

Value Focused Metrics for Improved Emergency Management Planning

Part 2: Identification and Assessment of Mission Tasks

Dr. Daniel T. Maxwell
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Knowledge and Decision Science (KaDSci)

Scientific Authority:
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DRDC Centre for Security Science

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

Defence R&D Canada – Centre for Security Science

Contractor Report
DRDC CSS CR 2013-021
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Abstract

This report is part two 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 disaster scenarios. This volume focuses on the identification and assessment of specific tasks that are accomplished to support the achievement of the objectives identified in the first phase of the project. This second report builds on the first phase, discussing what was learned in the task elicitation and impact assessment process that was executed in May and July of 2013. Some of the key findings include the development of evidence that this kind of process has significant potential for improving emergency management planning and assessment processes. That said, the research team identified a collection of limitations to current capabilities, particularly in the area of software. In particular, larger models for the more complex scenarios exceeded the computational capability of the free software. Additionally, larger models were difficult to visualize on one screen. Some of the most important contributions of this work are the problem decomposition strategies that were developed to support computation, visualization, and analysis of model results.

Résumé

Le présent rapport est le second 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 de catastrophe. Ce document porte sur l'identification et l'évaluation de tâches particulières accomplies pour favoriser l'atteinte des objectifs définis durant la première phase du projet. Ce second rapport s'inspire de la première phase, abordant les leçons retenues au cours du processus de définition des tâches et d'évaluation de l'incidence qui a été mené en mai et juillet 2013. Parmi les principaux résultats obtenus, il y a l'établissement d'une preuve que ce type de processus peut grandement améliorer les processus de planification et l'évaluation de la gestion des urgences. Ceci dit, l'équipe de recherche a déterminé que les capacités actuelles comportaient diverses limites, en particulier en matière de logiciels. De plus grands modèles pour des scénarios plus complexes ont notamment dépassé la capacité informatique du logiciel libre. En outre, il était difficile de visualiser ces modèles sur un seul écran. Certaines des plus importantes contributions découlant de ces travaux sont les stratégies de décomposition du problème qui ont été élaborées à l'appui du calcul, de la visualisation et de l'analyse des résultats des modèles.

Executive Summary

Value Focused Metrics for Improved Emergency Management Planning: Part 2: Identification and Assessment of Mission Tasks , Daniel T. Maxwell; David F. Davis, DRDC Centre for Security Science, DRDC CSS CR 2013-021, November 2013.

Introduction or background: This report is part two of a four part series of reports that describes a set of discovery experiments intended to improve emergency management planning at the local, provincial, and federal level by applying Value Focused Metrics. In this volume we will be discussing the tasks that were identified by the Subject Matter Expert (SME) participants during the model development process for four scenarios in two communities, as well as the projected impact they assigned to those tasks in a set of exercises that walked them through each of the scenarios.

Results: Overall, the participants reported that they felt as though they better understood their community plans, how they fit into those plans, and as a result were better prepared after identifying and discussing tasks for the objectives. They also reported that they did not feel as though they could execute the process without assistance. A key observation about the models that were developed is that all four models emphasized tasks relating to response more heavily than any of the other pillars of the emergency management cycle. This aligns with the objectives identified previously, and possibly reflects the skills and perspectives of the SMEs who participated. Moreover, the tasks identified for the prevention and mitigation, and preparedness pillars also tended to have strong ties to the response phase. A final critical finding at the conclusion of the task elicitation process is that the large number of tasks has pushed the computational limits of the GeNIe software in large scenarios. Moreover, the large number of tasks in some of the models causes the models to be relatively *stiff*, showing very little movement in response to changes in one or two tasks. These two factors make it extremely challenging to conduct meaningful analysis in very large scenarios, and across scenarios using the freely available GeNIe software.

Significance: The model decomposition and visualization techniques developed under this task 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. In fact, some of the results of this task are being provided back to the communities for their immediate use in support of their emergency management planning efforts. That said, because of the complexity of the process, computational properties of the Bayes Net models, and software limitations, the approach at its current stage of maturity is likely not executable without further refinement, external assistance, and resource support. The research team will explore and describe one or more alternative approaches to representing this large number of variables in a model that could potentially more easily be used by community stakeholders.

Future plans: In Task Three of this project, the research team will explore methods for either simplifying the models so that they can be reliably supported by the GeNIe software, as well as continuing to explore ways in which the elicitation process might be modified to make it easier for the SMEs to execute and make the model input more consistent across communities, thereby improving interoperability. In task four we will complete a more complete assessment of the pros and cons of the VFM approach to emergency management planning.

**Value Focused Metrics for Improved Emergency Management Planning:
Part 2: Identifiant and Assessment of Mission Tasks , Daniel T. Maxwell;
David F. Davis, RDDC Centre des science por la sécurité , DRDC CSS CR
2013-021, Novembre 2013.**

Introduction ou contexte : Le présent rapport est le second volet d'une série de quatre décrivant un ensemble d'expériences de découverte visant à améliorer la planification de la gestion des urgences aux niveaux local, provincial et fédéral en appliquant des mesures axées sur les valeurs (MAV). Ce document porte sur les tâches identifiées par des experts en la matière (EM) durant le processus d'élaboration d'un modèle pour quatre scénarios dans deux communautés, de même que sur l'incidence prévue qu'ils ont attribuée à ces tâches dans une série d'exercices leur ayant permis d'exécuter chaque scénario.

Résultats : De façon générale, les participants ont mentionné qu'ils avaient l'impression de mieux comprendre les plans de leur communauté et le rôle qu'ils ont à y jouer. Ils sont mieux préparés après avoir identifié et abordé les tâches liées aux objectifs. Ils ont également souligné qu'ils ne croyaient pas être en mesure d'exécuter le processus sans assistance. Une des principales observations effectuées montre que les quatre modèles élaborés mettaient davantage l'accent sur les tâches liées à l'intervention que sur tout autre pilier du cycle de gestion des urgences. Cela correspond aux objectifs identifiés précédemment, en plus de refléter possiblement les compétences et les points de vue des EM ayant participé. Par ailleurs, les tâches identifiées pour la prévention et l'atténuation, ainsi que l'état de préparation avait également tendance à établir des liens solides avec la phase d'intervention. À la fin du processus de définition des tâches, il a été constaté que le nombre élevé de tâches a repoussé les limites du logiciel GeNIe dans de grands scénarios. De plus, certains modèles deviennent relativement rigides en raison de leur nombre important de tâches; très peu de mouvements sont perçus en réponse aux changements apportés à une ou deux tâches. Ces deux facteurs rendent difficile la réalisation d'analyses sérieuses dans de très grands scénarios et dans l'ensemble de ceux-ci à l'aide du logiciel libre GeNIe.

