	56
Annex E	Parksville Scenario 1 – Wildland-Urban Interface Fire	57
E.1	Introduction	57
E.2	Scenario Overview	57
E.2.1	General Description	57
E.2.2	Detailed Description	58
E.3	Scenario Assumptions	58
E.3.1	Timeline	58
E.4	Planning Considerations	58
E.4.1	Variables	58
E.5	Implications	60
E.5.1	Secondary Hazards/Events	60
E.5.2	Fatalities/Injuries	60

E.5.3	Property Damage	61
E.5.4	Service Disruption	61
E.5.5	Economic Impact	61
E.5.6	Long-Term Health Issues	61
Annex F	Parksville Scenario 1 – Wildland-Urban Interface Fire Mission Statement and Mission Objectives	62
F.1	General	62
F.2	Parksville Scenario 1 Mission Statement	62
F.3	Parksville Scenario 1 Mission Objectives	62
F.3.1	Mitigation/Prevention	63
F.3.2	Preparedness	64
F.3.3	Response	68
F.3.4	Recovery	70
Annex G	Parksville Scenario 2 – Off-Shore Earthquake	72
G.1	Introduction	72
G.2	Scenario Overview	72
G.2.1	General Description	72
G.2.2	Detailed Description	73
G.3	Scenario Assumptions	73
G.3.1	Timeline	73
G.4	Planning Considerations	74
G.4.1	Variables	74
G.5	Implications	75
G.5.1	Secondary Hazards/Events	75
G.5.2	Fatalities/Injuries	75
G.5.3	Search and Rescue	75
G.5.4	Property Damage	76
G.5.5	Service Disruption	76
G.5.6	Economic Impact	76
G.5.7	Long-Term Health Issues	76
Annex H	Parksville Scenario 2 – Off-Shore Earthquake Mission Statement and Mission Objectives	77
H.1	General	77
H.2	Parksville Scenario 2 Mission Statement	77
H.3	Parksville Scenario 2 Mission Objectives	77
H.3.1	Mitigation/Prevention	78
H.3.2	Preparedness	78
H.3.3	Response	83
H.3.4	Recovery	85
	Bibliography	87
	List of symbols/abbreviations/acronyms/initialisms	88

List of figures

Figure 1: Four-Phase Cycle of Emergency Management.....	19
Figure 2: Alternate Objectives Framework for a HAZMAT Scenario.....	27
Figure 3: Location of the Propane Rail Accident.	33
Figure 4: View of Rail Accident Site.	34
Figure 5: Map of Potential Propane Spread.....	34
Figure 6: Most severely impacted area around Nanaimo and Parksville.	47
Figure 7: Parksville Map showing path of the Wildland-Urban Interface Fire.....	59
Figure 8: Most severely impacted area around Nanaimo and Parksville.	74

List of tables

Table 1: Nanaimo Stakeholder’s Meeting Attendees – 4 July 2012.	6
Table 2: Parksville Stakeholder’s Meeting Attendees – 5 July 2012.	7
Table 3: Nanaimo Workshop 1 Attendees – Morning 28 November 2012.....	7
Table 4: Nanaimo Workshop 2 Attendees – Afternoon 28 November 2012.....	8
Table 5: Nanaimo Workshop 3 Attendees – Morning 29 November 2012.....	8
Table 6: Parksville Workshop 1 Attendees – Morning 26 November 2012.....	9
Table 7: Parksville Workshop 2 Attendees – Afternoon 26 November 2012.	9
Table 8: Parksville Workshop 3 Attendees – Morning 27 November 2012.....	9
Table 9: Parksville Workshop 4 Attendees – Afternoon 27 November 2012.	10
Table 10: Nanaimo Scenario 1 Comments and Recommended Changes.....	14
Table 11: Nanaimo Scenario 2 Comments and Recommended Changes.....	15
Table 12: Parksville Scenario 1 Comments and Recommended Changes.	16
Table 13: Parksville Scenario 2 Comments and Recommended Changes.	17
Table 14: Nanaimo Scenario 1 Introduction Elements.....	31
Table 15: HAZMAT Scenario Planning Variables.	35
Table 16: Nanaimo Scenario 2 Introduction Elements.....	45
Table 17: Earthquake Scenario Planning Variables.	47
Table 18: Parksville Scenario 1 Introduction Elements.	57
Table 19: Wildfire Scenario Planning Variables.....	59
Table 20: Parksville Scenario 2 Introduction Elements.	72
Table 21: Earthquake Scenario Planning Variables.	74

Acknowledgements

The Research Team would like to acknowledge the support provided by Karen Lindsay and her emergency management team in the City of Nanaimo and to Aaron Dawson and his emergency management team in the City of Parksville.

1 Introduction

1.1 Background

The Centre for Security Science (CSS) of Defence Research & Development Canada (DRDC) has a collaborative project with Emergency Management British Columbia (EMBC) Integrated Public Safety (IPS) to demonstrate the value of a science and technology (S&T) structured approach for improving emergency management capabilities.

The objective of this EMBC-DRDC collaborative project is to evaluate options at the municipal and regional levels as applied to their risk assessment and Critical Infrastructure (CI) programs. There is a strong interdependency between the two programs as one must understand risk to understand risk to critical infrastructure but on the other hand one must understand critical infrastructure vulnerabilities to fully understand risk. This interdependency is reflected in the multi-stakeholder nature of an effective risk management framework for treating priority risks.

The initial work during the EMBC-DRDC project examined requirements for EMBC's risk and CI programs and compared this with the province's existing programs to identify gaps. Much good work has already been achieved through the employment of EMBC's Hazard Risk Vulnerability Assessment (HRVA) Tool Kit; however, a gap was found: while many municipalities were using the EMBC HRVA Tool Kit, there was uneven exploitation of the risk assessments as part of a holistic risk management framework, which is a challenge in a multi-stakeholder environment where there is no senior executive to decide on priorities. To resolve these types of problems, using scenarios can aid harmonized planning by providing a shared focus for the stakeholders through:

1. Identification of the overarching shared objective of risk treatment for the scenario (i.e., the collective "mission"); and
2. Decomposition of that mission into key tasks that are sufficiently specific such that a given task could be undertaken by individual stakeholders with minimal direction. The process is sometimes referred to as a mission-to-tasks analysis.

The intent of this work is to examine the utility of scenarios and mission-to-tasks analysis in supporting an effective holistic risk management framework for municipalities. To evaluate utility, the work will involve one small and one large municipality. The specific municipalities, which have been determined in consultation with EMBC, are Nanaimo and Parksville, both of which have already conducted risk assessments.

Through the development of “real world” scenario-based emergency measures risk mitigation plans, EMBC/DRDC aim to provide tools and techniques to Canadian communities, both large and small, to allow them to quickly and easily produce essential lifesaving Prevention and Mitigation, Preparedness, Response and Recovery plans and procedures.

1.2 Aim

The aim of the work associated with this project is to examine the utility of hazard scenarios and mission-to-tasks analyses in supporting the development of risk mitigation plans and other essential holistic risk management frameworks for municipalities. This work is intended to cover the four pillars of risk management (Prevention and Mitigation, Preparedness, Response and Recovery).

1.3 Objectives

1.3.1 General Objectives

There are several objectives for this project:

1. Work with the two identified communities to develop risk mitigation plans. The plans will be based on scenarios decomposed to the mission segment and task level where the risks associated with the tasks are identified and a mitigation plan is developed. Each task will have success and failure criteria associated with it. Closely associated with the work is the review of these four plans to create a generic list of tasks and their associated mitigation plans.
2. Develop a measurement framework that articulates how stakeholders will collectively achieve scenario “mission” objectives, the outcome states for each objective and success-failure criteria (information that indicates whether the objectives have been achieved).
3. Capture the methodology used, create a general framework or template that other communities could use, and generate a report indicating whether this would be a useful method to assist communities in risk mitigation planning.

1.3.2 Specific Requirements

The requirements are to exploit existing municipal risk assessments for one small (less than 50,000 inhabitants - Parksville) and one large (greater than 50000 inhabitants - Nanaimo) municipality to:

1. develop two scenarios for each municipality;
2. confirm the "mission" in each scenario with participating municipal stakeholders;
3. identify community objectives related to each scenario;
4. decompose the mission into tasks in consultation with municipal stakeholders; and
5. examine the tasks across all scenarios to identify duplicate and reinforcing tasks to provide an aggregate view of key tasks.

The project will achieve the requirements listed above through five specific tasks:

- Task 1: Development of scenarios and objectives;
- Task 2: Development of measurement frameworks;
- Task 3: Identification of key tasks;
- Task 4: Synthesis of key tasks across all scenarios; and
- Task 5: Evaluation of the utility of scenarios and mission-to-tasks analysis.

This report addresses Task 1.

1.4 Document Outline

This Scenario and Mission Objectives Research Report consists of the following parts:

Executive Summary

Section 1 - Introduction

Section 2 - Methodology

Section 3 - Results

Section 4 - Discussion of Results

Section 5 - Conclusions

Annexes - The following annexes are included in this document:

- Annex A Nanaimo Scenario 1 – Hazardous Material (HAZMAT) Propane Rail Accident
- Annex B Nanaimo Scenario 1 – Propane Rail Accident Mission Statement and Mission Objectives
- Annex C Nanaimo Scenario 2 – Off-Shore Earthquake
- Annex D Nanaimo Scenario 2 – Off-Shore Earthquake Mission Statement and Mission Objectives
- Annex E Parksville Scenario 1 – Wildland-Urban Interface Fire
- Annex F Parksville Scenario 1 – Wildland-Urban Interface Fire Mission Statement and Mission Objectives
- Annex G Parksville Scenario 2 – Off-Shore Earthquake
- Annex H Parksville Scenario 2 – Off-Shore Earthquake Mission Statement and Mission Objectives

2 Methodology

2.1 General

Overall, the methodology comprised the examination of existing municipal risk assessments, development of candidate scenarios for further analysis, review of existing material generated by emergency management agencies and extensive involvement of the communities. The methodology used for these steps is described in the following subsections.

2.2 Community Research

Prior to meeting with the community stakeholders, the research team reviewed material from Nanaimo [1][2], Parksville[3] and EMBC[4][5]. This material was either available online or was provided by the stakeholders. As an initial step, it was essential to develop an understanding of each community's emergency management structure, critical concerns and status of the hazard assumptions.

2.3 Scenario Development

An introductory working session was held with the municipal stakeholders to explain to each group the intent of the project and to conduct introductions of the team members. At each session the topic of scenario selection was discussed and a broad list of potential scenario types was put forward by each community. These were, for the most part, derived from earlier work conducted by each community using the HRVA Toolkit. Through discussion, agreement was gained at the introductory session regarding the two types of hazards to be addressed by scenarios for each of the two municipalities.

Additionally, at each of the introductory sessions, the project team was provided with a tour of the respective cities and during the tours specific hazards were discussed to give the team firsthand knowledge of the situation 'on the ground'.

The research team also referred to scenarios developed by the Department of Homeland Security as a guide to the format and potential content of scenarios[6].

2.4 Mission Statement

The concept of a mission statement is well understood by the military community; however, this is not a common term used in the civilian environment. In order to assist with the development of this statement it is important to identify the group or organization that has the purpose identified in the mission statement. For this project, the 'community' was chosen to be the group accepting responsibility for the mission. A mission is, in essence, what has to be done. Therefore, the mission statement relating to each of the scenarios was a sentence stating the purpose of the community when confronted with the hazard, or what has to be done by the community.

During the workshops conducted in Nanaimo and Parksville (see subsection 2.5 below), the analysis team initiated discussion on each of the scenarios to gain an understanding of the domain expert's appreciation for the purpose of the community when confronted with the hazard, or their appreciation of what has to be done by the community.

A community's response to a significant hazardous event will be complex and multi-faceted, and will unfold at many levels, all of which may be influenced by the preparation, response and recovery actions conducted by the community. As a result, the project team, comprised of DRDC and CMC members prepared statements (a single sentence) for each community for each of the hazards being analysed; however, they incorporated multiple subparagraphs to represent, in each case, the complete range of community goals and the philosophy underlying them.

Within the project team, a peer review was conducted for the four mission statements, which were documented for subsequent inclusion in this report.

2.5 Objectives

Once the scenarios had been prepared and the community's mission understood, the analysis team, comprised of CMC personnel began to build a listing of community objectives relating to each of the scenarios. Through discussion within the team a structure (framework) for organizing the objectives was created and used for subsequent working sessions to complete the list of community objectives. In order to produce the objectives framework, the team studied existing similar frameworks developed by the United States (US) Department of Homeland Security, and community scenarios developed to support city emergency response exercises.

Following a preparation period where the analysis team gained an understanding of the community objectives for each of the hazard events, the team met with domain experts from the city of Nanaimo and the city of Parksville. Considering that the intent of this project is to develop a methodology for communities to use scenarios to augment the development of response plans, the Nanaimo and Parksville domain experts were encouraged to produce their own community's mission objectives. Each working session involved a review of the scenario, as discussed earlier, after which the attendees were given the opportunity to brainstorm individual objectives organized in accordance with the objectives framework prepared earlier. The workshop attendees were asked to write their contributions on yellow 'Post-It-Notes', which were collected as each new objective was informally presented. The analysis team also took personal notes of discussions that occurred but were not documented using the 'Post-It-Notes'.

There were multiple working sessions at each community that generated lists of objectives for the four scenarios being studied. All contributions were compiled into four super-lists, one for each scenario. The entries were studied by the analysis team, which harmonized the wording, combined similar entries and subsumed minor objectives into upper level objectives. The analysis team used only community generated input for the production of mission objectives to allow a better understanding of the ability of community stakeholders to generate a decomposition from a mission scenario to objectives. In a later stage of the project, the four lists of objectives will be united to form a synthesized mission-to-task template that will serve as a potential generic template for the mission-to-tasks analysis.

2.6 Community Involvement

Community involvement was considered critical to the success of the project. Each community was expected to take ownership of the scenarios, objectives, key tasks and the eventual plans that will be created as part of this process. As described above there were two main interactions with the community stakeholders. The first set of meetings was held in July. In addition to those listed below, the project team members, consisting of Lynne Genik, Paul Chouinard, Curtis Coates and Bob Kobierski, were in attendance.

Table 1: Nanaimo Stakeholder's Meeting Attendees – 4 July 2012.

Name	Title	Association
Karen Lindsay	Emergency Program Manager	Nanaimo Fire Rescue
Shannon Krilow	Emergency Management Planning Coordinator	EMBC
Heather Lyle (by phone)	Emergency Management Coordination	EMBC
Ron Lambert	Fire Chief	Nanaimo Fire Rescue
Martin Drakely	Fire Captain	Nanaimo Fire Rescue
Craig Richardson	Deputy Chief	Nanaimo Fire Rescue
Wade Smith	Assistant Chief - Operations	Nanaimo Fire Rescue
Bruce Wright	Senior Patrol NCO	Royal Canadian Mounted Police (RCMP)
Lance Stephenson	Superintendent	BC Ambulance Service
Michael Sheppard	Plant Manager	Canexus Chemicals
Edward Dahlgren	Harbour Master	Nanaimo Port Authority
Barry Querengesser	Terminal Manager	Suncor Energy
Alex Grant	Safety Officer	BC Environment
Ritchie Fulla	General Foreman	Water Department
Susan Clift	Director	Engineering & Public Works
Mark Demecha	Manager of Civic Facilities	Parks Recreation and Culture City of Nanaimo

Table 2: Parksville Stakeholder's Meeting Attendees – 5 July 2012.

Name	Title	Association
Aaron Dawson	Emergency Program Coordinator	City of Parksville
Doug Banks	Fire Chief	Parksville Fire Department
Lance Stephenson	Superintendent	BC Ambulance Service
Bob Gallagher	Director Coastal Operations	BC Ambulance Service
Al Metcalf	Director of Operations	City of Parksville
Vaughn Figueira	Director of Engineering	City of Parksville
Alan Berry	Forest Protection Technician	Wildfire Management Branch
Darrell Robertson	NCO Oceanside Detachment	RCMP
Bob Longmore	Emergency Radio Coordinator	District of Vancouver Island
Tom Williams	Director	Oceanside Emergency Support Services
Tony Taylor	Operator	Radio Emergency System

The second set of project workshops was conducted at both Nanaimo and Parksville at which time the community domain experts:

1. reviewed and provided comment on the team-developed hazard scenarios and associated variables;
2. provided comment for subsequent development of the mission statements by the analysis team; and
3. brainstormed and documented the mission objectives to be assumed by each community in the event that the hazards identified earlier actually occurred.

The dates and attendees (community domain experts) for these workshops are listed from Table 3 to Table 9 below. In addition to those listed, the project team members, consisting of Lynne Genik, Curtis Coates and Bob Kobierski, were in attendance. Heather Lyle and Shannon Krilow (EMBC) also audited some of the sessions by telephone.

Table 3: Nanaimo Workshop 1 Attendees – Morning 28 November 2012.

Name	Title	Association
Boyd Hunter	Bylaw Officer	City of Nanaimo
Lance Stephenson	Superintendent	BC Ambulance Service

Name	Title	Association
Clare Fletcher	Regional Manager	EMBC
Craig Richardson	Deputy Chief	Nanaimo Fire Rescue
Stu Harrison	Deputy Chief	Nanaimo Fire Rescue
Martin Drakely	Fire Captain	Nanaimo Fire Rescue
Ron Dawley	Assistant Chief - Operations	Nanaimo Fire Rescue
Wade Smith	Assistant Chief - Operations	Nanaimo Fire Rescue
Karen Lindsay	Emergency Program Manager	Nanaimo Fire Rescue
Al O'Donnell	Operations Officer	RCMP

Table 4: Nanaimo Workshop 2 Attendees – Afternoon 28 November 2012.

Name	Title	Association
Dave McNulty	Safety Coordinator	Canexus Chemicals
Edward Dahlgren	Harbour Master	Nanaimo Port Authority
Barry Querengesser	Terminal Manager	Suncor Energy
Rob Gatehouse	Branch Manager	Newalta Corporation
Alex Grant	Safety Officer	BC Environment
Craig Richardson	Deputy Chief	Nanaimo Fire Rescue
Karen Lindsay	Emergency Program Manager	Nanaimo Fire Rescue
Wade Smith	Assistant Chief	Nanaimo Fire Rescue
Bruce Anderson	Manager Planning and Design	Census Subdivision (CSD) - City of Nanaimo
Ron Dawley	Assistant Chief - Operations	Nanaimo Fire Rescue

Table 5: Nanaimo Workshop 3 Attendees – Morning 29 November 2012.

