

Value Focused Metrics for Improved Emergency Management Planning

Part 1: Objectives Measurement Framework

Prepared by:

Dr. Daniel T. Maxwell

Professor David Davis,

Knowledge and Decision Science (KaDSci)

Scientific Authority:

Lynne Genik

DRDC Centre for Security Science

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Defence Research and Development Canada – Centre for Security Science

Contractor Reporter

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Principal Author

Original signed by

Daniel T. Maxwell, Ph.D.
Contractor, KaDSci, LLC

Approved by

Original signed by

Lynne Genik, MSc
Scientist, Decision Support Section, DRDC CSS

Approved for release by

Original signed by

Denis Bergeron, PhD
Manager, Decision Support Section, DRDC CSS

Defence R&D Canada – Centre for Security Science (CSS)

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Abstract

This report is part one of a four part series describing how a decision analytic modeling approach called Value Focused Metrics (VFM) was applied to emergency management planning processes in two cities on Vancouver Island using four scenarios. This volume focuses on the development and representation of objectives in the strategy to task decomposition. The overall objective of the project is to apply a *strategy to task analysis* to aid communities in the development and assessment of community-wide risk management plans. Because VFM models explicitly represent the relationships between the communities objectives and the tasks performed by the participating emergency management organizations in a network model, very complex plans can be more easily understood and communicated than unstructured approaches. Additionally, VFM models allow for rigorous quantitative analysis in support of resource allocation planning and overall readiness assessment. This first report provides an overview of VFM and focuses on describing the objectives and metrics framework in the context of the four scenarios that were developed and exercised in British Columbia over the past year.

Résumé

Le présent rapport est le premier volet d'une série de quatre décrivant comment une approche de modélisation analytique décisionnelle intitulée « mesures axées sur les valeurs » (MAV) a été appliquée aux processus de planification de la gestion des urgences dans deux villes, situées sur l'île de Vancouver, à l'aide de quatre scénarios. Ce document porte sur l'élaboration et la représentation des objectifs de la stratégie à la tâche. L'objectif principal du projet est d'appliquer une analyse stratégie-tâche afin de soutenir les communautés dans l'élaboration et l'évaluation des plans de gestion des risques dans l'ensemble de la collectivité. Puisque les modèles de MAV représentent de façon explicite les liens entre les objectifs des communautés et les tâches accomplies par les organisations de gestion des urgences participantes dans un modèle de réseau, il est plus facile de comprendre et de communiquer des plans très complexes que des approches non structurées. En outre, les modèles de MAV permettent de réaliser des analyses quantitatives rigoureuses en appui à la planification de l'affectation des ressources, ainsi qu'à l'évaluation de l'état de préparation global. Ce premier rapport offre un aperçu des MAV et il est axé sur la description des objectifs et du cadre des paramètres dans le contexte des quatre scénarios élaborés et exécutés en Colombie-Britannique au cours de la dernière année.

Executive Summary

Value Focused Metrics for Improved Emergency Management Planning: Part 1 Objectives Measurement Framework, Daniel T. Maxwell; David F. Davis; DRDC CSS CR 2013-020, DRDC Centre for Security Science November 2013

Introduction or background: Emergency management planning in Canada, while receiving increasing attention in recent years, is primarily the responsibility of local municipalities who may lack structured planning, analysis, and assessment processes and tools. Furthermore, organizations tend to plan and exercise in silos. Formal planning and assessment across organizations for natural and manmade disasters may be perceived as very difficult, time-consuming and oppressively expensive, especially at the local level, where resources may be minimal. One consequence of this situation is that community readiness for the complex hazards they face may be lacking. Interoperability among the different stakeholders in a community, across communities, as well as with the Provincial and Federal governments, is often limited. Another consequence is that readiness levels across communities are inconsistent and may be difficult for outside agencies, that are charged to provide assistance in a disaster situation, to assess. These limitations present a significant risk for the population, the responders, and government leaders at all levels.

This research effort, conducted by DRDC CSS, is a set of discovery experiments that explore the potential of Value Focused Metrics (VFM) to improve the status quo and practice in the area of emergency management planning. VFM models were constructed for four scenarios (Propane spill, Interface fire, two Earthquake scenarios) using a combination of literature research and interaction with subject matter experts on emergency management in the cities of Nanaimo and Parksville and the Province of British Columbia.

Results: The research team developed four VFM models, one for each scenario, using a combination of subject matter expert input and literature review. The communities remained energetically engaged in the facilitated planning process used to generate the objectives for the VFM, particularly during the onsite elicitation sessions. Participants almost universally found value in the effort, citing the focused discourse with other stakeholders in the community and the validation exercises as especially valuable. A key observation is that all four models emphasized objectives relating to response more heavily than any of the other pillars of the emergency management cycle. Moreover, the objectives identified for (1) prevention and mitigation and (2) preparedness also tended to have strong ties to the response phase. Additionally, analysis of the objectives in relation to the Target Capabilities List (TCL) indicates that most of the objectives identified by the stakeholders align (approximately) with those in the TCL. There were some inconsistencies in terminology and level of model resolution between communities and

with the TCL that could potentially lead to gaps in planning and interoperability challenges in response.

Another critical observation is that while participants found value in participating in the VFM process, they did not believe they had the expertise or resources to develop VFM models without external assistance. Moreover, the demands of day-to-day operations in small communities may make it difficult to execute the structured approach to planning and assessment that VFM requires, because of the time commitments required for meeting day-to-day operational challenges.

Significance: These initial findings support the team's initial belief that a VFM based approach has the potential for improving the quality of emergency management related planning and assessment. That said, the approach at its current stage of maturity is likely not executable without external assistance and resource support.

Future plans: The project team will be writing three additional reports that complement this discussion of objectives frameworks. The second report will focus on the tasks developed by the communities with an analysis of the judgments Subject Matter Experts provided about the relative contribution these tasks made to mission achievement in the scenario. In the third report, the research team is exploring methods for gaining the benefits of Value Focused Metrics that are more easily accessible to emergency management stakeholders at the local and provincial level looking across scenarios. Two specific ideas that warrant active exploration are: 1) integrating the VFM process with the TCL, extending the power of the TCL beyond a checklist, and providing a framework that will ease the burden on stakeholders; and 2) exploring the use of web-based tools that allow for stakeholders to execute the VFM process in smaller time chunks and to interact asynchronously. In the fourth report, the research team will complete an assessment of the tools and processes used in support of VFM for this application. And, finally the research team will craft a summary report that integrates what has been learned in this research project.

Value Focused Metrics for Improved Emergency Management Planning: Part 1 Objectives Measurement Framework, Daniel T. Maxwell; David F. Davis; DRDC CSS CR 2013-020, RDDC Centre des science pour la sécurité, Novembre 2013.

Introduction ou contexte : Même si elle a attiré davantage l'attention au cours des dernières années, la planification de la gestion des urgences au Canada incombe principalement aux municipalités locales chez qui la planification structurée, l'analyse, les processus d'évaluation et les outils peuvent être inadéquats. En outre, les organisations ont tendance à planifier et à s'exercer en vase clos. Il peut sembler très difficile, fastidieux et terriblement coûteux d'établir entre elles un processus officiel de planification et d'évaluation en cas de catastrophes naturelles ou d'origine humaine, en particulier à l'échelle locale où les ressources peuvent être minimales. Par conséquent, les communautés peuvent être mal préparées à intervenir en cas de dangers complexes. L'interopérabilité est souvent limitée entre les différents intervenants d'une collectivité, dans l'ensemble des communautés, de même qu'avec les gouvernements provincial et fédéral. En outre, puisque les niveaux de préparation à l'échelle des communautés ne sont pas uniformes, il peut être difficile pour les organismes extérieurs d'évaluer l'aide à fournir en cas de catastrophe. Ces restrictions présentent un risque important pour la population, les intervenants et les dirigeants gouvernementaux de tous les niveaux.

Le travail de recherche dirigé par RDDC CSS consiste en une série d'expériences de découvertes examinant les mesures axées sur les valeurs (MAV) possibles pour améliorer le statu quo et l'exécution dans le domaine de la planification de la gestion des urgences. Des modèles de MAV ont été élaborés pour quatre scénarios (déversement de propane, incendie en milieu périurbain et deux séismes) sur la gestion des urgences à Nanaimo et Parksville (Colombie-Britannique) en combinant recherche documentaire et interaction avec des experts en la matière.

Résultats : L'équipe de recherche a élaboré quatre modèles de MAV, un pour chaque scénario, en utilisant une combinaison de recherche documentaire et de conseils d'experts en la matière. Les communautés sont demeurées engagées énergiquement dans le processus de planification simplifié utilisé pour élaborer les objectifs relatifs aux MAV, en particulier durant les séances de découverte sur place. La plupart des participants ont trouvé la discussion ciblée avec d'autres intervenants de la communauté et les exercices de validation particulièrement utiles. Une des principales observations effectuées montre que les quatre modèles mettaient davantage l'accent sur les objectifs liés à l'intervention que sur tout autre pilier du cycle de gestion des urgences. Par ailleurs, les objectifs identifiés pour 1) la prévention et l'atténuation, ainsi que 2) l'état de préparation avait également tendance à établir des liens solides avec la phase d'intervention. L'analyse des objectifs en lien avec la liste des capacités visées (LCV) démontre que la majorité de ceux identifiés par les intervenants s'harmonisent (de façon approximative) à ceux de la LCV. Il y a un certain manque d'uniformité dans la terminologie et le niveau de modèle de résolution des communautés et de la LCV qui pourrait entraîner des lacunes dans la planification et des problèmes d'interopérabilité lors de la phase d'intervention.

Une autre observation importante est que, même si les participants ont trouvé utile de participer au processus de MAV, ils n'ont pas cru avoir l'expertise ou les ressources nécessaires pour élaborer des modèles sans aide externe. Le temps requis pour combler les besoins opérationnels

quotidiens dans les petites communautés peut nuire à la mise en œuvre de l'approche structurée visant la planification et l'évaluation des exigences en matière de MAV.

Importance : Ces premières constatations confortent l'hypothèse de l'équipe selon laquelle une approche fondée sur une MAV pourrait améliorer la qualité de la planification et de l'évaluation liées à la gestion des urgences. Ceci dit, le niveau de maturité actuel de l'approche n'en permet pas l'exécution sans aide externe et soutien des ressources.

Perspectives : L'équipe du projet rédigera trois autres rapports complétant la discussion sur le cadre des objectifs. Le deuxième document portera sur les tâches établies par les communautés, ainsi qu'une analyse des jugements formulés par les experts en la matière concernant la contribution relative de ces tâches sur la réussite de la mission dans le scénario. Dans le troisième rapport, l'équipe de recherche examinera des méthodes permettant de bénéficier des avantages de MAV qui sont plus accessibles aux intervenants de gestion des urgences au niveau local et provincial dans le cadre des scénarios. Voici deux idées précises qui nécessitent une exploration active : 1) intégrer le processus de MAV à la LCV, prolongeant le pouvoir de cette dernière au-delà d'une liste de vérification et offrant un cadre de travail qui réduit le fardeau des intervenants; 2) examiner l'utilisation des outils Web qui permettent aux intervenants d'exécuter plus rapidement le processus de MAV et d'interagir de façon asynchrone. Dans le quatrième rapport, l'équipe de recherche évaluera les outils et les processus utilisés à l'appui des MAV pour la présente application. Enfin, l'équipe rédigera un rapport sommaire incluant les leçons retenues dans le cadre de ce projet de recherche.

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1 Introduction

1.1 Background

Communities around the globe face many hazards to their health and welfare that are both natural and manmade. Regardless of the source and location of the hazard or threat, the consequences can be similar across communities and types of events. When they are similar, the required response is similar, often with some minor tailoring for special local circumstances. In most cases responsibility for addressing the hazard falls on individual citizens and local governments. Unfortunately, emergency management planning is not standardized and planners may have little guidance in transitioning the results of risk assessments to plans. In addition, planning typically occurs in silos and it is often at the interface between organizations that problems arise. In response to this reality, provincial and federal governments are developing planning frameworks that are intended to improve the preparedness of emergency managers. Provincial, federal, and international planning efforts are making significant contributions to improving the state of the practice in emergency management. For example, tools like the *Emergency Management in BC: Reference Manual* [1] and the *British Columbia Hazard, Risk and Vulnerability Analysis Tool Kit* [2] provide assistance for accomplishing the planning and assessment necessary for achieving the continuous improvement called for in federal and provincial plans. That said, these documents, while helpful, do not explain how to develop a plan that responds to the identified risks. Moreover, formal planning and assessment across organizations is often perceived as very difficult and oppressively expensive, especially at the local level where emergency personnel are usually consumed by immediate operational requirements, and may be volunteers with limited availability, especially in small communities. One consequence of this situation is that collaboration across agencies, communities, and levels of government is limited. Another is that readiness levels across communities and organizations to respond to large emergencies are both inconsistent and often unknown. These limitations and unknowns present a significant risk for the population, the responders, and government leaders at all levels.

1.2 Project Overview

This research effort, conducted by DRDC CSS, is a set of discovery experiments that is exploring the potential of Value Focused Metrics (VFM) as a way to improve the status quo and practice in the area of emergency management planning. The VFM models were constructed using a combination of literature research and interaction with subject matter experts on emergency management in the cities of Nanaimo and Parksville, and the Province of British Columbia. Specifically, the modeling efforts are focused on representing the response to four disaster scenarios, two in each of the communities. Two of the scenarios were of a scope that taxed the local community to the point of requiring some provincial assistance, but did not involve surrounding communities. One was an interface fire in Parksville and the other a propane spill in Nanaimo. Two scenarios were

community responses to a magnitude 7 earthquake that affected a wide area, including both communities. The communities selected these scenarios because they were the highest risks in their community risk assessments. Additionally, the set of scenarios explored a range of different situations that also included a significant stress to the provincial emergency management system.

The VFM models described in this report were developed largely through a series of in-person and distributed elicitation sessions conducted using conference call services and Skype. The in-person sessions allowed the research team to gain the benefit of firsthand exposure to the communities, gain insight into their respective planning and operational cultures, and develop a deeper appreciation for the challenges associated with emergency management. Further consultation, exercise preparation, and review of interim products was accomplished using distributed meeting services.