Importance : Les techniques de décomposition et de visualisation d'un modèle élaborées dans le cadre du second volet 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. En fait, certains résultats obtenus sont fournis aux communautés afin qu'elles les utilisent immédiatement à l'appui de leurs efforts de planification de la gestion des urgences. Ceci dit, étant donné la complexité du processus, des propriétés informatiques des modèles Bayes Net et des limites des logiciels, le niveau de maturité actuel de l'approche n'en permet pas l'exécution sans aide externe et soutien des ressources. L'équipe de recherche examinera et décrira une ou plusieurs solutions de

rechange pour représenter ce grand nombre de variables dans un modèle pouvant être possiblement utilisé plus facilement par des intervenants communautaires.

Futurs plans : Dans le cadre du troisième volet de ce projet, l'équipe de recherche examinera des méthodes permettant de simplifier les modèles afin qu'ils puissent être supportés par le logiciel GeNIe. De plus, elle continuera d'étudier les façons de modifier le processus de définition pour que les EM puissent exécuter plus facilement le modèle et rendre les données plus cohérentes entre les communautés, ce qui améliorera l'interopérabilité. Dans le cadre du quatrième volet, nous effectuerons une analyse plus complète des pour et des contres relativement à l'approche de MAV.

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1 Introduction

1.1 Background & Project Overview

This research effort, conducted by DRDC CSS, is a set of discovery experiments that explores the potential of a decision analysis based technique called Value Focused Metrics (VFM) as a way to improve the state of the art and practice in the area of emergency management planning. This is the second volume of a four volume report that describes a set of discovery experiments that applied VFM to emergency management planning. The research team worked with emergency management stakeholders in two communities to develop and assess four emergency response plans. The particular focus of this volume is on the elicitation and impact assessment of tasks that Subject Matter Experts believed needed to be accomplished to support the objectives they had previously identified (Part 1 of this report.)

The first phase of the project focused on the development and documentation of the goals and objectives the communities hoped to achieve in relation to the hazards presented by two scenarios in each of two communities. The results of that report are documented [1].

1.2 Structure of the Report

The previous volume of this report provides an overview of VFM, addressing the components of the models, the software we used to instantiate the models, and the model development process. It also discusses how the VFM model development process was tailored to meet the needs of this particular research effort. This volume focuses on how the tasks that are intended to support the achievement of the objectives were identified and then assessed for their potential contribution to those objectives. That description is followed by analysis of the tasks as they relate to the pillars of the emergency preparedness cycle, objectives, and organizations. We then discuss some of the technical observations about the limitations of the software and the VFM process in this context. Finally, we offer some conclusions about what we have learned about what may be possible for using VFM to improve emergency management, and conclude with a description of what we will be doing in the next phase as a result of what we have learned.

2 Identification and Assessment of Tasks

In Part 1 of this series of reports we described how the research team worked with the communities to develop a set of objectives for four different disaster response scenarios that were identified by the communities as representative of their biggest concerns. As identified in the section describing Value Focused Metrics (VFM), these objectives consisted of fundamental objectives that describe the most important objectives and means objectives of the communities, which describe intermediate objectives that contribute to the achievement of fundamental objectives. Tasks are things that an organization can do to support the achievement of an objective, actionable items against which a decision can be made to commit resources in the pursuit of achieving an objective. These are things like: *Conduct EOC Training* and *Communicate with Families*. In all, the stakeholders identified 950 tasks across the four scenarios during the model development process.

The task elicitation process was initiated between the research team and the stakeholders using questionnaires generated by the research team and e-mail communication from the stakeholders during the period leading up to each of the on-site exercises. Organizations were provided the objectives that they identified in the initial sessions (under Task 1), and asked to respond to the question: *What can your organization do to directly impact the accomplishment of this objective?* Each task input by the stakeholders consisted of a task name, objective (or objectives) the task supported, relevant pillar in the emergency management cycle, and the organization(s) that are responsible for executing that task. The research team input all of this information into both a GeNIe model and a browser-based display tool that was then used as the mechanism to drive a validation exercise where the tasks were discussed in detail, responsibilities for execution were assigned, and their impact was assessed.

In all, there were four validation exercises conducted, one for each scenario. They were conducted in the respective cities, with the stakeholders in attendance. The stakeholders were distributed into facilitated groups where they were asked to score the importance of the tasks in relation to the objective(s) they were intended to support. Additionally, each task was reviewed in some detail using the scenario as context. This review stimulated discussion among the stakeholders during which they refined their shared understanding of the task, and occasionally added new tasks, or adjusted the existing task. The final step for each task was to *score* impact along a five-point scale ranging from very low to very high. Figure 2-1 is a screen capture depicting the online software tool that was presented to the participants for the exercise. In addition to accepting scores, the software allowed stakeholders to modify the tasks based on their discussion, potentially reassign the task to another group, and add comments about the task or the score that was recorded.

