

Designing an Emergency Response Communications Model for Complex Adaptive Bio-Threats Like Avian Flu (Mayor's Version)

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Introduction

This paper proposes a communications response model to a bio-emergency, for use by elected officials and staff in a community under threat. In different jurisdictions, and/or for different bio-threats, the elected officials who have responsibility for bio-emergency response may be located in other levels of governance; eg. province/state or federal. However, for the purposes of this paper the responsibility for developing a well-informed governance communication strategy for bio-emergencies is assumed to be that of the Mayor and City Staff. It might well be a provincial/state Minister/Secretary, Premier/Governor or Prime Minister/President.

Mayors need a framework appropriately complex to respond to the emergence of zoonotic diseases (ie. diseases that cross over from animal populations into human populations) (Sapient Circle, 2004). These threats make demands on emergency response systems that are not merely *complicated*, but are *complex*. This means that the interconnections of animal and human health systems, through diseases such as SARS, West Nile Disease, BSE, E-Coli and Avian Influenza, create exponential levels of complexity. It appears that zoonotic bio-emergencies are more dynamic and subject to sudden jumps in severity, than non-bio-emergencies, because the underlying viral/biological elements are capable of learning or adapting to their human environments/life conditions. Thus they require complex non-linear approaches to develop successful response strategies.

The Sapient Circle consulting team (2004) is aware that there may be “competing” models, values, beliefs, and approaches (and certainly jurisdictions) when an emergency response team makes priority decisions. However, in respect to recent experience with zoonotic diseases (eg. in UK, Netherlands, Texas, Toronto), it is becoming apparent that not all views can be held equal to solve a particular situation. This discussion paper, is drafted with the intention to “complement” other views (and in many cases both include and transcend them). More than one approach is outlined below, with the expectation that the reader will choose the “most appropriate” view (or combinations and/or syntheses) to suit their situations.

All that being said, the writer is concerned enough about the implications of zoonotic emergencies, to propose, that a logarithmic classification system be developed (like the earthquake or hurricane classification systems) to clearly set out the meaning of bio-threat (and its obverse “safety”). This is because bio-threats continue to propagate exponentially on a 24/7 basis and do not respect human schedules or work days/weeks. It is therefore essential that the Mayor be aware of how, what and with whom to communicate, in order to ensure human health and safety, support the emergency response team, enable economic recovery and keep the public informed within key critical time lines.

What is a Bio-Emergency?

Biological threats like avian flu create a new class of emergencies that require more complex response systems to be called into play, than emergencies arising from the classes of natural and human-made disaster, such as fire, flood, storm, earthquake, war that destroy property and threaten lives.

Emergency response capacities need to be elevated to the level of complexity that matches a health based threat. In the second half of the twentieth century, in most cities of the developed world, we have come to expect that our water management, waste management and health management systems can prevent bio-threats through purification systems, disinfectants and antibiotics. We have been lulled into believing that we have conquered most biological threats. However, recent experience has demonstrated that the micro-biological life forms have developed new survival capabilities that end-run our “eradication” strategies.

We are quickly realizing that a biological threat is able to learn and change with the living system on which it depends (thus it is both complex and adaptive). The systems that are now under attack include the environment, the plant and animal food chain and humans themselves. When a bio-threat gets out of control in the urban setting, it may undermine infrastructure systems that we don’t even realize are interconnected (eg. e-coli contamination in Walkerton originating the town water system; the SARS outbreak in Toronto hospitals, originating from a traveler from China) (CFIA, 2004). This means that a single occurrence can quickly become a widespread threat to human health and life.

Levels Of Complexity

Levels of complexity make zoonotic emergencies particularly challenging to emergency response systems. In the 2004 Abbotsford, BC, Avian Flu incident the stakeholders could be clustered into four areas of interests as listed in Figure 1.

Figure 1: Abbotsford BC, Avian Flu Stakeholders

<p>Individuals</p> <ul style="list-style-type: none"> • Producers • Processors • Workers • Distributors • Retailers • Consumers 	<p>Bio-Experts</p> <ul style="list-style-type: none"> • Veterinarians • Medical Doctors, Nurses • Micro-Biologists • Laboratories (Local, BC, CA, WHO) • Animal Health (CAHC)
<p>Industry Groups</p> <ul style="list-style-type: none"> • 4 Feather Groups • Commercial, Free Range, Backyard • Breeders, Hatcheries • Marketing • Provincial • National 	<p>Government Agencies</p> <ul style="list-style-type: none"> • City • MAFF • Health Ministries • PEP • CFIA • WHO

An appropriate response needed to be developed not only for each of these human players, but also integrated with the at multiple levels of complexity occurring at the animal level as well. A cursory overview of the multiple scales of complexity includes:

- Micro-biotic
- Bio-physical / animal welfare
- Bio-region
- Individual/Family
- Industry /Economic eg. poultry production, processing, distribution, manufacture, retail

- City
- Province
- Nation
- Globe

With this level of complexity, the Mayor needs to ensure that the City or designated emergency response team establishes a “situation-room”. A “situation room” is a central command station for mapping, tracking and evaluating the complexities, and from which information, response options (defenses, solutions and/or resources) for combating and surviving the threat can be deployed. Response options at each level of complexity should be developed to match appropriate:

- Human and Animal Needs with Actions
- Vital Signs Triggers with Appropriate Responses

Communication

At the same time the Mayor needs communications strategies that define who should be communicating to whom through appropriate:

- Messages to the public, industry and other organizations and governments
- Questions to appropriate authorities, experts and responders

The Mayor can play a special role in communicating strategies that meet peoples’ core needs for individuals/families, industry and the city (at each level of complexity).

To remain responsive, coherent and adaptable, the Mayor needs to know the kinds of communication to direct and to whom.