Name	Title	Association
Craig Richardson	Deputy Chief	Nanaimo Fire Rescue
Bill Sims	Manager Water Resources	Engineering & Public Works
Ritchie Fulla	General Foreman	Water Department
Karen Lindsay	Emergency Program Manager	Nanaimo Fire Rescue

Name	Title	Association
Susan Clift	Director	Engineering & Public Works
Mark Demecha	Manager of Civic Facilities	Parks Recreation and Culture City of Nanaimo
Ron Dawley	Assistant Chief - Operations	Nanaimo Fire Rescue

Table 6: Parksville Workshop 1 Attendees – Morning 26 November 2012.

Name	Title	Association
Aaron Dawson	Emergency Program Coordinator	City of Parksville
Blaine Russell	Director of Community Planning	City of Parksville
Al Metcalf	Director of Operations	City of Parksville
Vaughn Figueira	Director of Engineering	City of Parksville

Table 7: Parksville Workshop 2 Attendees – Afternoon 26 November 2012.

Name	Title	Association
Aaron Dawson	Emergency Program Coordinator	City of Parksville
Bob Longmore	Emergency Radio Coordinator	District of Vancouver Island
Tom Williams	Director	Oceanside Emergency Support Services
Krystal Hanson	Coordinator	Vancouver Island Health Authority
Terry Smith	A/Ops Non-Commissioned Officer (NCO)	Oceanside RCMP
Clare Fletcher	Regional Manager	EMBC

Table 8: Parksville Workshop 3 Attendees – Morning 27 November 2012.

Name	Title	Association
Aaron Dawson	Emergency Program Coordinator	City of Parksville
Alan Berry	Forest Protection Technician	Wildfire Management Branch
Lance Stephenson	Superintendent	BC Ambulance Service
Cam Murray	French Creek	Canadian Coast Guard

Doug Banks	Fire Chief	Parksville Fire Department
------------	------------	----------------------------

Table 9: Parksville Workshop 4 Attendees – Afternoon 27 November 2012.

Name	Title	Association
Aaron Dawson	Emergency Program Coordinator	City of Parksville
Christine Trejanenko	Manager, Emergency Planning and Business Continuity	Fortis BC
Ed Campbell	Manager	BC Hydro

3 Results

3.1 General

The results of the work associated with Task 1 of this project are included in this section and the related annexes contained at the end of this report. The results are organized into the following subsections:

1. Candidate Scenarios;
2. Community Scenario Narratives;
3. Scenario Review Feedback; and
4. Mission Statements and Mission Objectives.

3.2 Community Research

The research team reviewed several documents prior to the first meeting with the community stakeholders. The Nanaimo documentation included their Response and Recovery Plan[1] and the Emergency Program Guide[2]. The documentation specific to Parksville was their Hazard, Risk and Vulnerability Assessment [3].

3.3 Candidate Scenarios

3.3.1 General

The cities of Nanaimo and Parksville are centrally located on the east coast of Vancouver Island. Nanaimo is the second largest urban centre on Vancouver Island and serves as the regional centre for mid and north Vancouver Island. Both communities are located on the ocean with regions of steep terrain near the water. The population of Nanaimo (approximately 90,000) is an aging population and even more so for Parksville (population approximately 12,000). Other than the size difference, one of the major dissimilarities between the two communities is that Nanaimo has a varied zoning structure with pockets of light and heavy industry intertwined with residential areas.

Of the potential scenario topics that were considered for this analysis, the following were identified:

- earthquake;
- large scale fire(s);
- tsunami;
- a Hazardous Material (HAZMAT) situation;

- a biological situation;
- terrorist attack;
- a fuel spill (either Petroleum, Oil & Lubricants (POL) or propane); and
- flooding (either naturally occurring or from the failure of a dam).

Additionally, combinations of these disasters were considered, and it was clear that many of the hazardous situations are linked to the earthquake scenario.

3.3.2 Scenario Selection

Prior to the first meeting with the stakeholders, the emergency response members most closely associated with the project had selected the two hazards they wished to have included in the analysis.

In consultation with the respective municipalities (i.e., municipal stakeholders), EMBC and DRDC, two scenarios were chosen for Parksville and two scenarios were chosen for Nanaimo. In consultation (workshops) with municipal stakeholders, a shared understanding of each scenario's "mission" was developed as well as an objectives framework articulating the "mission" (i.e., a set of "mission" objectives). Based on the city tours (held in July 2012), discussions with the Emergency Management staff and details obtained in the working sessions, the project team prepared a short list of scenarios for each of the types of hazards agreed upon at the introductory working sessions. A comparison was made between each scenario on the short list, and the one most suited for the project was chosen for further analysis. In total four scenarios were selected, one was chosen for each of the two hazards identified by the community stakeholders, for each of the two cities. Sample scenarios were collected from the domain experts, that for the most part had been used for training exercises, and these were used to further inform the analysis. Each of the selected scenario topics was elaborated upon as prose based on input from domain experts. The resulting documents, following peer review and modification within the team, were presented to the community stakeholders. Along with the scenario narrative, which details one specific fictitious event, a list was prepared of differences (scenario variables) that could change the outcome of the scenario. For example, if the hazardous event could occur at any time of the day, then 'time of day' was identified as a variable.

The City of Nanaimo Emergency Program Manager suggested that the hazards considered for the two scenarios be taken from the top hazards in the city's risk assessment: a hazardous material event and an earthquake. The City of Parksville Emergency Program Coordinator similarly suggested the top two hazards from Parksville's HRVA, namely fire (interface and wildfire) and earthquake.

In summary, the scenario types selected for this analysis were:

1. Nanaimo:
 - a. HAZMAT event, and
 - b. earthquake; and

2. Parksville:
 - a. Wildland-Urban Interface Fire (WUI Fire or Interface Fire), and
 - b. earthquake.

For further refinement of the scenario type (to select a scenario topic), consideration was given to issues such as the risk presented to the community by the particular scenario, the analytical usefulness of the specific scenario and the extent to which the scenario would engage multiple stakeholders and contribute to collaboration and shared understanding.

3.4 Community Scenario Narratives

Each of the four framework scenarios, included in the annexes, follow the specific format provided below:

1. Introduction;
2. Scenario Overview:
 - a. General Description, and
 - b. Detailed Scenario,
3. Scenario Assumptions; and
4. Planning Considerations:
 - a. Variables, and
 - b. Implications.

Within the Nanaimo scenarios the Emergency Operations Centre (EOC) will be referred to as the Emergency Coordination Centre (ECC) which is the term used for an EOC for the last 10 years in the central Vancouver Island area. This allows the community domain experts to use the expression most familiar to them which is one of the fundamental tenants of good scenario preparation.

The scenarios generated during Task 1 of this project and as presented to the stakeholders during the November workshops are:

- Nanaimo Scenario No 1 – Propane Rail Accident, which is a HAZMAT scenario, is contained in Annex A.
- Nanaimo Scenario No 2 – Off-Shore Earthquake is contained in Annex C.
- Parksville Scenario No 1 – Wildland-Urban Interface Fire is contained in Annex E.
- Parksville Scenario No 2 – Off-Shore Earthquake is contained in Annex G.

Although some of the participants arrived at the working sessions having already read the material, it was noted that the scenarios were not studied in detail and many of the participants saw them for the first time at the working sessions. The result was that the scenarios were used exclusively to orient the discussions to support the brainstorming of scenario variables and mission objectives. The analytical process of decomposition of scenarios by study of the scenarios was not emphasized.

3.5 Scenario Review Feedback

The following feedback on the four community scenarios was provided by the stakeholders during the November workshops. It is recommended that these changes be made to the applicable scenarios and the updated scenarios be used in this project moving forward.

3.5.1 Nanaimo Scenario Review Results

3.5.1.1 Scenario 1 – Hazardous Material – Propane Rail Accident

Comments and recommended changes by section of Nanaimo Scenario 1 are provided in Table 10.

Table 10: Nanaimo Scenario 1 Comments and Recommended Changes.

Scenario Section	Details	Recommended Change
Introduction	Evacuation	Potential numbers requiring evacuation should be changed to ‘up to 8 to 10,000’.
Variables	Type of material	Add implications: <ul style="list-style-type: none"> ♦ Toxicity; ♦ Environmental impact; and ♦ Time for clean-up.
	Time of day	School day should be considered.
	Location of fire	Add: <ul style="list-style-type: none"> ♦ Requirement to evacuate critical infrastructure such as Emergency Coordination Centre (ECC) or 911 centre. Add implications: <ul style="list-style-type: none"> ♦ Time to respond.

Implications	Long-term health issues	Add danger of carcinogens to the potential health hazards.
--------------	-------------------------	--

3.5.1.2 Scenario 2 – Earthquake

Comments and recommended changes by section of Nanaimo Scenario 2 are provided in Table 11.

Table 11: Nanaimo Scenario 2 Comments and Recommended Changes.

Scenario Section	Details	Recommended Change
Introduction		No changes.
Scenario Assumptions		No changes.
Variables	Earthquake characteristics	Add: <ul style="list-style-type: none"> ♦ Consider the occurrence and severity of aftershocks as each major aftershock will require a new survey of infrastructure; and ♦ Collapse of coal mines.
Implications	Property Damage	There may be additional property damage related to the collapse of coal mines.
	Service disruption	<p>The impact caused by damage to the natural gas distribution lines is they can ‘feed’ fires not cause fires.</p> <p>There must be more emphasis on smaller bridges within in the city, not just those on the main roads. The collapse of smaller bridges will divide / segment the city.</p> <p>The entire water supply for the city is at risk.</p> <p>A harbour floor survey will be required before deep draft ships can re-enter the port.</p>

3.5.2 Parksville Scenario Review Results

3.5.2.1 Scenario 1 – Wildland Urban Interface Fire

Comments and recommended changes by section of Parksville Scenario 1 are provided in Table 12.

Table 12: Parksville Scenario 1 Comments and Recommended Changes.

Scenario Section	Details	Recommended Change
Introduction	Evacuation	Potential numbers requiring evacuation should be increased to 5,000.
Detailed Description	Fire start time	Time should be changed to noon to allow more hours of burn time before nightfall.
	Date	Date of the fire should be changed to the August long weekend; the days are longer increasing the risk.
	Details of location	The area is only within the Parksville city limits; this should be changed to 'region of area of responsibility of the Parksville Fire Department.'
Variables	Environmental challenges	Add: <ul style="list-style-type: none">♦ Condition of the Englishman River; and♦ Temperature and humidity.
	Location of fire	Add: <ul style="list-style-type: none">♦ Access to water supply in area Fire Department is responding;♦ Access to fire; and♦ Proximity to evacuation routes.
	Time of day	School day.
Implications	Fatalities/injuries	Smoke is an increased risk given the elderly population in Parksville.

	Service disruption	Cellular service may be overloaded.
	Long-term health issues	Smoke should be considered as a potential for long term hazards.

3.5.2.2 Scenario 2 – Earthquake

Comments and recommended changes by section of Parksville Scenario 2 are provided in Table 13.

Table 13: Parksville Scenario 2 Comments and Recommended Changes.

Scenario Section	Details	Recommended Change
Introduction		No changes.
Scenario Assumptions	General assumptions	Indicate it is a school day.
Variables	Earthquake characteristics	Must break down the critical infrastructure impacts.
	Time of day	School day should be considered State of the tide must be considered, the threat posed by a tsunami is increased if coincident with high tide.
	Time of year	This section must be added as the population of Parksville varies dramatically throughout the year. Seasonal impacts also increase the risk of flooding.
Implications	Public Expectations	There will be implications associated with the high expectations of the community for support from government directly after an earthquake. The expectations are highest for health care and temporary housing.
	Service disruption	The impact caused by damage to the natural gas distribution lines is they can ‘feed’ fires

		not cause fires.
--	--	------------------

3.6 Mission Statements and Mission Objectives

3.6.1 General

The analysis conducted to produce mission statements and a list of mission objectives for each of the four scenarios quickly led to the British Columbia Emergency Response Management System (BCERMS) response goals [4] as an outline for the mission statements, and the four pillars of emergency management as a suitable upper level taxonomy for the structure of generic mission objectives. The pillars are generally temporal in nature which facilitates creation of mission objectives. Additionally, it was found that domain experts related most often to one of the pillars which allowed them to contribute to a manageable group of mission objectives. Although the BCERMS response goals and the four pillars of emergency management are well known to those associated with emergency management in B.C., to assist the reader they have been repeated below for convenience.

3.6.2 BCERMS Response Goals (Community Goals)

The British Columbia Emergency Response Management System is a comprehensive management framework that ensures a coordinated and organized provincial response and recovery to any and all emergency incidents. The broad spectrum of components of BCERMS includes operations and control management, qualifications, technology, training and publications.

Based on the study of the mission scenarios and EMBC reference material collected during the project [5], the BCERMS Response Goals, listed below, have been selected as the basis for the community mission statements for the communities' responses to the incidents described in the four scenarios. The use of the BCERMS Response Goals was considered suitable as a method of grouping the objectives in all four pillars of Emergency Management, not just the response pillar. These Top Level Goals as a unit are considered the "shared goal" of the community. The eight BCERMS Community Response Goals are to:

1. provide for the safety and health of all responders;
2. save lives;
3. reduce suffering;
4. protect public health;
5. protect government (and critical) infrastructure;
6. protect property;

7. protect the environment; and
8. reduce economic and social losses.

These eight response goals were then aligned with the four pillars and the overall community objectives as the starting point for each hazard's mission statement.

3.6.3 The Four Pillars of Emergency Management

With regard to the four pillars of emergency management, the following outline is provided from the Emergency Management in BC: Reference Manual.

“Emergency management cycle is based on the four pillars of emergency management – mitigation and prevention, preparedness, response and recovery. They are all interconnected. The activities within the various phases take place concurrently and in support of the others. For example, recovery needs to begin shortly after response activities are initiated, and mitigation activities often start prior to recovery being complete and carry on while preparedness activities are underway. The cycle as a whole is an ongoing process.

This four-phase cycle of emergency management—mitigation and prevention, preparedness, response, and recovery—is illustrated by Figure 1 below.



Figure 1: Four-Phase Cycle of Emergency Management.

A comprehensive emergency management program is based on the four-pillar approach:

Mitigation and Prevention – means actions taken to eliminate or reduce hazards and their impacts. Mitigation involves actions taken to protect lives and property, such as dike enhancements, land-use management and public education.

Preparedness – means measures undertaken in advance to ensure that individuals and agencies will be ready to react, by developing emergency plans, mutual aid agreements, resource inventories, training, exercises, and emergency communications systems.

Response – begins when an emergency is imminent or as the event occurs. Response encompasses the activities that address the direct effects of an incident and are designed to limit the loss of life, personal injury and property damage. Local government is responsible for emergency response. As indicated by the situation, response activities include:

- gathering information and prioritizing response activities,
- investigating the nature and source of the threat,
- allocating scarce resources and lifesaving needs (e.g., evacuation, search and rescue, emergency medical assistance),
- restoring critical infrastructure (e.g., communication systems, transportation, utilities), and
- ensuring continuity of critical services (e.g., public works).

Recovery – focuses on actions to restore a community to as close to pre-disaster state as possible. Recovery measures include activities such as:

- establishing resiliency centers,
- supporting evacuees directly impacted by emergencies,
- providing financial assistance and restoring economic activity,
- managing donations, and
- developing initiatives to mitigate the effects of future incidents.” [4]

3.6.4 Mission Statements

The project notes collected at the workshops showed that during discussions of the four BCERMS Pillars the community prioritised their activities in accordance with the BCERMS goals listed in subsection 3.6.2. This indicated that either the goals are a good listing of a community’s natural response tendencies or the EMBC training has been well accepted by the communities. Regardless, these goals and the order in which the goals are presented are a good indication of ‘what the community must do’ or the purpose of the community when a hazard occurs.

Using the knowledge obtained during the development of the scenarios and drafts of the mission statements and mission objectives, and from the project workshops, the analysis team wrote the

community mission statements to align with the BCERMS goals. The mission statements were peer reviewed and are contained in the following annexes:

1. Annex B Nanaimo Scenario 1 – Propane Rail Accident Mission Statement and Mission Objectives
2. Annex D Nanaimo Scenario 2 – Off-Shore Earthquake Mission Statement and Mission Objectives
3. Annex F Parksville Scenario 1 – Wildland-Urban Interface Fire Mission Statement and Mission Objectives
4. Annex H Parksville Scenario 2 – Off-Shore Earthquake Mission Statement and Mission Objectives

3.6.5 Mission Objectives

Once the team had harmonized the wording of the mission objectives provided during the workshops, combined similar entries and subsumed minor objectives into upper level objectives, the results were collated in accordance with the four pillars of emergency management outlined in Section 3.6.3. The objectives were then peer reviewed and recorded in the following annexes:

1. Annex B Nanaimo Scenario 1 – Propane Rail Accident Mission Statement and Mission Objectives
2. Annex D Nanaimo Scenario 2 – Off-Shore Earthquake Mission Statement and Mission Objectives
3. Annex F Parksville Scenario 1 – Wildland-Urban Interface Fire Mission Statement and Mission Objectives
4. Annex H Parksville Scenario 2 – Off-Shore Earthquake Mission Statement and Mission Objectives

It was noted that for many of the pillars there were a large number of objectives identified, the most being 99 objectives for the pillar of Preparedness for the earthquake scenario in Parksville (Annex H). Sixty-five objectives were generated for the same pillar and the same hazard in Nanaimo (Annex D).

3.6.6 Analysis Team Observations

The following observations were recorded during the conduct of the work reported herein. These observations relate to the community responses received during the working sessions.

During the feedback session that was conducted following each workshop, comments received by the attendees were positive and there was general support for the process. The following quotes were recorded:

1. “The use of scenarios is very helpful for determining the objectives and the gaps”;
2. “Yes, it makes sense that we use scenarios”; and
3. “I really like it because it makes you think – we should continue”.

Constructive comments voiced by the participants related to their interest in reviewing the material in advance and perhaps obtaining more in depth material prior to the workshop.

4 Discussion of Results

4.1 General

This section contains discussion of the results presented in Section 3. It is worthwhile noting that this document, for the most part, is a vehicle for reporting the decomposition of the community scenarios into an objectives framework for subsequent decomposition to key tasks. During this process observations were made by the analysis team and those observations are discussed herein.