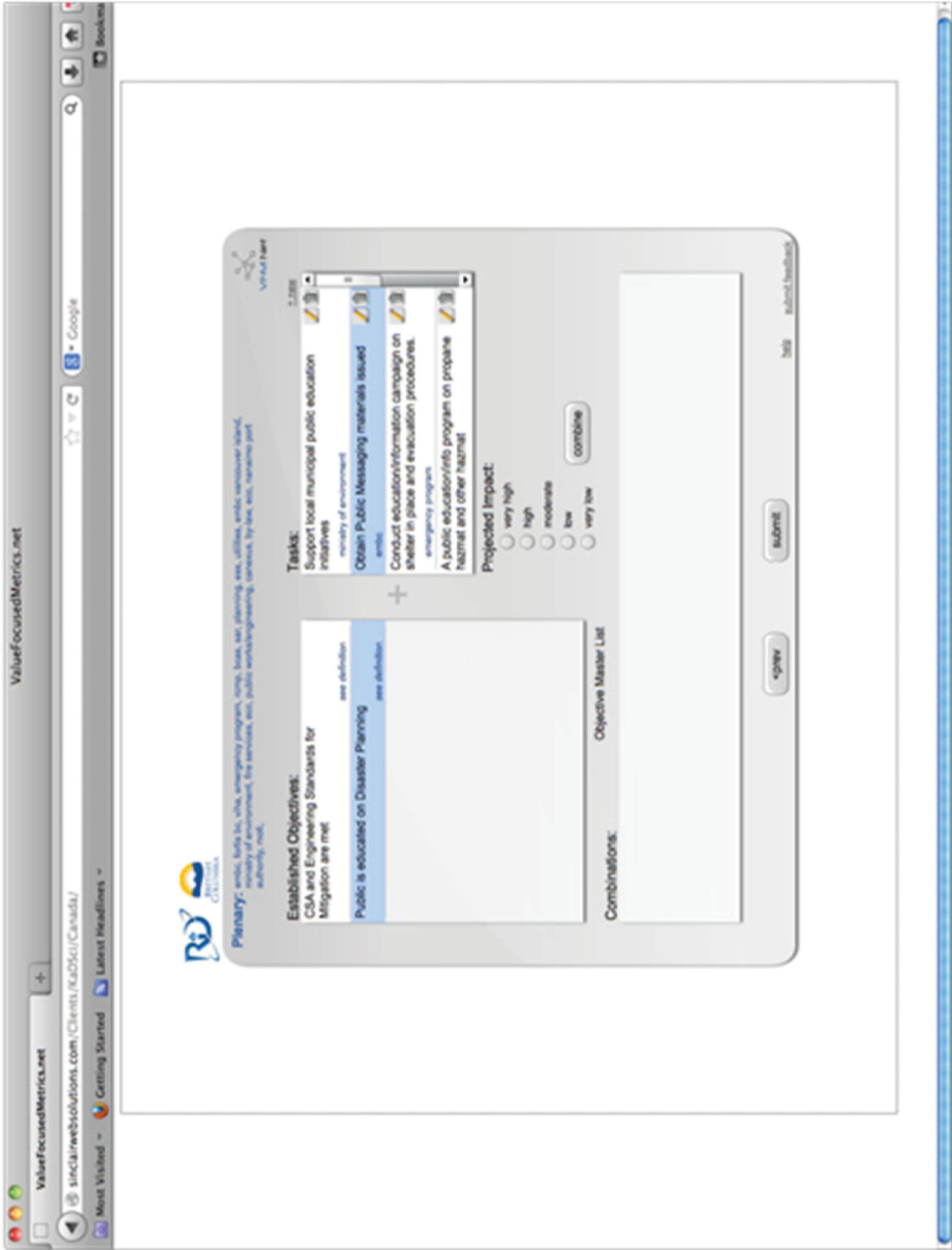


Figure 2-1. Exercise Tool for Assessing Task Impact

As previously indicated there were approximately 950 tasks identified across the four scenarios. All of the tasks were discussed and scored by the stakeholders for the Interface fire scenario and Propane spill scenarios. The large size of the Earthquake scenarios did not allow for as complete an elicitation in the time that was available to interact with the community stakeholders. To gain the maximum benefit possible from the sessions focusing on the earthquake scenarios, the research team operated the software-based elicitation for the tasks relating to preparedness and response, and engaged in facilitated group discussion when addressing mitigation and prevention and the recovery pillars. The research team then interpreted the substance of the discussion and completed the models, thus allowing the completion of the research objectives.

The large number of tasks and their relationships to one or more objectives makes it virtually impossible to display the model on one, or even a small number of screens or printed pages. To make the models and their results, the research team decomposed each model into pillars and then further down to one or two objectives, with a small number of supporting tasks. Figure 2-2 is an example of how these are displayed using an objective *Reduce Vulnerability of Buildings* and three supporting tasks from the Prevention and Mitigation Pillar of the Parksville Interface fire scenario. All of this material is contained in the *Detailed Model Description documents* developed for each scenario. Additionally, the graphical representation is supplemented with definitions of each of the objectives, as well as the impact scores each of the tasks and responsible organization in that section of the model received.

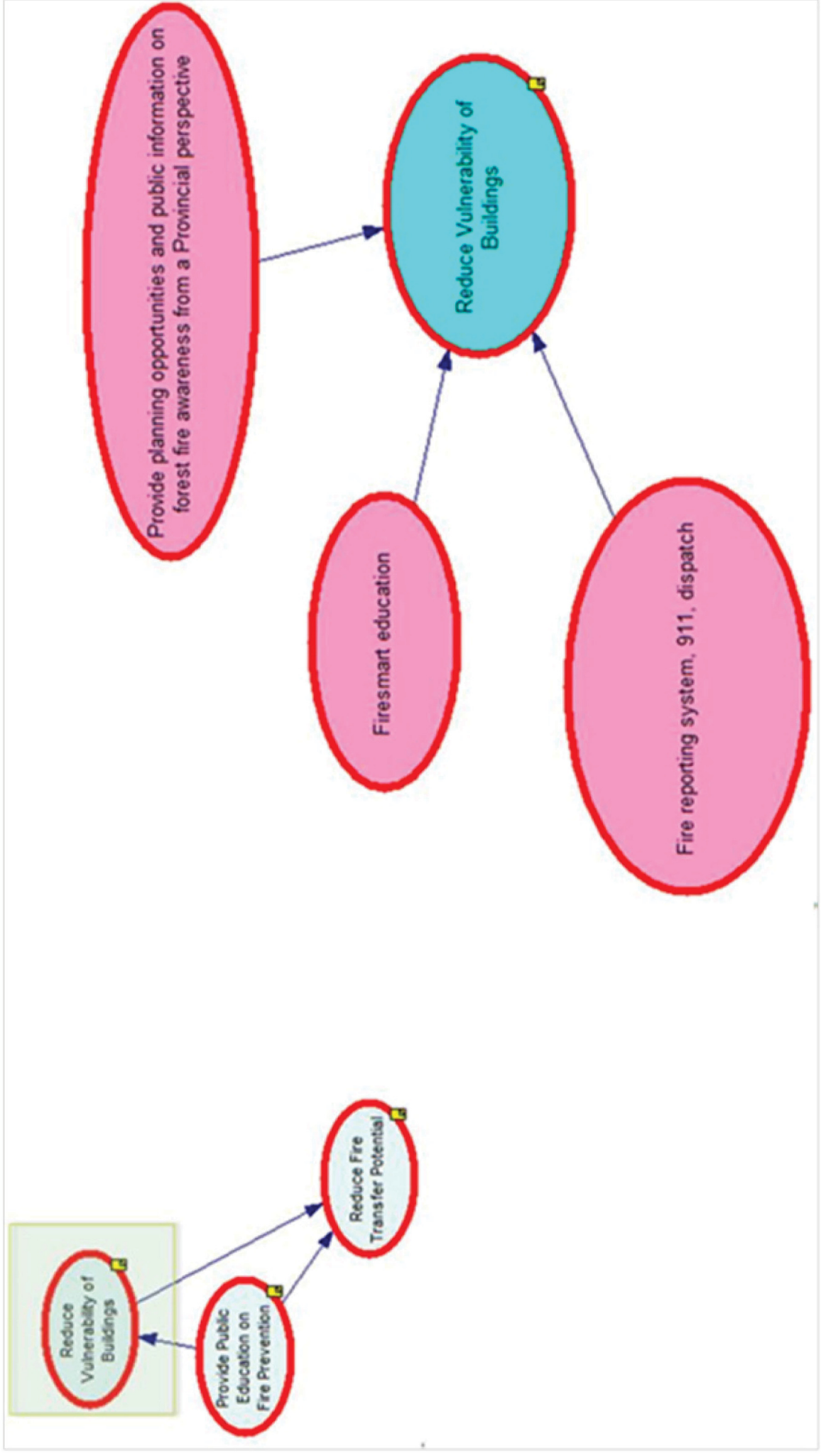


Figure 2-2. Sample — Reduce Vulnerability of Buildings Objective Display

3 Analysis of Results

Analysis was accomplished from two perspectives. First we conducted a relatively qualitative analysis that looked across the models and developed descriptive statistics to search out areas of emphasis, patterns in SME judgments, clues that might support the synthesis required in future tasks. Then, we looked into each scenario, calculated expected utility scores associated with alternatives and conducted quantitative sensitivity analysis that identified the tasks with the biggest impact in each scenario.