Furthermore, by asking the right questions to the right authorities, the Mayor can ensure a coordinated checklist of resources/interventions is assembled to ensure that at a minimum these integral human resources (ie. those that address subjective, objective, intersubjective and interobjective needs) are made available in the emergency response team during the crisis and after. Resources are needed to support :

- Subjective needs: emotional, mental, spiritual
- Objective needs: economic, food, shelter, clothing
- Intersubjective needs: belonging, beliefs, relationships
- Interobjective needs: food preparation, clothing distribution, shelter systems, engineering, communication technology

An integral approach, recognizing all four of these needs at multiple levels of complexity is the only way to create sufficient resiliency for multiple stakeholders, to adapt to changing life conditions on both the micro and macro scales.

The recent conference on the Avian Flu 2004 incident in British Columbia, co-sponsored by the Canadian Food Inspection Agency, BC Government and Four Feather Groups (CFIA et al, 2004) invited speakers from the Netherlands, Texas, Toronto and Canadian Animal Health Agency who spoke to all of these issues, with vivid stories of post-emergency learnings .

Dr. Waelen (CFIA et al, 2004) related the experience of the Netherlands, where producers’ mental and physical health deteriorated both during and long after the 2003 avian flu outbreak had occurred in Holland. (As a measure of the severity of these personal effects, Dr. Waelen noted that several instances of farmer suicide are known.) She spoke of the basic economic needs

of key poultry producing areas, where farmers received no compensation for the loss of their flocks, and local economies were decimated.

Dr. Coats, Deputy Executive Director, Animal Health Programs, Texas Animal Health Commission (CFIA et al, 2004), speaking of the swift response to the 2004 Texas avian flu outbreak, emphasized the value of developing relationships with all the types of producers and distributors – including and especially with backyard flock owners and live bird markets. These phenomenon are culturally separate from the commercial flocks, but required respect and cooperation for the small producers, in order to effectively contain the potential threat of small operations to large operations. Even in BC, during the 2004 Avian Flu outbreak, backyard flock owners were attempting to protect valuable and/or “loved” birds by “smuggling” them out of the quarantine areas. Thus, anticipating a full range of human emotions can be major factors in effective emergency response.

Likewise, Dr. James Young, Commissioner of Emergency Management, Province of Ontario (CFIA et al, 2004) described the cultural interconnections that affected the 2003 SARS outbreak in Toronto, both from Asian travelers and immigrants and also a closely knit religious community. He also noted the recursive nature of the bio-threat, citing the professional, individual and system exhaustion that arose when the second outbreak occurred, just when Ontario thought they had put the emergency to rest. The SARS and post-SARS economic devastation to Toronto and Ontario (and other places in Canada) is well documented and still showing evidence of negative effects.

A final example in support of a four-way integral response to human needs, came from Matt Taylor, Executive Director of Canadian Animal Health Coalition (CAHC). He called for scenario planning and new creative approaches to a national animal health strategy. With the recurring frequency of BSE, foot and mouth disease, avian flu and other zoonotic diseases, world wide, Mr. Taylor made the case for developing new standards of animal health and changes to critical agricultural infrastructure, so that not only unnecessary animal deaths can be prevented, but threats to human health can also be avoided.

Designing Appropriate Emergency Responses

The Mayor should expect to receive regular and/or as required reports on the situation from the emergency response team (ERT) as set out in Appendices A, B and C.

The Mayor can use Appendix A2a to ensure that the scientific team are communicating as suggested. The Mayor can also use the list of questions to in Appendix A2b to ensure they are receiving appropriate answers from the scientists.

The Mayor should be aware of the ripple effects that can occur in the community, if the bio-threat causes a down-spiral from the higher levels of complexity to the lower levels of complexity as set out in Appendix B1a.

Probably the most important job for the Mayor in this type of emergency is to be aware of the communications strategy set out in Table 1. These are the messages Mayor and City staff should insure are being released to the public and media. It should be noted that the sequence of these messages corresponds to the level of urgency (and the level of complexity in the Appendix A, B, C maps). In Table 1 the highest number designates the most urgent message to local people.

Table 1: Messages to Deliver to the Public

Level of Urgency 8=Highly Urgent 1= Least Urgent	Key Messages	Targeted at these people/groups	Spoken by
8	This is an emergency situation. We have declared it an emergency and are sending you resources (food, water, medicine) so that you can survive and help others survive.	Individuals, families	Prime Minister Premier Mayor Faith Leaders
7	This is an emergency situation. We have declared it an emergency and are sending in the emergency teams to restore basic services, so you can create or restore a place where you feel safe and belong to.	Families, Neighbours, communities	Mayor PEP, OCIPEP, Local ERP Faith Leaders
6	We are gaining ground on this emergency situation. We are proud of how people have demonstrated such strength and resilience. Join us in celebrating in our heroes who have contributed so much to helping you and your family to survive this crisis and live another day.	Families Industry Community Leaders	Prime Minister Premier Mayor Councilors Media Local Leaders Faith Leaders
5	We have resources in place so we are able to support your family, neighbours and co-workers. We have organized resources to enable you to get back to work and return to normal as productive members of our community/society.	Industry Community Leaders Early Response Teams Local bankers, Market leaders	Mayor Councilors Media Local Leaders: Police, Medical, Education Infrastructure Engineers Faith Leaders
4	We are tracking this situation closely with experts. All the experts have been called in to monitor the situation as necessary. We have called on all our leaders to check with employees and workers to ensure our organizations are able to operate effectively and efficiently, even under these circumstances.	Regional & national financial markets operational ; multiple levels of law observed & maintained	Media Local, Regional, National, Industry Leaders Infrastructure Engineers Community Leaders
3	We have been in touch with all leaders from all the parts of our community. They have assured us that they are cooperating to look after everyone's needs so we have resources to share fairly, cooperatively and for the greatest good.	Industry & Community Leaders Success Teams Regional & national financiers, Market leaders Community leaders Labour Leaders	Media Local, Regional, National, Industry Leaders Infrastructure Engineers Community Leaders
2	We have been communicating with a wide network of regional, national and global experts. We have access to a global network of knowledge, expertise and science that will enable us to develop systems that will maintain	Regional & national industry leaders, financiers,	Global Media National & International Industry Leaders