The information collected during the development of the four scenarios cited above provides the foundation upon which the research team conducted its analysis.

1.3 Structure of the Report

The report begins with an overview of Value Focused Metrics (VFM), addressing both the components of the models and the model development process. We then discuss how the VFM model development process was tailored to meet the needs of this particular research effort. The technical meat of this report focuses on how the communities represented their objectives (Fundamental and Means) in the four scenarios. That is followed by preliminary analysis of key points of consistency and difference among the communities and models. Finally, we offer some (preliminary) conclusions about what we have learned about what may be possible for improving emergency management.

2 Value Focused Metrics and Software (GeNIe) Overview

Value Focused Metrics are an approach to modeling very complex — usually high stakes — challenges, sometimes referred to as *Wicked Problems* [3]. Value Focused Metrics provide a framework for identifying and assessing key variables, the dependencies among them, and the uncertainties that are present in the situation being assessed. The Value Focused Metrics approach has two key components: a Value Focused Metrics (VFM) Model, and a model development process that emphasizes explicit consideration of objectives and observable metrics. Once developed, VFM models can provide valuable insight that support the development, analysis, and assessment of plans for complex environments. Moreover, the VFM development process encourages interaction among stakeholders in complex environments that have repeatedly shown to improve the quality of collaboration and interoperability among the various stakeholders.

VFM models are implemented using a rather powerful decision analysis modeling technique called *Influence Diagrams* [4]. Influence diagrams are models that when fully specified, are simultaneously a graphical and a mathematical representation of the situation of interest. The graphical component is a set of nodes that represent the factors of interest and a set of arcs representing relationships that exist among those nodes (factors). Each of the nodes types contains different kinds of relevant information that is used to support mathematical analysis. Figure 2-1 shows the five types of nodes created for use in VFM models that extend basic influence diagrams to more effectively address complex environments. The first component is the fundamental objectives hierarchy. These (green) nodes represent explicitly the essential reasons for stakeholders to have interest in the decisions (e.g., *save lives*). There are usually multiple, often competing, objectives that are arranged hierarchically. When taken in combination, they can be combined using multi-attribute modeling techniques into the overall objective, which is the top node of the hierarchy [5]. The blue nodes represent means objectives (e.g., *respond quickly*), which we call the Means-Ends Network in the model. These objectives are important in the model because they affect the fundamental objectives. The yellow nodes are metrics. These are the observable things in the complex situation that provide visible indications of effectiveness. There are two classes of metrics. Process metrics (e.g., *time to respond in minutes*) are indicative of the efficiency of the system. Outcome metrics (e.g., *number of fatalities*) (called output metrics in some communities) provide (observable or estimable) concrete evidence about the decision situation overall. These metrics connect to either high-level means objectives or fundamental objectives, depending on the complexity of the situation under consideration. The rose color nodes represent decisions. Decisions are tasks that can be performed, projects, or other investments of resources that are within the control of one or more stakeholders. The final class of node (red) are called triggers. These are external stimuli, beyond the control of the stakeholders that somehow affects the situation or set of possible situations under consideration. Usually these are events that put a special strain of some sort on the

environment (e.g., interface fire, earthquake). The metrics, means objectives, and triggers are all represented in the model as probability nodes. This provides clear visibility into the uncertainty that is characteristic of complex environments. Just as importantly, when combined, the probability information is combined with stakeholder preferences that are encoded in the fundamental objectives [6]. VFM models provide a complete mathematical formulation that supports quantitative analysis from multiple perspectives.

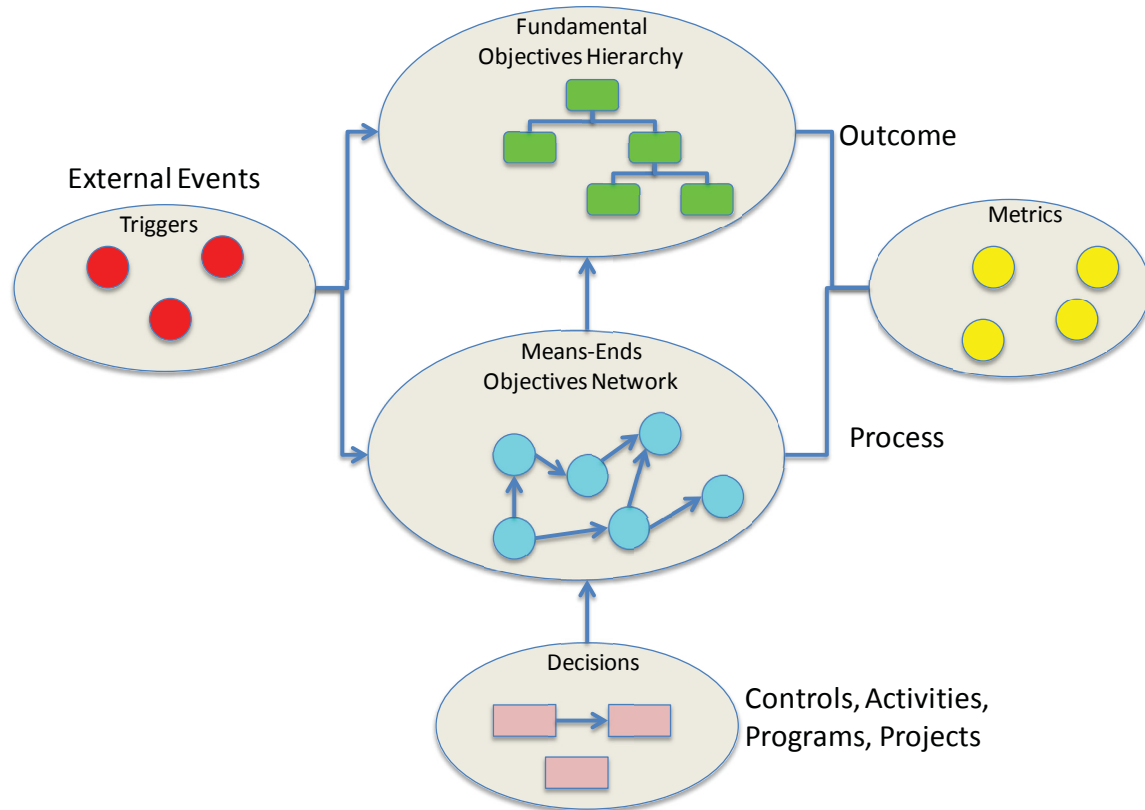


Figure 2-1. Value Focused Metrics Models

As important as the model itself, the VFM process also contributes immensely to improved planning, assessment, and execution in the face of complexity. VFM derives its name from an approach to decision analytic modeling called *Value Focused Thinking (VFT)* [7]. The essence of VFT is that rather than first thinking about alternatives, which is a common practice, stakeholders should invest significant energy focusing on their goals and objectives. Keeney coins a term called *Fundamental Objectives*, which are a stakeholder's essential reason for having an interest in making a decision. He further defines a class of objectives, called *means objectives*, that are important because they have some relationship with the fundamental objectives. Research and experience have shown that by doing this, people are regularly able to identify better options as well as identify important factors that would have been overlooked; the intermediate result being a richer planning and assessment model, and the end result being improved planning and execution in complex environments. To implement this in the context of VFM, we

initially conduct brainstorming sessions that emphasize thinking about the fundamental objectives. This stimulates dialogue among the stakeholders about what are *fundamental* and what are *means* objectives. This process naturally generates two sections of the model: the fundamental objectives hierarchy and the Means-Ends Objective Network (MEON). This interaction is supplemented with problem domain specific research seeking out policy documents and technical sources that can be used to identify the inevitable gaps and inconsistencies that are inherent in complex decision situations [8]. Stakeholders are then asked what tasks they would perform, or investments they would make, that will contribute to the achievement of those objectives, providing the possible decisions or courses of action. This then results in a set of possible options that could provide a course of action, or a portfolio of things that can be done collectively, depending on the situation. Subject matter experts are then asked how they would know they were successful (or unsuccessful) in the achievement of each objective. Their answers are then used to develop a collection of metrics for use in VFM model based assessments.

Members of the research team have applied this process to many tens, if not hundreds, of complex military decision situations with consistently favourable results. Additionally, the experience over time led us to the observation that in similar situations, very similar models are applicable. Moreover, in crisis and humanitarian response scenarios, the fundamental objectives, as well as many of the means objectives, usually focus on accomplishing the organization's mission and preserving life, similar to objectives of emergency responders [9, 10]. That led us to believe it may be possible to create model templates that are representative of a portion of the desired capability space, and can be used to more efficiently and effectively construct VFM models, making them more accessible to organizations that have limited resources (e.g., municipalities and volunteer organizations). We are hopeful that this research will help to confirm (or refute) that hypothesis.

The software we used to implement the VFM models is a specialized influence diagram package called GeNIe. It was developed at the University of Pittsburgh in their Decision Systems Laboratory. We selected this software because it is freely available,¹ it has (in our professional judgment) the most intuitive graphical user interface (GUI) for the price, and it has Application Program Interfaces (APIs) that allow it to be connected to other software. Additionally, the contract research team had used GeNIe for multiple VFM projects, and had taught the DRDC researchers how to use the tool as part of a class they had previously attended. This allowed the team to more quickly focus on the research task, rather than expend resources on selecting a new software infrastructure.

It is not necessary for users of a VFM approach to understand the intricacies of the GeNIe software or the underlying mathematics of influence diagrams. That said, it is helpful to understand some of the basic concepts of the software so that the process is

¹ <http://genie.sis.pitt.edu/>

understood well enough that the results are reasonably intuitive, allowing stakeholders to either accept results or, more importantly, question things the models generate that appear counterintuitive.

To show how the software works in this context, we will show a simple four node model. The model contains one fundamental objective, one means objective, one task, and one metric. Figure 2-2 is exactly how the model would look after the structure has been obtained from the stakeholders and reference material.

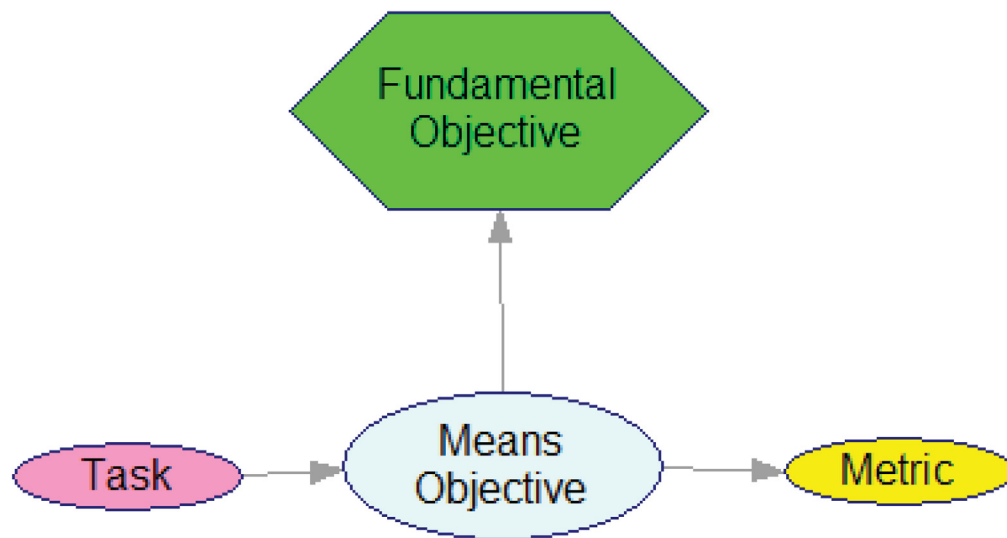


Figure 2-2. Sample GeNIe Model Structure

The color codes and node shapes are the same as what the research team used with the stakeholders in working through the four scenarios (we did find that we needed to extend the notation further, which will be described later). The actual models were many times more complicated than this simple example. These *maps* of the relationships among the variables were posted on the wall and served as a reference for stakeholders as they traced chains of causal relationships through the tasks and objectives.

Once the top-level structure of the model is developed, detail must be added that will allow for quantitative analysis. The first step in completing this process is to add states that the variables can be in (one characteristic of most influence diagrams and Bayes net software is that the variables must have discrete states rather than continuous distributions). Figure 2-3 shows how this looks in the software. The screenshot from GeNIe shows that the *Task* node has two states: *Done* and *Not_Done*.

Node properties: Task

General | Definition | Observation Cost | Format | Documentation | User properties

Identifier:

Name:

Type: Outcome order:

Diagnostic type: ☐ Target ☐ Observation ☒ Auxiliary ☐ Mandatory ☐ Ranked Target name format:

	State name	State ID	Target	Default	Special name
▶	Done		<input type="checkbox"/>	<input type="checkbox"/>	
	Not_Done		<input type="checkbox"/>	<input type="checkbox"/>	

Figure 2-3. States of the Task Node

The next set of data that is required in the model is to input probabilities for the uncertain nodes. As an example, Figure 2-4 shows the probability data for the metrics node. The metrics node has three states: *Looks_Good*, *Looks_OK*, and *Looks_Poor*. This is representative of what an evaluator might see when they observe a training exercise, or evaluate the quality of a plan, and is in the rows of the matrix. The metric is conditioned by the means objective that has five states ranging from *Very_Low* to *Very_High*. The way to interpret this table is that if the means objective (the thing we cannot see directly, but is important) was *Very_High*, then there is an 80% likelihood that our observation would be *Looks_Good*. At the other end of the spectrum, if the Means Objective were *Very_Low*, then there is an 80% chance we would see *Looks_Poor*. This kind of data is required for every node in the model and is called a Conditional Probability Table (CPT). One of the things the research team did was to create templates for these data that allowed stakeholders to answer questions that related to their knowledge of relationships, and the research team then provided the numbers.

Means Objective	Very_High	High	Moderate	Low	Very_Low
Looks_Good	0.6	0.25	0.1	0.05	
Looks_OK	0.15	0.3	0.5	0.3	0.15
Looks_Poor	0.05	0.1	0.25	0.6	0.8

Figure 2-4. Sample Conditional Probability Table (CPT)

The last type of data that is used by the GeNIe software (or any influence diagram) is a utility, or value function. This is encoded in the fundamental objective (green node) for this simple model. In more complex models it is likely a set of values or fundamental objectives (green nodes). Figure 2-5 shows the simple utility table that was used in the sample model. If the means objective is *Very_High*, then we receive a utility score of 100. If it is *Very_Low*, the score is 0.