One major finding in the qualitative analysis is that Preparedness and Response tasks were more heavily represented in the models as well as more heavily weighted in terms of impact and number of tasks in comparison to the tasks under the Prevention/Mitigation and Recovery pillars. Although this was known anecdotally from the exercises, the analysis heavily backs that finding. 83% of all Very High impacts were allocated to Response organizations (Fire, RCMP, BCAS, and SAR), 60% of the Moderate to Very High impact tasks are assignable to the Coordinators/Supporters (all other organizations not marked *All*) and 31% to the Response organizations, only 9% were marked for All (organizations involved in the scenario).

Some of the descriptive statistics with supporting discussion used in our analysis are contained in the following tables.

Table 1 contains the data elements that are contained in each of the four scenario task tables in the appendix.

Table 1: Data Elements Used

Data Element	Data Description
Seq	Node Sequence number used for internal purposes only
Pillar	Pillar: One of Prevent and Mitigate, Preparedness, Response and Recovery
Obj ID	The assigned identification code for each objective or task. Members of the Fundamental Objective Hierarchy (FOH) have codes starting with 'F,' except for the strategic goal which starts with an 'S.' Members of the Means Ends Objective Network (MEON) start with 'M,' Tasks with 'A,' and Metrics with 'X.'
Obj Name	The name of the objective
Organization	The performing organization for this task/objective pair
Task ID	The assigned identification code for the task
Task Name	The name of the task
Task Impact	The level of impact of the task conducted by the organization on the objective. Very High (VH), High (H), Moderate (M), Low (L), Very Low (VL) and not rated (N)

3.1 By Pillar

Table 2 lists the number of objectives identified in the four scenarios and Table 3 provides the percentages. This number represents the internal complexity of the models. Note that the MEONs were weighted towards the Preparation and Response pillars, but that the overall size remained. If the number of nodes in the MEON is an indication of complexity, then the earthquake models do appear to be more complex than the other two. However, Parksville Interface Fire (PIF) had a large number of objectives stemming from the multi-hazard problem — rural house fire, forest fire, transportation interruptions and the potential for urban fire. In comparison, the Nanaimo Propane Spill (NPS) model was less complex as it dealt with a localized propane spill with no fire. NEQ is Nanaimo Earthquake and PEQ is Parksville Earthquake.

Table 2: Number of Objectives

	FOH	MEON				Total
		Pre/Mit	Prepare	Respond	Recover	
NEQ	6	3	20	33	8	70
NPS	5	1	10	21	2	39
PEQ	6	3	19	32	8	68
PIF	5	3	17	27	3	55
Total	22	10	76	103	21	232

Table 3: Objective Percentages

	FOH	MEON				Total
		Pre/Mit	Prepare	Respond	Recover	
NEQ	8.6%	4.3%	28.6%	47.1%	11.4%	100.0%
NPS	12.8%	2.6%	25.6%	53.8%	5.1%	100.0%
PEQ	8.8%	4.4%	27.9%	47.1%	11.8%	100.0%
PIF	9.1%	5.5%	30.9%	49.1%	5.5%	100.0%
Total	9.5%	4.3%	32.8%	44.4%	9.1%	100.0%

Table 4 and Table 5 contain the counts and percentages of tasks by scenario broken out by pillar. The majority of tasks were identified for the Response pillar, and then for the Preparedness pillar. Recovery was third and Prevention and Mitigation fourth. This confirmed the general view during the four exercises that Prevention and Mitigation and Recovery had not been sufficiently developed (see also Table 2 and Table 3). One explanation for this was the participation of a high percentage of first responders during each of the exercises. The responders concentrated on response — the doing — and secondly to the planning or preparedness. It is possible that they were not as knowledgeable in the prevention or recovery pillars.

Table 4: Number of Tasks by Scenario

Scenario	Number of Tasks				Total Tasks
	Pre/Mit	Prepare	Respond	Recover	
NEQ	9	31	135	16	191
NPS	5	68	127	9	209
PEQ	12	76	178	19	285
PIF	9	93	116	11	229
Total	35	268	556	55	914

Table 5: Percentage of Tasks by Scenario

Scenario	Task Percentages by Scenario				Total Tasks
	Pre/Mit	Prepare	Respond	Recover	
NEQ	4.7%	16.2%	70.7%	8.4%	100.0%
NPS	2.4%	32.5%	60.8%	4.3%	100.0%
PEQ	4.2%	26.7%	62.5%	6.7%	100.0%
PIF	3.9%	40.6%	50.7%	4.8%	100.0%
Total	3.8%	29.3%	60.8%	6.0%	100.0%

Table 6: Tasks per Objective

	Tasks per Objective			
	Pre/Mit	Prepare	Respond	Recover
NEQ	3.0	1.6	4.1	2.0
NPS	5.0	6.8	6.0	4.5
PEQ	4.0	4.0	5.6	2.4
PIF	3.0	3.4	6.8	3.7

The average number of tasks per objective ranges between 1.6 (NEQ Preparedness) and 6.8 (NPS Preparedness and PIF Response). Note that there were two tasks in NPS Prevention and Mitigation that actually influenced Preparedness objectives. These were: Public information campaign on reverse 911, and Create Public Messaging Templates. These two tasks were added during the exercise; no Prevention and Mitigation objectives were added.

3.2 By Impact

Impact was defined as the direct effect the execution of a task would likely have on an objective and was graded from Very High to Very Low. During the conduct of the exercises it was determined that the Very Low score was problematic. The discussion revolved around the utility of modeling a task that had very low impact on an objective. Why would it be undertaken at all? For these prototype models these tasks were not deleted, but were left in the data without impact. Table 7 contains a recap of task impact by pillar for each scenario, with the very low tasks redacted from the analysis.

Table 7: Number of Tasks Assigned a Given Impact by Pillar for Each Scenario

NEQ Pillar Impact Rankings										
	Low	L% by Pillar	Med	M% by Pillar	High	H% by Pillar	Very High	VH% by Pillar	Total	T%
Prevent/Mitigate	0	0%	4	15%	5	6%	0	0%	9	5%
Preparedness	0	0%	8	30%	20	23%	3	4%	31	16%
Response	0	0%	14	52%	51	59%	70	90%	135	71%
Recovery	0	0%	1	4%	10	12%	5	6%	16	8%
% or total impact assessments made	0	0%	27	14%	86	45%	78	41%	191	
NPS Pillar Impact Rankings										
	Low	L%	Med	M%	High	H%	Very High	VH%	Total	T%
Prevent/Mitigate	0	0%	1	4%	3	2%	1	2%	5	3%
Preparedness	2	40%	15	60%	42	34%	9	16%	68	36%
Response	3	60%	8	32%	70	57%	46	82%	127	66%
Recovery	0	0%	1	4%	8	7%	0	0%	9	5%
	5	2%	25	12%	123	59%	56	27%	209	
PEQ Pillar Impact Rankings										
	Low	L%	Med	M%	High	H%	Very High	VH%	Total	T%
Prevent/Mitigate	0	0%	3	6%	7	4%	2	3%	12	6%
Preparedness	0	0%	21	44%	44	27%	11	15%	76	40%
Response	0	0%	22	46%	96	59%	60	80%	178	93%
Recovery	0	0%	2	4%	15	9%	2	3%	19	10%
	0	0%	48	17%	162	57%	75	26%	285	