	both local and global health to ensure long term local and global sustainability.	Market leaders Regional and national Community Coalitions Labour Leaders	Engineering Professions Community Coalitions
1	We are cooperating globally so we can harmonize global systems for the greatest local and global good. With increasing cooperation we are learning and implementing sustainable global systems.	Regional & national ecologists, industry leaders, financiers, Market leaders Regional and national Community Coalitions Labour Leaders	Global Media Global economic forums, Ecology Leaders International Industry Leaders Engineering Professions Global Communities of Practice/ Interest

The questions the Mayor (and other officials/staff) need to ask and answer (and their target audience) are set out below in Table 2.

Table 2: Questions to Ask @ 8 Levels of Situation Complexity

Level of Situation Complexity 1=low 8 = high	Key Questions	Targeted at these people/groups	Asked by
1	Who is doing the science on this situation? What do we know about the microbe? Who is doing the Petri dish work?	Chief veterinarian; Food Inspection Agencies; Disease Study Centres	Prime Minister Premier Mayor Councilors Media
2	How can we contain the microbe? What do humans do to protect themselves? Who needs emergency services?	Chief veterinarian; Food Inspection Agencies; Disease Study Centres Water, electrical infrastructure engineers	Mayor Councilors Media
3	What are our key assets? Where is the damage? How bad is the damage? What are our most pressing needs? How can we keep spirits high?	Industry Community Leaders Early Response Teams Water, electrical infrastructure	Mayor Councilors Media Regional Leaders, Police, Medical, Infrastructure

		engineers	Engineers
4	How can we restore infrastructure services? How can we restore order? How is the peace being kept?	Industry Community Leaders Early Response Teams Local bankers, Market leaders Community leaders Labour leaders	Mayor Councilors Media Local Leaders: Police, Medical, Education Infrastructure Engineers
5	How can we improve economic functioning? What markets have been affected? What financial compensation do we need? How do we support the labour/intellectual market? What can we do to prevent this another time?	Industry & Community Leaders Recovery Teams Local financiers, Market leaders Community leaders Labour Leaders	Media Local, Regional, National, Industry Leaders Infrastructure Engineers Community Leaders
6	What can we do to celebrate the whole community? How can we recognize our accomplishments in face of the crisis? How can we put safety nets in place to look after the common good better?	Industry & Community Leaders Cross-sectoral Partnerships Local financiers, Market leaders Community leaders Labour Leaders	Media Community Leaders Industry experts
7	How can we look at this situation systemically? What Vital Signs Monitors need to be in place? What does health look like on a global basis?	Regional & national ecologists, industry leaders, financiers, Market leaders Regional and national Community Coalitions Labour Leaders	Global Media Ecology Movements National & International Industry Leaders Engineering Professions Community Coalitions
8	What Global Vital Signs Monitors need to be in place? Who has responsibility for VSM? How do we maintain whole system global health ?	Bio-Regional & national ecologists, global industry leaders, financiers, Bio-Regional and international Coalitions Human systems experts	Global Media Global economic forums, Ecology Leaders International Industry Leaders Engineering Professions Global Communities

			of Practice/ Interest
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Implementing a Complex Adaptive Emergency Response Strategy

The maps in Appendices A, B and C can help Mayors realize the levels of complexity that are at play in a bio threat situation. A “one size fits all” communications strategy is not sufficient because so many levels of complexity arise with a bio-threat.

Every situation will require site and case specific knowledge. However, the mapping of the evolutionary patterns of complexity in these generic maps allow the Emergency Response Team (ERT) to use an appropriate level of complexity to develop an emergency response and to communicate effectively.

It is critical for the Mayor, to work with the ERT to involve multiple sectors of the community in the response. The Mayor will have special insight, contacts and knowledge to obtain representation from organizations who have the vested interests or deep expertise in serving the needs summarized as set out in Table 4 below.

Use and implementation of this model can start at any stage of a bio-emergency, because the levels of complexity mapped here are evolutionary. The basic steps for a bio-emergency threatening a food source (like avian flu) are:

1. Post the maps in the Emergency Response “situation room”.
2. Develop your interdisciplinary meta-team to observe the meta-connections amongst maps.
3. Locate the level of complexity which the Bio Experts report (Appendix A1a).
4. Request the appropriate Bio Expert communication strategy (Appendix A2a).
5. Locate the appropriate Individual / Family needs (Appendix B1a).
6. Request the appropriate Individual/Family communication strategy (Appendix B2a).
7. Locate the appropriate Industry needs (Appendix C1a).
8. Request the appropriate Industry communication strategy (Appendix C2a).
9. Develop, implement and coordinate a strategy for each scale of the issue, mapping the stages and direction of change as you go.
(It should be noted that Mayor and Media may find the maps help to organize the chaos of the stories, anecdotes and news as it emerges during the emergency situation.)
10. Meta-track the interconnections and develop strategies to address the unpredictabilities and/or feedback loops and/or hypercycles.

A meta-tracking map might map the various scales and the emergent complexities like Table 3.

Table 3: Meta-tracking Map

Level of Complexity	Micro-biotic	Animal	Bio-Region	Individual / Family	Industry	City	Province Nation Global
1							
2							
3							
4							
5							

6							
7							
8							

It is critical to involve multiple sectors of the community in the response. An integral approach to ensuring such participation is to seek representation from organizations who have vested interests or deep expertise in serving the needs summarized in Table 4.