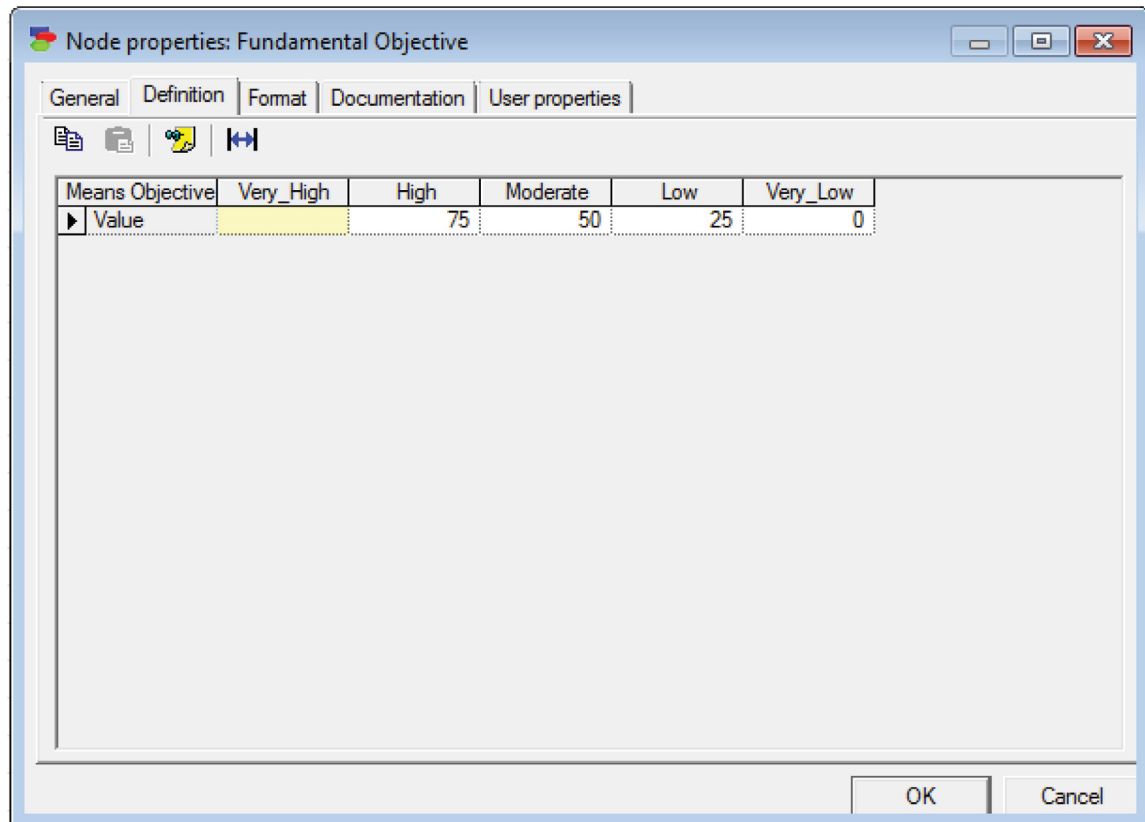


Figure 2-5. Sample Utility Node in GeNIe

Once the model has all of this probability and utility data entered, it is complete and is ready for mathematical analysis. The details of how these computations are accomplished is extremely technical and beyond the scope of this report. Interested readers should refer to available primers on the mathematics of Bayesian Networks (which is the computational engine of influence diagrams) [11]. Figure 2-6 shows what the results of the model would look like with the data we have described, assuming that the task is *Not_Done*.

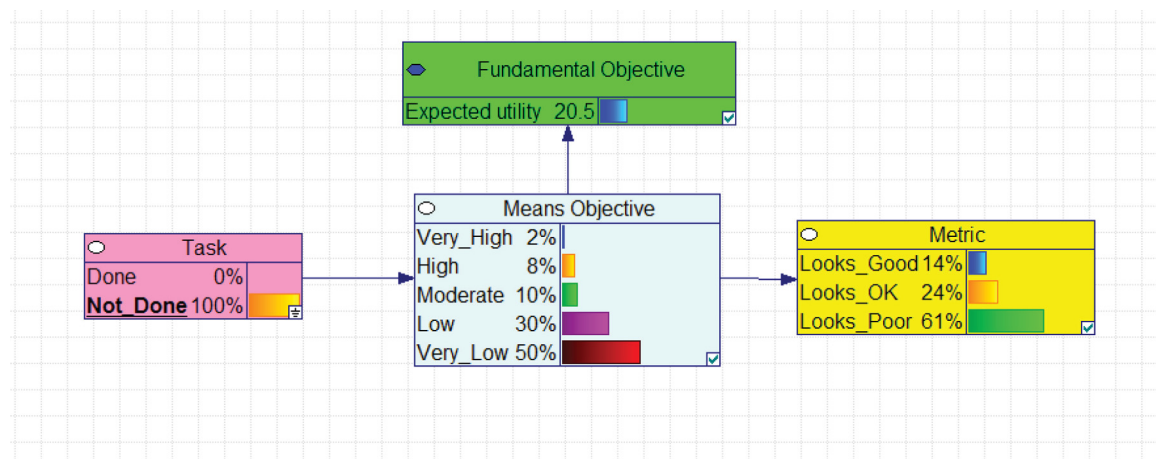


Figure 2-6. Quantitative Results of Sample Model: Task Not_Done

We can see that the expected utility score is quite low at 20.5, and the likelihood of the means objective being *Very_Low* is 50% (it should be noted that in practice, these results are usually not presented to stakeholders using the GeNIe software directly). When there are many nodes, it is more effective to synthesize the results and present highlights that help stakeholders to focus on the immediate challenge, rather than sifting through many numbers for an insight.

Figure 2-7 shows how the model results change if the Task is *Done*. We can see that the expected utility jumps from 20.5 to 79.5, a much more desirable state of affairs.

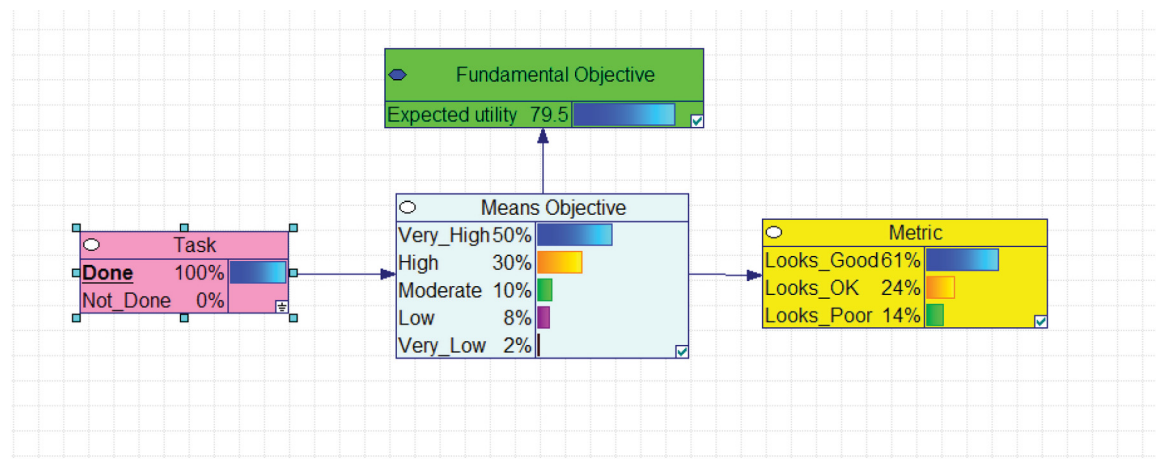


Figure 2-7. Quantitative Results of Sample Model: Task Done

The final characteristic of the model and the value of metrics is what observing actual results tells us about our expected outcome; in this case if we had to respond to an emergency. Figure 2-8 tells us that if we observe that our metric *Looks_Good*, then our expected utility increases to approximately 89, and the likelihood that our means

objective is *Very_High* increases to 65% from the 50% we observe in Figure 2-8, where our only information is the Task was *Done*.

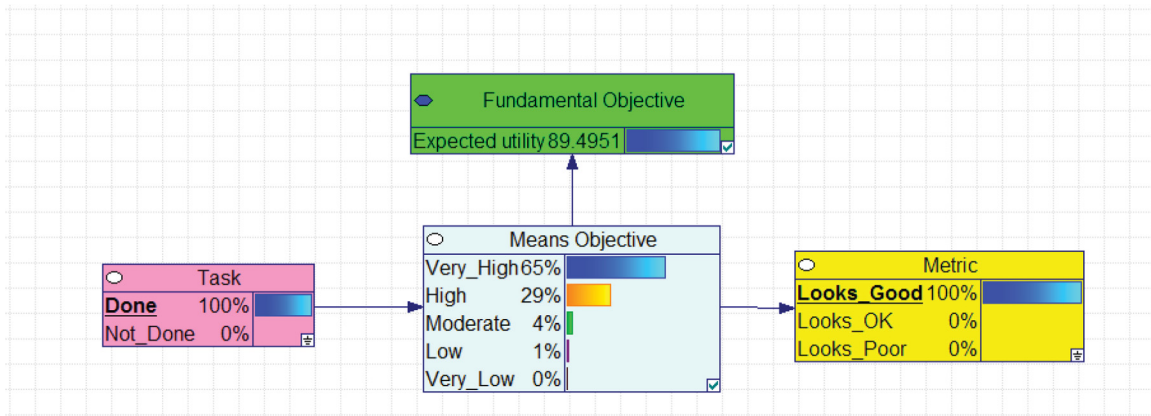


Figure 2-8. Sample Model Observed Metric as Looks_Good

3 Approach to This Project

VFM models are constructed to aggregate a set of complex, often competing objectives into a single, strategic goal. This strategic goal provides the decision context of the model — what are the key analysis questions, and how will they be answered? For this research effort, it was decided that the context would be developed using a set of scenarios that describe complex hazard situations of concern to two communities on Vancouver Island, British Columbia. To most effectively accomplish the model development effort, the research team interacted with a multidisciplinary set of subject matter experts (SMEs) from the local communities as well as the Provincial Government of British Columbia. The types of skills ranged from first responders, such as firefighters and law enforcement personnel to professional engineers and planners on the government staffs. Figure 3-1 lays out both the event sequence and schedule the research team followed for SME interaction to support the model building and exercise process.

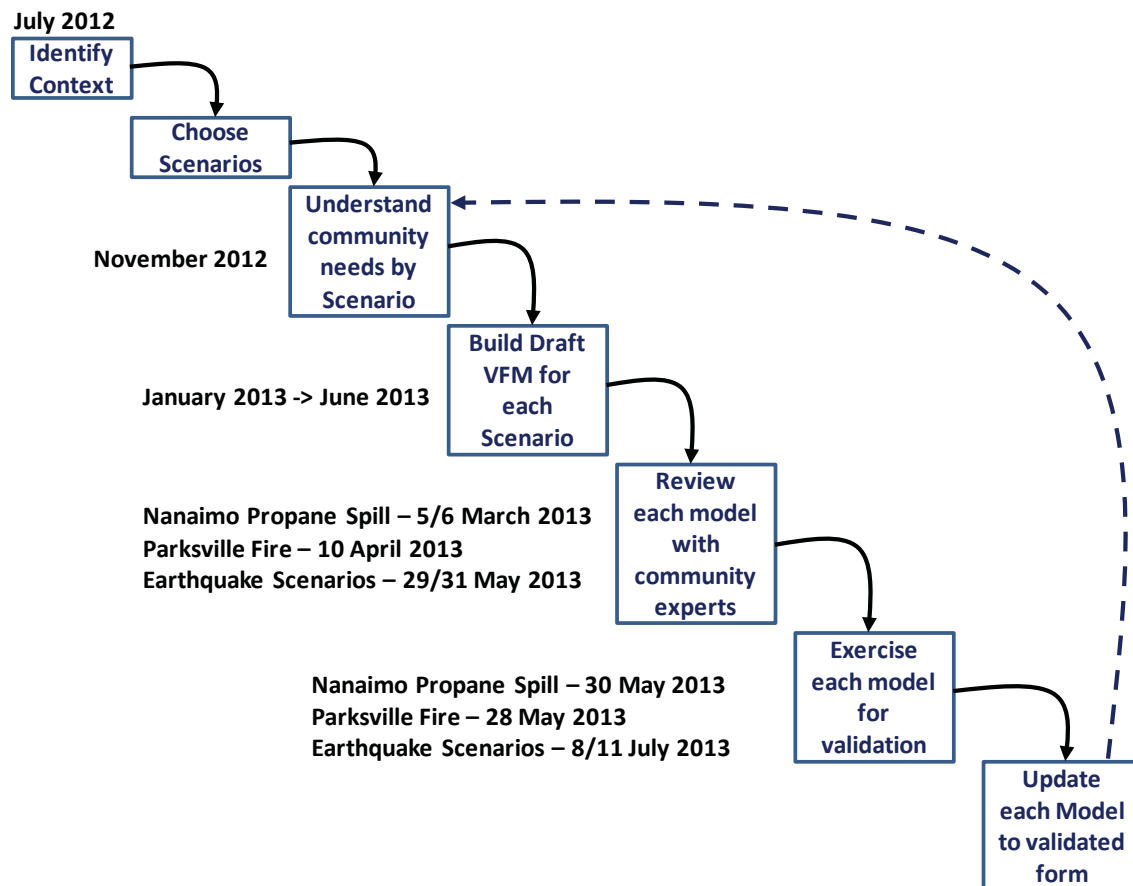


Figure 3-1. VFM Model Building Process

The process followed is described below. This process was designed to ensure that the models developed represent the goals of the community as well as the community's understanding of the logic of change — that is, how those goals can be achieved. This required a significant amount of elicitation, workshops, and group feedback sessions as described.