4.2 Development of a Suitable Scenario

4.2.1 Scenario Selection

Preparation of a framework scenario narrative to use as the start point for the scenario-to-task decomposition begins with the selection of the general hazard (scenario type) with which to work. The community stakeholders, specifically the city Emergency Program Managers, were well versed in the hazards their cities face and generation of a long list, and then a short list, of hazards to consider was not a difficult task.

During the progress of the work associated with Task 1, many different approaches were used for the preparation of scenarios. These included higher level strategic scenarios through to complex tactical narratives. As discussed in the following subsection, the analysis team gravitated towards a less complex scenario, which used scenario variables, as the best approach. This is important because the selection of the scenario topic within the scenario type was easier given that complex details did not have to be accommodated or approved by the stakeholders. The final scenario topics were chosen by the analysis team through consensus and in consultation with community stakeholders. It was easy to gain agreement on the final selection.

4.2.2 Scenario Detail

The nature of this research project is one of determining the value of a scenario-to-task decomposition for use when generating or updating community emergency management plans. The work undertaken in Task 1 involved trialing one approach to the use of scenarios, the methodology of which is detailed in Section 2 of this report. The scenario prose describes the conditions before the event and the results of the event itself; responder's actions are only briefly outlined. In essence this approach utilized a scenario that was succinct, could be read and understood during a working meeting and stimulated a 'brainstorming' session to produce a list of community objectives. The advantage of such a scenario style is that it is easy to produce and easy to gain agreement within a community because the details are left to the readers imagination. The subsequent process of scenario review and generation of community objectives is rapid (days rather than weeks) and involves input from many different representatives from various community organizations. Disadvantages are that the 'brainstorming' sessions may provide an incomplete listing of objectives; however, this problem may be ameliorated by EMBC's future provision of a sample list of community objectives based on the results of this DRDC study.

An alternate approach for the use of scenarios, and the style of the scenario prose, is to prepare a more comprehensive document that includes not only the original setting within which the hazard occurs but also the evolution of events as the responders react in accordance with best practices. This style of scenario is most often used during the design of complex systems and the preparation of the associated operator's procedures for these systems. During the preparation of such a scenario, when the analysis team encounters a choice or branch in the scenario (e.g. the number of propane rail tank cars to leak during a HAZMAT incident) the story line always follows the most complex but realistic path. For the example cited, the scenario would indicate that one car was leaking and the second may be leaking, the status was unknown. The perceived advantages of a more comprehensive scenario are that the analysis team can, by inspection, generate a long list of community objectives for review by domain experts. A 'brainstorming' session with a large number of domain experts is not required, rather the list of objectives would be reviewed by fewer individual and their observations provided in written form using Word 'Track Changes' or other similar method. Disadvantages of a more comprehensive scenario are that they take considerable effort to prepare, follow only one evolution of the hazard and are less widely read and reviewed by community members.

The level of detail that can be contained in any scenario may be very comprehensive as domain experts provide step by step sequences to their actions. Considering that, in the area of emergency response, an event can last multiple days, a detailed scenario can become very long very fast. Considering the user population's time constraints, combined with the use case for these scenarios, the value of detailed scenarios descriptions was found to be limited. Rather, accurate scenarios that were short but compelling were judged to be of more value. Considering that decomposition of the scenarios into objectives and the identification of key tasks is yet to come, the length of a scenario and the details contained in the scenario should be such that it stimulates discussion and reflection in order to ensure that the subsequent analysis effort is correctly directed.

With regard to the selection of detail to include in a scenario, a comparison of the advantages and disadvantages presented above leads to the finding that a brief scenario, similar to those contained in Annexes A, C, E and G, is better suited to EMBC's scenario-to-task decomposition than a more comprehensive scenario. The main advantages of the brief scenario are the speed of preparation and employment, and the more inclusive nature of community involvement. The advantage of the more comprehensive scenario is perceived to be the more comprehensive list of objectives that would result; however, this advantage will be compensated for with the 'pick list' of community objectives included with a mission to task work package provided by EMBC. It should be noted that the production of a list of scenario variables is important to produce in each of the two cases discussed above and that this activity does not favour either style of scenario.

4.3 Creation of a Mission Statement

The mission statements, created as a result of the application of the methodology presented in Section 2, should reflect the goals and philosophy of the community and as a result matched up with the published BCERMS goals. A mission statement is prepared more for the group that has the mission (the community's Emergency Management (EM) staff and first responders) than for the individuals who benefit from the community's actions. The BCERMS goals are publicized internally and serve this purpose well. Maintaining, and when necessary, updating these goals

satisfies the purpose of developing or renewing a community mission statement. Incorporation of the community mission statement into the mission-to-task processes is desirable, but a more efficient approach would be to relate (document the specifics of) the BCERMS goals as they apply to the specific hazard type under analysis, and omit the preparation of a specific scenario mission statement.

4.4 Development of Mission Objectives

Once the analysis team had developed a community scenario and the associated mission statement, and applied the methodology described in Section 2 to generate mission objectives, the production of Annexes B, D, F and H was both straightforward and time efficient. An understanding of the intent of the domain experts' written comments was necessary in order to reword the handwritten objectives passed in during the 'brainstorming' sessions and this was possible based on the verbal description that accompanied each submission of an objective.

Within every pillar of each scenario the objectives were ordered in accordance with the description contained in the definition of the pillar (see subsection 3.6.3). For example, under the pillar of 'Preparedness', objectives were ordered by: emergency plans, mutual aid agreements, resource inventories, training, exercises, and emergency communications systems. This was easy to accomplish and considered by the analysis team to be a reasonable procedure to incorporate.

When two objectives were listed near each other, they were ordered in accordance with the priorities of the BCERMS goals and this was also straightforward. Once all the objectives identified by the domain experts had been binned (under the four pillars of emergency management) and ordered, similar entries were combined. All entries were rewritten (if necessary) in the form of a verb-object phrase. This was also an uncomplicated task, although time consuming.

When the lists of objectives from one community were compared to the corresponding lists from the other community, for example earthquake preparedness in Nanaimo and Parksville, the contents were very similar. Wording of each objective was different, but content was most often repeated. For example where Nanaimo had the objective to:

"Develop and maintain a plan to respond to aftershocks which, in each case, are essentially a new event."

Parksville had the objective to:

"Develop and maintain policies and plans for utility inspections following each aftershock, including an allowance for one service provider to inspect for multiple service providers."

Occasionally an objective was included in one list but not the corresponding list from the other community as is the case with Nanaimo's earthquake objective to:

"Establish policies and procedures for prioritizing incident responses and communicating the decisions regarding which area of the city will receive assistance in which order."

This item was not included in the corresponding list for Parksville.

It was found that the methodology used to produce the lists of objectives, in the framework defined by the four pillars of emergency management for each scenario, was satisfactory. The list of objectives that was generated, although not complete at the end of the working session, was adequate and could easily be completed through review of other similar lists. This will be conducted during the next phase of the research project.

It was also found that the objectives contained in Annexes B, D, F and H should be used for this project “as is”, without addition. That is to say, if an objective from the ‘Response’ pillar of Nanaimo Scenario 1 could reasonably be added to the ‘Response’ pillar of Scenario 2, this should not be done. The rationale for this is that the four lists will eventually be combined into one master list and attempting to maintain consistency with identical entries in different locations would be very difficult. In the event that a bona fide objective is found subsequently by the project team, that is not accounted for in one of the scenarios, this should be added to the most relevant list of objectives.

It was also observed that the pillar of ‘Preparedness’ included many entries which reasonably correspond to items on the lists of objectives contained in other pillars. For example in the ‘Preparedness’ objectives list of Nanaimo Scenario 2 the following entry is made:

“Verification of responders’ family wellness in first stages of emergency.”

Within the ‘Response’ pillar there is the following corresponding entry:

“Encourage first responders to immediately check on their own families.”

This logical pairing of objectives is not always maintained, for example within the same list is the objective:

“Pre-plan muster points.”

However, there is no corresponding objective related to muster points in the ‘Response’ list. When the lists of objectives are amalgamated, the analysis team should confirm that all preparedness objectives that should have a corresponding response objective do indeed have such pairing. This will be conducted during the next phase of the research project.

It was noted in subsection 3.6.5 that the objectives framework was very flat with in one case 99 objectives contained in one grouping. Long lists like this are problematic to work with; for example it is very difficult to ensure that all appropriate objectives are represented when the listing is so long. Multiple entries may occur and not be identified.

Long lists of objectives should be avoided by subdividing the four pillars of emergency management into subgroups such as the groups indicated within the pillar definitions themselves. As cited above, for the pillar of ‘Preparedness’, objectives could be subdivided into: emergency plans, mutual aid agreements, resource inventories, training, exercises, and emergency communications systems.

An alternate objectives framework for consideration is depicted in Figure 2 below. This will subdivide the four pillars into eight goals (aligned with the mission statements) and will result in a manageable list of objectives for each pillar. This objectives structure results in a minimum of

32 pages of data and is best used once the various lists of objectives have been combined into one master list.

4.5 Analysis Team Observations

The positive comments received from workshop participants indicated that the activities they had been exposed to were new to them and appeared at face value to be appropriate for development of future emergency response plans. It was determined that continued work on this DRDC project would be well received by the communities involved to date.

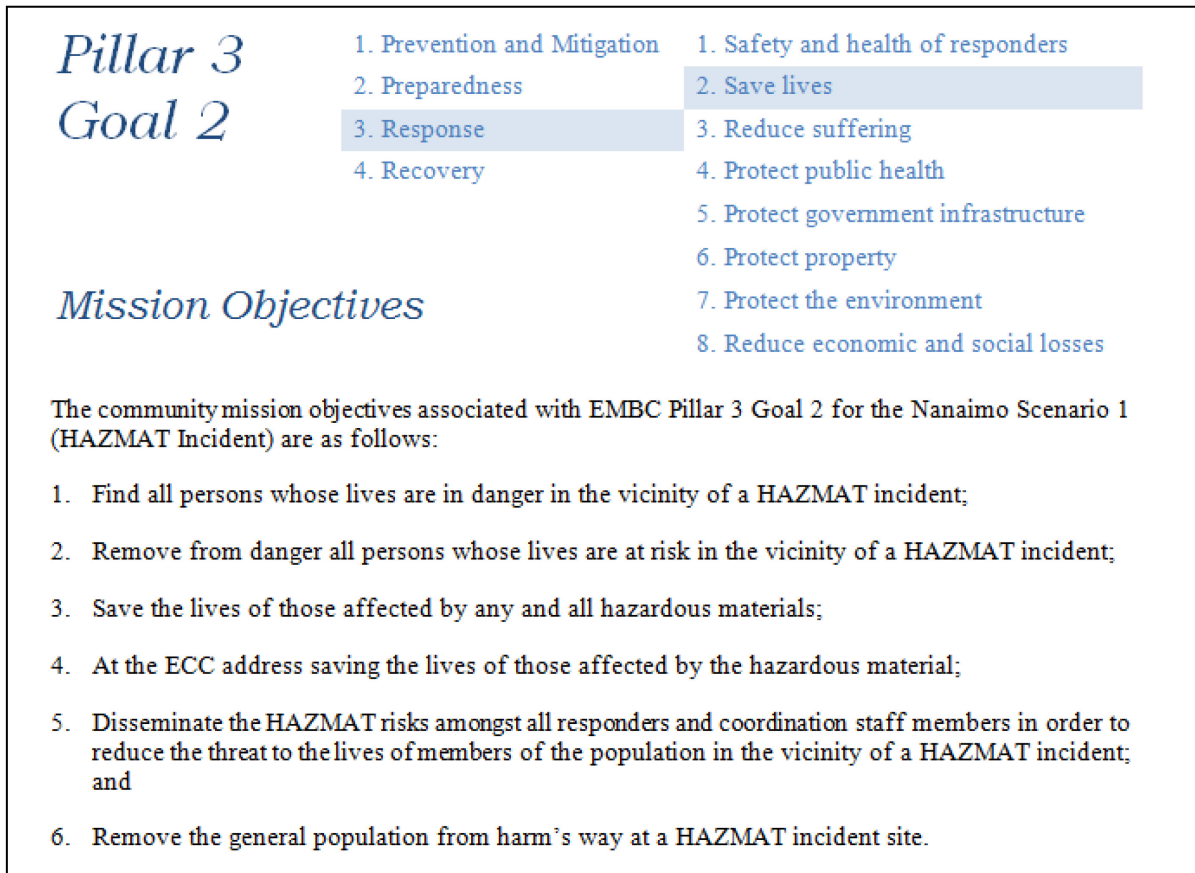


Figure 2: Alternate Objectives Framework for a HAZMAT Scenario.

5 Conclusions and Future Work

5.1 General

This document is the first in a series of reports that will, in total, provide the complete examination of hazard scenarios and the value of the mission-to-task analysis methodology to support the development of risk mitigation plans. In general it was concluded that the Nanaimo and Parksville scenarios, mission statements and mission objectives that are contained in the annexes of this report are suitable for use in the balance of the DRDC Mission-to-Task Analysis Project and that this work would be well received by the communities involved to date.

Further conclusions drawn from the development of these annexes is contained in this section.

5.2 Conclusions

It was concluded that:

1. **Scenario Selection.** The most straightforward method to select the community scenario topic to analyse was to achieve consensus in a workshop environment that allows the stakeholders to take part in the selection process. (para 4.2.1)
2. **Scenario Detail.** A brief scenario, similar to those contained in Annexes A, C, E and G, is better suited to EMBC's scenario-to-task decomposition than a more comprehensive scenario. The use of scenario variables is an acceptable method to capture the unique concerns of individual stakeholders. (para 4.2.2)
3. **Mission Statement.** The best approach to the use of a mission statement within the scenario-to-task analysis process would be to relate (document the specifics of) the BCERMS goals as they apply to the specific hazard type under analysis, and omit the preparation of a specific scenario mission statement, as the concept or usage of a single mission statement is not familiar to the majority of Emergency Management stakeholders. (para 4.3)
4. **Mission Objectives.** With regard to community mission objectives, it was concluded that:
 - a. the methodology used to produce the lists of objectives, in the framework defined by the four pillars of emergency management for each scenario, was satisfactory (para 4.4),
 - b. the mission objectives contained in Annexes B, D, F and H should be used for this project "as is"; however, in the event that a bona fide objective is found subsequently by the project team, that is not accounted for in one of the scenarios, this should be added to the most relevant list of objectives and annotated as such for future reference (para 4.4),
 - c. the analysis team should confirm that all 'Preparedness' objectives that should have a corresponding 'Response' objective do indeed have such pairing (para 4.4), and

- d. long lists of objectives should be avoided by subdividing the lists associated with the four pillars of emergency management into subgroups (para 4.4).

5.3 Future Work

This report constitutes the completion of Task 1 of the DRDC Scenario Mission-to-Task Analysis Project. This project consists of five tasks and the remaining tasks to be completed are:

- Task 2: Development of measurement frameworks;
- Task 3: Identification of key tasks;
- Task 4: Synthesis of key tasks across all scenarios; and
- Task 5: Evaluation of the utility of scenarios and mission-to-tasks analysis.

References

- [1] City of Nanaimo Response and Recovery Plan. February 1, 2012.
- [2] City of Nanaimo Emergency Program Guide. February 2003
- [3] City of Parksville, Risk and Vulnerability Assessment. February 2009.
- [4] *Emergency Management in BC: Reference Manual*, 22 June 2011, Version 1.
- [5] *British Columbia Emergency Response Management System: Overview (Interim)*. Victoria, B. C. Ministry of Public Safety and Solicitor General, Provincial Emergency Program, 2000.
- [6] *Target Capability List*, Department of Homeland Security, September 2007.

Annex A Nanaimo Scenario 1 – Hazardous Material (HAZMAT) Propane Rail Accident

A.1 Introduction

This annex contains the Nanaimo Scenario 1 details that were provided to Nanaimo workshop participants prior to the scenario review workshop in November 2012. The scenario introduction elements are presented in Table 14.

Table 14: Nanaimo Scenario 1 Introduction Elements.

Scenario Introduction Elements	Details
Casualties	0 fatalities; several injuries; up to 50% of people in the vicinity of the incident may be “worried well” seeking medical treatment
Infrastructure Damage	Limited
Evacuation/Displaced Persons	Approximately 1000 (to be confirmed by community) evacuated for a limited time
Contamination	Temporary
Potential for Multiple Events	Potential for fire and explosion
Recovery Timeline	24 to 48 hours
Economic Impact	Limited

A.2 Scenario Overview

A.2.1 General Description

The transport of hazardous materials poses a risk to communities. Railroad tank cars are a principal means of moving bulk propane from refineries and gas plants to bulk plants.

Explosion and asphyxiation (loss of consciousness and suffocation) are the main risks of propane. The gas by itself is odourless, but suppliers add a strong smelling chemical to the gas so that leaks

can be detected. Propane gas is heavier than air. If it leaks from equipment or cylinders, it can accumulate in low lying areas such as basements, pits, and trenches. A person who enters that area may be overcome by the gas and lose consciousness. Propane will explode if ignited. Simply turning on a light switch or an electric drill can ignite propane concentrations in a basement or trench.¹

The sudden release of propane near the ground results in horizontal spreading. Propane clouds drift downwind and downhill from the source location along the ground, providing an opportunity of ignition if the gas is flammable as well as posing a toxic threat to people in its path.

In this scenario, a rail accident results in a propane spill that spreads into the downtown area.

A.2.2 Detailed Description

This scenario describes a fictitious event that occurs on a Tuesday morning in January at 0830. The temperature is 0 degrees Celsius with mainly clear skies and the wind is light and variable².

The scenario is initiated with an accident involving a locomotive, towing five propane tank cars, and a cement truck at a level crossing on Fitzwilliam Street at location (A) as shown in Figure 3 and the photograph in Figure 4. The accident results in two tank cars overturning and at least one of the cars rupturing. The ruptured railcar contained 12,000 gallons of propane which equals approximately 50,000 pounds or 24,000 kg of propane. The truck driver is seriously injured in the collision. The accident precipitates 911 calls from witnesses.

The propane spill from the damaged rail car threatens the area of the city situated downhill (east) of the release point as shown in Figure 5. The incident does not include a fire although the risk of a fire is very high since a spark or flame could potentially ignite the propane.