Table 4: Integrated Community Emergency Response Team

Needs	Examples	Organizations on ER Team
Subjective needs	emotional, mental, spiritual	Trauma specialists Grief Counselors Learning & Education Institutions Spiritual & Religious Orgs. Cultural & Ethnic Orgs.
Objective needs	food, shelter, clothing, economic, medical	Emergency Response Teams (fire, medical, police) Salvation Army Red Cross Food, energy, water producers, processors, suppliers Hospitals, Doctors, Nurses Healers Health & Wellness Experts Academic and Private Scientists Economists, Financiers
Intersubjective needs	belonging, beliefs, relationships	Change Facilitators Spiritual & Religious Orgs. Arts & Culture Orgs. Team Building Orgs (Trainers, Facilitators) Law & Order Justice & Governance specialists Lawyers Communications & Media specialists Emergency Response Teams (fire, medical, police) Social Workers
Interobjective needs	food preparation, clothing distribution, shelter systems, engineering, communication technology, economic development	3 Levels of Government City Infrastructure Telecommunications Chamber of Commerce Economic Developers Business Leaders Science & Technology leaders Environment & Ecology specialist Infrastructure Specialist: Heat, Light, Power Transportation Orgs.

Summary

A community threatened by a bio-emergency requires a complex adaptive communication response model. It should deliver appropriate action strategies and communication strategies for multiple stakeholders at multiple levels of complexity. The Mayor and staff can play a critical role in ensuring appropriate strategies are developed, managed, implemented and coordinated amongst various governance structures and for profit and NFP sectors, on behalf of both human and animal health.

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- Don Beck, PhD, Founder National Values Center, Spiral Dynamics Integral
- Anita M. Burke, International Sustainable Development Thought Leader; Managing Director - The Catalyst Institute; Former EVP Shell International - Sustainable Development and Climate Change
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Appendix A,B,C Summary

Maps for Designing Complex Adaptive Emergency Responses

The following Appendices set up maps for emergency response teams to frame their bio-emergency issues, gather resources and deploy their expertise. By printing and placing these in an emergency “situation room” the emerging conditions can be monitored, tracked and influenced.

These scalar maps are correlated to each other through all levels of complexity. As a general rule on each map, each level of complexity transcends and includes **ALL** the lower levels of complexity. However, the maps and scales are ***not*** connected solely in a horizontal or linear manner but are massively intertwined and entangled at all levels of complexity. Thus changes in one map will have ripple effects to many (if not all) others. The tracking of these ripple effects needs to be monitored at a meta-level by a special meta-team who monitor the direction of emergency response and activity and identify other chaotic effects arising from changing life conditions as noted above (eg. feedback loops, butterfly effects, emergent conditions).

For the purpose of illustration, this model demonstrates four maps for three Stakeholder Groups and three scales:

- A. Bio-Experts (Micro-biotic focus)**
- B. Individuals; and**
- C. Industry.**

Appendix A focuses on the issues faced by the Bio-Experts related to the Microbiotic Scale. Appendix A1a summarizes the Micro-biotic Indicators and Emergency Responses at six+ levels of complexity. Table A1b summarizes the Anti-biotic Strategies & Vital Sign Triggers for New Action.

Appendix A2a summarizes the Communications relevant to each level of complexity related to Messages to release to various publics. Appendix A2b summarizes Key Questions for Elected Officials and their Target Respondents.

Appendix B focuses on the Individual and Family Scale. Appendix B1a identifies Needs, Resources, Outcomes and Indicators of Recovery and Emergency Responders. Appendix B1b Strategies & Vital Sign Triggers for New Action.

Appendix B2a summarizes the Communications relevant to each level of complexity related to Messages to release to various publics. Appendix B2b summarizes Key Questions for Elected Officials and their Target Respondents.

Appendix C focuses on the Industry Scale. Appendix C1a identifies Needs, Resources, Outcomes and Indicators of Recovery and Emergency Responders. Appendix C1b Strategies & Vital Sign Triggers for New Action.

Appendix C2a summarizes the Communications relevant to each level of complexity related to Messages to release to various publics. Appendix C2b summarizes Key Questions for Elected Officials and their Target Respondents.

Appendix A: Bio-Expert Issues Related to Micro-biotic Scale

Appendix A1a: Micro-biotic Indicators & Responses @ 6+ Levels of Complexity

Indicators @ Increasing Levels of Complexity	Key Strategies of Microbe	Microbe Strength (Resonance/ Resistance)	Microbe Coherence / Connection with other Scales	Microbe Adaptability (Emergence / Resilience)	Human Emergency Response
1	Substrate / habitat on which to survive	Survival of microbe	Resilience and adaptation to life conditions	Evolution and reproduction	Contain Eradicate habitat
2	Expanded capacity to access more substrate	Multiplication of microbe	Increased capacity to adapt; mutation	Continued evolution and/or accelerated reproduction	Expand Containment Eradicate Quarantine Develop immunity
3	Continued expansion of capacity to access more substrate	Gaining strength of microbe	Microbe becomes systemic and endemic	Microbe adapts cooptive capacity to use/co-evolve with other microbes	Enforced Containment Eradicate Quarantine
4	Microbe develops multiple strategies for mobility and survival	Exponential expansion of microbial territory	Microbe highly contagious and virulent	Microbe's speed and capacity to change exceeds counter-measures	Enforced Containment Eradicate Quarantine ++ Develop immunity, vaccine Coevolve
5	Microbe reappears in another location – go back to level 1 and repeat at local level				
6	Microbe appears in multiple global pandemic – go back to level 1 and repeat at global level				
7	na				
8	na				