PIF Pillar Impact Rankings										
	Low	L%	Med	M%	High	H%	Very High	VH%	Total	T%
Prevent/Mitigate	1	14%	4	6%	4	3%	0	0%	9	5%
Preparedness	3	43%	35	54%	50	42%	5	13%	93	49%
Response	3	43%	24	37%	58	49%	31	79%	116	61%
Recovery	0	0%	2	3%	6	5%	3	8%	11	6%
	7	3%	65	28%	118	52%	39	17%	229	

The largest percentages of High and Very High impact tasks appear to be in the Preparedness and Response pillars. In fact, Preparedness and Response account for 81% of all impacts (NEQ – 86%, NPS – 86%, PEQ – 83% and PIF – 69%). Overall the number of Low and Moderate impact tasks is small: NEQ – 14%, NPS – 14%, PEQ – 17% and PIF – 31%. The PIF exercise was the first to be conducted and the differences in numerical results across scenarios could represent a learning effect. 83% of all Very High impacts were allocated to Response. This aligns with the type of participants in the exercise; which could be a bias in the experimental results. Moreover, the imbalance in the number and resolution of tasks in the other pillars, especially recovery, could also be biasing these results. However, given the immediate impact of a typical Response task inside a particular scenario, this may also be a finding and is likely worth further exploration.

3.3 By Organization

Table 8 shows the assessed impacts for tasks associated with individual organizations. Note that the organizations are not equally represented across communities, or even within communities across scenarios. This reflects the voluntary nature of the participant pool. Organizations that are not represented in the data likely did not participate in the exercise, and those that are represented with a high number of tasks provided a lot of input. For example, the Ministry of Forests Wildfire Management Branch is absent in the following table for the Parksville interface fire scenario. In reality, they would have a large role and impact if this scenario were an actual event. There are two solutions to these gaps in tasks. First, these types of gaps should be identified and addressed by communities during their planning activities. Second, in some cases the lack of involvement might be an oversight by the planners. VFM supported planning tools, supported with adequate data, could suggest to planners other stakeholders that likely should be participating in the model development and assessment process.

Table 8: Number of Task Assigned Given Impacts, Shown by Organization

NEQ Org by Impact Rank										
	Low	L%	Med	M%	High	H%	Very High	VH%	Total	Total %
All	0	0%	4	15%	6	7%	2	3%	12	6%

BCAS	0	0%	1	4%	0	0%	1	1%	2	1%
CANEXUS	0	0%	0	0%	1	1%	0	0%	1	1%
ECC	0	0%	1	4%	21	24%	34	44%	56	29%
EMBC	0	0%	12	44%	15	17%	16	21%	43	23%
Emergency Program	0	0%	3	11%	8	9%	1	1%	12	6%
ESS	0	0%	0	0%	1	1%	0	0%	1	1%
Fire	0	0%	3	11%	17	20%	23	29%	43	23%
Ministry of Environment	0	0%	2	7%	3	3%	0	0%	5	3%
Nanaimo Port Authority	0	0%	0	0%	1	1%	0	0%	1	1%
Public Works	0	0%	0	0%	3	3%	0	0%	3	2%
RCMP	0	0%	0	0%	4	5%	0	0%	4	2%
VIHA	0	0%	1	4%	5	6%	1	1%	7	4%
Utilities	0	0%	0	0%	1	1%	0	0%	1	1%
	0	0%	27	14%	86	45%	78	41%	191	

NPS Org by Impact Rank

	Low	L%	Med	M%	High	H%	Very High	VH%	Total	Total %
All	0	0%	1	4%	4	3%	3	5%	8	4%
BCAS	0	0%	0	0%	1	1%	0	0%	1	0%
By-Law	0	0%	0	0%	1	1%	0	0%	1	0%
ECC	1	20%	3	12%	18	15%	9	16%	31	15%
EMBC	4	80%	7	28%	23	19%	10	18%	44	21%
ESS	0	0%	1	4%	3	2%	0	0%	4	2%
Fire	0	0%	10	40%	53	43%	32	57%	95	45%
Ministry of Environment	0	0%	2	8%	14	11%	1	2%	17	8%
Public Works	0	0%	1	4%	3	2%	0	0%	4	2%
RCMP	0	0%	0	0%	2	2%	1	2%	3	1%
Utilities	0	0%	0	0%	1	1%	0	0%	1	0%
	5	2%	25	12%	123	59%	56	27%	209	100%

PEQ Org by Impact Rank

	Low	L%	Med	M%	High	H%	Very High	VH%	Total	Total %
All	0	0%	7	15%	18	11%	25	33%	50	18%
BCAS	0	0%	2	4%	4	3%	1	1%	7	2%
By-Law	0	0%	1	2%	0	0%	0	0%	1	0%
EMBC	0	0%	9	19%	31	19%	11	15%	51	18%
Emergency Program	0	0%	9	19%	11	7%	7	9%	27	10%

EOC	0	0%	6	13%	32	20%	12	16%	50	18%
ESS	0	0%	2	4%	15	9%	6	8%	23	8%
Fire	0	0%	5	10%	20	13%	8	11%	33	12%
FortisBC	0	0%	0	0%	2	1%	0	0%	2	1%
Public Works	0	0%	2	4%	13	8%	4	5%	19	7%
RCMP	0	0%	0	0%	7	4%	1	1%	8	3%
SAR	0	0%	0	0%	1	1%	0	0%	1	0%
VIHA	0	0%	5	10%	4	3%	0	0%	9	3%
Utilities	0	0%	0	0%	2	1%	0	0%	2	1%
	0	0%	48	17%	160	57%	75	27%	283	100%
PIF Org by Impact Rank										
	Low	L%	Med	M%	High	H%	Very High	VH%	Total	Total %
All	0	0%	3	5%	5	4%	2	5%	10	4%
BC Hydro	0	0%	0	0%	0	0%	1	3%	1	0%
BCAS	0	0%	2	3%	1	1%	0	0%	3	1%
EMBC	1	14%	13	20%	30	25%	14	36%	58	25%
Emergency Program	1	14%	18	28%	18	15%	1	3%	38	17%
EOC	1	14%	7	11%	31	26%	4	10%	43	19%
ESS	0	0%	5	8%	10	8%	3	8%	18	8%
Fire	1	14%	9	14%	16	14%	5	13%	31	14%
FortisBC	0	0%	1	2%	0	0%	0	0%	1	0%
Public Works	1	14%	1	2%	4	3%	5	13%	11	5%
RCMP	0	0%	2	3%	1	1%	4	10%	7	3%
VIHA	2	29%	4	6%	1	1%	0	0%	7	3%
Utilities	0	0%	0	0%	1	1%	0	0%	1	0%
	7	3%	65	28%	118	52%	39	17%	229	100%

Table 9 recaps the organizations that were captured in the scenarios. In order to condense the analysis, each scenario was further recapped into; All, First Responders in **Bold** below (FR), Coordinator/Supporter (CS). See Table 10.