A.3 Scenario Assumptions

The following assumptions have been made with respect to this scenario:

- Prior to the accident, rush hour was proceeding normally. There are no other traffic accidents.
- As many as 10% of the population in the area surrounding the accident may self-evacuate, although there could be considerable confusion regarding the best evacuation route.

A.3.1 Timeline

- A substantial amount of propane escapes the rail car within one hour.
- The size of the potentially flammable propane cloud, based on complete release of the propane, is estimated to be 300-1000m^{3,4}.

¹ Construction Safety Association of Ontario

² <http://www.climate.weatheroffice.gc.ca/>

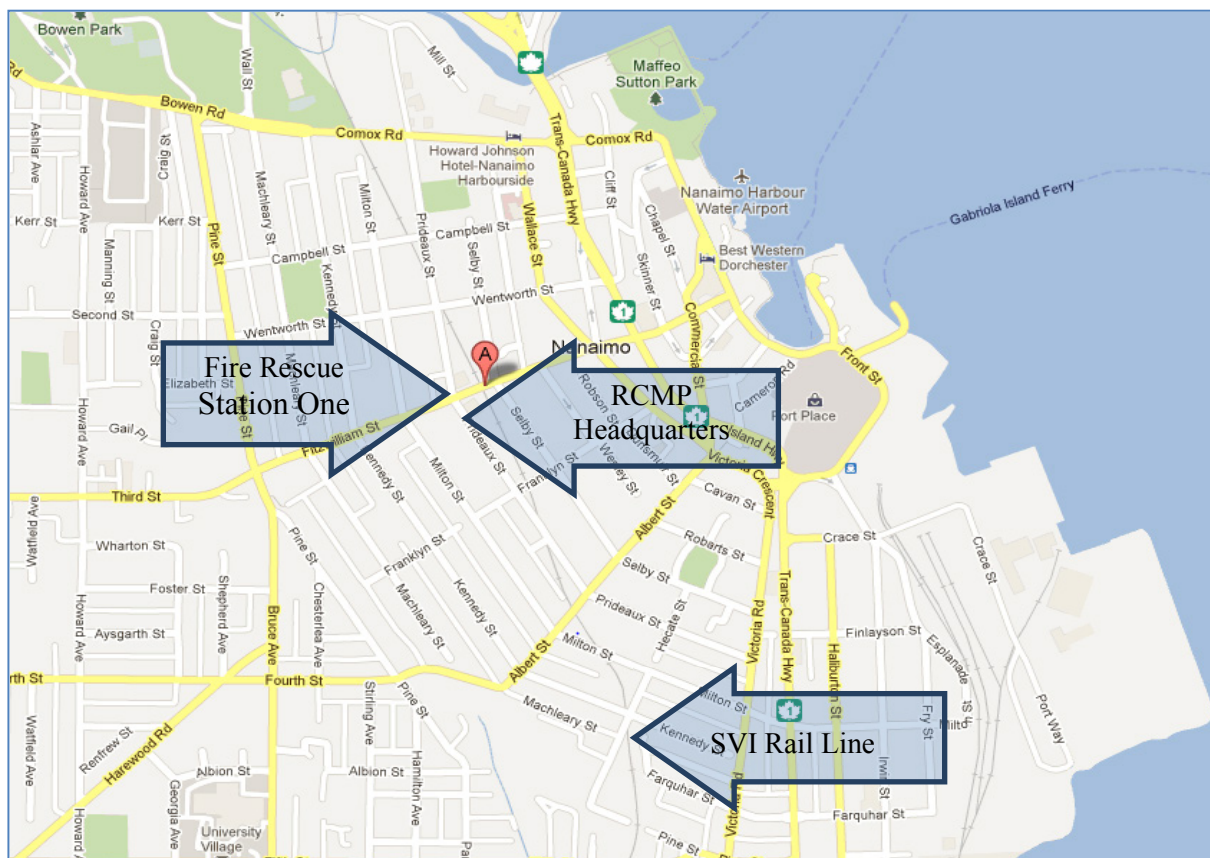


Figure 3: Location of the Propane Rail Accident.

³ Prediction of propane cloud dispersion by a wind-tunnel data calibrated box model, R.N. Meroney, Colorado State University and A. Lohmeyer, Institut Wasserbau., Table 1.

⁴ Transport Canada model indicates that an explosive atmosphere will exist at 405 meters from the initial release after an hour for 24,000 kg of propane



Figure 4: View of Rail Accident Site.

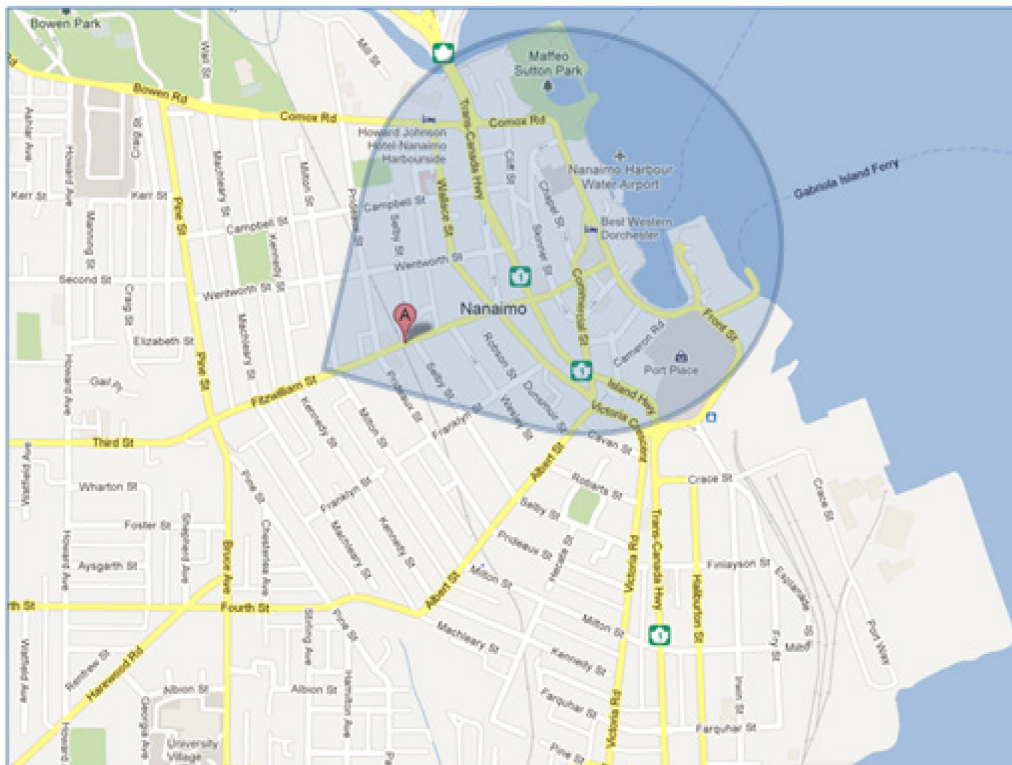


Figure 5: Map of Potential Propane Spread.

- The propane will disperse, eventually to a concentration where the risk of fire or explosion is no longer a threat; however, the exact amount of time for this is difficult to predict.

A.4 Planning Considerations

A.4.1 Variables

The potential hazmat scenario planning variables and considerations are contained in Table 15.

Table 15: HAZMAT Scenario Planning Variables.

Variable	Considerations
Type of material	Other potential hazardous materials being transported through Nanaimo may include: sodium hydroxide (also known as lye or caustic soda), hydrochloric acid, sodium chlorate, chlorine, petroleum, oil, lubricants, explosives to support the pulp and paper industry, etc.
Amount of hazardous materials	The overall quantity is important. Local resources can be overwhelmed by large quantities of hazardous materials and may require external assistance.
Time of day	Variables include time of day and day of the week (e.g. during rush hour, middle of the work day, evenings, overnight, weekend / holiday).
Location	<p>Various locations include:</p> <ul style="list-style-type: none"> ♦ spill from a tank car that is in the process of off-loading from a ferry; ♦ spill in vicinity of community's water supply; ♦ spill where run off will reach the harbour or the Nanaimo river water shed; ♦ close to a school; ♦ in a residential area; ♦ on a major transportation artery; ♦ private company site; and ♦ Pacific Biological Station.
Environmental challenges	Effects of weather including:

	<ul style="list-style-type: none"> ♦ time of year; ♦ temperature; ♦ wind direction; ♦ wind speed; ♦ cloud cover; and ♦ precipitation.
--	---

A.5 Implications

The implications of the scenario described above are listed in bullet form in the following subparagraphs.

A.5.1 Secondary Hazards/Events

- There is a high risk of fire/explosion, which could cause fatalities, injuries and damage to property and infrastructure.

A.5.2 Fatalities/Injuries

- Fatalities may occur from secondary hazards or events.
- A number of injuries may result from population panic and motor vehicle accidents during evacuation. No fatalities are expected.⁵
- As many as 50% of the population in the vicinity of the accident site and evacuation area - the “worried well” - may seek medical treatment.⁶

A.5.3 Property Damage

- Property damage is limited to the cement truck, rail cars and the rail line. No other damage is expected unless there is a secondary fire or explosion.

A.5.4 Service Disruption

- The roads and rail lines directly impacted will be temporarily closed.

A.5.5 Economic Impact

- With no secondary effects there will be very limited economic impact.

⁵ DHS scenarios, Scenario 8: Chemical Attack, pg 8-6.

⁶ DHS scenarios, Scenario 8: Chemical Attack, pg 8-6.

A.5.6 Long-Term Health Issues

- There are no long-term health issues associated with this specific hazardous spill (other materials may have long-term health effects).

Annex B Nanaimo Scenario 1 – Propane Rail Accident Mission Statement and Mission Objectives

B.1 General

The Mission Statement and Mission Objectives for Nanaimo Scenario 1 are structured in accordance with the Four Pillars of Emergency Management and the eight BCERMS Community Goals.

B.2 Nanaimo Scenario 1 Mission Statement

With regard to a HAZMAT incident involving the release of a hazardous material within the city limits, the community shall endeavour to (in order of priority):

1. put in place a management structure, equipment, procedures and training to protect the safety and health of all incident responders;
2. identify individuals at risk and use every available resource to protect and/or save lives;
3. identify individuals who are suffering from the effects of the HAZMAT incident (on site or long term) and reduce the suffering;
4. identify the risks to public health caused by the HAZMAT incident and work to resolve the risks as soon as possible;
5. identify risks to public infrastructure and mitigate the risks;
6. identify risks to both public and private property and mitigate the risks to property;
7. identify the risks to the environment caused by the hazardous material and work to protect the environment; and
8. reduce the economic and social losses caused by the hazardous material, all in balance with the other goals listed above.

B.3 Nanaimo Scenario 1 Mission Objectives

As indicated earlier, Mission Objectives for Nanaimo Scenario 1 are structured in accordance with the Four Pillars of Emergency Management and are informed by the eight BCERMS Community Goals. The mission objectives for the Nanaimo Scenario 1 Hazardous Material (HAZMAT) Propane Rail Accident are recorded below.

B.3.1 Mitigation/Prevention

Within the EMBC Emergency Management Pillar of Mitigation/Prevention, the following HAZMAT incident community objectives were identified by Nanaimo domain experts:

1. Maintain ongoing monitoring and enforcement of safety regulations by enhancing/enforcing transportation of dangerous goods by-law, etc.
2. Enhance and enforce designated Transportation of Dangerous Goods (TDG) routes and the ability of local authority to limit/control shipping.
3. Establish a transportation plan and HAZMAT vehicle routes through municipalities which helps prepare for emergency plans.
4. Restrict access through feeder roads and conduct an evaluation of intersections/crossings – are they controlled?
5. Restrict the hours for dangerous goods transport through town by scheduling hazardous transports during times with minimal population impact.
6. Establish permanent evacuation routes and signage (through community general hazards).
7. Consider managing and mitigating island delays – support response, tech experts, recovery resources (ensure plans mitigate delays).
8. Ensure effective notification on the restriction for use - ferries, Notice To Airmen (NOTAM), marina traffic, coast guard, etc.
9. Educate responders and community (residents/business) on hazards that exist in the community and hazardous products properties (i.e., fire, toxic, corrosive, etc.).
10. Improve public/community notification system to speed (facilitate) appropriate response.
11. Education on large scale evacuation routes for community.
12. Public education and public awareness: interagency/business education and sharing of Business Continuity Plans (BCPs)/emergency plans – make individuals aware they exist.
13. Education of reception centres to public.
14. Maintain permanent signage at designated reception centres.
15. Conduct public education with respect to the preparation of survival kits.

B.3.2 Preparedness

Within the EMBC Emergency Management Pillar of Preparedness, the following HAZMAT incident community objectives were identified by Nanaimo domain experts:

1. Ensure emergency response agencies have backup plans and infrastructure to support rapid, coordinated relocation.
2. Establish communications protocols with residents/business associations in the downtown.
3. Maintain, in the response plan, methods and procedures to warn the population to self-evacuate from high risk areas (including neighbour to neighbour assistance).
4. Develop and maintain plans for the ECC (including a unified command) to work with the spiller (responsible party) in responding to the HAZMAT incident (e.g. for details regarding when areas can be reoccupied)
5. Ensure response plans address the temporary loss of support from the city 911 capability, the ECC and RCMP management due to evacuation of, or damage to, these facilities.
6. Plan for rapid identification of hazardous substances at the site of a HAZMAT incident.
7. Create specific evacuation plans for high risk areas/situations.
8. Develop, maintain and disseminate response plans for each type of hazardous material.
9. Plan for and conduct first responder exercises that are more inclusive than a basic training exercise.
10. Allow for alternate location of ECC within the response plans.
11. Ensure that a detailed traffic plan is in place for various HAZMAT scenarios to determine best places for barricades, traffic control personnel, and the overriding of traffic signals.
12. Maintain Business Continuity Plans (BCPs).
13. Ensure awareness of evacuation procedures – what are their (businesses') plans.
14. Establish shutdown procedure for various utilities.
15. Establish a series of bi-lateral and joint co-operation agreements with adjacent communities to strengthen mutual support.
16. Maintain a backup plan for emergency services and infrastructure for ECC, RCMP, Fire.
17. Develop and maintain procedures to determine the extent of the evacuation area and determination of "safe" areas.
18. Maintain procedures for quickly and efficiently notifying the public of detail regarding a hazardous materials incident.
19. Tie into bi-national maritime commerce resilience plan.

20. Ensure that equivalent members of the Fire Rescue Department, RCMP, British Columbia Ambulance Service (BCAS), Coast Guard, etc. establish communications and potentially a working relationship prior to the occurrence of a hazardous event.
21. Work with agencies and industry to identify areas of cooperation.
22. Develop mutual aid agreements with other communities with similar exposures.
23. Establish mutual aid agreements with HazMag group to support response.
24. Coordinate with Ministry of Transportation and Infrastructure (MOTI), BC Ferries, and other agencies so each party is aware of others' response, roles.
25. Conduct an assessment of hazardous materials that transport through Nanaimo, including the establishment of a central database of dangerous goods movements.
26. Create an inventory or catalogue of resources available across the city.
27. Identify response resources – availability, capabilities, limitations.
28. Plan to share resources across departments – city inventory – equipment, capacity, trained personnel, etc.
29. Create a central inventory list of hazmat equipment available.
30. Practice unified command situations.
31. Establish incident specific training including knowledge to react to the hazard.
32. Establish how to notify citizens of the problem and actions needed.
33. Conduct multi-agency training.
34. Conduct local government officials training to create “buy in” for a unified response.
35. Conduct first responders training with (and liaise with) industry stakeholders.
36. Schedule exercises with combined first responders to develop familiarity with requirements.
37. Ensure through training that all agencies understand from the ground level up so that effects don't domino (e.g. contaminated person leaving area).
38. Ensure through training that all of the first responders in a HAZMAT incident understand that the capacity to respond to hazardous materials is limited and ultimately defensive; they will be relying on outside expertise.
39. Ensure training and update of community response plan – transportation designations (contacts, notifications), mutual aid, etc.

40. Conduct Incident Command System (ICS) training.
41. Enhance self-evacuation notification and training.
42. Run community drills requiring evacuation to a number of recovery centres.
43. Funding should be available from government for training and equipping local responders.
44. Maintain a training program that involves the collaboration of both first responders and industry.
45. Ensure that response training occurs at both the management level and the first responder level.
46. Conduct continued education in ECC and hazmat issues for Fire Rescue, Police Staff, City staff.
47. Evaluate, on a continuing basis, the timeliness of contracted HAZMAT assistance to ensure response times are acceptable.
48. Establish downtown neighbourhood response teams.
49. Advertise reverse 911 (schools, how are people hearing about this?).
50. Facilitate the funding of incident responses by provision of threat details to fund managers.
51. Ensure that all evacuation orders include a destination to which to evacuate.
52. Ensure resources are available for both immediate response (including standby capability) and regular responses.
53. Determine the policy for Fire Rescue's responsibilities for ensuring the public's evacuation from self-evacuation areas.
54. Ensure that the public is aware of how to shut off their household gas line.
55. Determine a city wide policy for reduction of sources of ignition (shutting down of the electrical grid, shutting down of the natural gas grid, preventing the use of vehicles, etc.) in the event of a large scale propane leak.
56. Educate local authorities and industry on the realistic understanding of availability of ER help (and how long it takes to arrive).
57. Maintain access to air meteorology plume dispersion modelling for pre-determined air release of chemicals.
58. Ensure hazardous materials handlers provide their Emergency Response Plan to Nanaimo ER who look for opportunities to standardize/consolidate.

59. Establish priority emergency evacuation routes to ensure responders can access site for fastest response.

B.3.3 Response

Within the EMBC Emergency Management Pillar of Response, the following HAZMAT incident community objectives were identified by Nanaimo domain experts:

1. Create a response (through council) equal to the risks identified.
2. Reduce risk of explosion, fire or injury due to inhalation (exposure).
3. Ensure first responders are able to respond to look after the task at hand.
4. Isolate – evacuate.
5. Establish an ECC (and have alternate site) to support site, and coordination of evacuation of public and businesses in evacuation zone.
6. Ensure coordinated approach and that ECC is utilized for effective management of response.
7. Establish and provide support to a unified command.
8. Establish a unified command with private industry in order to facilitate interagency coordination.
9. Focus decision making within the city's ECC to ensure that side decisions are not counter to ECC decisions and expectations.
10. Share key messages with all responders.
11. Maintain effective communications during and after an event.
12. Ensure that all groups and agencies (e.g. first responders, spiller, etc.) are aware of assistance requested and/or available from outside the area.
13. Facilitate public response to a HAZMAT incident by quickly communicating details of the substance associated with the incident and recommended community response (e.g. shelter in place, etc.).
14. Ensure response is coordinated amongst agencies and response is effective – all areas address transportation/infrastructure/evacuation (timely).
15. Provide notification to people in the affected area.
16. Advise the public of egress routes to minimize exposure to the hazardous substance.