Appendix A1b: Anti-biotic Strategies & Vital Sign Triggers for New Action @ 4+ Levels of Complexity

Indicators @ Increasing Levels of	Key Response Strategy	Intended Outcome	Effects on Microbe &/or Environment	Microbe Indicator of Downshift to	Vital Sign Trigger for New Action

Complexity				Lesser Virulence	
1	Anti-biologic strategy	Destruction of microbe	Inability to adapt to environment	Inability to reproduce	Linear growth
2	Anti-biologic strategy	Reduction of microbe	Destruction / consumption of substrate	Reduction of ability to reproduce	Exponential growth
3	Anti-biologic and anti-substrate strategy	Weakening of microbe	Reduction/elimination of substrate	Stop microbe reproduction	Destruction of substrate on exponential scale endangering local ecosystem
4	Multi-system containment	Systemic elimination of microbe or habitat	Microbe eliminated at high cost to human population	Human system adapts or suffers/dies	Develop immunity, vaccine Co-evolve
5	tbd				
6	tbd				
7	tbd				
8	tbd				

Appendix A2a: Communication Strategies for Elected Officials @ 8 Levels of Complexity

Level of Complexity	Key Messages	Targeted at these people/groups	Spoken by
1	We are examining the features of this microbe to learn about its basic life conditions.	Government Leaders	Chief Vet Senior Scientists
2	We know this microbe belongs to this class of microbe: x Or We've never seen this microbe before and need to study it further	Chief Vet Senior Scientists	Global Disease Control
3	We are proud to announce that x (persons, scientists, countries) are racing against time to learn how to combat this microbe.	Media	Scientific community: private, govt, academia Global Disease Control
4	We are organizing all the scientific resources we can bring to bear on this problem to develop a solution.	Media Public	Governments
5	Here is the solution and how to look after yourself and your organization so our community, nation and economy can survive effectively and efficiently.	Mayor Councilors Media Local Leaders: Police, Medical, Education Infrastructure Engineers	Government Scientists

6	Now we know what we must do together to help our country/region to recover from this bio attack. We will cooperate to help create responsible institutions so this doesn't happen again.	Mayor Councilors Media Local Leaders: Police, Medical, Education Infrastructure Engineers	Government Scientists Industry & Community Leaders Recovery Teams
7	We have the knowledge for us to design systems to prevent recurrence, support recovery and develop protection against similar microbial attacks. This is what we must so our global food production systems can be healthy.	Global Media National & International Industry Leaders Engineering Professions Community Coalitions	Global Disease Control Government Scientists Industry & Community Leaders Recovery Teams
8	It is time that we recognized the massive interdependence of global food production, processing and distribution systems. Let's harmonize global food systems for the greatest local and global good.	Global Media National & International Industry Leaders Engineering Professions Community Coalitions	Global Disease Control Government Scientists Industry & Community Leaders Recovery Teams

Appendix A2b: Key Questions for Elected Officials @ 8 Levels of Complexity

Level of Complexity	Key Questions	Respondents	Inquirers
1	Who is the world expert on this microbe? What do we know about the microbe? Who is doing the Petri dish work? How does it spread?	Global Disease Control	Chief Vet Senior Scientists
2	How can we contain the microbe? What are its multiple contagion strategies? Eg. air, water, touch, body fluids, etc. What do humans do to protect themselves? Who needs emergency services? Who has emergency services? Who wants to study this microbe? Who has related experience in studying this microbe? Who has a track record of breakthroughs in new research?	Global Disease Control Scientists /labs around the globe	Chief Vet Senior Scientists Global Disease Control
3	What are our key insights? About microbe's information, energy, matter, replication systems? What scientific capacities do we need? How can we accelerate the study? Who is most desperate? How bad is the current epidemiological damage? What is most critical to discover? Who is paying? How much?	Scientific community: private, govt, academia Global Disease Control	Scientific community: private, govt, academia Global Disease Control

	What will the recognition be?		
4	How can we protect ourselves? What do we need to start/stop doing? How can we maintain/restore order? How do we prevent/overcome fear? How is the peace being kept?	Government Scientists	Mayor Councilors Media Local Leaders: Police, Medical, Education Infrastructure Engineers
5	How can we improve protection and/or prevention? What regions/sectors have been affected? What financial compensation and/or other resources do we need to fight this? What can we do to prevent this situation another time?	Government Scientists Industry & Community Leaders Recovery Teams	Mayor Councilors Media Local Leaders: Police, Medical, Education Infrastructure Engineers
6	What can we do to celebrate how this community survived this attack? How can we prevent a recurrence? How can we recognize our accomplishments in face of the crisis? How can we put safety nets in place to look after the common good better?	Industry & Community Leaders Cross-sectoral Partnerships Local financiers, Market leaders Community leaders Labour Leaders	Media Community Leaders Industry experts Mayor Councilors Media Local Leaders: Police, Medical, Education Infrastructure Engineers
7	How can we look at this food production situation systemically? What Vital Signs Monitors need to be in place to ensure its health and the health of the human population? What does health look like on a global basis at multiple levels of scale?	Global Disease Control Government Scientists Industry & Community Leaders Recovery Teams	Global Disease Control Government Scientists Industry & Community Leaders Recovery Teams
8	What Global Vital Signs Monitors need to be in place? Who has responsibility for VSM? How do we maintain and improve whole system global health ?	Global Disease Control Government Scientists Industry & Community Leaders Recovery Teams Bio-Regional & national ecologists, global industry leaders, financiers, Bio-Regional and international	Global Media Global economic forums, Ecology Leaders International Industry Leaders Engineering Professions Global Communities of Practice/ Interest

		Coalitions Human systems experts	
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Appendix B. Human Individual/Family Scale