Table 9: Organization Recap

PIF	PEQ	NPS	NEQ
EMBC	EMBC	EMBC	EMBC
Fire	Fire	Fire	Fire Services
RCMP	RCMP	RCMP	RCMP

PIF	PEQ	NPS	NEQ
BCAS	BCAS	ESS	BCAS
Emergency Program	SAR	ECC	VIHA
EOC	VIHA	Public Works	ESS
VIHA	ESS	Utilities	Emergency Program
ESS	Emergency Program	By-Law	ECC
Public Works	EOC	Ministry of Environment	Public Works
Utilities	By-Law		Utilities
BC Hydro	Public Works		Ministry of Environment
FortisBC	Utilities		Nanaimo Port Authority
	FortisBC		CANEXUS

Table 10 has been condensed by organizations and by impact. Low impacts have been dropped so that only Moderate, High, and Very High are shown.

Table 10: Numbers of Tasks Shown for Grouped Organizations by Impact

NEQ Org by Impact Rank								
	Med	M%	High	H%	Very High	VH%	Total	Total %
All	4	15%	6	7%	2	3%	12	6%
First Responders	4	15%	21	24%	24	31%	49	26%
Coordinators/Supporters	19	70%	59	69%	52	67%	130	68%
	27		86		78		191	
NPS Org by Impact Rank								
	Med	M%	High	H%	Very High	VH%	Total	Total %
All	1	4%	4	3%	3	5%	8	4%
First Responders	10	40%	56	46%	33	59%	99	49%
Coordinators/Supporters	14	56%	63	51%	20	36%	97	48%
	25		123		56		204	
PEQ Org by Impact Rank								
	Med	M%	High	H%	Very High	VH%	Total	Total %
All	7	15%	18	11%	25	33%	50	18%
First Responders	7	15%	32	20%	10	13%	49	17%
Coordinators/Supporters	34	71%	110	69%	40	53%	184	65%
	48		160		75		283	

PIF Org by Impact Rank								
	Med	M%	High	H%	Very High	VH%	Total	Total %
All	3	5%	5	4%	2	5%	10	5%
First Responders	13	20%	18	15%	9	23%	40	18%
Coordinators/Supporters	49	75%	95	81%	28	72%	172	77%
	65		118		39		222	
All Scenarios								
	Med	M%	High	H%	Very High	VH%	Total	Total %
All	15	9%	33	7%	32	13%	80	9%
First Responders	34	21%	127	26%	76	31%	237	26%
Coordinators/Supporters	116	70%	327	67%	140	56%	583	65%
	165		487		248		900	

65% of the Moderate to Very High impact tasks were assigned to the Coordinators/Supporters and 26% to the First Responders, and only 9% were marked for All. Table 11 continues the analysis by showing the number of tasks allocated to the condensed organizations by pillar.

Table 11: Number of Tasks per Organization by Pillar

NEQ Pillar Impact Rankings								
	Prevent/Mitigate	PM%	Preparedness	P%	Response	Rs%	Recovery	Rc%
All	0	0%	4	13%	6	4%	2	13%
First Responders	0	0%	6	19%	43	32%	0	0%
Coordinators/Supporters	9	0%	21	68%	86	64%	14	88%
	9		31		135		16	
NPS Pillar Impact Rankings								
	Prevent/Mitigate	PM%	Preparedness	P%	Response	Rs%	Recovery	Rc%
All	1	20%	2	3%	4	3%	1	11%
First Responders	1	20%	26	38%	69	54%	3	33%
Coordinators/Supporters	3	60%	40	59%	54	43%	5	56%
	5		68		127		9	

PEQ Pillar Impact Rankings								
	Prevent/ Mitigate	PM%	Preparedness	P%	Response	Rs%	Recov -ery	Rc%
All	0	0%	9	12%	38	21%	3	18%
First Responders	0	0%	11	14%	34	19%	4	24%
Coordinators /Supporters	12	100%	56	74%	106	60%	10	59%
	12		76		178		17	
PIF Pillar Impact Rankings								
	Prevent/ Mitigate	PM%	Preparedness	P%	Response	Rs%	Recov -ery	Rc%
All	0	0%	5	5%	4	3%	1	9%
First Responders	5	56%	13	14%	23	20%	0	0%
Coordinators /Supporters	4	44%	75	81%	89	77%	10	91%
	9		93		116		11	
All Scenarios								
	Prevent/ Mitigate	PM%	Preparedness	P%	Response	Rs%	Recov -ery	Rc%
All	1	3%	20	7%	52	9%	7	13%
First Responders	6	17%	56	21%	169	30%	7	13%
Coordinators /Supporters	28	80%	192	72%	335	60%	39	74%
	35	4%	268	29%	556	61%	53	6%

61% of all tasks are allocated to Response, with 29% to Preparedness leaving only 10% for Prevention and Mitigation and Recovery.

This first order analysis only addresses the responses that were provided by the participating SMEs. While it provides some insight into the areas the SMEs were emphasizing and has a wealth of information for the team's research goals, it does not address the *So what?*: the indirect impact the combinations of these assessments has on the Fundamental Objectives and ultimately the Strategic Objective. That is accomplished using the Influence Diagram (GeNIe implementation) software to calculate the immediate and overall impacts on the Strategic and Fundamental Goals.

4 Analysis of Tasks

The essential question for the planners and leaders in the communities is really: *What do I do next to improve our community's disaster preparedness?* Once the influence diagram model is fully specified (has all of the numbers and relationships), this can be determined for all four of the scenarios. These results are contained in the detailed model descriptions and are packaged in a form that can be shared with the communities. For purposes of documenting the research effort, we will describe some of the analysis results out of the Parksville Earthquake (PEQ) scenario and model.

What tasks are most important?

Models of large complex systems such as the PEQ model tend to be very *stiff* in a mathematical sense. This means that the influence of any one variable (task or objective) on the overall strategic objective's score is usually quite small. This sometimes makes it difficult to determine the relative contribution of individual tasks. To compensate for this property of the model and the complex scenario we are attempting to represent, we are assessing the relative impact of success (or failure) with respect to the means objectives in each pillar. This provides a sense of what means objectives have the most impact on success or failure. Then, using that insight, SMEs can focus on the tasks that are judged to have the most impact on that objective.

The model uses the concept of a “utility score” to quantitatively represent the level of satisfaction one would have with the outcome of the situation being represented in the model. Utilities have a value between 0 and 1 (1 being the most satisfaction and 0 the least). The relative impact of different objectives can be estimated using sensitivity or “swing” analysis in the model. Sensitivity analysis is accomplished by setting each means objective to its lowest level, then its highest level, and calculating the difference in the two utility scores. The Parksville Earthquake Means Objective table on the following page identifies the five means objectives in the PEQ model with the biggest impact on overall utility. There are few things that are interesting to note that explain these observed values.