1. Identify Context: In July of 2012, members of DRDC CSS, assisted by contract support, convened discussion sessions in both Parksville and Nanaimo. A full range of stakeholders was interviewed, and the potential concerns around an interface fire and earthquake in Parksville and a hazardous material incident and earthquake in Nanaimo were discussed.
2. Develop Scenarios: After the July 2012 meetings, the contract support analysts and the members of DRDC CSS developed four specific scenarios for providing context for the mission to task analysis. These were an Interface Fire in Parksville, a Propane Spill in Nanaimo, and Earthquakes for both communities. The scenarios can be found in the *Scenario and Mission Objectives Research Report* [12].
3. Elicit Community Objectives: In November of 2012, the proposed scenarios were presented to the communities. Sessions were held to develop the fundamental and means objectives (see section 2 above) across the four pillars of emergency management. Comprehensive notes were collected by the contractor [12] and DRDC CSS for each scenario. These notes formed the basis for the Affinity Lists discussed below.
4. Build Draft VFM Models: Beginning in January 2013, the Affinity Lists were developed based on the November 2012 notes. An Affinity List is a list of all elements discussed which is then reviewed to categorize each element. The analytic team conducted the review of the Affinity List to identify Strategic and Fundamental objectives, as well as to begin the process of developing relationships between the Means Objectives (see previous discussion of VFM). Potential tasks and constraints were contained in the Affinity Lists which were retained for future use.

The analyzed Affinity Lists along with other literature, such as the *Emergency Management in BC: Reference Manual* [1] and the *British Columbia Hazard, Risk and Vulnerability Analysis Tool Kit* [2], were then reviewed and first draft models

were developed for further review. This initial modeling was subjective, and required high-level stakeholder involvement to ensure the overall context was being met.

5. Review Models: From March 2013 through late May 2013, the individual draft VFM Scenario Models were put before the communities for review. This review process consisted of a comprehensive, objective by objective, examination of the causal relationships in the model. Questions were asked of the stakeholders to confirm that these relationships were appropriate, were not missing any key objectives, and did not contain duplicates. Each session required almost a full day to review the objectives. (The earthquake scenario review was a sample of the objectives because of its large size.) The result of this review was a model that represented the synthesized thinking of the stakeholders regarding the scenario events.
6. Exercise Models: Following each model review, the community was asked to provide further input to the models in the form of identifying tasks. Tasks were differentiated from objectives in that tasks are activities that various organizations can do. Objectives are not expected to be directly achievable, but are stated as aspirations. Objectives are achieved based on the other objectives that have been identified as causes, or influences on them, as well as by the combined set of tasks. The identified tasks were reviewed for completeness by the lead planners in each community and then added to the VFM Model. Once that was accomplished, during the exercise, each task was analyzed by groups of the stakeholders to determine if the tasks were appropriate for that objective, and if so, what level of impact accomplishing the task would have on the objective. During the discussion of task impact on objectives, some tasks were deleted, others were moved to differing organizations, and some new tasks were added. The result of this in-depth review of the model and its components by the stakeholders is assumed to represent a high level of validation for this model.

The exercises were conducted in groups. The Parksville Interface Fire and Nanaimo Propane Spill exercises were conducted by one group each during the last week of May 2013, and the two Earthquake exercises were similarly conducted during the middle of July 2013.

7. Update Models: After the exercises were conducted, each model was updated with the results of the exercise and provided to DRDC CSS for their records. As

Figure 3-1 shows, the updated models should be used to deepen the analytical understanding of the needs of the community, and support the research team's exploration of the utility of broader applicability of VFM modeling techniques.

4 Emergency Management Objectives

'If you can not measure it, you can not improve it.'

—Lord Kelvin

As discussed previously, there are two classes of objectives represented in a VFM model. The fundamental objectives are the set of most important reasons we are interested in a decision, planning, or assessment situation. These are usually organized hierarchically and when fully specified can be mathematically combined into a single aggregate *score*. The actual mathematical algorithm that should be applied to compute the score depends on the actual preferences of the stakeholders. These preferences are usually expressed as responses to very focused questions about the relative importance of the different fundamental objectives. Means objectives are important because they influence the achievement of the fundamental objective(s). There are usually many more means objectives than fundamental objectives, and they are highly interdependent. Because of this they are structurally represented as networks. The mathematical relationship between any two connected objectives in the network is represented as a conditional probability distribution. We will first discuss the fundamental objectives hierarchies and then explore the Means-Ends Objective Networks that the community SMEs contributed to.

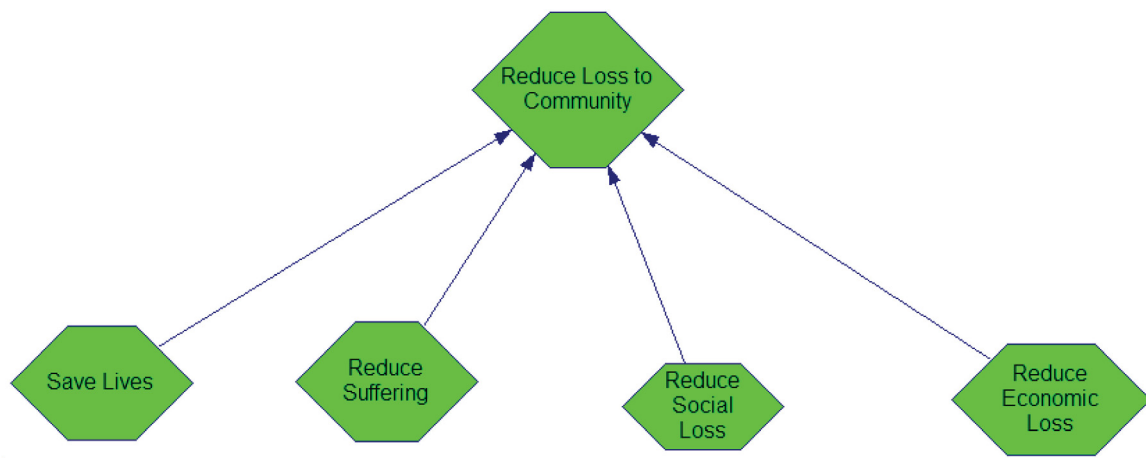
It turned out that the overall fundamental, or strategic, objective was similar, but not identical for the four models. The analysts and stakeholders in Parksville identified *Reduce loss to the community*, which was defined to be *Minimize the community's overall risk* as the overall fundamental objective. And for the Nanaimo propane spill, the stakeholders identified *Minimize risk*, which was defined to be *Minimize the community's overall risk (i.e., likelihood, impact, vulnerability) from the event (propane spill)* as the overall fundamental objective. It is important to note that these linguistic definitions are important for developing initial stakeholder understanding and for stimulating the collaboration among stakeholders. In a fully specified (complete) model, the strategic objective is nothing more (or less) than the aggregation via a mathematical function of some sort of the parent fundamental objectives that feed into it. Therefore, the strategic objective is essentially roughly equivalent across the four scenarios, with an additional consideration of “*Protecting the Environment*” added for the earthquake scenario. How aggregation is accomplished generally in complex influence diagrams is described in Maxwell (1994) and Maxwell and Buede (2005) [6].

Figure 4-1 is illustrative of the fundamental objectives hierarchies that was developed for the interface fire and propane spill scenarios. There are four fundamental objectives: *Save Lives*, *Reduce Suffering and*, *Reduce Economic Loss*. The final definitions for these objectives (and all others) are contained in Annex B. Additionally, a detailed description of every scenario is provided in the “Detailed Model Descriptions” provided as supplemental deliverables. It may come as no surprise that these objectives

correlate very closely to the BCERMS response goals identified on page 2 of the *Standards for BCERMS Training Providers and BCERMS Training Materials* [13], since these goals are collectively used by organizations to prioritize emergency response and were used as the foundation for discussion. Specifically:

BCERMS supports a prescribed set of response goals, set out in priority order, to:

- 1. Provide for the safety and health of all responders*
- 2. Save lives*
- 3. Reduce suffering*
- 4. Protect public health*
- 5. Protect government infrastructure*
- 6. Protect property*
- 7. Protect the environment*
- 8. Reduce economic and social losses*



*Figure 4-1. Fundamental Objectives Hierarchy
(Nanaimo Propane Spill and Parksville Interface Fire)*

One structural difference between the BCERMS goals and the fundamental objectives hierarchy is that BCERMS identifies *provide for the safety and health of all responders* as the highest prioritized response goal. Responders and emergency planners at the community level discussed this at length and concluded that responder safety should be a means objective that supports the fundamental objective of saving lives rather than an explicitly identified fundamental objective.

Figure 4-2 reflects the Fundamental Objectives Hierarchy for both communities' earthquake scenarios. The one additional fundamental objective identified, compared to the interface fire and propane spill scenarios, is to *Protect the Environment*. It is

represented explicitly in the BCERMS training material and it is implicitly represented in the MEONs of the interface fire and propane spill scenarios in two ways: 1) there is an objective with a different title, but similar definition as the protect the environment objective; and 2) there are identical tasks specified that are characterized as supporting a different means objective, but would also protect the environment.

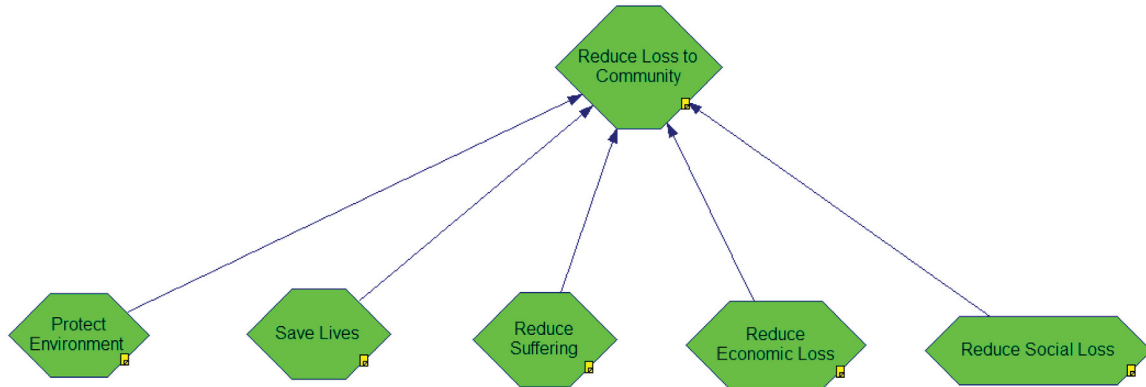


Figure 4-2. Fundamental Objectives Hierarchy (Nanaimo and Parksville Earthquakes)

There were four different MEONs developed in support of the project — one for each of the scenarios. Not surprisingly, the MEONs for the earthquake scenarios were significantly larger than the smaller-scale scenarios. Overall, it was in the development of the MEONs that we observed the biggest differences among the communities. These differences seemed to have three causes. First, in some cases the communities used different terms for what was fundamentally the same objective or phenomenon. For example, one community uses the term Emergency Operations Center (EOC) while the other uses Emergency Coordination Center (ECC). Second, the larger community had a larger collection of professional stakeholders that participated in the elicitation sessions. That difference brought a different and in some cases more focused perspective to many of the same potential objectives. For example, the smaller community spent a good deal of time talking about how the families of first responders would be cared for. The larger community did not discuss these issues in as much detail. (One possible explanation for this lies in the work of Gary Klein on naturalistic decision making, but is beyond the scope of this study [14].) And third, in some cases there are substantive differences between the scenarios and communities that were accounted for explicitly in the MEON.

The details of how we represented a MEON for these scenarios evolved as the project matured. We found in dialogue with the SMEs that they identified with the four pillars of emergency management (Prevention and Mitigation, Preparedness, Response, and Recovery) as organizing bins for their thinking. To accommodate that, we created color codes for each pillar that are applied as borders to the outside of the nodes in the influence diagram. The color codes are: Red—Prevention and Mitigation, Yellow—Preparedness, Black—Response, and Green—Recovery.

The MEON model in Figure 4-3 captures the objectives identified by the SMEs for the Nanaimo propane spill scenario. The model has 34 means objectives identified with a relatively sparse network of dependencies identified. Like all of the MEON models, most objectives relate to the response pillar, followed by preparation objectives that most directly support the response pillar. This emphasis aligns with the roles of the people who participated in the model development process. After the MEON was completed and task elicitation was conducted, the tasks classified as mitigation (Create Public Messaging Templates, Educate Public on Reverse 911) were associated by the SMEs with what they had identified as a preparation objective (Educate Public on Hazards / Routes / Procedures). While this does not affect the model computationally, it is important to explore for clarity and broader organizational collaboration perspectives. These inconsistencies in binning tasks and objectives have the potential for creating gaps, redundancies, or inconsistencies in disaster preparedness plans that involve multiple organizations.