Appendix B1a: Human Individual/Family Needs@ 8 Levels of Complexity

Level of Complexity Indicators	Key Needs	Target Standards for Resources	Intended Outcome	Indicators of Recovery/ Restored Balance	Emergency Responder
1	Water, air, nutrition, anti-bio disinfectants	1-4 L /day, breathable air, x calories/day, first aid kit	Some have sufficient, others suffering	Survival, immune system responds	Family &/or Neighbour checks, visits, OCIPEP via military assistance
2	Food, clothing, Shelter from Climate, environment	Food, clothing shelter for 1-3 days	Enough food, Clothing, Shelter for 7 days	Self-sufficient for food, clothing, shelter	Deliver/drop water, emergency rations, meds clothing, Shelter ; Food Bank; PEP via military assistance
3	Neighbourhood able to access & prepare / maintain food, clothing shelter for family needs	Family needs met month to month	Individuals & family have energy to focus beyond emergency to re-assert personal interests & intentions	Barter and/or local economy able to supply food, clothing, shelter	Support as needed via military assistance; organize to restore infrastructure
4	Basic economy of exchange for town, city enabling local market exchanges of commodities & goods	Local banking, markets operational ; rule of law established	Water, food, medical, market and basic government systems operational including medical & school systems	Predictable life conditions restored; greater opportunities for local service exchanges & more distant goods exchanges	Regional and national support as needed to restore basics to local law & order and economy
5	Regional & national economies for of commodities, goods & services in operation	Regional & national financial markets operational ; multiple levels of law observed & maintained	Complex government systems operational including justice, social, medical & education systems; international trade restored	Economic value creation restored; Conditions for success and wealth restored; entrepreneurship, innovation and quality standards implemented	Local & regional economy re-adapted to larger economic system and creating value in it; national justice system in operation
6	Fairness, sharing and cooperation for the distribution of economic gains;	Acceptance of differences; recognition of the value of diversity of means	All groups feel they are being treated equally in key economic and social systems	Shared decision processes; expanded opportunities to learn from	Restore order; monitor fairness through accountability reporting; transparent,

	availability of services and public property		and issues	differences	responsible governance; if necessary separate factions
7	Efficient, effective, eco-friendly economic and development systems	Each and all appropriately participate in economy to suit circumstances & ecosystem	Multiple co-existing, complementary process, products, communications	Highly complex & sophisticated systems for individual and social benefit	Representation and activity at global level to ensure access to and emergence in the global system
8	Systems of systems of economy and ecology operating at a global level of balance and self-organizing recycling and stability	International agreements about commitments for maintaining the health of the planet	Global economies and ecologies appropriate to each of the 17 habitats within the global system	Planetary thriving	Vital Signs Monitors for all to see and correct on; whole global systems for resonance, coherence and emergence

Appendix B1b: Human Individual/Family Threats, Responses & Triggers @ 8 Levels of Complexity

Indicators @ Increasing Levels of Complexity	Key Response Strategy	Intended Outcome	Effects on Individual &/or Family Environment	Indicator of Downshift to Lesser Capacity	Vital Sign Trigger for New Action
1	Isolation	Dehydration, Infection, starvation	Survival basics not available, esp. water	Illness, death	Move out of danger zone
2	Family, group fragmentation	Family disintegrates, Scavenging, homelessness	Survival basics not available, esp. food	Dependent on others for handouts	Scale/time of Handouts exceeds short term
3	Local disagreement, in-fighting	Disobedience to emergency response protocols; thieving	Rival factions; looting	Fighting between gangs, factions	Destruction of basic needs for local survival
4	Clashes and/or lack of cooperation between local economies	Revolt against rules set by higher authorities, eg. province, feds	Lack of cooperation between local economies and/or by individuals to support the system	Open revolt; passive aggressive behavior; refusal to cooperate; fundamentalisms	Civil disobedience threatening rule of law
5	Regional isolation	Guerilla , tactical warfare	Manipulation of economy to ensure some individuals or groups succeed while others are exclude or ignored	Every person for themselves, hoarding, nepotism;	Black market, underground, manipulation, coercion, illegal international cartels
6	Denial of the common good	Dissonance, disagreement,	Impatience with decisions	Holier than thou factions	Infighting, emotional

	One size fits all; Inability/refusal to see the mix of individual needs	judgment, stereotyping	on behalf of common good; cooperative civil disobedience		blackmail, public embarrassment
7	Pollution, ignorance of global interconnections on multiple systemic levels	Survival of some ecosystems at expense of others	More complex ecosystems threaten health of less complex systems or vice versa	Instability and/or downshifting of complex systems to lower levels of complexity	Failure of global system basics on which human economy and wellness depend; esp. water, air, food, immunity
8	Global system breakdown eg. ocean temperature, bio-threat, meteoric invasion	Self-organizing adaptiveness is prevented or disturbed	Ripple effect to all lower levels of complexity	Downshift to less than whole planet resilience	Disturbance to any major ecosystem in any of 17 habitats

Appendix B2a: Communication Strategies for Elected Officials @ 8 Levels of Complexity