- The means objective “Provide for Public Health and Safety” directly supports two fundamental objectives — Save Lives and Reduce Suffering — which are the two most highly valued fundamental objectives.
- Not all of the highest valued means objectives came from the response phase, even though most of the discussion and input in the exercises focused on response. This provided some counterintuitive insights that could influence planning and investment decisions. (** This is not a recommendation, only a research finding.)

Parksville Earthquake (PEQ)	
Means Objective	Strategic Objective
Provide for public health and safety	0.2247
Long-term public assistance is available	0.2037
Shelter and humanitarian assistance for affected population is available	0.156
Shelter in place for low risk population	0.0952
Critical infrastructure restored	0.0939

A swing value is the amount of change in utility of a fundamental or strategic objective directly due to a swing in an objective or action from its most favorable to least favorable state.

Each of the means objectives in the above table impact the Fundamental Objectives Hierarchy directly with no intervening nodes. Therefore, given that the most important tasks as defined by the model are those which impact the achievement of the most important objectives, then we get the following results, consisting of the tasks that contribute to the above objectives.

Provide for Public Health and Safety	Impact
Execute Response Plans consistent with Assessment (water...)	VH
Assess and report damage to city provided infrastructure (water, sanitation, transportation)	H
Collaborate and communicate with key stakeholders on Evacuation Planning/Advanced Planning with respect to housing/facilities/support services	H
Repair municipal infrastructure according to coordinated priorities	H
Establish health authority EOC	H
At Reception Centers or other mass gatherings, contact VIHA Health Protection & Environmental Services	H
Assess vulnerable populations at risk	H
Coordinate with the EOC to develop municipal infrastructure repair priorities	H

Long term public assistance is available	Impact
Establish Recovery/Resilience Centres	VH
Initiate financial cost recovery procedures (i.e., DFA, DFAA)	H
To provide ongoing information and updates through public messaging	H

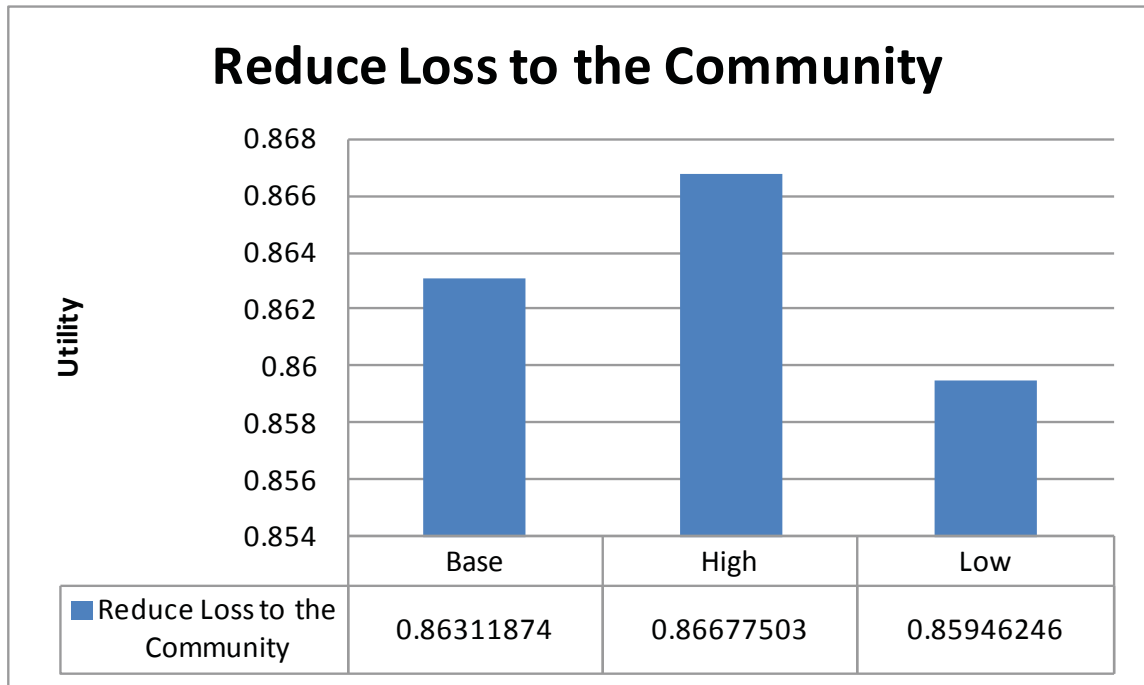
Shelter and Humanitarian assistance for affected population is available	Impact
ESS to maintain reception and group lodging centres	VH
Inform populace of potable water quality	H
Encourage maximal use of ESS comfort stations, family contact, and contacting VIHA Home & Community Care for chronically ill	M

Shelter in place for low risk population	Impact
Assess, determine, and advise occupants of stay or go decision	VH
Record and report to EOC occupant information (name, address, location, contact information) for residents sheltering in place	H

Critical Infrastructure restored	Impact
CI repaired or replaced- damaged structures made safe and functional	VH
Coordinate with CI stakeholders to (re)evaluate priorities	VH
Conduct assessment of Critical Infrastructure potentially at risk	H
Assessment and or removal of all debris addressing environmental considerations	H
Manage Logistical Resources to support priorities	H

The task below is a task rated as having a Very High impact on the means objective: Provide for Public Health and Safety. The impact of the tasks' completeness on the strategic objective of Reduce Loss to Community is in the second decimal place of the expected utility. Note that this objective swings from a low of 0.859 when the task is in the *NotProvided* state to a high of 0.867 when the task is in the *Provided* state. See swing calculations for Means objectives.

Example Task: Execute Response Plans consistent with Assessment (water...) (VH)



The PEQ model was also analyzed by pillar, and in the Preparedness and Response pillars it was further broken down into clusters of closely related objectives inside the pillars, as shown in the categories below. The purpose of this decomposition was to explore the possibility that the model would be easier to understand when communicating results or perhaps to conduct model elicitation in sections. No assertions are made that these are in fact the “right” clusters or that the individual objectives are perfectly aligned (therefore, results should be interpreted accordingly). In fact, this is an area that will be explored further in Task 3 of this research.

Categories	PEQ
PreventMitigate	12
Preparedness_Critical_Infrastructure	6
Preparedness_Logistics	8
Preparedness_Planning	28
Preparedness_Support	9
Preparedness_Training	17
Preparedness_Understanding	0
Response_Access	3
Response_Care	55
Response_Command	18
Response_Critical_Infrastructure	11
Response_Logistics	16
Response_Respond	17
Response_Support	4
Response_Understanding	19
Recovery	20
	243

Note that multiple tasks for different organizations were consolidated. Not all categories are present in all models.

The swings for the tasks in each pillar or pillar group were calculated for the local, or group value objective. They were then ranked in order of decreasing impact based on those swings. The following tables show the top five (and ties) tasks as measured by impact given the particular categories and task groupings — with the modification that only those that seemed to be noticeably higher than the others within the group are included.