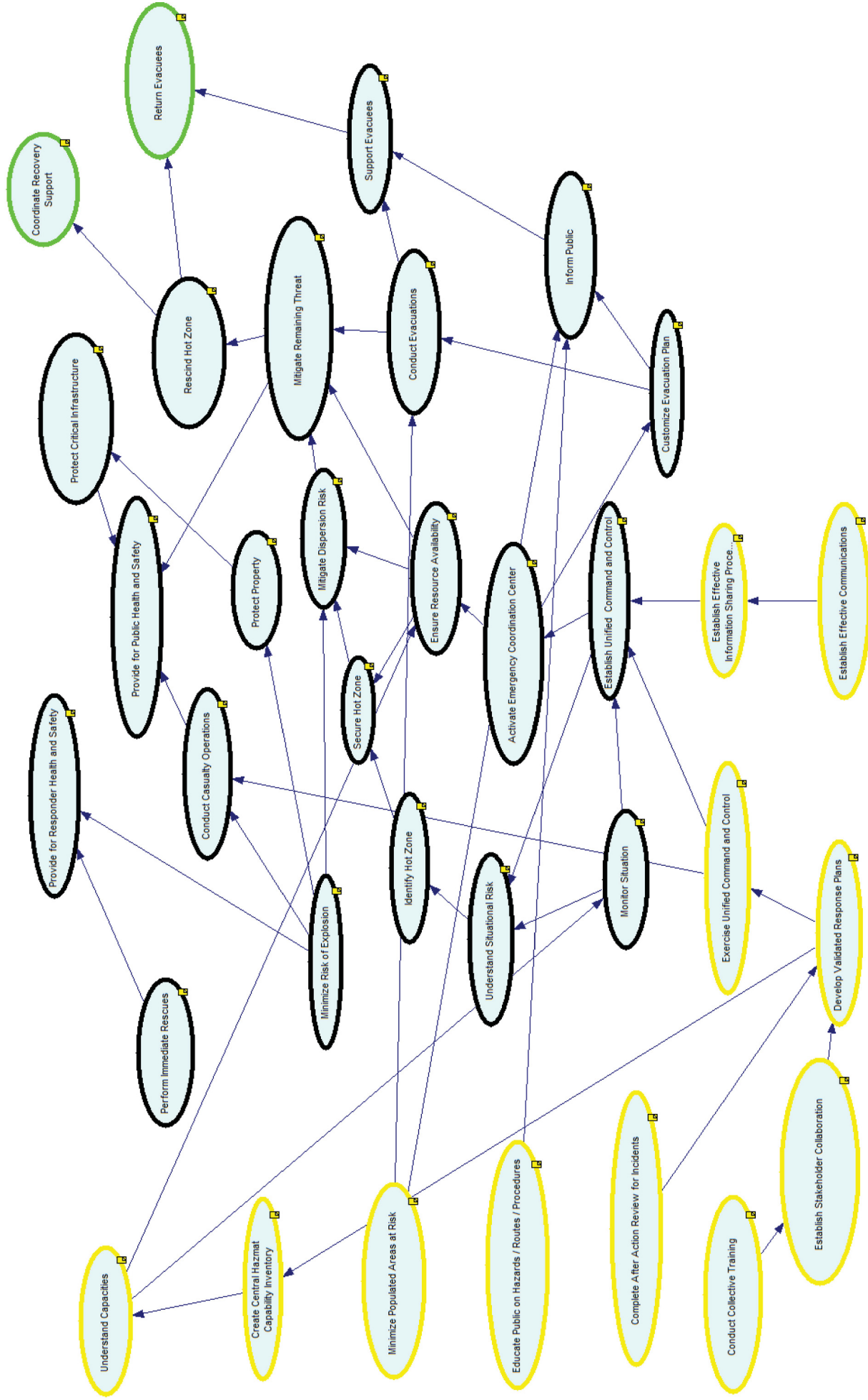


Figure 4-3. MEON—Nanaimo Propane Spill

Figure 4-4 depicts the MEON for the Parksville interface fire scenario. It is slightly more detailed than the Nanaimo model with 51 means objectives identified. These differences appear to be caused by two key factors: 1) there are objectives associated with longer term evacuation that are not required for the propane spill scenario; and 2) there are cases where the objectives in the propane scenario are decomposed into multiple means objectives in the Parksville model. An example of this is that the response pillar of the propane model identifies two means objectives that speak to all casualty and health care objectives. Conversely, in the interface fire model, there are six nodes focused on health care and casualty management, with explicit treatment of planning processes and evacuees. The interface fire model also identifies three prevention and mitigation related objectives that focus on communicating risks to the population, and addressing the environment to reduce the likelihood that a fire will spread. These kinds of inconsistencies in the resolution (fidelity) of the objectives have the potential to cause miscommunication among communities and with the provincial government, especially in high pressure (disaster response) situations. For example: the six explicitly identified nodes in the interface fire model could be goals that are part of the standard procedures in full-time organizations (i.e., Nanaimo Fire Department), therefore they do not see the need to document them explicitly in a plan. This makes perfect sense for each organization because of the difference in their membership, but it sets up the potential for misunderstanding and miscommunication when the two communities are interacting with the Provincial government.

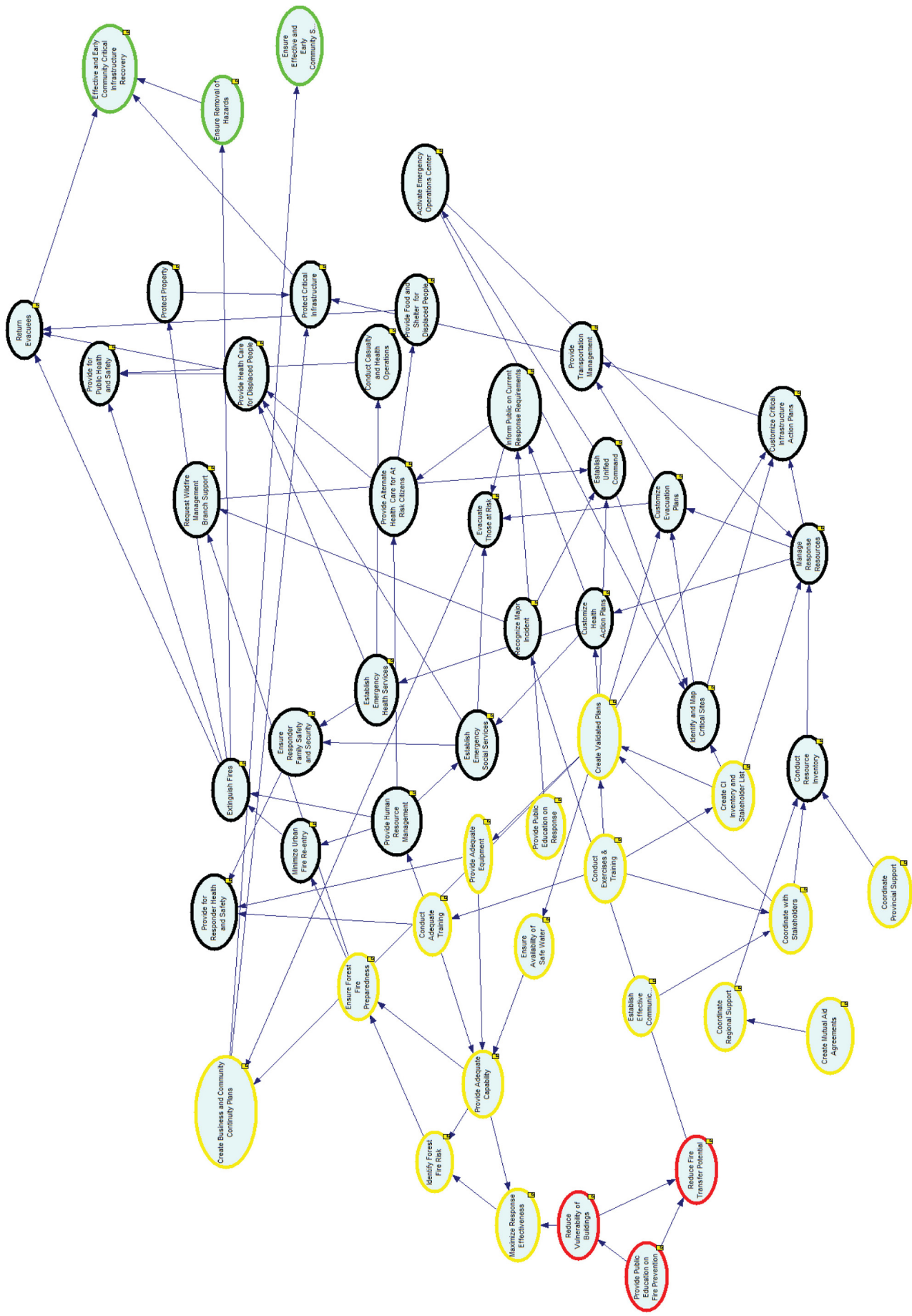


Figure 4-4. MEON—Parksville Interface Fire

Figure 4-5 depicts the Nanaimo earthquake MEON. It is a much denser model than the smaller scale scenarios with objectives relating to all four pillars of the emergency response cycle. It is very interesting to note some of the key differences that cause the model to be larger in size. For example, some of the means objectives reflect the need to obtain significant external assistance in the scenario. Additionally, in this scenario the Nanaimo SMEs identified specific public education goals as existing under the prevention and mitigation pillar, rather than more general statements in the smaller scenarios.

Similar to the smaller scale scenarios, there are many common objectives across scenarios. Also similar to the first two cases, there are means objectives with subtly different titles, but definitions that are strikingly similar.

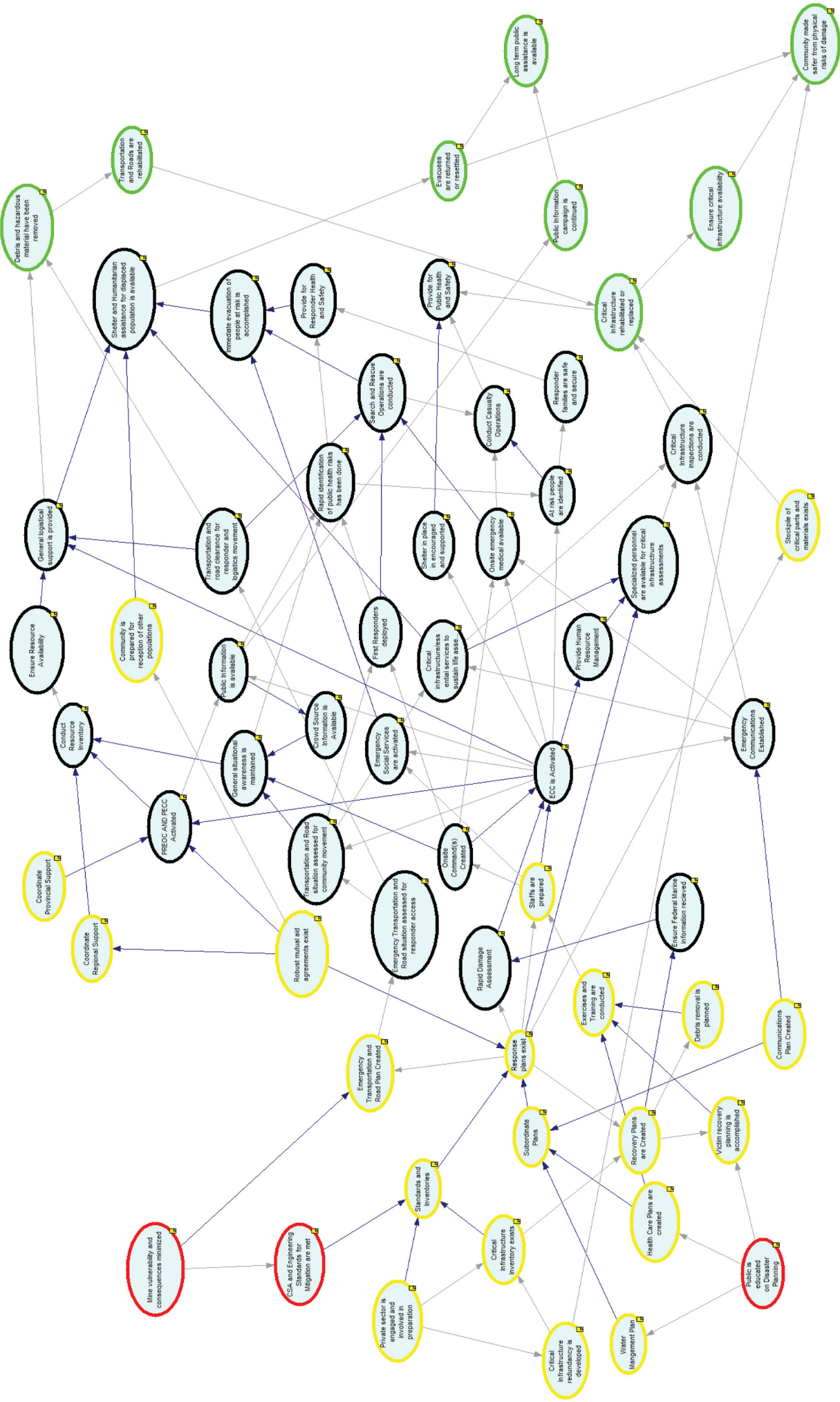


Figure 4-5. MEON—Nanaimo Earthquake

The fourth and final MEON, displayed in Figure 4-6, focuses on the Parksville earthquake scenario. It is also a bigger model than the smaller scale scenarios, and is very similar to the Nanaimo model with one key exception — the stakeholders in Parksville added an explicit means objective focusing on *Critical Infrastructure Redundancy* under mitigation. While we cannot be certain why this occurred, it should be noted that the Parksville participants for the earthquake scenario included a broader cross section of organizations, including utilities, city planners, and engineers. Consequently, those sessions had a different focus than in the other community.