Level of Complexity	Key Messages	Targeted at these people/groups	Spoken by
1	This is an emergency situation. We have declared it an emergency and are sending you food, water, medicine so that you can survive help others survive.	Individuals, families	Prime Minister Premier Mayor Faith Leaders
2	This is an emergency situation. We have declared it an emergency and are sending in the emergency teams to restore basic services, so you can create or restore a place where you feel safe and belong to.	Families, Neighbours, communities	Mayor PEP, OCIEPEP, Local ERP Faith Leaders
3	We are gaining ground on this emergency situation. We are proud of how people have demonstrated such strength and resilience. Join us in celebrating in our heroes who have contributed so much to helping you and your family to survive this crisis and live another day.	Families Industry Community Leaders	Prime Minister Premier Mayor Councilors Media Local Leaders Faith Leaders
4	We have resources in place so we are able to support your family, neighbours and co-workers. We have organized resources to enable you to get back to work and return to normal as productive members of our community/society.	Industry Community Leaders Early Response Teams Local bankers, Market leaders	Mayor Councilors Media Local Leaders: Police, Medical, Education Infrastructure Engineers Faith Leaders
5	We are tracking this situation closely with experts. All the experts have been called in to monitor the situation as necessary. We have called on all our leaders to check with employees and workers to ensure our organizations are able to operate effectively and efficiently, even under these circumstances.	Regional & national financial markets operational ; multiple levels of law	Media Local, Regional, National, Industry Leaders Infrastructure

		observed & maintained	Engineers Community Leaders
6	We have been in touch with all leaders from all the parts of our community. They have assured us that they are cooperating to look after everyone's needs so we have resources to share fairly, cooperatively and for the greatest good.	Industry & Community Leaders Success Teams Regional & national financiers, Market leaders Community leaders Labour Leaders	Media Local, Regional, National, Industry Leaders Infrastructure Engineers Community Leaders
7	We have been communicating with a wide network of regional, national and global experts. We have access to a global network of knowledge, expertise and science that will enable us to develop systems that will maintain both local and global health to ensure long term local and global sustainability.	Regional & national industry leaders, financiers, Market leaders Regional and national Community Coalitions Labour Leaders	Global Media National & International Industry Leaders Engineering Professions Community Coalitions
8	We are cooperating globally so we can harmonize global systems for the greatest local and global good. With increasing cooperation we are learning and implementing sustainable global systems.	Regional & national ecologists, industry leaders, financiers, Market leaders Regional and national Community Coalitions Labour Leaders	Global Media Global economic forums, Ecology Leaders International Industry Leaders Engineering Professions Global Communities of Practice/ Interest

Appendix B2b: Human Individual/Family Key Questions @ 8 Levels of Complexity

Level of Complexity	Key Questions	Respondents	Inquirers
1	Who is doing the science on this situation? What do we know about the microbe? Who is doing the Petri dish work?	Chief veterinarian; Food Inspection Agencies; Disease Study Centres	Prime Minister Premier Mayor Councilors Media
2	How can we contain the microbe? What do humans do to protect themselves? Who needs emergency services?	Chief veterinarian; Food	Mayor Councilors Media

		Inspection Agencies; Disease Study Centres Water, electrical infrastructure engineers	
3	What are our key assets? Where is the damage? How bad is the damage? What are our most pressing needs? How can we keep spirits high?	Industry Community Leaders Early Response Teams Water, electrical infrastructure engineers	Mayor Councilors Media Regional Leaders, Police, Medical, Infrastructure Engineers
4	How can we restore infrastructure services? How can we restore order? How is the peace being kept?	Industry Community Leaders Early Response Teams Local bankers, Market leaders Community leaders Labour leaders	Mayor Councilors Media Local Leaders: Police, Medical, Education Infrastructure Engineers
5	How can we improve economic functioning? What markets have been affected? What financial compensation do we need? How do we support the labour/intellectual market? What can we do to prevent this another time?	Industry & Community Leaders Recovery Teams Local financiers, Market leaders Community leaders Labour Leaders	Media Local, Regional, National, Industry Leaders Infrastructure Engineers Community Leaders
6	What can we do to celebrate the whole community? How can we recognize our accomplishments in face of the crisis? How can we put safety nets in place to look after the common good better?	Industry & Community Leaders Cross-sectoral Partnerships Local financiers, Market leaders Community leaders Labour Leaders	Media Community Leaders Industry experts
7	How can we look at this situation systemically? What Vital Signs Monitors need to be in place? What does health look like on a global basis?	Regional & national ecologists, industry leaders, financiers, Market leaders Regional and national Community	Global Media Ecology Movements National & International Industry Leaders Engineering Professions Community

		Coalitions Labour Leaders	Coalitions
8	What Global Vital Signs Monitors need to be in place? Who has responsibility for VSM? How do we maintain whole system global health ?	Bio-Regional & national ecologists, global industry leaders, financiers, Bio-Regional and international Coalitions Human systems experts	Global Media Global economic forums, Ecology Leaders International Industry Leaders Engineering Professions Global Communities of Practice/ Interest

Appendix C: Industry Scale (eg. production, processing, distribution, manufacture, retail)

Appendix C1a: Industry /Economy Needs @ 8 Levels of Complexity

Level of Complexity Indicators	Key Needs	Target Standards for Resources	Intended Outcome	Indicators of Recovery/ Restored Balance	Emergency Responder
1	See Human Individual/ Family	See Human Individual/ Family	See Human Individual/ Family	See Human Individual/ Family	See Human Individual/ Family
2	See Human Individual/ Family	See Human Individual/ Family	See Human Individual/ Family	See Human Individual/ Family	See Human Individual/ Family
3	See Human Individual/ Family	See Human Individual/ Family	See Human Individual/ Family	See Human Individual/ Family	See Human Individual/ Family
4	Urban infrastructure functioning. Basic access to raw materials, supplies, collection, processing & distribution infrastructure Labour Financing	Local trade, banking, markets operational ; rule of law established	Management, Labour otj Maintenance of urban, transportation, energy, communication infrastructures	Able to meet and/or exceed target processing and production	Regional and national support as needed to restore basics to local economic infrastructure
5	Urban infrastructure operational at high level. Regional & national trade operational for raw materials, supplies, collection, processing & distribution. Financing and transportation functioning. Labour Financing commodities, goods & services in operation	Science & technology accessible for evaluation, prevention and innovation. Regional & national financial markets operational ; multiple levels of law observed & maintained	Complex trade and government systems operational including justice, social, medical & education systems; international trade operational	Economic value being delivered; Conditions for success and wealth delivering results; Entrepreneurism, innovation and quality standards operational.	Local & regional economy re-built to higher standard, creating new values and competitive edge. National finance, services and justice system in operation
6	Cooperation, coalitions and collaboration for the distribution of economic resources. Creation of services and	Recognition and encouragement of cross-sectoral agreements. Industry self-policing.	All organizations see opportunities and roles to play in supporting economic and social issues.	Shared decision processes; forums, coalitions; public ownership.	Restore order; monitor fairness through accountability reporting; transparent, responsible governance.