17. Coordinate use of public works to contract traffic control personnel to assist in directing traffic.
18. Plan “orderly” evacuation routes and communicate the plan quickly.
19. Prepare for an escalation in the event – higher volume water in streams.
20. Gain access to evacuation/emergency plans for facilities in the affected areas.
21. Establish an immediate information hotline.
22. Designate reception centres.
23. Identify and make info available for resources (public/private), their quantities, availability, restrictions/costs.
24. Identify resources and apply processes for declaring hot zones safe for return.
25. Coordinate with downtown hotels, arrange bus transportation for hotel patrons who may not have evacuation vehicles.
26. Coordinate with BC Ferries a plan for ferry patrons in line up waiting at downtown terminal or those on ferry en route.

B.3.4 Recovery

Within the EMBC Emergency Management Pillar of Recovery, the following HAZMAT incident community objectives were identified by Nanaimo domain experts:

1. Establish Critical Incident Stress Management (CISM) for responders.
2. Return to downtown, public relations “it’s safe now”.
3. Ensure designated and identified, and make the public aware of recovery centres.
4. Post event communications with public at all recovery centres.
5. Activate Maritime Commerce Recovery Plan which is mandated federally on ports – communications/economic/environmental.
6. Ensure business and individuals have access to resources to recover/continue (i.e. insurance, business, etc.).
7. Protect specific city business continuity. What if City Hall is out of service for weeks/months?
8. Support businesses in re-establishing themselves - recovery centre, include private sector.

Annex C Nanaimo Scenario 2 – Off-Shore Earthquake

C.1 Introduction

This annex contains the Nanaimo Scenario 2 details that were provided to Nanaimo workshop participants prior to the scenario review workshop in November 2012. The scenario introduction elements are presented in Table 16.

Table 16: Nanaimo Scenario 2 Introduction Elements.

Scenario Introduction Elements	Details
Casualties	Several fatalities, numerous serious injuries and a number of people trapped in collapsed buildings
Infrastructure Damage	Severe
Evacuation / Displaced Persons	Thousands displaced by earthquake damage and fire
Contamination	Potential from hazardous materials
Potential for Multiple Events	Multiple aftershocks
Recovery Timeline	Years
Economic Impact	Billions

C.2 Scenario Overview

C.2.1 General Description

The magnitude of an earthquake is typically measured using the Richter Scale. A magnitude 2 earthquake is the smallest earthquake normally felt by people and anything over a magnitude 6 is commonly considered a major earthquake. Historically there have been a number of earthquakes in and around British Columbia (BC) that are typically in the magnitude 7-8 range. This includes the October 27, 2012 magnitude 7.7 earthquake that occurred in the Haida Gwaii region⁷. Numerous aftershocks of magnitude 3-5 were felt in the hours following that earthquake.

⁷ <http://www.earthquakescanada.nrcan.gc.ca/historic-historique/map-carte-eng.php>

Liquefaction is the phenomenon where soil loses stiffness and strength in response to stress (such as earthquake shaking), causing it to behave like a liquid⁸. Liquefaction reduces the ability of a soil deposit to support foundations for buildings and bridges.

The incident in this scenario is a magnitude 7.3 crustal earthquake along a fault in the Strait of Georgia with an epicentre 20 km north-northwest of Nanaimo. A tsunami is not triggered.

C.2.2 Detailed Description

A magnitude 7.3 earthquake occurs on a Monday in February at 0930. The outside air temperature is 3 degrees Celsius (C) and it is a cold, wet overcast day. The wind is light from the southeast and forecast temperature for the night time low is -4 C.

Strong to violent shaking occurs for 30-40 seconds across central Vancouver Island and light to strong shaking across other parts of southwestern BC, northwestern Washington State, and southern Vancouver Island. The shaking is intense enough to cause moderate to heavy damage on Vancouver Island, and very light to light damage across the rest of southwestern BC. Figure 6 indicates the most severely impacted area around Nanaimo and Parksville.

In the Nanaimo area the earthquake causes surface faulting, liquefaction of old mine tailings in the city and river deltas, and rockfalls and landslides along the steeply banked shore line of the northern part of the city. Earthquake-triggered landslides damage transportation networks, pipelines, buildings and other critical infrastructure.

C.3 Scenario Assumptions

The following assumptions have been made with respect to this scenario:

- Most people are at work rather than at home or in transit.
- The earthquake has significant impacts in Victoria.

C.3.1 Timeline

- Several aftershocks are expected to occur within the first couple of days following the initial earthquake, originating from approximately the same location.
- After 24 hours the first preliminary damage assessments are made.

⁸ <http://www.ce.washington.edu/~liquefaction/html/main.html>

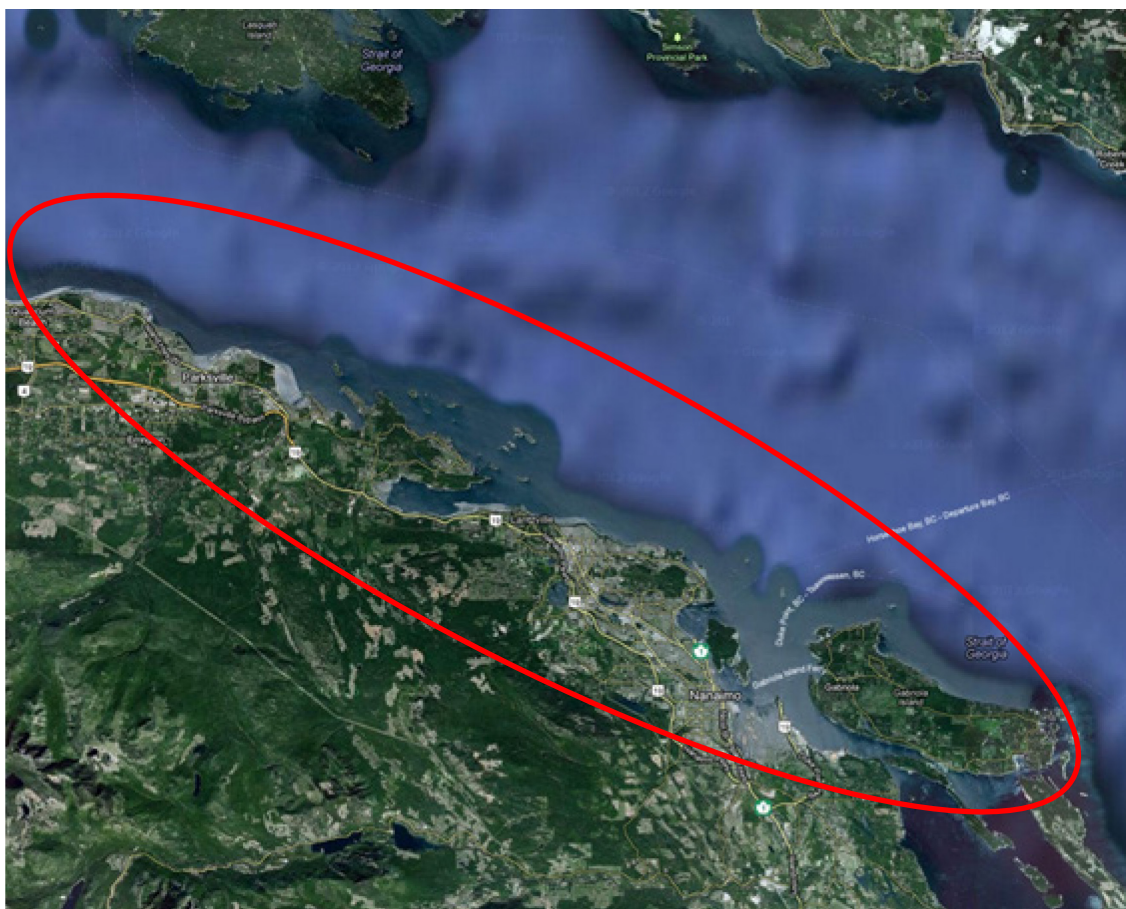


Figure 6: Most severely impacted area around Nanaimo and Parksville.

C.4 Planning Considerations

C.4.1 Variables

The potential Earthquake scenario planning variables and considerations are contained in Table 17.

Table 17: Earthquake Scenario Planning Variables.

Variable	Considerations
Earthquake characteristics (location of epicentre, type, magnitude, etc.)	<p>The earthquake characteristics must be considered as they affect:</p> <ul style="list-style-type: none"> ◆ Number of injuries / fatalities; ◆ Total damage;

	<ul style="list-style-type: none"> ♦ Critical infrastructure impacts; ♦ Support from other regions; and ♦ Risk of tsunami.
Time of day	Variables include time of day and day of the week (e.g. during rush hour, middle of the work day, evenings, overnight, weekend / holiday).
Environmental challenges (climatic effects)	<p>Effects of weather including:</p> <ul style="list-style-type: none"> ♦ Temperature; and ♦ Precipitation.

C.5 Implications⁹

The implications of the scenario described above are listed in bullet form in the following subparagraphs.

C.5.1 Secondary Hazards/Events

- Numerous hazmat incidents may occur throughout the city;
- Flooding is possible from dam breaches and / or damaged water and sewage systems;
- Fires are one of the most common secondary events associated with earthquakes;
- Disease from increased concentration of people (e.g. shelters); and
- Debris may amount to thousands of tonnes.

C.5.2 Fatalities/Injuries

- The earthquake results in several fatalities and numerous serious injuries.
- Building “non-structural” damage is a source of many injuries to persons. Non-structural damage includes breaking glass, falling furniture, falling light fixtures, falling chimneys and panels and facades from taller buildings.

C.5.3 Search and Rescue

- There are a number of people missing and trapped in collapsed buildings.

⁹ DHS scenarios, Scenario 9: Natural Disaster – Major Earthquake, pg 9-4.

C.5.4 Property Damage

- The earthquake causes the collapse of or serious damage to buildings in various parts of the city. Many more buildings have structural damage and must be evacuated until inspected; only a few of these buildings may be re-inhabited. Many older houses are damaged and must be evacuated.

C.5.5 Service Disruption

- The Nanaimo Parkway (Highway 19), the Island Highway South (Highway 1) and the Island Highway North (Highway 19A) are affected by surface faulting, liquefaction, settlement, bridge and overpass damage, and bridge-abutment settlement. Most other roads are affected by debris.
- The port facility and ferry terminals are damaged.
- The airport is initially closed.
- Power is out in many areas. In most areas the electrical power is restored within a week after the event. Emergency power generators are functional until fuel is depleted.
- Disruption to natural gas distribution is widespread with many homes and businesses losing service. Distribution lines are damaged or broken in some locations and in some cases cause fires.
- Portions of the Nanaimo Regional General Hospital are uninhabitable due to non-structural damage. In total a small portion of the beds in the hospital are lost. Almost all remaining beds were occupied prior to the event and remain occupied afterward.
- Communications systems are damaged and will be overwhelmed.
- The water supply and sewage are disrupted in parts of the city. In some cases disruption to the water system is caused by power outages to the pumping stations.

C.5.6 Economic Impact

- The disruption to Nanaimo's economy is severe. Reconstruction, repairs, disposal, and replacement of lost infrastructure will cost billions.

C.5.7 Long-Term Health Issues

- Alongside the many injuries there will be mental health issues related to this catastrophic event.

Annex D Nanaimo Scenario 2 – Off-Shore Earthquake Mission Statement and Mission Objectives

D.1 General

The Mission Statement and Mission Objectives for Nanaimo Scenario 2 are structured in accordance with the Four Pillars of Emergency Management and the eight BCERMS Community Goals.

D.2 Nanaimo Scenario 2 Mission Statement

With regard to an earthquake incident, the community shall endeavour to (in order of priority):

1. put in place a management structure, equipment, procedures and training to protect the safety and health of all incident responders;
2. identify individuals at risk and use every available resource to protect and/or save lives;
3. identify individuals who are suffering from the effects of the earthquake incident (on site or long term) and reduce the suffering;
4. identify the risks to public health caused by the earthquake incident and work to resolve the risks as soon as possible;
5. identify risks to public infrastructure and mitigate the risks;
6. identify risks to both public and private property and mitigate the risks to property;
7. identify the risks to the environment caused by the earthquake and work to protect the environment; and
8. reduce the economic and social losses caused by the earthquake, all in balance with the other goals listed above.

D.3 Nanaimo Scenario 2 Mission Objectives

As indicated earlier, Mission Objectives for Nanaimo Scenario 2 are structured in accordance with the Four Pillars of Emergency Management and are informed by the eight BCERMS Community Goals. The mission objectives for the Nanaimo Scenario 2 Earthquake are as follows:

D.3.1 Mitigation/Prevention

Within the EMBC Emergency Management Pillar of Mitigation/Prevention, the following earthquake incident community objectives were identified by Nanaimo domain experts:

1. Establish building codes and bylaws appropriate for the environment.
2. Harden facilities, conduct preventative maintenance, and secure furnishings.
3. Ensure that new infrastructure is built to current earthquake standards and specs.
4. Remove hazardous infrastructure no longer performing useful functions e.g. recreational dams near residential areas.
5. Encourage corporations to give out earthquake kits as Christmas gifts.
6. Public education – self-help, food water, fan out email (city), 5 days?
7. Educate residents and businesses to prepare and educate on risks.
8. Develop education for public on resources available.
9. Establish public awareness and education.
10. Disseminate information to the public regarding the damage tolerance of their homes and/or businesses.

D.3.2 Preparedness

Within the EMBC Emergency Management Pillar of Preparedness, the following earthquake incident community objectives were identified by Nanaimo domain experts:

1. Create a responder management plan – family first, family support (insurance, etc.).
2. Verification of responders' family wellness in first stages of emergency.
3. Address staff sensitivities (safety at home first) in the Family First Plan.
4. Have support mechanisms in place for families.
5. Provide responders with guidance on how to deal with personal/family safety versus professional responsibilities.
6. Create a recovery plan which addresses housing issues, disruption of CI, incoming volunteer/assistance, critical resource limitations.
7. Develop and maintain a plan to respond to aftershocks which, in each case, are essentially a new event.
8. Develop and maintain a tsunami plan.
9. Incorporate and maintain procedures in response plans to make available to first responders construction vehicles to clear the way of debris to accommodate movement about the city.

10. Establish policies and procedures for prioritizing incident responses and communicating the decisions regarding which area of the city will receive assistance and in which order.
11. Establish pre-plan muster points.
12. Develop and maintain policies, plans and procedures to accommodate the anticipated influx of persons to the city searching for health services.
13. Develop and maintain a plan for inspection of bridges and underwater structures to speed the reopening of these CI items.
14. Widely disseminate the response communication plan.
15. Develop and maintain a plan to use the TELUS satellite Cellular on Wheels (COW) truck, the Satellite Cell on Light Trucks (SATCOLT) capability and/or any similar technology.
16. Develop and maintain procedures for the conduct of a rapid, city wide, assessment of damage.
17. Develop and maintain plans for rapid damage assessment and identification of habitable buildings following both the main earthquake event and each aftershock.
18. Verify that earthquake response plans include provisions and equipment to accommodate the number of personnel that are obligated to report to the ECC in the event of an earthquake.
19. Maintain a debris removal plan with pre-identified sites, recycling/methods of removal and disposal.
20. Maintain the Port Security Plan, including items such as distribution of IDs to response personnel.
21. Plan for evacuation of staff.
22. Develop shelter in place plan and duty rosters.
23. Maintain plans to use Prince Rupert port as Nanaimo's designated alternate.
24. Maintain a debris management plan.
25. Develop strategic plan for sequencing repairs/rebuilds for water system damage in accordance with criticality – before event and after event based on damage.
26. Plan as much as possible e.g. building codes, new developments.
27. Develop a communication plan – how to communicate.
28. Revisit the plan for potable water tank locations and tank availability.

29. Establish links with companies or agencies (Provincial, National and/or International) with a Heavy Urban Search and Rescue (HUSAR) capability in order to facilitate rapid rescue following an earthquake.
30. Engage private sector.
31. Identify any infrastructure (public/private) which has been assessed and rated for earthquake: potential for failure, potential for secondment.
32. Facilitate utility personnel's access to their trucks, tools and supplies.
33. Ensure that operation of vehicle refuelling pumps is possible with damage to the electrical power grid.
34. Assess the Emergency Social Services (ESS) reception centres to ensure habitable conditions can be maintained without access to the city's electrical power grid (e.g. wiring for the use of portable generators, etc.).
35. Key messages pertinent to loss of infrastructure (water, sewer, power, etc.) food/rehab - Need to understand loss of infrastructure, how are we going to handle daily needs for food and water?
36. Develop a pool of skills/resources (list of names and equipment).
37. Identify radio source of information.
38. Pre-set strike teams or task force – backhoe – fire – BCAS – RCMP – city engineering.
39. Establish emergency kits at all community halls (donations).
40. Provide responders with an awareness of the location and use of emergency generators.
41. Prepare emergency “stockpiles” around city.
42. Ensure an adequate stock of parts/pipe for repair of infrastructure.
43. Maintaining public works trucks after hours with radios, tools, etc. throughout the city.
44. Develop a standalone utility – with (a) generator set backup or generator pumps (b) our own radio system for system communication for the water department.
45. Disseminate information regarding the maintenance of fuel filters on standby generators in that an earthquake may stir up sediment in the bottom of the fuel tanks quickly clogging filters and shutting down the generators.
46. Identify high risk locations, buildings in plan for response.