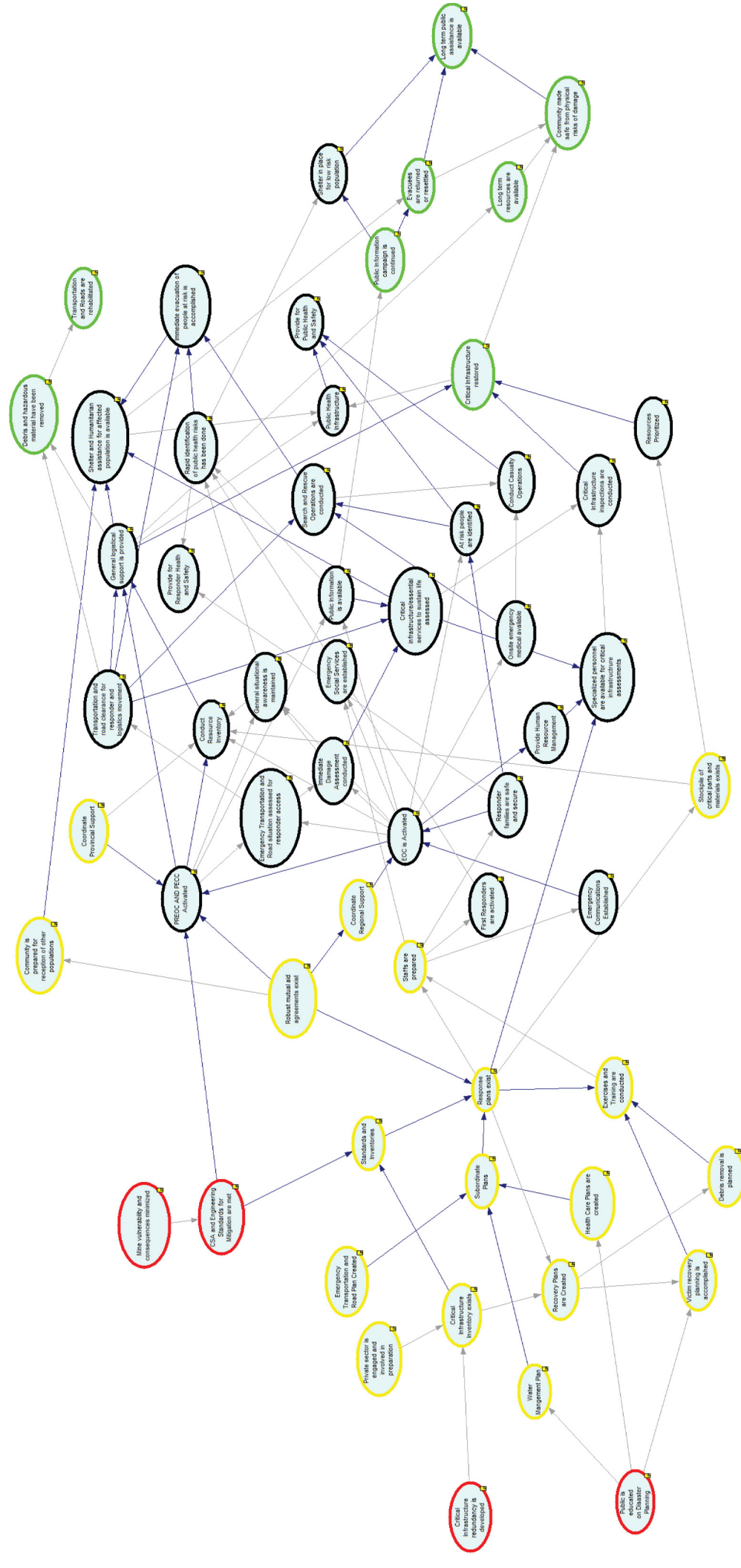


Figure 4-6. MEON—Parksville Earthquake

A key user guide that could be used to increase the consistency of how objectives are developed, represented, and communicated could be a document like the (U.S.) *Target Capabilities List (TCL)* [15]. As an example, both the Parksville and Nanaimo Earthquake models had a means objective called *Public is educated on Disaster Planning*. Similarly, the Parksville Interface Fire model has a means objective called *Provide Public Education on Fire Prevention* and the Nanaimo Propane Spill model has an objective called *Educate Public on Hazards/Routes/Procedures*. In the case of the earthquake models, it is a reasonably well-formed objective, but the other two examples have been formulated more as tasks, making it more difficult to identify specific tasks or develop meaningful metrics. Additionally, in all four cases, the preparedness objectives were focused as if the community already knew that a specific hazard was one the community would face. (This was a design issue in the research; not a community shortcoming.) Consider the possibility that the interaction with stakeholders regarding public education was guided by the community preparedness and participation section of the TCL. Identified performance measures such as *percentage of citizens prepared to evacuate or relocate to designated shelter* could provide the foundation for both means objectives, aspirational statements, and observable metrics. Additionally, an approach like this could have two additional benefits. First, it will help community planners from missing something that they may have previously overlooked. Second, as more detailed data is entered, it provides examples other communities can use to guide their planning efforts. It is worth noting that there are currently multiple international standards organizations attempting to develop frameworks that will provide this kind of consistency (e.g., Open Geospatial Consortium, IEEE), but the efforts are not mature enough to recommend adoption of a standard or set of standards.

5 Analysis of Results to Date

We have observed from a technical perspective that it has been relatively easy to adapt the VFM modeling techniques to address the nuances of modeling emergency management planning. Some specific things we have identified at this early stage of this project are:

- The use of color codes across pillars and node types has been well received by the SMEs, and eases the cognitive burden for identifying segments of the model that may be of interest.
- In spite of the use of color to ease the cognitive load, as the models grow in size it becomes increasingly difficult to develop a quick and intuitive understanding of the model. Without further advances in how these models are illustrated, the involvement of trained analysts that are familiar with VFM will be required.
- The SME community already appears to be facing a workload that presents significant challenges for the time, effort and facilitation required to develop collective planning and training across agencies. The support the project has received is likely due to the SMEs desire to see collaborative plans developed. Any enduring capability will need to be somehow less onerous to the SMEs than the approach the team used to construct the models and collect data.

6 Conclusions

The research team developed four VFM models, one for each scenario, using a combination of subject matter expert input supplemented by other sources of information. The communities remained energetically engaged in the facilitated planning process used to generate the objectives for the VFM, particularly during the on-site elicitation sessions. Participants almost universally found value in the effort, citing the focused discourse with other stakeholders in the community, and the validation exercises as especially valuable. A key observation is that all four models emphasized objectives relating to response, more heavily than any of the other pillars of the emergency management cycle. As previously discussed, this (may be likely) is a reflection of the skills and perspectives of the participants. Moreover, the objectives identified for prevention and mitigation and preparedness also tended to have strong ties to the response phase. Additionally, analysis of the objectives, in relation to the Target Capabilities List (TCL), indicates that most of the objectives identified by the stakeholders align (approximately) with those in the TCL. There were some inconsistencies in terminology, and level of model resolution, between communities and with the TCL that could potentially lead to gaps in planning and interoperability challenges in response.

Another critical observation is that while participants found value in participating in the VFM process, they did not believe they had the expertise or resources to develop VFM models without external assistance. Moreover, the demands of day-to-day operations in small communities may make it difficult to execute the structured approach to planning and assessment VFM requires, because of the time commitments required for meeting day-to-day operational challenges.

Finally, at this stage of the process, the models are not complete. They can, and should, continue to evolve as additional detail in the form of tasks are identified or, just as importantly, as additional perspectives are provided by new participants with different skills and perspectives.

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Annex A Community Participants

Table 1: Nanaimo Propane Spill

<u>Name</u>	<u>Organization</u>
Rene Bernklau	British Columbia Ambulance Service (BCAS)
Susan Clift	City of Nanaimo, Eng & Public Works
Ron Dawley	Nanaimo Fire Rescue (NFR)
Mark Demecha	City of Nanaimo, Parks Recreation and Culture
Martin Drakeley	NFR
Clare Fletcher	Emergency Management British Columbia (EMBC)
Ritchie Fulla	City of Nanaimo, Water
Len Gatey	Canexus
Alex Grant	BC Environment
Rodney Grounds	Nanaimo Port Authority (NPA)
Stu Harrison	NFR
Boyd Hunter	City of Nanaimo, Bylaw
Shannon Krilow	Emergency Management British Columbia (EMBC)
Ron Lambert	NFR
Karen Lindsay	NFR, Emergency Program
Phil Lue	Royal Canadian Mounted Police (RCMP)
Heather Lyle	Emergency Management British Columbia (EMBC)
Greg Norman	NFR
Barry Querengesser	Suncor Energy
Craig Richardson	NFR
Michael Sheppard	Canexus
Bill Sims	City of Nanaimo, Eng & Public Works
Lance Stephenson	BCAS

Table 2: Parksville Fire

<u>Name</u>	<u>Organization</u>
Ed Baird	BCAS Qualicum (<i>sic</i>)
Rene Bernklau	BCAS
Vaughn Figueira	City of Parksville
Clare Fletcher	EMBC
Shannon Krilow	EMBC

<u>Name</u>	<u>Organization</u>
Bob Longmore	EMCOMS District 69
Heather Lyle	EMBC
Alan Metcalf	City of Parksville
Marc Norris	Parksville Fire Department
Blaine Russell	City of Parksville Planning Department
Christine Trefaneko	Fortis BC
Tom Williams	Oceanside Emergency Support

Table 3: Nanaimo Earthquake

<u>Name</u>	<u>Organization</u>
Rene Bernklau	BCAS
Edward Dahlgren	NPA
Ron Dawley	NFR
Martin Drakeley	NFR
Clare Fletcher	EMBC
Ritchie Fulla	City of Nanaimo
Rodney Grounds	NPA
Shannon Krilow	EMBC
Ron Lambert	NFR
Karen Lindsay	NFR
Phil Lue	RCMP
Heather Lyle	EMBC
Craig Richardson	NFR
Michael Sheppard	Canexus
Bill Sims	City of Nanaimo
Lance Stephenson	BCAS

Table 4: Parksville Earthquake

<u>Name</u>	<u>Organization</u>
Keeva Kehler	City of Parksville
Ed Baird	BCAS Qualicum (<i>sic</i>)
Aaron Dawson	City of Parksville
Vaughn Figueira	City of Parksville
Clare Fletcher	EMBC
Charles Hofman	RCMP
Shannon Krilow	EMBC
Bob Longmore	EMCOMS District 69
Heather Lyle	EMBC
Alan Metcalf	City of Parksville

<u>Name</u>	<u>Organization</u>
Marc Norris	Parksville Fire Department
Blaine Russell	City of Parksville Planning Department
Christine Trefaneko	Fortis BC
Tom Williams	Oceanside Emergency Support

Annex B List View of Objectives with Definitions

B.1 Nanaimo Propane Spill Definitions

Table 5: Nanaimo Propane Spill Definitions

Nanaimo Propane Spill Objective Type	Nanaimo Propane Spill Objective Name	Nanaimo Propane Spill Objective Definition
Fundamental	Save Lives	Save the lives of those at risk of death from the event (e.g., from asphyxiation, explosion, other injuries, etc.)
Fundamental	Reduce Suffering	Reduce suffering (i.e., emotional and physical pain and distress) for those who have been affected by the event (e.g., those injured, evacuated, concerned about family & pets, etc.) and eliminate further harm
Fundamental	Reduce Economic and Social Losses	Reduce the economic (i.e., financial) and social (i.e., ability to carry out "normal" social and cultural "life as normal" activities within the community) losses caused by the event
Fundamental	Protect Environment	Protect the natural environment — water, air, wildlife, etc. — from harm
Means	Provide for Responder Health and Safety	Provide for the mental and physical health and safety of responders (e.g., by providing personal protective equipment, appropriate support services during and following operations, keeping them out of high risk areas, etc.)
Means	Perform Immediate Rescues	Perform immediate rescues of those who are injured and/or at risk (e.g., vulnerable populations) to remove them from harm's way
Means	Provide for Public Health and Safety	Provide for the mental and physical health and safety of the public (e.g., hospitals, ambulance service, psycho-social support services, etc.)
Means	Conduct Casualty Operations	Conduct triage and transport of casualties to appropriate treatment facilities
Means	Minimize Risk of Explosion	Minimize the risk of explosion of the rail tank cars (e.g., by cooling the tanks, eliminating ignition sources, etc.)

Nanaimo Propane Spill Objective Type	Nanaimo Propane Spill Objective Name	Nanaimo Propane Spill Objective Definition
Means	Protect Critical Infrastructure	Protect CI from damage and disruption in order to minimize service disruption. Canada has 10 CI sectors including Health, Food, Finance, Water, Information and Communication Technology, Safety, Energy and Utilities, Manufacturing, Government, and Transportation. In this scenario, critical facilities for emergency services (e.g., Fire Station, RCMP HQ, 911 facilities, Emergency Coordination Centre, etc.) are at risk
Means	Protect Property	Protect private and public property from damage
Means	Return Evacuees	Return evacuees to their homes and businesses (for shelter in place, citizens can return to normal activity)
Means	Support Evacuees	Support evacuees (e.g., by establishing reception centres for food and shelter, providing information, post-event assistance, etc.)
Means	Inform Public	Inform the public of what is happening and what is expected of them
Means	Educate Public on Hazards / Routes / Procedures	Educate the public on hazards, evacuation routes, procedures for responding to various hazardous materials, etc.
Means	Coordinate Recovery Support	Coordinate recovery support to restore the community to pre-event state, including providing information, support to businesses and the public, etc.
Means	Rescind Hot Zone	Rescind the hot zone, allowing people to return to their property / resume normal activity
Means	Mitigate Remaining Threat	Mitigate remaining hazard threat (i.e., the propane that has already leaked) once the leak is controlled/stopped (e.g., identify and manage residual gas in confined/low spaces)
Means	Ensure Resource Availability	Ensure that resources are available to manage concurrent events in the community (may require external assistance through mutual aid)
Means	Understand Capacities	Understand the overall resources and response capacities of the community
Means	Create Central Hazmat Capability Inventory	Create a central hazmat capability inventory including equipment, subject matter experts, other personnel, critical resources, etc.