Parksville Earthquake Prevention Task	Rank in Pillar
Ensure overflow redundancy - sanitation systems	1
Complete addition and upgrade projects	T2
Complete utility upgrade and addition projects	T2
Public presentations on emergency preparedness delivered by EPC	T3
Provide public awareness (website, brochure, etc.) on earthquake awareness	T3

Parksville Earthquake Preparedness Task	Rank in Pillar
EOC Liaison officer to work with EMBC for spending support and equipment and staff support when local resources are exhausted	1
Alternate safe drinking water supply	2
ESS to maintain reception and group lodging centres	3
Create debris removal plan	T4
Public and business community consulted to develop recovery plan	T4

Parksville Earthquake Response Task	Rank in Pillar
Identify landing zones for helicopters and sea vessels	1
Conduct Rapid Damage and Safety Assessments of PREOC and PECC facilities	2
First responders are alerted and/or report for duty after families safe.	3
Organize response / Initiate response plan / Prioritize.	4
Initiate staff, TEAMS and Ministry notifications to report to designated PREOC/PECC	T5
Establish communications and situational awareness with impacted communities	T5

Parksville Earthquake Recovery Task	Rank in Pillar
Establish Recovery/Resilience Centres	1
Initiate financial cost recovery procedures (i.e., DFA, DFAA)	T2
To provide ongoing information and updates through public messaging	T2
Assessment and or removal of all debris addressing environmental considerations	T3
EOC Operations to create teams to clear roads of hazards when Unified Command deems safe	T3
EOC activates debris removal plan	T3

5 Conclusions

The second phase of this research demonstrated that Value Focused Models can be successfully developed by emergency preparedness Subject Matter Experts (SMEs), at least with professional analysis support. That said, while the SMEs were extremely supportive, it appeared by the end of the exercises that the process, as it is currently designed, is too labor intensive for communities with limited resources, and is technically complex enough that they do not appear as though they would be successful in an unassisted attempt to execute the process. This reinforces the observations from phase one of our research, and will be explored in some detail as part of the project's assessment task.

Once fully specified, the models did produce quantitative results that are capable of supporting prioritization, resource allocation, and assessment processes. This is a perspective, level of detail and logical consistency not previously available to support emergency management planning and assessment. With continued refinement it is a potential advance in the state of the practice for emergency management planning.

The larger scenarios (Parksville Earthquake in particular) stressed the computational limits of the GeNIe software. This is not a limitation of the Value Focused Metrics process, as there are multiple software packages available for processing influence diagram models with numerous algorithms that can significantly speed computation. (One such algorithm in the free GeNIe software was tested, but appeared to have computational anomalies, so it was not pursued as part of this project.) Another observation on the behavior of the fully specified models is that they are large enough that they are relatively unresponsive to changes in individual inputs. The research team compensated for this by decomposing the model into smaller segments, and using those results for analysis. This is showing particular promise and will be a major point of emphasis in the Task Three research.

References

- [1] Maxwell, Daniel and David Davis (2013), *Value Focused Metrics for Improved Emergency Management Planning: Part 1: Objectives Measurement Framework*, Contract Report DRDC CSS 2013-020, September 2013

Annex A Community Participants

Table 12: 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 13: 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 14: 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 15: 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 16: 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

Nanaimo Propane Spill Objective Type	Nanaimo Propane Spill Objective Name	Nanaimo Propane Spill Objective Definition
Means	Identify Hot Zone	Identify the hot zone, i.e., the area immediately surrounding the hazard where the risk is at the highest level
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 17: 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)

Parkville Interface Fire Objective Type	Parkville Interface Fire Objective Name	Parkville Interface Fire Objective Definition
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.)
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

Parksville Interface Fire Objective Type	Parksville Interface Fire Objective Name	Parksville Interface Fire Objective Definition
		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
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	Ensure the availability of water to use for

Parkville Interface Fire Objective Type	Parkville Interface Fire Objective Name	Parkville Interface Fire Objective Definition
	Water	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
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

Parksville Interface Fire Objective Type	Parksville Interface Fire Objective Name	Parksville Interface Fire Objective Definition
		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 Inventory	Create a central capability inventory including 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,

Parksville Interface Fire Objective Type	Parksville Interface Fire Objective Name	Parksville Interface Fire Objective Definition
		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 18: 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)

Nanaimo Earthquake Objective Type	Nanaimo Earthquake Objective Name	Nanaimo Earthquake Objective Definition
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
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

Nanaimo Earthquake Objective Type	Nanaimo Earthquake Objective Name	Nanaimo Earthquake Objective Definition
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
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

Nanaimo Earthquake Objective Type	Nanaimo Earthquake Objective Name	Nanaimo 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
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

Nanaimo Earthquake Objective Type	Nanaimo Earthquake Objective Name	Nanaimo Earthquake Objective Definition
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
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

Nanaimo Earthquake Objective Type	Nanaimo Earthquake Objective Name	Nanaimo Earthquake Objective Definition
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 19: 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

Parkville Earthquake Objective Type	Parkville Earthquake Objective Name	Parkville 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	

Parkville Earthquake Objective Type	Parkville Earthquake Objective Name	Parkville Earthquake Objective Definition
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 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

Parkville Earthquake Objective Type	Parkville Earthquake Objective Name	Parkville 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	Public Health Infrastructure	Infrastructure for the provision of public health, standard CI, transportation, and logistics
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

Parkville Earthquake Objective Type	Parkville Earthquake Objective Name	Parkville Earthquake Objective Definition
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
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

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

This report is part two 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 disaster scenarios. This volume focuses on the identification and assessment of specific tasks that are accomplished to support the achievement of the objectives identified in the first phase of the project. This second report builds on the first phase, discussing what was learned in the task elicitation and impact assessment process that was executed in May and July of 2013. Some of the key findings include the development of evidence that this kind of process has significant potential for improving emergency management planning and assessment processes. That said, the research team identified a collection of limitations to current capabilities, particularly in the area of software. In particular, larger models for the more complex scenarios exceeded the computational capability of the free software. Additionally, larger models were difficult to visualize on one screen. Some of the most important contributions of this work are the problem decomposition strategies that were developed to support computation, visualization, and analysis of model results.

Le présent rapport est le second 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 de catastrophe. Ce document porte sur l'identification et l'évaluation de tâches particulières accomplies pour favoriser l'atteinte des objectifs définis durant la première phase du projet. Ce second rapport s'inspire de la première phase, abordant les leçons retenues au cours du processus de définition des tâches et d'évaluation de l'incidence qui a été mené en mai et juillet 2013. Parmi les principaux résultats obtenus, il y a l'établissement d'une preuve que ce type de processus peut grandement améliorer les processus de planification et l'évaluation de la gestion des urgences. Ceci dit, l'équipe de recherche a déterminé que les capacités actuelles comportaient diverses limites, en particulier en matière de logiciels. De plus grands modèles pour des scénarios plus complexes ont notamment dépassé la capacité informatique du logiciel libre. En outre, il était difficile de visualiser ces modèles sur un seul écran. Certaines des plus importantes contributions découlant de ces travaux sont les stratégies de décomposition du problème qui ont été élaborées à l'appui du calcul, de la visualisation et de l'analyse des résultats des modèles.

14. KEYWORDS, DESCRIPTORS or IDENTIFIERS

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