47. Conduct an assessment of the susceptibility of the city's infrastructure (buildings, bridges, dams, etc.) to various types and magnitudes of earthquakes in order to determine which areas of the city are most at risk.
48. Prepare response agencies and first responders/educate.
49. Exercise ECC.
50. Conduct shakeout drills for all.
51. Planning – ECC exercises.
52. Clarify roles and responsibilities for impact assessment: hazmat, environmental, etc.
53. Train ECC.
54. Police/fire/public works awareness and education.
55. Establish expectations of staff short term, long term.
56. Facilitate first response-wide communication – coordination.
57. Communication of the communication plan – does the general public know where to go?
58. Pre-plan and communicate triage between responders.
59. Develop a 72 hour plan for individuals and what's the expectation in the first 72 hours if there are no resources?
60. Establish survival kits for 72 hours at industry/homes.
61. Educate the public on the requirement for 72 hour kits and self-sufficiency.
62. Encourage company-provided survival kits.
63. Establish sub-centre neighbourhood response teams.
64. Educate the community regarding making earthquake survival kits, even with limited resources.
65. Conduct seismic vulnerability assessment of CI – plan to upgrade?

D.3.3 Response

Within the EMBC Emergency Management Pillar of Response, the following earthquake incident community objectives were identified by Nanaimo domain experts:

1. Prioritize response to highest incidents i.e., school collapse versus Motor Vehicle Accident (MVA).
2. Respond to emergency events in priority order.
3. Request help from outside - HUSAR and rapid damage assessment teams.
4. Bring in resources outside of Nanaimo e.g. Vancouver HUSAR teams for rescue.
5. Ensure that ID cards are made available to first responders to allow them to move about the city.
6. Encourage first responders to immediately check on their own families.
7. Take care of emergency responder's families.
8. Develop and maintain policies and procedures (through recovery centres) to assist the families of responders with managing claims (e.g. meeting insurance deadlines, etc.).
9. Conduct rapid damage assessment – need for plan, need for added resources, prioritization of Rapid Damage Assessment (RDA) for critical buildings.
10. Combine organized review/fallout assessment with first responders.
11. Identify sectors/islands created by failed road network/bridges.
12. Maintain access escape kits – supplies, duty rosters, sweeping (sounding) navigation channels.
13. Establish expert structural assessment teams to determine when critical structures (e.g. bridges and major buildings) are safe for use.
14. Establish and communicate level of service capabilities – fire, EMS, etc. - throughout the incident and into recovery.
15. Ensure ECC provides a coordinated response – response/province, etc.
16. Facilitate the use of the emergency management structure.
17. Conduct joint operations between fire, police, ambulance and city works, contractors - may need a task force.
18. Establish control of damage and triage response teams – considering segregated response districts due to damage.
19. Engage private sector.
20. Establish alternate communications potentially using the TELUS COW truck (TELUS Communication Outreach).

21. Establish effective communication.
22. Facilitate communications by establishing group to group communications and inter-agency communications via the ECC.
23. Capitalize upon the robust amateur radio network resident in Nanaimo for communications within the city and external to the city.
24. Communicate tsunami risk as soon as possible (for reassurance).
25. Determine where to locate, and supplies for, emergency shelters (i.e. tent cities).
26. Expansion of smaller reception centres to avoid long travel for isolated zones.
27. Deploy additional water quality monitoring and testing lab work to allow earliest possible use of potable water.
28. Prioritize the repair schedule for infrastructure.

D.3.4 Recovery

Within the EMBC Emergency Management Pillar of Recovery, the following earthquake incident community objectives were identified by Nanaimo domain experts:

1. Establish post recovery centre(s).
2. Recovery sites – info/planning department, prepare for this in advance, communication about recovery sites.
3. Ensure sub-centres established within identified sectors.
4. Conduct business continuity – establish areas of refuge, recovery centres – long term recovery centre for municipality.
5. Activate the federally mandated Maritime Commerce Resiliency Plan.
6. Conduct debris management (many months later).
7. Work with BC Ferries on repairing docks for ferries, help get alternate route for accessing Vancouver Island.

Annex E Parksville Scenario 1 – Wildland-Urban Interface Fire

E.1 Introduction

This annex contains the Parksville Scenario 1 details that were provided to Parksville workshop participants prior to the scenario review workshop in November 2012. The scenario introduction elements are presented in Table 18.

Table 18: Parksville Scenario 1 Introduction Elements.

Scenario Introduction Elements	Details
Casualties	0 fatalities, several serious injuries
Infrastructure Damage	Limited
Evacuation/Displaced Persons	Up to 2000 people (to be confirmed by community) displaced by fire; including resort guests.
Contamination	Limited potential
Potential for Multiple Events	Not Applicable
Recovery Timeline	Weeks to months
Economic Impact	Hundreds of millions

E.2 Scenario Overview

E.2.1 General Description

Interface fires pose a large risk to communities that are situated near forested areas. The “wildland-urban interface” is where the wilderness and urban development meet. In the interface area, the proximity of structures and vegetation means that a wildfire may spread to structures or a structural fire may ignite vegetation¹⁰.

In this scenario a house fire in an interface area causes the nearby forest to catch fire.

¹⁰<http://bcwildfire.ca/FAQ/interface.htm#32>

E.2.2 Detailed Description

An accidental house fire begins at 1700 on the Friday before Labour Day weekend. The temperature is 21 degrees Celsius, the skies are mainly clear and the wind is light from the south. Conditions are dry following 6 weeks of dry, hot weather and there is no rain in the forecast.

The empty house that catches fire is on Kaye Road (shown in Figure 7), within the Parksville city limits. Very quickly, the house becomes fully engulfed in flames. Embers drift into the forested area north of Kaye Road in Electoral Area F (outside the city limits), and the forest catches fire. From there the fire spreads northwards towards Highway 19 – Parksville Bypass.

The fire breeches the highway within a few hours causing some damage to buildings in the light industrial park along Herring Gull Way. Winds subside in the evening but morning offshore winds (from the south-southeast) cause the fire to spread to Rath Trevor Beach Provincial Park. The path of the fire is indicated in Figure 7.

E.3 Scenario Assumptions

The following assumptions have been made with respect to this scenario:

- The Englishman River is still flowing with water.
- The woodlands have a build-up of “fuel ladder” (vegetation that allows a fire to climb up from the forest floor into the tree canopy).
- Due to the approaching long weekend the population has increased with the influx of the holiday crowd. In particular, the resorts along Rath Trevor Beach are populated with many out-of-towners.

E.3.1 Timeline

- The house fire starts at 1700. The surrounding forest catches fire shortly thereafter, crosses Highway 19 within a few hours and continues to burn overnight.

E.4 Planning Considerations

E.4.1 Variables

The potential wildfire scenario planning variables and considerations are contained in Table 19.



Figure 7: Parkville Map showing path of the Wildland-Urban Interface Fire.

Table 19: Wildfire Scenario Planning Variables.

Variable	Considerations
Environmental challenges	<p>Forest conditions with respect to fire hazard:</p> <ul style="list-style-type: none"> ♦ Vegetation types; ♦ Fuel load; ♦ Slope; and ♦ Soil conditions. <p>Effects of weather including:</p>

	<ul style="list-style-type: none"> ♦ Wind direction; ♦ Wind speed; ♦ Cloud cover; and ♦ Precipitation.
Location of fire	<p>Variations to location include:</p> <ul style="list-style-type: none"> ♦ Close to a school; ♦ Densely populated residential area; ♦ Building materials used in construction; ♦ Near critical infrastructure facilities; ♦ Near flammable sites (e.g. gas stations); ♦ Designed fire breaks; ♦ Greater distance from the city.
Time of day	<p>Variables include time of day and day of the week (e.g. rush hour, middle of the work day, evenings, overnight, weekend / holiday).</p>
Time of year	<p>Variables include times of year and any implications. In this scenario tourist season increases the population in Parksville – evacuation / relocation becomes a problem.</p>

E.5 Implications

The implications of the scenario described above are listed in bullet form in the following subparagraphs.

E.5.1 Secondary Hazards/Events

- There are no secondary hazards or events expected to be associated with this interface fire.

E.5.2 Fatalities/Injuries

- No fatalities are expected, however there may be a few serious injuries caused by the fire, smoke or during evacuation.

E.5.3 Property Damage

- Residential buildings on Kaye Road, and those south and west of the Provincial Park as well as buildings in the industrial area could be affected by the fire. The resorts are also at risk.

E.5.4 Service Disruption

- Transportation is disrupted by the closure of Highway 19 and Island Highway East.
- Power lines are damaged.
- Some loss of land lines will occur but cellular services will continue.

E.5.5 Economic Impact

- The disruption to Parksville's tourist economy could be large. If the fire is not contained and destroys a number of the resort properties and the park forest, the long term impact could be substantial.

E.5.6 Long-Term Health Issues

- No long-term health issues are expected.

Annex F Parksville Scenario 1 – Wildland-Urban Interface Fire Mission Statement and Mission Objectives

F.1 General

The Mission Statement and Mission Objectives for Parksville Scenario 1 are structured in accordance with the Four Pillars of Emergency Management and the eight BCERMS Community Goals.

F.2 Parksville Scenario 1 Mission Statement

With regard to a wildland-urban interface fire incident, the community shall endeavour to (in order of priority):

1. put in place a management structure, equipment, procedures and training to protect the safety and health of all incident responders;
2. identify individuals at risk and use every available resource to protect and/or save lives;
3. identify individuals who are suffering from the effects of the wildland-urban interface fire incident (on site or long term) and reduce the suffering;
4. identify the risks to public health caused by the wildland-urban interface fire incident and work to resolve the risks as soon as possible;
5. identify risks to public infrastructure and mitigate the risks;
6. identify risks to both public and private property and mitigate the risks to property;
7. identify the risks to the environment caused by the wildland-urban interface fire and work to protect the environment; and
8. reduce the economic and social losses caused by the wildland-urban interface fire, all in balance with the other goals listed above.

F.3 Parksville Scenario 1 Mission Objectives

As indicated earlier, Mission Objectives for Parksville Scenario 1 are structured in accordance with the Four Pillars of Emergency Management and are informed by the eight BCERMS Community Goals. The mission objectives for the Parksville Scenario 1 Wildland-Urban Interface Fire are recorded below.

F.3.1 Mitigation/Prevention

Within the EMBC Emergency Management Pillar of Mitigation/Prevention, the following wildland-urban interface fire incident community objectives were identified by Parksville domain experts:

1. Continue to support and enhance development regulations that address wildfire interface issues such as construction materials and tree separation distances (Development Permit Guidelines).
2. Work to reduce fuel ladder build up and work to get community agencies involved.
3. Reconsider wildlife corridor use to include fire break opportunities.
4. Engage community in ensuring preventative measures are established ahead of time – FireSmart, etc.
5. Reduce fuels in the wildlands by using FireSmart advice.
6. In considering subdivision layout keep in mind emergency routes to avoid entrapment where possible.
7. Encourage BC Hydro to be proactive in reducing fuel around CI.
8. Establish fuel management/clearing by residents and land owners.
9. Restrict certain types of work during fire season – rural areas.
10. Communicate advisories to the public, e.g. extremely dry conditions.
11. Ensure BC Hydro responds to reports of trees arcing in the wires.
12. Maintain vegetation clearances from conductors and right of ways.
13. Share or explain hazard risk to stakeholders e.g. extreme risks.
14. Establish education program for public reduction of fire fuel load.
15. Educate the population on emergency management capabilities in order to temper expectations.
16. Educate public on preparedness.
17. Eliminate/reduce wildfires through public education and awareness at early stages through schools, service clubs, retirement homes, etc.
18. Establish public education and awareness workshops.

19. Establish public education – Neighbourhood Emergency Preparation (NEP), individual residences, businesses, churches, stratas, etc.

F.3.2 Preparedness

Within the EMBC Emergency Management Pillar of Preparedness, the following wildland-urban interface fire incident community objectives were identified by Parksville domain experts:

1. Develop and maintain effective evacuation plans for all high risk areas of the city.
2. Create Business Continuity Plan to allow for public to return to normal as fast as possible.
3. Ensure that community hazard response plans are disseminated to all appropriate groups and agencies.
4. Develop and maintain an animal emergency response plan.
5. Develop and maintain a plan for provision of alternate emergency health care (and triage) in the event that Oceanside is closed or overwhelmed.
6. Ensure that the age of the homes is taken into account when deciding to direct the residents to “shelter in place” within the wildland-urban interface fire response plan.
7. Within the response plan ensure that reopening of highways is given priority to allow transit of emergency vehicles.
8. Develop and maintain a plan, and train for and exercise the use of the plan, to operate with a unified command during a wildland-urban interface fire event. Accepting that the city has control over the Fire Department, include within the response plan appropriate interaction with the BCAS, Ministry of Forests (MoF) and the Coast Guard.
9. Within the response plan include provision of requesting assistance if the available resources are unable to adequately respond to the hazard.
10. Planning - relocation of water intake upstream of current location and aquifer storage and recovery for more reliable source of water (Aerosmith Water Service – look at relocating water intake upstream, downstream has more likelihood of contamination, could store higher volumes of water in ground).
11. Ensure that evacuation plans address anticipated traffic based on the month of the year, day of the week and time of day.
12. Develop a plan for the protection of CI for water – establish fire breaks for reservoir #5 and intake.
13. Prepare contingency for possible water supply issues.
14. Ensure emergency plans are up to date and address wildland-urban interface fire.

15. Work with resort community reps to build response plans (evacuations or hosting of disabled persons).
16. Plan for access to equipment from other municipalities and/or regions (mutual aid).
17. Establish protocols to access technical experts to safely and effectively respond to incident.
18. Maintain and disseminate policies and procedures to allow support funds to be passed quickly between Federal, Provincial, Regional and City staff members.
19. Develop and maintain a plan for the contracting and use of private security companies to keep order at reception centres.
20. Plan for evacuation – who will do it and how, including evacuation by water.
21. Establish EM plans (all hazards) – ESS plan, Communication plan, debris removal plan, recovery plan, animal plan.
22. Plan for triage and alternate care.
23. Maintain evacuation plans – authority, who does what.
24. In the response plan, designate, equip and train to open: reception centres, Recreational Vehicle (RV) reception centres, group lodgings, recovery centres and feeding centres.
25. Maintain recovery plan with designated centres and trained volunteers.
26. Engage community in development of all hazards plans.
27. Ensure relevant emergency plans are in place and have been tested.
28. Ensure plans are in place to provide a primary medical response and standby services.
29. Ensure CI is identified and protection plans are in place.
30. Ensure response plans that are coordinated and complementary.
31. Maintain a volunteer convergence and donation management plan.
32. Communication plan: coordinated with CI/providers; employs a municipality spokesperson – consistent message, ongoing/evolving public safety issues (e.g. carbon monoxide poisoning from generators).
33. Ensure communication plans accommodate the loss of cell towers, etc.
34. Take care of family of responders.
35. Ensure that sufficient temporary buildings are available on short notice to provide immediate accommodation and medium term accommodation.

36. Determine and then maintain a database of the gaps between the community's response capabilities and the needed capabilities for various hazards, in order to expedite requests for assistance from the Province.
37. Create electoral areas assistance inventories/agreements.
38. Determine availability of firefighting support/equipment from other electoral areas.
39. Develop relationships with outside agencies for support if needed.
40. Determine availability of Non-Governmental Organizations (NGOs) to assist.
41. Develop contact information for NGO and Government agencies for the wildland-urban interface fire situations.
42. Maintain an inventory of CI and CI stakeholders.
43. Establish Memorandums of Understanding (MOUs) for ESS support with contacts.
44. Ensure coordinated response with neighbouring jurisdictions (i.e. joint EOC).
45. Take measures to ensure closed loop communication with all agencies – example is coast guard combined events channel (EHS/RCMP/ Parksville Fire Department (PVFD), etc.).
46. Develop and maintain plans, including coordination between plans, to share human resources to ensure sufficient persons are available when required.
47. Ensure coordinated response with all emergency responders (unified command).
48. Undertake practice events with adjacent authorities to develop working relationships.
49. Conduct electoral area response scenarios (periodic).
50. Produce a regional transportation strategy if highway access is cut off.
51. Ensure that access and evacuation routes are available for rescue, regardless of the location of the fire.
52. Mapping of critical sites – EOC, reception centre, evacuation centre – shared with CI owners for restoration/provision of energy/utilities.
53. Conduct a long term look at municipal boundary adjustment to deal with coordination issues in disaster events.
54. Prioritize CI so that first responders and the EOC have a mutual awareness of which items need to be protected during a wildfire event.
55. Ensure that water is available to fight a wildfire in the Parksville area regardless of where the fire is located.

56. Determine ability to fight fire with well infrastructure only.
57. Undertake assessment of available facilities to ensure suitability for evacuation.
58. Maintain resource inventory master lists.
59. Maintain the risk assessment using the HRVA Toolkit.
60. Ensure amateur radio operators are in place to provide alternate communications.
61. Obtain Federal, Provincial, and Municipal support - funding, training, grants.
62. Carry increased fire protection equipment on Fire Rescue trucks during fire season.
63. Justify Federal, Provincial and City support: staff cuts could interfere with response times, cuts in grants for equipment reduce capability.
64. Develop a system for personnel access for volunteers, service providers, etc. - facilitate with local law enforcement on volunteers for field locations – outside agencies need to be aware of management structures and personnel in place.
65. Ensure proper equipment and training is provided for firefighters.
66. Ensure ESS reception centres are stocked to accept evacuees and the ESS volunteers are trained.
67. Develop and maintain a training plan.
68. Ensure EOC readiness.
69. Conduct volunteer training – ESS personnel, communications personnel, Citizens on Patrol (CoP), Salvation Army, Red Cross, community policing.
70. Conduct ongoing EM training for staff, stakeholders and volunteers.
71. Develop and maintain exercise plans.
72. Ensure regular exercises are conducted with key stakeholders.
73. Ensure ESS team in place and the organizations are robust, and personnel are trained and exercised.
74. Educate public on what to expect - prepare public and make them aware of what the community plans are.
75. Make sure volunteer responders are prepared as well as you want public to be prepared (food, water, supplies, etc. for multiple days).
76. Ensure a robust public relations and media program.

77. Encourage community volunteers to maintain a 72 hour emergency cache of critical supplies for their families to enable or promote their return to their assigned volunteer location to support others during an emergency.
78. Create an effective emergency communication protocol/strategy for emergency response – creation of shared emergency radio frequencies.
79. Ensure rapid access to emergency radio frequencies (emergency protocols) by streamlining the Industry Canada approval process.
80. Establish a communication network that accommodates the RCMP digital communication system(s).
81. Creation of shared radio frequencies – establish communication protocols/strategy for emergency response.
82. Note the strengths of the population as well as vulnerability – aged population's strength are resiliency, they are players in the BCP/recovery.
83. Limit response time during fire season.
84. Conduct pre-established information briefs for individuals/citizens – individual response activities, e.g. link to utility website or what to do if there is a requirement to evacuate.