Nanaimo Propane Spill Objective Type	Nanaimo Propane Spill Objective Name	Nanaimo Propane Spill Objective Definition
Means	Develop Validated Response Plans	Develop validated response plans (e.g., hazmat, evacuation, etc.), including training and exercising of plans, validating assumptions, revisiting/updating periodically, etc.
Means	Complete After Action Review for Incidents	Complete after action reviews for incidents, including multi-agency debriefs, to learn and improve from previous events, and incorporate relevant lessons learned from other communities
Means	Activate Emergency Coordination Center	Activate the ECC for support in response to request from incident command
Means	Establish Unified Command and Control	Establish unified command and control (i.e., incident commanders from various jurisdictions/agencies operating together to form a single command structure) to enable institutions and agencies with different legal, geographic, and functional responsibilities to coordinate, plan, and interact effectively
Means	Exercise Unified Command and Control	Exercise (practice) unified command and control in order to develop and improve the capability
Means	Establish Effective Information Sharing Processes and Procedures	Establish effective processes, protocols, procedures, etc. for sharing information between stakeholders for unified command and control
Means	Establish Effective Communications	Establish effective communications (systems, networks, protocols, etc.) between stakeholders
Means	Establish Stakeholder Collaboration	Establish effective relationships and collaboration among stakeholders that would be involved in, and impacted by, the event
Means	Conduct Collective Training	Conduct collective training for stakeholders to enhance joint effectiveness
Means	Monitor Situation	Monitor the conditions of the event and the situation as it evolves
Means	Mitigate Dispersion Risk	Mitigate the dispersion risk from the leaking propane by controlling/stopping the propane leak (e.g., ventilate with large fans)
Means	Secure Hot Zone	Secure the hot zone (the area immediately surrounding the hazard where the risk is at the highest level) from unauthorized access
Means	Identify Hot Zone	Identify the hot zone, i.e., the area immediately surrounding the hazard where the risk is at the highest level

Nanaimo Propane Spill Objective Type	Nanaimo Propane Spill Objective Name	Nanaimo Propane Spill Objective Definition
Means	Understand Situational Risk	Understand the situation and the risks at any given point in time. Factors influencing risk levels include life and property exposures, the probability of harm to response teams, the proximity of ignition sources, the amount of product released, and levels of available resources
Means	Conduct Evacuations	Conduct the evacuation (including shelter in place) of identified areas
Means	Minimize Populated Areas at Risk	Minimize the populated areas at risk to a propane spill
Means	Customize Evacuation Plan	Customize the community evacuation plan to the specifics of the event, identifying evacuation areas, routes, reception centres, coordinating stakeholder roles, etc.
Strategic	Minimize Risk	Minimize the community's overall risk (i.e., likelihood , impact, vulnerability) from the event (propane spill)

B.2 Parksville Interface Fire Definitions

Table 6: Parksville Interface Fire Definitions

Parksville Interface Fire Objective Type	Parksville Interface Fire Objective Name	Parksville Interface Fire Objective Definition
Fundamental	Save Lives	Save the lives of those at risk of death from the event (e.g., from burns, respiratory and other injuries, etc.)
Fundamental	Reduce Suffering	Reduce suffering (i.e., emotional and physical pain and distress) for those who have been affected by the event (e.g., those injured, evacuated, concerned about family & pets, etc.) and eliminate further harm
Fundamental	Reduce Economic Loss	Reduce the community's financial loss caused by the event (e.g., business, trade, and fiscal capabilities)
Fundamental	Reduce Social Loss	Reduce the community's social loss (i.e., ability to carry out "normal" social and cultural activities within the community)
Means	Provide for Responder Health and Safety	Provide for the mental and physical health and safety of responders (e.g., by providing personal protective equipment, appropriate support services during and following operations, keeping them out of high risk areas, etc.)

Parkville Interface Fire Objective Type	Parkville Interface Fire Objective Name	Parkville Interface Fire Objective Definition
Means	Conduct Adequate Training	Conduct training for stakeholders to enhance joint effectiveness
Means	Conduct Exercises & Training	Exercise (practice) command, control, and multi-agency responses in order to develop and improve the capability
Means	Provide Adequate Equipment	Adequate equipment includes equipment to fight the fire (e.g., firefighting vehicles), communications equipment (radios, computers, etc.) and any command and control, computers, or other equipment such as heavy recovery. Adequate equipment is determined during the planning process
Means	Create Validated Plans	Create validated response plans (e.g., fire, hazmat, evacuation, etc.), including training and exercising of plans, validating assumptions, revisiting/updating periodically, etc.
Means	Create Critical Infrastructure Inventory and Stakeholder List	Create a central inventory of critical infrastructure in the region and who is responsible for it, or impacted by this infrastructure being at risk
Means	Coordinate with Stakeholders	Coordinate among stakeholders that are involved in and impacted by the event
Means	Establish Effective Communication	Establish effective communications (systems, networks, protocols, etc.) between stakeholders
Means	Ensure Responder Family Safety and Security	Identification of responder family members, location and level of risk. Ensure that these individuals receive support for their safety and security (well-being) so that first responders are able to commit to their work duties
Means	Establish Emergency Social Services	Set up the infrastructure necessary for the provision and/or coordination of social services such as food and shelter, health care , and persons at risk
Means	Customize Health Action Plans	Customize the health response plans (from the validated plans) to respond to the current situation
Means	Establish Emergency Health Services	Set up the additional health services necessary for the emergent care of responders and the population
Means	Provide for Public Health and Safety	Provide for the mental and physical health and safety of the public (e.g., hospitals, ambulance service, psycho-social support services, etc.) This includes reducing the risks from all hazards, fire, and displacement

Parkville Interface Fire Objective Type	Parkville Interface Fire Objective Name	Parkville Interface Fire Objective Definition
Means	Conduct Casualty and Health Operations	Conduct triage and transport of casualties to appropriate treatment facilities
Means	Extinguish Fires	Put out the fires
Means	Minimize Urban Fire Re-entry	Actions that will reduce the risk of the fire re-entering an urban area from the forest
Means	Ensure Forest Fire Preparedness	Activities conducted by the Wildfire Management Branch and others to ensure that they are prepared to deal with forest fires either by monitoring, containing current fires, or reducing the fire extent or risk
Means	Identify Forest Fire Risk	Identify the forest fire risk due to forest conditions, forecasted weather, etc.
Means	Maximize Response Effectiveness	Activities that enhance the ability of the responders to respond quickly and effectively to fires and potential fire threats
Means	Reduce Vulnerability of Buildings	Activities that reduce the vulnerability of a structure to fire, or provide immediate notification of fire
Means	Provide Public Education on Fire Prevention	Provide public education such as public service announcements, school curricula, and wide dispersal information campaigns about the dangers in fire and efforts that can prevent and reduce the risk of fires
Means	Provide Adequate Capability	Equipment, personnel, and training that will reduce the risk of fires, or allow for rapid containment and management of fires
Means	Ensure Availability of Safe Water	Ensure the availability of water to use for firefighting as well as potable water for the responders and the population. Note that salt water can be used in firefighting, but it can be very detrimental in a forest or agricultural area, as well as damaging to equipment
Means	Provide Human Resource Management	Management of all personnel in response or support of the response. This includes volunteer firefighters, other volunteer responders, and professional staff
Means	Establish Unified Command	Establish unified command and control (i.e., incident commanders from various jurisdictions/agencies operating together to form a single command structure) to enable institutions and agencies with different legal, geographic, and functional responsibilities to coordinate, plan, and interact effectively

Parkville Interface Fire Objective Type	Parkville Interface Fire Objective Name	Parkville Interface Fire Objective Definition
Means	Recognize Major Incident	Determine that the incident is more than routine and will require significant and coordinated response
Means	Request Wildfire Management Branch Support	Notification to the Wildfire Management Branch that the situation could require their involvement and support
Means	Reduce Fire Transfer Potential	Activities that will reduce the ability of the fire to bridge the urban/wildland interface
Means	Return Evacuees	Return evacuees to their homes and businesses (for shelter in place, citizens can return to normal activity)
Means	Provide Health Care for Displaced People	Provide for the health needs of the displaced population, such as medications, medical equipment or other support that may not have been evacuated with them
Means	Provide Alternate Health Care for At-Risk Citizens	Provide support to those at risk in the population, such as respiratory, medication, or other support that may not be available due to transportation or medical personnel shortages
Means	Inform Public on Current Response Requirements	Inform the public of what is happening and what is expected of them
Means	Provide Public Education on Response	Educate the public on hazards, evacuation routes, procedures for responding to various fire risks and situations
Means	Provide Food and Shelter for Displaced People	Provisions of food and shelter for evacuees, including the overall requirement, locations, and provision of commodities
Means	Evacuate Those at Risk	Conduct the evacuation (including possible shelter in place) of identified areas
Means	Customize Evacuation Plans	Customize the community evacuation plan to the specifics of the event, identifying evacuation areas, routes, reception centres, coordinating stakeholder roles, etc.
Means	Identify and Map Critical Sites	Identification and mapping of critical sites that may require priority and attention for protection, such as elements of critical infrastructure (e.g., gas, hydro, telecommunication infrastructure), sites with special significance to the community, etc.
Means	Manage Response Resources	Provision, support, maintenance, and prioritization of critical equipment and human resources
Means	Conduct Resource	Create a central capability inventory including

Parksville Interface Fire Objective Type	Parksville Interface Fire Objective Name	Parksville Interface Fire Objective Definition
	Inventory	equipment, subject matter experts, other personnel, critical resources, etc.
Means	Coordinate Provincial Support	Activities to coordinate support from the Province through Emergency Management British Columbia
Means	Coordinate Regional Support	Activities to establish and coordinate support from other communities and entities in the region
Means	Create Mutual Aid Agreements	Create agreements with entities outside of the community for future support and response for major incidents
Means	Activate Emergency Operations Center	Activate the EOC for support in response to request from incident command
Means	Effective and Early Community Critical Infrastructure Recovery	Ensure effective and timely social recovery of the community, facilitated through, for example, the establishment of recovery support services. Ensure that cultural and community activities are re-established
Means	Protect Critical Infrastructure	Protect CI from damage and disruption in order to minimize service disruption. Canada has 10 CI sectors including Health, Food, Finance, Water, Information and Communication Technology, Safety, Energy and Utilities, Manufacturing, Government, and Transportation
Means	Provide Transportation Management	Provide management of road (traffic), rail, and dock assets during the event
Means	Customize Critical Infrastructure Action Plans	Customize critical infrastructure response plans (from the validated plans) to respond to the current situation
Means	Create Business and Community Continuity Plans	Create business continuity plans and community continuity plans to identify risks and mitigating actions for businesses and community services, and ensure that disruptions are minimized
Means	Ensure Removal of Hazards	Remove hazards created by the fires, including the physical removal or destruction of hazards (e.g., burnt structures)
Means	Ensure Effective and Early Community Social Recovery	
Strategic	Reduce Loss to Community	Minimize the community's overall loss (Social and Infrastructure) from the event (Interface Fire)

B.3 Nanaimo Earthquake Definitions

Table 7: Nanaimo Earthquake Objective Definitions

Nanaimo Earthquake Objective Type	Nanaimo Earthquake Objective Name	Nanaimo Earthquake Objective Definition
Fundamental	Save Lives	Save the lives of those at risk of death from the event
Fundamental	Reduce Suffering	Reduce suffering (i.e., emotional and physical pain and distress) for those who have been affected by the event (e.g., those injured, evacuated, concerned about family & pets, etc.) and eliminate further harm
Fundamental	Reduce Economic Loss	Reduce the community's financial loss caused by the event (e.g., business, trade, and fiscal capabilities)
Fundamental	Reduce Social Loss	Reduce the community's social loss (i.e., ability to carry out "normal" social and cultural activities within the community)
Fundamental	Protect Environment	Protect the natural environment — water, air, wildlife, etc. — from harm
Means	Immediate evacuation of people at risk is accomplished	Identification and removal of personnel at risk of injury or trauma
Means	Rapid identification of public health risks has been done	Rapid public health and safety assessment of community including ways to reduce/mitigate the risks from all hazards, fires, rubble, loss of mains electricity, and displacement
Means	Public Information is available	Public service announcements, school curricula, wide dispersal information campaigns about the dangers and instructions accessible to public
Means	General situational awareness is maintained	Information on the event, response and civilian impact is collected, correlated, and analyzed, as well as made available to relevant stakeholders
Means	Transportation and Road situation assessed for community movement	Inventory of transportation modes of movement to ensure community is aware of safe routes
Means	Crowd Source Information is available	Community has access to social media for live updates on situation
Means	Offset — General situational awareness is maintained	
Means	First Responders deployed	Fire, emergency medical technicians, and police deploy

Nanaimo Earthquake Objective Type	Nanaimo Earthquake Objective Name	Nanaimo Earthquake Objective Definition
Means	Transportation and road clearance for responder and logistics movement	All possible road blocks and hazardous routes identified, and emergency responders are directed to most efficient and safe route
Means	Provide for Responder Health and Safety	Provide for the mental and physical health and safety of responders (e.g., by providing personal protective equipment, appropriate support services during and following operations, keeping them out of high risk areas, etc.)
Means	Search and Rescue Operations are conducted	Operations conducted for missing or trapped persons
Means	On-site emergency medical available	Providing support to the populace whether evacuated or not. Respiratory, medication, or other support that may not be available due to transportation or medical personnel shortages
Means	ECC is activated	Activate the ECC in response to request from on-site responders. Call in personnel, activate communications channels, and establish presence
Means	Emergency Social Services are activated	Response cells that establish reception centres and provide for humanitarian requirements are established
Means	Staffs are prepared	Staff are educated, prepared, and can access the resources for crisis situations
Means	Exercises and Training are conducted	Conduct training for stakeholders to enhance joint effectiveness
Means	Debris removal is planned	Staff is accounted for, routes are mapped, and coordination is explained for eventual need to remove debris
Means	Recovery Plans are created	Plans are drafted for recovery and rehabilitation after crisis
Means	Victim recovery planning is accomplished	Plans for the recovery, documentation, and care of casualties have been developed
Means	Emergency Communications established	Establish effective communications (systems, networks, protocols, etc.) between stakeholders
Means	Communications Plan created	Plans to establish effective communications (systems, networks, protocols, etc.) between stakeholders
Means	Ensure Federal Marine information received	Marine information, port and vessel status, as well as communications capability

Nanaimo Earthquake Objective Type	Nanaimo Earthquake Objective Name	Nanaimo Earthquake Objective Definition
Means	On-site Command(s) created	On-site incident command(s) are in contact with external and internal agencies
Means	Rapid Damage Assessment	Damage to property and persons tallied and appropriate response deployed
Means	At-risk people are identified	Identification where and who critical populations are
Means	Emergency Transportation and Road situation assessed for responder access	Assessment is made of major or minor transportation obstructions or hazardous conditions that would block access of Fire, Police, and Rescue personnel
Means	Emergency Transportation and Road Plan created	Assessment of transportation risks and possible outcome to mitigate them are planned with necessary agencies
Means	Response plans exist	Response plans for earthquake in place and people educated on their roles
Means	Private sector is engaged and involved in preparation	Private sector, business, and individuals are in communications with and aware of responsibilities
Means	Critical Infrastructure Inventory exists	Extensive list of all critical infrastructure needed to maintain and sustain stability
Means	Critical Infrastructure redundancy is developed	Backup of existing CI in case of primary failure
Means	Water Management Plan	Protect existing supply and provide for populations with limited access, both potable and for fires
Means	Public is educated on Disaster Planning	Civilians aware of responsibility of individual, community, and organizations
Means	Health Care Plans are created	Special health needs are provided for. Medications, medical equipment, or other support that may not have been evacuated with them
Means	Standards and Inventories	Standards are known for buildings and planning, and inventories of buildings and other infrastructure exist
Means	Subordinate Plans	All necessary subordinate plans for recovery are known and developed
Means	Provide for Public Health and Safety	Overall public health and safety is provided for. This includes reducing the risks from all hazards, fire, and displacement