F.3.3 Response

Within the EMBC Emergency Management Pillar of Response, the following wildland-urban interface fire incident community objectives were identified by Parksville domain experts:

1. Minimize long term health issues by minimizing person's (both members of the population and first responders) exposure to smoke and fumes.
2. Minimize injury and casualties caused by the need to evacuate, as opposed to the wildfire hazard.
3. Ensure human resources respond to fight the fire and provide security.
4. Provide local volunteers, and individuals from other parts of the country, with ID cards or other credentials that allows them to carry out their assigned tasks.
5. Deliver alternate triage or alternate care.
6. Conduct and monitor evacuation.
7. Activate the physical resources and equipment to respond to fire.
8. Provide BCAS resources to the event while maintaining a local response.

9. Ensure safety of responders and public is main focus for operational resources.
10. Inform decision-making, timely response, and good coordination, result in first responder safety (volunteers).
11. Maintain security of the evacuated areas (RCMP objective).
12. Ensure that the right persons are employed for the response tasks.
13. Activate the ESS team.
14. Establish and maintain a unified and coordinated operational structure.
15. Provide BCAS support to a unified command.
16. Establish a unified command system that is not influenced by stakeholders with vested interests.
17. Activate the amateur radio operators.
18. Modification/adjustment of communication plan for advising residents on progress of emergency.
19. Facilitate inter-jurisdictional communications, when needed, to expedite evacuation of the population.
20. Consider the firefighting water usage, management of water usage and potential contamination of water supplies due to the fire; ensure that “boil water” warnings are issued in a timely manner.
21. Maintain robust community-wide communications through radio stations, telephone and email (note that some of this infrastructure may not be working). The information to be transmitted includes details on the events and locations to which affected persons should move.
22. Maintain communications with the utility companies with regard to the location of CI.
23. Ensure that all required information is communicated to critical agencies (accommodating failures in the telephone system).
24. Ensure that up-to-date information about the situation on the ground is communicated to the reception centres.
25. Ensure that information to critical agencies is communicated to the hospital, police, fire, ambulance.
26. Maintain robust community communications.

27. Maintain communications amongst responders and coordinators regarding the current risk and methods and techniques to combat the risk.
28. Provide timely and accurate public information.
29. Ensure effective and current communications to all affected community members – media, public, business owners, etc.
30. Ensure access and egress routes for the public evacuations – awareness of this to the public while maintaining routes for emergency vehicles.
31. Notification of CI evacuation alert – shutoff plans/take actions to mitigate effect on infrastructure.
32. Rapid notification to CI owners of an interface/potential interface fire.
33. In a timely manner, advise the utility companies (Fortis BC, BC Hydro, etc.) of the details of an evacuation.
34. Advise the utility companies of the location of reception centres so that they can maintain service if the surrounding area is to be isolated.
35. Ensure that all required information is communicated to the utility companies.
36. Facilitate Provincial support to logistics – task #, eligible response costs.
37. Access of buses for evacuation limited by scenario (coming from Nanaimo).
38. Designate, equip and open: reception centres, RV reception centres, group lodgings, recovery centres and feeding centres.
39. Sharing of evacuation routes/dedicated response routes with underground CI – coordinate shutoff plans versus routes.
40. Evacuation zone mapping - street boundaries as well as Google map images.

F.3.4 Recovery

Within the EMBC Emergency Management Pillar of Recovery, the following wildland-urban interface fire incident community objectives were identified by Parksville domain experts:

1. Support individual and business recovery.
2. Execute Provincial support recovery – eligible recovery costs.
3. Establish communication centre – one centre for coordinated effort.
4. Communicate safe areas for citizens.

5. Develop a priority framework for restoration: recovery is coordinated with all CI, debris cleared/restore as team.
6. Ensure safety for responders – appropriate Personal Protective Equipment (PPE).
7. Ensure effective and early recovery response plan.
8. Ensure return to “new normal” as soon as possible.
9. Expedite the building permits process.
10. Conduct rehabilitation of ecologically sensitive locations done quickly and effectively - funding sources?
11. Ensure right person for the job.
12. Facilitate assessment and or removal of damaged trees and buildings.
13. Remove all types of debris from a site (street) at the same time.
14. Reduce red tape during recovery process – streamline processes.

Annex G Parksville Scenario 2 – Off-Shore Earthquake

G.1 Introduction

This annex contains the Parksville Scenario 2 details that were provided to Parksville workshop participants prior to the scenario review workshop in November 2012. The scenario introduction elements are presented in Table 20.

Table 20: Parksville Scenario 2 Introduction Elements.

Scenario Introduction Elements	Details
Casualties	A few fatalities, numerous serious injuries and a number of people trapped in collapsed buildings
Infrastructure Damage	Severe
Evacuation/Displaced Persons	Hundreds to a thousand displaced by earthquake damage and fire
Contamination	Potential from hazardous materials
Potential for Multiple Events	Multiple aftershocks
Recovery Timeline	Years
Economic Impact	Hundreds of millions

G.2 Scenario Overview

G.2.1 General Description

The magnitude of an earthquake is typically measured using the Richter Scale. A magnitude 2 earthquake is the smallest earthquake normally felt by people and anything over a magnitude 6 is commonly considered a major earthquake. Historically there have been a number of earthquakes in and around BC that are typically in the magnitude 7-8 range. This includes the October 27, 2012 magnitude 7.7 earthquake that occurred in the Haida Gwaii region¹¹. Numerous aftershocks of magnitude 3-5 were felt in the hours following that earthquake.

¹¹ <http://www.earthquakescanada.nrcan.gc.ca/historic-historique/map-carte-eng.php>

Liquefaction is the phenomenon where soil loses stiffness and strength in response to stress (such as earthquake shaking), causing it to behave like a liquid¹². Liquefaction reduces the ability of a soil deposit to support foundations for buildings and bridges.

The incident in this scenario is a magnitude 7.3 crustal earthquake along a fault in the Strait of Georgia with an epicentre 15 km east of Parksville. A tsunami is not triggered.

G.2.2 Detailed Description

A magnitude 7.3 earthquake occurs on a Monday in February at 0930. The outside air temperature is 3 degrees Celsius (C) and it is a cold, wet overcast day. The wind is light from the southeast and forecast temperature for the night time low is -4 C.

Strong to violent shaking occurs for 30-40 seconds across central Vancouver Island and light to strong shaking across other parts of south-western BC, north-western Washington State, and southern Vancouver Island. The shaking is intense enough to cause moderate to heavy damage on Vancouver Island, and very light to light damage across the rest of south-western BC. Figure 8 indicates the most severely impacted area around Parksville and Nanaimo.

In the Parksville area the earthquake causes surface faulting and liquefaction.

The earthquake causes damage to transportation networks, pipelines, buildings and other critical infrastructure.

G.3 Scenario Assumptions

The following assumptions have been made with respect to this scenario:

- Most employed people are at work rather than at home or in transit.
- The earthquake has significant impacts in Nanaimo and Victoria, rush hour is over and the population is fully engaged with daily activities. Based on the efforts of Parksville Emergency Preparedness approximately ten percent of the local population have a personal preparedness kit at home or at work.

G.3.1 Timeline

- Several aftershocks are expected to occur within the first couple of days following the initial earthquake, originating from approximately the same location.
- After 24 hours the first preliminary damage assessments are made.

¹² <http://www.ce.washington.edu/~liquefaction/html/main.html>

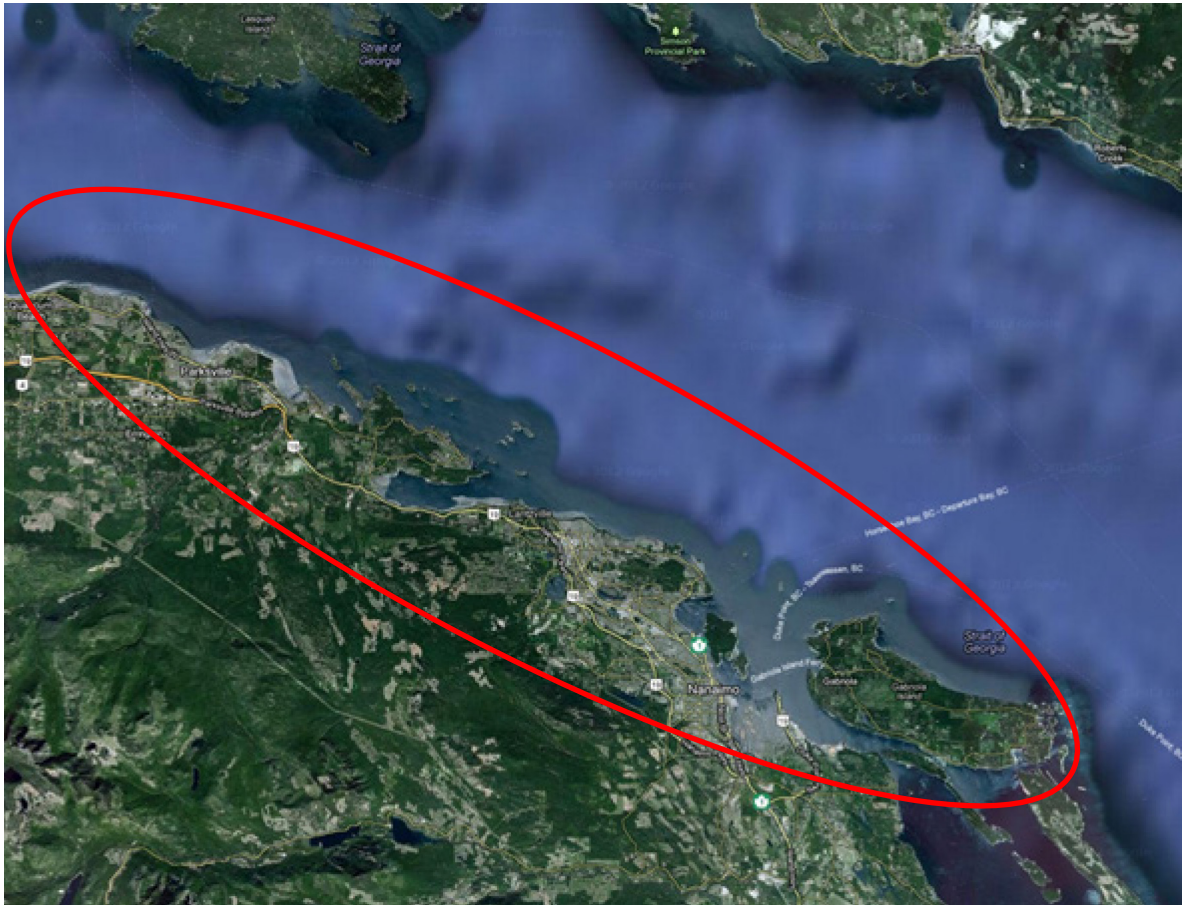


Figure 8: Most severely impacted area around Nanaimo and Parksville.

G.4 Planning Considerations

G.4.1 Variables

The potential Earthquake scenario planning variables and considerations are contained in Table 21.

Table 21: Earthquake Scenario Planning Variables.

Variable	Considerations
Earthquake characteristics (location of epicentre, type, magnitude, etc.)	<p>The earthquake characteristics must be considered as they affect:</p> <ul style="list-style-type: none"> ◆ Number of injuries / fatalities; ◆ Total damage;

	<ul style="list-style-type: none"> ♦ Critical infrastructure impacts; ♦ Support from other regions; and ♦ Risk of tsunami.
Time of day	Variables include time of day and day of the week (e.g. during rush hour, middle of the work day, evenings, overnight, weekend / holiday).
Environmental challenges (climatic affects)	Effects of weather including: <ul style="list-style-type: none"> ♦ Temperature; and ♦ Precipitation.

G.5 Implications¹³

The implications of the scenario described above are listed in bullet form in the following subparagraphs.

G.5.1 Secondary Hazards/Events

- Fires are one of the most common secondary events associated with earthquakes;
- Flooding from damaged water and sewage systems;
- Disease from increased concentration of people (e.g. shelters);
- Limited hazmat incidents may occur; and
- Debris may amount to thousands of tonnes.

G.5.2 Fatalities/Injuries

- The earthquake may result in a few fatalities and there will likely be numerous serious injuries.
- Building “non-structural” damage is a source of many injuries to persons. Non-structural damage includes breaking glass, falling furniture, falling light fixtures, falling chimneys and panels and facades from taller buildings.

G.5.3 Search and Rescue

- There are a number of people missing and trapped in collapsed buildings.

¹³ DHS scenarios, Scenario 9: Natural Disaster – Major Earthquake, pg 9-4.

G.5.4 Property Damage

- The earthquake causes the collapse of or serious damage to buildings in various parts of the city. Many more buildings have structural damage and must be evacuated until inspected; only a few of these buildings may be re-inhabited. Many older houses are damaged and must be evacuated.

G.5.5 Service Disruption

- Highway 19 (Parkville Bypass) and the Island Highway are affected by surface faulting, liquefaction, settlement, bridge and overpass damage, and bridge-abutment settlement. Most other roads are affected by debris.
- The port facilities in Nanaimo and French Creek are damaged.
- Power is out in many areas. In most areas the electrical power is restored within a week after the event. Emergency power generators are functional until fuel is depleted.
- Disruption to natural gas distribution is widespread with many homes and businesses losing service. Distribution lines are damaged or broken in some locations and in some cases cause fires.
- Portions of the Nanaimo Regional General Hospital are uninhabitable due to non-structural damage. In total a small portion of the beds in the hospital are lost. Almost all remaining beds were occupied prior to the event and remain occupied afterward.
- Communications systems are damaged and will be overwhelmed.
- The water supply and sewage are disrupted in parts of the city. In some cases disruption to the water system is caused by power outages to the pumping stations.
- There is restricted access to prescription medications.

G.5.6 Economic Impact

- The disruption to Parkville's economy is severe. Reconstruction, repairs, disposal, and replacement of lost infrastructure will cost hundreds of millions.

G.5.7 Long-Term Health Issues

- Alongside the many injuries there will be mental health issues related to this catastrophic event.

Annex H Parksville Scenario 2 – Off-Shore Earthquake Mission Statement and Mission Objectives

H.1 General

The Mission Statement and Mission Objectives for Parksville Scenario 2 are structured in accordance with the Four Pillars of Emergency Management and the eight BCERMS Community Goals.

H.2 Parksville Scenario 2 Mission Statement

With regard to an earthquake incident, the community shall endeavour to (in order of priority):

1. put in place a management structure, equipment, procedures and training to protect the safety and health of all incident responders;
2. identify individuals at risk and use every available resource to protect and/or save lives;
3. identify individuals who are suffering from the effects of the earthquake incident (on site or long term) and reduce the suffering;
4. identify the risks to public health caused by the earthquake incident and work to resolve the risks as soon as possible;
5. identify risks to public infrastructure and mitigate the risks;
6. identify risks to both public and private property and mitigate the risks to property;
7. identify the risks to the environment caused by the earthquake and work to protect the environment; and
8. reduce the economic and social losses caused by the earthquake, all in balance with the other goals listed above.

H.3 Parksville Scenario 2 Mission Objectives

As indicated earlier, Mission Objectives for Parksville Scenario 2 are structured in accordance with the Four Pillars of Emergency Management and are informed by the eight BCERMS Community Goals. The mission objectives for the Parksville Scenario 2 Off-Shore Earthquake are recorded below.

H.3.1 Mitigation/Prevention

Within the EMBC Emergency Management Pillar of Mitigation/Prevention, the following earthquake incident community objectives were identified by Parksville domain experts:

1. Identify areas prone to liquefaction, enhance development permit area requirements.
2. Develop a policy to restrict or limit development in high hazard areas.
3. Follow CSA/engineering standards for resiliency; reduce vulnerability.
4. Relocate water intake upstream of potential contamination and improve storage with aquifer storage and recovery.
5. Maintain a public awareness and preparation campaign, and communicate this plan to the public.
6. Education of public on how to be prepared to help themselves.
7. Provide public education with respect to self-sustainment for a minimum of 72 hours: NEPs, household preparation, ability to communicate, etc.
8. Keep the public aware of the need to hold a 72 hrs cache of supplies for self-support in the event of a hazardous event.
9. Inform the public that they may have to be self-sufficient for 7 to 10 days following an earthquake.

H.3.2 Preparedness

Within the EMBC Emergency Management Pillar of Preparedness, the following earthquake incident community objectives were identified by Parksville domain experts:

1. Ensure that all required response plans are developed, maintained and disseminated.
2. Develop and maintain a plan for provision of warmth (within 72 hours) for residents, either in their homes or at ESS reception centres.
3. Develop and maintain a water plan to ensure the availability of water during an earthquake or any other disaster.
4. Within the earthquake response plan accommodate the location of the EOC at Parksville, Qualicum Beach or the Regional District of Nanaimo.
5. Develop and maintain a staffing plan to ensure optimal use of volunteers.
6. Ensure responders and 'staff on duty' have a chance to check in at home.

7. Ensure response plans are in place (including a family first policy).
8. Develop a plan for interim assistance for the families of workers that are brought to the workplace.
9. Develop and maintain a plan for temporary residence or housing for volunteers.
10. Ensure that the response plans include planning details regarding the housing and feeding of out-of-town utility responders and those supporting reconstruction.
11. Plan to provide for out of area recovery crews (tents, hotels) in addition to local population.
12. Plan for identification and employment of outside assistance.
13. Develop a debris removal/victim recovery strategy.
14. Determine alternate care locations – triage areas, National Emergency Stockpile System (NESS) clinic setup location(s), morgue, auto launch locations (BCAS helicopters).
15. Establish incident command post/EOC locations – able to provide support?
16. Within the response plans, accommodate the potential unavailability of utility personnel at the EOC.
17. Accommodate, within the community earthquake response plan, slow or very slow response from the Provincial Regional Emergency Operations Centre (PREOC) and Provincial Emergency Coordination Centre (PECC) due to the number of EOCs attempting to communicate with these provincial agencies.
18. Plan to get first responders to equipment and supplies.
19. Plan to communicate within city/region and outside the region for support/resources.
20. Establish robust communications networks – staff to contact families, ensure that communication with outside agencies is maintained.
21. Maintain a robust communication plan.
22. Include within the response plan the establishment of effective and robust communications between the EOC and EMBC members located at the PREOC and PECC.
23. Within the response plan accommodate isolated pockets of responders (cut off by failures of bridges and overpasses, etc.) through provision of predetermined taskings for those caught in pockets.
24. Determine and plan to employ the utility companies surge capacity.
25. Develop and maintain policies and plans for rationing of supplies, including priority for reconstruction staff and contractors who must have access to fuel, and other supplies.

26. Develop and maintain policies and plans for utility inspections following each aftershock, including an allowance for one service provider to inspect for multiple service providers.
27. Develop and maintain an ability to conduct rapid damage assessment of critical buildings: EOC, reception centres, hospitals, etc.
28. Update and maintain Business Continuity Planning/Awareness – social, economic, etc.
29. Ensure that a sufficient number of trained building inspectors are available to allow persons to move back into damaged homes after the earthquake and after each aftershock.
30. Establish and maintain a plan for rapid damage assessment of private homes to support the “shelter in place” philosophy in order to reduce demands on the ESS centres.
31. Develop and maintain both a tsunami mitigation and a tsunami response plan, considering that if a damaging tsunami was to strike Parksville, it will originate in the Strait of Georgia and will occur without appreciable warning.
32. Develop and maintain a plan to organize the community volunteers to help with response and recovery.
33. Create robust communications plan.
34. Prepare and maintain a HAZMAT mitigation plan.
35. Maintain the HAZMAT response plan.
36. Create recovery plan specific to an earthquake.
37. Ensure emergency preparedness for public, city and emergency response workers.
38. Develop a list of CI for water and sewer and a plan of what to do in the event of failure/rapid assessment.
39. Develop and maintain a plan for damage assessment after the event.
40. Develop building evaluation plan and checklist to allow for rapid assessment of standing buildings.
41. Develop a plan for disposal of debris - plan for removal with sites identified.
42. Develop an action plan for workers who live outside the community.
43. Develop a plan to address visitors to city to get them out quickly and free up resources.
44. Review emergency plans for drinking water protocols with the Vancouver Island Health Authority (VIHA) – have a water emergency plan.
45. Develop a transportation strategy assuming highway is damaged for extended period.

46. Accommodate the use of vessels (landing craft) for transportation within the city considering that bridges may not be available following an earthquake.
47. Develop psycho-social response plan for mental health (intended to be used in recovery).
48. Plan for transportation for volunteer access to reception centres.
49. Develop environmental health response plan – communicable diseases, damage to water systems, air quality, etc.
50. Ensure EOC plan and alternate EOC site – well trained team.
51. When accounting for the numbers of persons who will be available to assist following an earthquake ensure the count is adjusted to accommodate for those who live outside the city.
52. Develop and maintain a plan for rapid reconstruction of the city's CI.
53. Maintain long term recovery planning.
54. Maintain emergency plans - EM plan, ESS plan, communications plan and recovery plan.
55. Communications plans – cell towers, repeater challenges, landline infrastructure may be damaged.
56. Test emergency communication systems and plans.
57. Ensure media plan in place to provide current and accurate public information.
58. Develop coordinated neighbourhood response plans.
59. Ensure adequate staffing plan for responders.
60. Ensure debris management plan includes coordination with all stakeholders.
61. Enable responders to shelter families at their place of work prior to taking shelter at an ESS facility.
62. Plan for and implement a program to train volunteers to train other volunteers.
63. Work with VIHA to establish regional medical resource availability (Nanaimo may not be an option for casualties).
64. In order to support the recovery effort, prepare and maintain a plan for facilitating the issuance of building permits and conduct of site inspections.
65. Develop and maintain an approach to sustaining communications following an earthquake event through means other than the telephone - methods such as texting or the use of Citizen Band (CB) radios.

66. Develop procedures to ensure that fuel stations can access the underground tanks without the main electrical grid.
67. Maintain adequate supplies (such as power bars) for operation of the EOC and reception centres.
68. Implement effective measures to limit or eliminate health problems caused by pollutants in the water after an event.
69. Ensure effective and timely communications, especially with a tsunami – use the green vest in order that everyone in the vicinity knows who is in charge.
70. Ensure robust mutual aid agreements are in place, both interprovincial and international.
71. Ensure that the utility companies (Fortis BC, BC Hydro, etc.) have suitable mutual aid agreements in place with other provinces and/or US states.
72. Establish mutual aid agreements or other agreements with the Province to speed the rebuilding of bridges and roads.
73. Develop and maintain mutual aid agreements with other municipalities.
74. Develop lists for key contractors and mutual aid agreements for municipalities.
75. Ensure coordinated response from neighbouring jurisdictions (local, provincial, federal).
76. Establish relationships with outside agencies to supply equipment, labour and materials to address damaged infrastructure.
77. Have emergency suppliers ready for areas outside of affected local area and a plan for delivery by multiple means.
78. Create a supplier list for material likely needed during response and recovery – how much material, where is it, etc?
79. Plan for outside volunteer support.
80. Develop CI – inventory and mapping of CI and stakeholder engagement.
81. Prioritization of critical assets.
82. Develop relationships with infrastructure stakeholders.
83. Determine regional capacities to handle large number of displaced persons.
84. Coordinate response plans with CI providers.
85. Provide coordination of impacts in community to CI providers.

86. Develop redundancy in areas of operation to operate CI.
87. Understand what people have for redundancies.
88. Look at opportunities for equipment replacement where the equipment can be used in various ways and for multiple rebuilding tasks.
89. Conduct emergency management training for EOC and site staff, volunteers and stakeholders.
90. Design regulations to have emergency provisions to allow for rapid recovery without regulatory road blocks.
91. Ensure timely approval of building permits to allow rebuilding by establishing in advance a method for streamlining the approval process while at the same time ensuring building “best practices”.
92. Develop and publish the command structure – what are the reporting relationships?
93. Train sufficient Emergency Communications Team (ECT)/ESS staff to service seven reception centres.
94. Train staff in building structural evaluation (homes and other buildings).
95. Improve the availability of portable radios and associated communication strategy.
96. Ensure mobile or portable EOC communications ready to go.
97. Conduct convergent Volunteer Training – human resource leadership in a crisis.
98. Set realistic public expectations for timelines for help to arrive.
99. Plan to maintain communications during the hazard.

H.3.3 Response

Within the EMBC Emergency Management Pillar of Response, the following earthquake incident community objectives were identified by Parksville domain experts:

1. Ensure safety of responders during rescue efforts (aftershocks).
2. Facilitate first responder’s communications with their families and provision of essential support prior to reporting for duty.
3. Conduct Search and Rescue.
4. Request and employ HUSAR.
5. Coordinate response for all emergency responders.

6. Secure additional resources from the interior of the province – “mutual aid”.
7. Request for volunteers through EOC to province – EOC, ESS.
8. Coordinate response plans.
9. Maintain situational awareness – what is affected – where do emergency response agencies start first?
10. Ensure effective EOC activation.
11. Ensure unified command at all levels - Regional Ops Centres – Local Ops Centres.
12. Ensure that robust communications are maintained between the responders and the EOC.
13. Facilitate movement of persons around the city following the earthquake.
14. On an ongoing basis provide information to the public.
15. Ensure media influence – effective information in a timely manner.
16. Provide logistical support – determine how to get resources to the locations of highest priorities.
17. Establish temporary shelters for emergency workers and displaced residents.
18. Identify safe reception and group lodging centres – rapid damage assessment, inspections (ongoing), heat (warming centres)/light/water/sewer status.
19. Execute water supply restriction protocols.
20. Maintain potable water for residents.
21. Maintain sanitary conditions for residents.
22. Pocket staff in units (BCAS) within specific areas where public needs are greatest.
23. Initiate communication plan and corresponding validation of rapid damage assessment of local groups to CI owners.
24. Establish infrastructure inspection priorities.
25. Support inter-agency unified command – for rapid damage assessment versus respond to each site.
26. Conduct rapid damage assessment of critical buildings – EOC, reception centres, hospitals, etc.

27. Conduct a timely rapid (and accurate) damage assessment of the whole city and all important structures and transmit these details to the EOC as quickly as possible so that the unified command can make decisions for the community as a whole.
28. Incorporate air support to survey damage and resource needs.
29. Provide SA to CI owners.
30. Execute water utility damage recovery strategy.
31. Facilitate transportation – repair damage to roads and ports.
32. Initiate debris removal.
33. Request outside assistance and facilitate resources being brought in.
34. Establish general security for property.
35. Understand that Coast Guard vessels/ships put to sea in the event of a tsunami.
36. Determine response numbers (volunteers).
37. Provide for out of area recovery crews.
38. Prioritization plans – rationing resources, e.g. fuel, gas contractors, backhoe, catering trucks.

H.3.4 Recovery

Within the EMBC Emergency Management Pillar of Recovery, the following earthquake incident community objectives were identified by Parksville domain experts:

1. Ensure safety of responders during rescue efforts (aftershocks).
2. Provide long term assistance for the public – temporary housing.
3. Provide for out of area recovery crews.
4. Deal with any kind of contamination – mixture of fuels, sewage, debris – what kind of health effect does that have? How to deal with fallout of constant array of sickness in community.
5. Prioritize critical bridges as they are the key to recovery.
6. Recover critical transportation infrastructure.
7. Ensure replacement/repair of CI, i.e. water, sewer, hydro, telephone (back to normal).
8. Facilitate the provision of utilities services to homes by rapid issuance of building permits and conditional occupancy permits.

9. Provide periodic recovery reports for information to public.
10. Establish recovery priorities – what in the community is the priority for restoration? e.g. school, nursing homes, downtown core.
11. Empower people to help.
12. Accommodate the balance between BC Safety Authority versus local assessment for building assessment – restoration versus condemned.

Bibliography

British Columbia Emergency Response Management System: Overview (Interim). Victoria, B. C. Ministry of Public Safety and Solicitor General, Provincial Emergency Program, 2000.

dePolo, C. M., Rigby, J. G., Johnson, G. L., Jacobson, S. L., Anderson, J. G., & Wythes, T. J. (1996). *Planning Scenario for a Major Earthquake in Western Nevada*. Nevada Bureau of Mines and Geology Special Publication 20.

NATO Code of Best Practice for Command and Control Assessments. DoD Command and Control Research Program, Library of Congress Cataloging-in-Publication Data, ISBN 1-893723-09-7 (pbk), October 2002, 273 pages.

NATO, *Application of Human Engineering to Advanced Aircrew Systems*. STANAG 3994 Edition 3, 2007, Brussels: NATO Standardization Agency, 19 pages.

Genik, L., *Operations Research Support for Critical Infrastructure Resilience in the Province of British Columbia*. The Homeland Security Review. v. 7 (1) p. 105-118, Winter 2013

Target Capability List, Department of Homeland Security, September 2007, 588 pages.

The Canadian Forces Operational Planning Process (OPP). B-GJ-005-500/FP-000. Issued on authority of the Chief of the Defence Staff. Canadian Forces Joint Publication 5.0, April 2008.

Genik, L. & Chouinard, P., *Hazard Risk and Vulnerability Analysis in BC: Requirements and Gap Assessment and DRDC Proposals for Support*, DRDC Letter Report to EMBC, September 2011, File 3700-1.

Genik, L. & Chouinard, P., *DRDC Support to Emergency Management British Columbia's (EMBC) Hazard Risk Vulnerability Analysis (HRVA) and Critical Infrastructure (CI) Programs: Problem Formulation and Solution Strategy*. DRDC CSS Technical Memorandum, DRDC CSS TM 2012-015, April 2012, 66 pages.

British Columbia Hazard, Risk and Vulnerability Analysis Tool Kit. Ministry of Public Safety and Solicitor General, Provincial Emergency Program, 2004.

Emergency Management in BC: Reference Manual, http://embc.gov.bc.ca/em/training/reference_manual.pdf, 22 June 2011, Version 1, downloaded 7 January 2013.

List of symbols/abbreviations/acronyms/initialisms

BC	British Columbia
BCAS	British Columbia Ambulance Service
BCERMS	British Columbia Emergency Response Management System
BCP	Business Continuity Plans
CB	Citizen Band
CI	Critical Infrastructure
CISM	Critical Incident Stress Management
CMC	Esterline CMC Electronics Inc.
CoP	Citizens on Patrol
COW	Cellular on Wheels
CSD	Census Subdivision
CSS	Centre for Security Science
DND	Department of National Defence
DRDC	Defence Research & Development Canada
ECC	Emergency Coordination Centre
ECT	Emergency Communications Team
EHS	Emergency Helicopter Service
EM	Emergency Management
EMBC	Emergency Management British Columbia
EOC	Emergency Operations Centre
ESS	Emergency Social Services
HAZMAT	Hazardous Material
HRVA	Hazard Risk Vulnerability Assessment
HUSAR	Heavy Urban Search And Rescue
IC	Incident Commander
ICP	Incident Command Post
ICS	Incident Command System
IPS	Integrated Public Safety
MoF	Ministry of Forests

MOTI	Ministry of the Interior
MOU	Memorandum of Understanding
MVA	Motor Vehicle Accident
NCO	Non-Commissioned Officer
NEP	Neighbourhood Emergency Preparation
NESS	National Emergency Stockpile System
NGO	Non-Governmental Organization
NOTAM	Notice To Airmen
OR	Operational Research
PECC	Provincial Emergency Coordination Centre
POL	Petroleum, Oil, Lubricants
PPE	Personal Protective Equipment
PREOC	Provincial Regional Emergency Operations Centre
PVFD	Parksville Fire Department
R&D	Research & Development
RCMP	Royal Canadian Mounted Police
RDA	Rapid Damage Assessment
RV	Recreational Vehicle
S&T	Science and Technology
SA	Situation Awareness
SAR	Search and Rescue
SATCOLT	Satellite Cell on Light Trucks
TDG	Transportation of Dangerous Goods
US	United States
VIHA	Vancouver Island Health Authority
WUI	Wildland-Urban Interface

DOCUMENT CONTROL DATA		
(Security classification of title, body of abstract and indexing annotation must be entered when the overall document is classified)		
1. ORIGINATOR (The name and address of the organization preparing the document. Organizations for whom the document was prepared, e.g. Centre sponsoring a contractor's report, or tasking agency, are entered in section 8.) Esterline CMC Electronics 415 Legget Drive P.O. Box 13330 Ottawa, ON K2K 2B2	2. SECURITY CLASSIFICATION (Overall security classification of the document including special warning terms if applicable.) UNCLASSIFIED (NON-CONTROLLED GOODS) DMC-A REVIEW: GCEC JUNE 2010	
3. TITLE (The complete document title as indicated on the title page. Its classification should be indicated by the appropriate abbreviation (S, C or U) in parentheses after the title.) Scenario Mission Task Analysis Report: Scenario and Mission Objectives Research Report		
4. AUTHORS (last name, followed by initials – ranks, titles, etc. not to be used) Coates. C.; Kobierski, R.		
5. DATE OF PUBLICATION (Month and year of publication of document.) February 2013	6a. NO. OF PAGES (Total containing information, including Annexes, Appendices, etc.) 112	6b. NO. OF REFS (Total cited in document.) 11
7. DESCRIPTIVE NOTES (The category of the document, e.g. technical report, technical note or memorandum. If appropriate, enter the type of report, e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.) Contract Report		
8. SPONSORING ACTIVITY (The name of the department project office or laboratory sponsoring the research and development – include address.) Defence R&D Canada – Centre for Security Science 222 Nepean St Ottawa, Ontario K1A 0K2		
9a. PROJECT OR GRANT NO. (If appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant.)	9b. CONTRACT NO. (If appropriate, the applicable number under which the document was written.) W7714-125456	
10a. ORIGINATOR'S DOCUMENT NUMBER (The official document number by which the document is identified by the originating activity. This number must be unique to this document.) 1000-1544	10b. OTHER DOCUMENT NO(s). (Any other numbers which may be assigned this document either by the originator or by the sponsor.) DRDC CSS CR 2013-008	
11. DOCUMENT AVAILABILITY (Any limitations on further dissemination of the document, other than those imposed by security classification.) Unlimited		
12. DOCUMENT ANNOUNCEMENT (Any limitation to the bibliographic announcement of this document. This will normally correspond to the Document Availability (11). However, where further distribution (beyond the audience specified in (11) is possible, a wider announcement audience may be selected.) Unlimited		

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.)

The Centre for Security Science (CSS) of Defence Research & Development Canada (DRDC) has a collaborative project with Emergency Management British Columbia (EMBC) Integrated Public Safety (IPS) to demonstrate the value of a science and technology (S&T) structured approach for improving emergency management capabilities. The objective of this EMBC-DRDC collaborative project is to evaluate options at the municipal and regional levels as applied to their risk assessment and Critical Infrastructure (CI) programs. Specifically, this work looks at the identification of the overarching shared objective of risk treatment for a scenario (i.e., the collective "mission"); and decomposition of that mission into key tasks that are sufficiently specific that a given task could be undertaken by individual stakeholders with minimal direction.

Le Centre des sciences pour la sécurité (CSS) de Recherche et développement pour la défense Canada (RDDC) a entrepris un projet en collaboration avec l'Unité intégrée de la sécurité publique de la Gestion des interventions d'urgence de la Colombie Britannique (EMBC) dans le but de démontrer la valeur d'une approche structurée en sciences et technologie (S & T) pour améliorer les capacités de gestion des urgences. L'objectif du projet concerté EMBC-RDDC consiste à évaluer les options aux échelles municipale et régionale en fonction des programmes d'infrastructures essentielles (IE) et d'évaluation des risques. De façon plus précise, la présente vise à déterminer l'objectif commun global de traitement des risques d'un scénario (c. à d., la « mission » collective) et à décomposer cette mission en tâches principales suffisamment précises pour qu'une tâche donnée puisse être entreprise par un intervenant avec un minimum de directives.

14. **KEYWORDS, DESCRIPTORS or IDENTIFIERS** (Technically meaningful terms or short phrases that characterize a document and could be helpful in cataloguing the document. They should be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location may also be included. If possible keywords should be selected from a published thesaurus, e.g. Thesaurus of Engineering and Scientific Terms (TEST) and that thesaurus identified. If it is not possible to select indexing terms which are Unclassified, the classification of each should be indicated as with the title.)

Emergency Management; Scenarios; Framework; Community; Risk; Plan; British Columbia; Nanaimo; Parksville; Mission to Task Analysis; Objectives; Earthquake; Hazmat; Propane spill; Interface Fire