Nanaimo Earthquake Objective Type	Nanaimo Earthquake Objective Name	Nanaimo Earthquake Objective Definition
Means	Responder families are safe and secure	Identification of responder family members, location and level of risk. Ensuring that these individuals receive a level of support minimizing the first responders' level of concentration
Means	Conduct Casualty Operations	Conduct triage and transport of casualties to appropriate treatment facilities
Means	Shelter in place is encouraged and supported	Public is informed of the need to shelter in place if safety allows
Means	Community made safer from physical risks of damage	Protect community from personal, physical, or property damage due to earthquake
Means	Evacuees are returned or resettled	Return evacuees to their homes and businesses (for shelter in place, citizens can return to normal activity) where possible and resettled elsewhere otherwise
Means	Shelter and Humanitarian assistance for displaced population is available	Identification of the need for food and shelter for the at-risk population. Requirement, location, and provision of commodities
Means	Community is prepared for reception of other populations	Pre-disaster identification of the need for food and shelter for the at-risk population. Requirement, location, and provision of commodities
Means	Ensure Critical Infrastructure availability	Ensure availability of CI such as water, electricity, shelter, medical services, and food
Means	Critical Infrastructure rehabilitated or replaced	Damaged infrastructure repaired or replaced with working and stable parts
Means	Stockpile of critical parts and materials exists	Large surplus of material deemed necessary for large-scale, long-term inaccessibility of critical parts or material
Means	Critical Infrastructure inspections are conducted	Regular verification that CI is in good working order
Means	Critical Infrastructure/Essential Services to sustain life assessed	CI and essential services evaluated for weakness or issues
Means	Public Information campaign is continued	Community is regularly informed on status of situation and activities of public works
Means	Specialized personnel are available for critical infrastructure assessments	Experts are identified and available for regular verification and evaluation of CI

Nanaimo Earthquake Objective Type	Nanaimo Earthquake Objective Name	Nanaimo Earthquake Objective Definition
Means	Provide Human Resource Management	Management of all personnel in response or support of the response. This includes volunteer firefighters, other volunteer responders, and professional staff
Means	Transportation and Roads are rehabilitated	Road, rail, airport, and seaport damaged in event are cleared and repaired
Means	Long-term public assistance is available	Social services, medical rehabilitation, mental health professionals, building services, and public information is available for more robust complications
Means	Debris and hazardous material have been removed	Rubble, fallen trees, and various dangerous or obstructive material is cleared from the roadways and public spaces
Means	General logistical support is provided	External and internal support to assess, process, and complete key tasks are available to key staff and agencies
Means	Conduct Resource Inventory	Create a central capability inventory including equipment, subject matter experts, other personnel, critical resources, etc.
Means	Coordinate Provincial Support	Identification and communication of needs to the provincial disaster management authorities
Means	Coordinate Regional Support	Discussion of the event and the communication of risk to other communities and entities in the region to include coordination of requests for support from the same communities and entities
Means	Robust mutual aid agreements exist	Agreements with entities outside of the community for future support and risk response
Means	PREOC AND PECC activated	PREOC and PECC contacted and engaged for external support
Means	CSA and Engineering Standards for Mitigation are met	Standards and evaluations are maintained
Means	Mine vulnerability and consequences minimized	Structures assessed for risk, and key personal educated on possible dangers
Means	Ensure Resource Availability	Community able to access materials needed to repair, rehabilitate, or resume daily activities
Strategic	Reduce Loss to Community	Minimize the community's overall loss (Social and Infrastructure) from the event (earthquake)

B.4 Parksville Earthquake Definitions

Table 8: Parksville Earthquake Definitions

Parksville Earthquake Objective Type	Parksville Earthquake Objective Name	Parksville Earthquake Objective Definition
Fundamental	Save Lives	Save the lives of those at risk of death from the event
Fundamental	Reduce Suffering	Reduce suffering (i.e., emotional and physical pain and distress) for those who have been affected by the event (e.g., those injured, evacuated, concerned about family & pets, etc.) and eliminate further harm
Fundamental	Reduce Economic Loss	Reduce the community's financial loss caused by the event (e.g., business, trade, and fiscal capabilities)
Fundamental	Reduce Social Loss	Reduce the community's social loss (i.e., ability to carry out "normal" social and cultural activities within the community)
Fundamental	Protect Environment	Protect the natural environment — water, air, wildlife, etc. — from harm
Means	Immediate evacuation of people at risk is accomplished	Identification and removal of personnel at risk of injury or trauma
Means	Rapid identification of public health risks has been done	Rapid public health and safety assessment of community, including ways to reduce/mitigate the risks from all hazards, fires, rubble, loss of mains electric, and displacement
Means	Public Information is available	Public service announcements, school curricula, wide dispersal information campaigns about the dangers and instructions accessible to public
Means	General situational awareness is maintained	Information on the event, response, and civilian impact is collected, correlated, and analyzed, as well as made available to relevant stakeholders
Means	Immediate Damage Assessment conducted	Inventory of all damage and injury to property or persons
Means	First Responders are activated	Fire, emergency medical technicians, and police deploy
Means	Transportation and road clearance for responder and logistics movement	All possible road blocks and hazardous routes identified, and emergency responders are directed to most efficient and safe route

Parksville Earthquake Objective Type	Parksville Earthquake Objective Name	Parksville Earthquake Objective Definition
Means	Provide for Responder Health and Safety	Provide for the mental and physical health and safety of responders (e.g., by providing personal protective equipment, appropriate support services during and following operations, keeping them out of high risk areas, etc.)
Means	Search and Rescue Operations are conducted	Operations conducted for missing or trapped persons
Means	On-site emergency medical available	Providing support to the populace whether evacuated or not. Respiratory, medication, or other support that may not be available due to transportation or medical personnel shortages
Means	EOC is activated	Activate the EOC in response to request from on-site responders. Call in personnel, activate communications channels, and establish presence
Means	Emergency Social Services are established	Response cells that establish reception centres and provide for humanitarian requirements are established
Means	Offset Emergency Social Services are established	Response cells that establish reception centres and provide for humanitarian requirements are established
Means	Staffs are prepared	Staff are educated, prepared, and can access the resources for crisis situations
Means	Exercises and Training are conducted	Conduct training for stakeholders to enhance joint effectiveness
Means	Debris removal is planned	Staff is accounted for, routes are mapped, and coordination is explained for eventual need to remove debris
Means	Recovery Plans are created	Plans are drafted for recovery and rehabilitation after crisis
Means	Exercises and Training are conducted	Conduct training for stakeholders to enhance joint effectiveness
Means	Victim recovery planning is accomplished	Plans for the recovery, documentation, and care of casualties have been developed
Means	Emergency Communications Established	Establish effective communications (systems, networks, protocols, etc.) between stakeholders
Means	Emergency Communications Established	
Means	At-risk people are identified	Identification where and who critical populations are

Parkville Earthquake Objective Type	Parkville Earthquake Objective Name	Parkville Earthquake Objective Definition
Means	Emergency Transportation and Road situation assessed for responder access	Assessment is made of major or minor transportation obstructions or hazardous conditions that would block access of Fire, Police, and Rescue personnel
Means	Emergency Transportation and Road Plan Created	Assessment of transportation risks and possible outcome to mitigate them are planned with necessary agencies
Means	Response plans exist	Response plans for earthquake in place and people educated on their roles
Means	Private sector is engaged and involved in preparation	Private sector, business, and individuals are in communications with and aware of responsibilities
Means	Critical Infrastructure Inventory exists	Extensive list of all critical infrastructure needed to maintain and sustain stability
Means	Critical Infrastructure redundancy is developed	Backup of existing CI in case of primary failure is planned for
Means	Water Management Plan	Protect existing supply and provide for populations with limited access, both potable and for fires
Means	Public is educated on Disaster Planning	Civilians aware of responsibility of individual, community, and organizations
Means	Health Care Plans are created	Special health needs are provided for. Medications, medical equipment, or other support that may not have been evacuated with them
Means	Standards and Inventories	Standards are known for buildings and planning, and inventories of buildings and other infrastructure exist
Means	Subordinate Plans	All necessary subordinate plans for recovery are known and developed
Means	Provide for Public Health and Safety	Overall public health and safety is provided for. This includes reducing the risks from all hazards, fire, and displacement
Means	Responder families are safe and secure	Identification of responder family members, location, and level of risk. Ensuring that these individuals receive a level of support minimizing the first responders' level of concentration
Means	Conduct Casualty Operations	Conduct triage and transport of casualties to appropriate treatment facilities
Means	Public Health Infrastructure	Infrastructure for the provision of public health, standard CI, transportation, and logistics

Parkville Earthquake Objective Type	Parkville Earthquake Objective Name	Parkville Earthquake Objective Definition
Means	Community made safe from physical risks of damage	Protect community from personal, physical, or property damage due to earthquake
Means	Evacuees are returned or resettled	Return evacuees to their homes and businesses (for shelter in place, citizens can return to normal activity) where possible and resettled elsewhere otherwise
Means	Shelter and Humanitarian assistance for affected population is available	Identification of the need for food and shelter for the at-risk population. Requirement, location, and provision of commodities
Means	Community is prepared for reception of other populations	Identification of the need for food and shelter for the at-risk population. Requirement, location, and provision of commodities
Means	Long-term resources are available	Ensure availability of CI such as water, electricity, shelter, medical services, and food
Means	Critical Infrastructure restored	Water, electricity, access to healthcare, clear transportation, and medical services are functioning at full levels
Means	Stockpile of critical parts and materials exists	Large surplus of material deemed necessary for large-scale, long-term inaccessibility of critical parts or material
Means	Critical Infrastructure inspections are conducted	Regular verification that CI is in good working order
Means	Critical Infrastructure/Essential Services to sustain life assessed	CI and essential services evaluated for weakness or issues
Means	Public Information campaign is continued	Community is regularly informed on status of situation and activities of public works
Means	Specialized personnel are available for critical infrastructure assessments	Experts are identified and available for regular verification and evaluation of CI
Means	Provide Human Resource Management	Management of all personnel in response or support of the response. This includes volunteer firefighters, other volunteer responders, and professional staff
Means	Resources Prioritized	Food, shelter, medical supplies, water access, transportation, and other various supplies are counted, and levels of necessity are assessed
Means	Transportation and Roads are rehabilitated	Road, rail, airport, and seaport damaged in event are cleared and repaired

Parksville Earthquake Objective Type	Parksville Earthquake Objective Name	Parksville Earthquake Objective Definition
Means	Long-term public assistance is available	Social services, medical rehabilitation, mental health professionals, building services, and public information is available for more robust complications
Means	Shelter in place for low-risk population	Populations not in immediate danger asked to remain in homes or businesses until situation stabilized
Means	Debris and hazardous material have been removed	Rubble, fallen trees, and various dangerous or obstructive material is cleared from the roadways and public spaces
Means	General logistical support is provided	External and internal support to assess, process, and complete key tasks are available to key staff and agencies
Means	Conduct Resource Inventory	Create a central capability inventory including equipment, subject matter experts, other personnel, critical resources, etc.
Means	Coordinate Provincial Support	Identification and communication of needs to the Provincial disaster management authorities
Means	Coordinate Regional Support	Discussion of the event and the communication of risk to other communities and entities in the region, to include coordination of requests for support from the same communities and entities
Means	Robust mutual aid agreements exist	Agreements with entities outside of the community for future support and risk response
Means	PREOC AND PECC activated	PREOC and PECC contacted and engaged for external support
Means	CSA and Engineering Standards for Mitigation are met	Standards and evaluations are maintained
Strategic	Reduce Loss to Community	Minimize the community's overall loss (Social and Infrastructure) from the event (earthquake)

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<p>12. DOCUMENT ANNOUNCEMENT</p> <p>Unlimited</p>
<p>13. ABSTRACT</p> <p>This report is part one of a four part series describing how a decision analytic modeling approach called Value Focused Metrics (VFM) was applied to emergency management planning processes in two cities on Vancouver Island using four scenarios. This volume focuses on the development and representation of objectives in the strategy to task decomposition. The overall objective of the project is to apply a <i>strategy to task analysis</i> to aid communities in the development and assessment of community-wide risk management plans. Because VFM models explicitly represent the relationships between the communities objectives and the tasks performed by the participating emergency management organizations in a network model, very complex plans can be more easily understood and communicated than unstructured approaches. Additionally, VFM models allow for rigorous quantitative analysis in support of resource allocation planning and overall readiness assessment. This first report provides an overview of VFM and focuses on describing the objectives and metrics framework in the context of the four scenarios that were developed and exercised in British Columbia over the past year.</p> <p>Le présent rapport est le premier volet d'une série de quatre décrivant comment une approche de modélisation analytique décisionnelle intitulée « mesures axées sur les valeurs » (MAV) a été appliquée aux processus de planification de la gestion des urgences dans deux villes, situées sur l'île de Vancouver, à l'aide de quatre scénarios. Ce document porte sur l'élaboration et la représentation des objectifs de la stratégie à la tâche. L'objectif principal du projet est d'appliquer une analyse stratégie-tâche afin de soutenir les communautés dans l'élaboration et l'évaluation des plans de gestion des risques dans l'ensemble de la collectivité. Puisque les modèles de MAV représentent de façon explicite les liens entre les objectifs des communautés et les tâches accomplies par les organisations de gestion des urgences participantes dans un modèle de réseau, il est plus facile de comprendre et de communiquer des plans très complexes que des approches non structurées. En outre, les modèles de MAV permettent de réaliser des analyses quantitatives rigoureuses en appui à la planification de l'affectation des ressources, ainsi qu'à l'évaluation de l'état de préparation global. Ce premier rapport offre un aperçu des MAV et il est axé sur la description des objectifs et du cadre des paramètres dans le contexte des quatre scénarios élaborés et exécutés en Colombie-Britannique au cours de la dernière année.</p>
<p>14. KEYWORDS, DESCRIPTORS or IDENTIFIERS</p> <p>Emergency Management;Prevention; Mitigation; Preparedness; Response; Recovery; Emergency Planning; Value Focused Thinking; Value Focused Metrics; Mission to task analysis, Strategy to task analysis, Risk Management,, Community planning,, Models, Objectives, Metrics</p>

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