	public property				
7	Industry takes responsibility for efficiency, effectiveness, eco-friendliness, and economic and developmental systems	Multiple organizations, industries, sectors appropriately participate in economy to suit circumstances & ecosystem	Multiple party, multiple level, multiple complexities co-existing, complementary processes, products, communications	Highly complex & sophisticated systems for organization, industry and social benefit	Collaborations and activity at global level to ensure access to resources and success in the global system
8	Systems of systems of economy and ecology operating at a global level of balance and self-organizing recycling and stability	International agreements about commitments for maintaining the health of the planet	Global economies and ecologies appropriate to each of the 17 habitats within the global system	Planetary thriving at all levels of the ecosystem	Vital Signs Monitors for all to see and correct on; whole global systems for resonance, coherence and emergence

Appendix C1b: Industry /Economy Threats, Responses & Triggers @ 8 Levels of Complexity

Indicators @ Increasing Levels of Complexity	Key Response Strategy	Intended Outcome	Effects on Industry &/or Environment	Indicator of Downshift to Lesser Capacity	Vital Sign Trigger for New Action
1	See Human Individual/Family	See Human Individual/Family	See Human Individual/Family	See Human Individual/Family	See Human Individual/Family
2	See Human Individual/Family	See Human Individual/Family	See Human Individual/Family	See Human Individual/Family	See Human Individual/Family
3	See Human Individual/Family	See Human Individual/Family	See Human Individual/Family	See Human Individual/Family	See Human Individual/Family
4	Clashes and/or lack of cooperation between infrastructure maintenance (eg. energy, water, waste disposal), producers, processors	Revolt against rules set by higher authorities, eg. province, feds; undermining of protocols	Lack of cooperation between local producers or processors	Strikes Closed shops Poaching labour, supplies, materials	Inability to deliver key products to market
5	Urban infrastructure breaks down and/or ceases. Regional processing and production breaks down and/or ceases. Science and	Unfair competition. Cornering markets. Short term thinking. Tactical warfare	Manipulation of economy to ensure some organizations, industries, and/or sectors succeed while others are excluded or ignored	Every company for themselves, raw materials hoarding, Under the table agreements	Black markets, underground, manipulation, coercion, illegal international cartels

	technology not available for evaluation, prevention or adaptive innovation.				
6	Criticism of the common good Policies tend to be one size fits all regardless of differences; Inability/refusal to see the mix of different industry needs	At industry level: professional /expert dissonance, disagreement, judgment, stereotyping	Public criticism of decisions on behalf of common good; cooperation to thwart protocols and get around agreements.	Industry and organization denial of wrongdoing.	Refusal to cooperate; strikes by service and/or knowledge sector; Social services blackmail, public embarrassment of government wrongdoing
7	Pollution, blindness to global interconnections on multiple systemic levels	Survival of some organizational and industry systems at expense of others	More complex economic systems threaten health of less complex systems or vice versa	Instability and/or downshifting of complex industrial systems to lower levels of complexity	Failure of global system basics on which human economy and wellness depend; esp. water, air, food, immunity
8	Global system breakdown eg. ocean temperature, bio-threat, meteoric invasion	Self-organizing adaptiveness is prevented or disturbed	Ripple effect to all lower levels of complexity	Downshift to less than whole planet resilience	Disturbance to any major ecosystem in any of 17 habitats

Appendix C2a: Communication Strategies for Industry @ 8 Levels of Complexity

Level of Complexity	Key Messages	Targeted at these people/groups	Spoken by
1	This is an emergency situation. We are sending in basic help so that you and your organization can survive.	Organization Leaders, Employees	Prime Minister Premier Mayor Ec Devt Officer
2	We stand beside you in this emergency situation. We have a proud history in our region, organizations, industry. We care about all that we have worked so hard to create for the benefit of our community and our families. We will look after industry so you can create or restore a place where you feel safe to do business.	Org Leaders	Industry Leaders Org. Peers in other Regions Mayor PEP, OCIPEP, Local ERP
3	Eat Chicken!! Eat Turkey!! Let's show the world that this region's (eg. Fraser Valley's) poultry is the healthiest, best quality in the nation/world. We join your celebrations of the value and energy in your business/organization. You and your employees should be proud of the strength	Industry Leaders Org. Leaders Community Leaders	Industry Leaders Peer Industry Leaders Prime Minister Premier Mayor Councilors

	that you have demonstrated in the face of this crisis and live to enjoy working today and tomorrow.		Media Local Peer Leaders Faith Leaders
4	This is a healthy industry who totally supports healthy, high quality production and processing. We will support our industry 100%. We will stand by you to help make your business/organization successful again. We depend on what your organization and people contribute to the industry and the economy.	Org. Leaders Local bankers, Market leaders	Industry Leaders Org. Leaders Local bankers Mayor Councilors
5	Our customers are our greatest concern. Our products meet their high standards and expectations. We have a healthy product/industry which meets the highest standards – bar none. We can compete with other food products/industries and be proud of our record of success. We are doing everything we can to help you look after yourself and your organization so our local economy can survive and return to a healthy state.	Org. Leaders Local bankers, Market leaders	Regional & national financial markets Industry Leaders Org. Leaders Local bankers Industry
6	Our food products support the best of everything that matters in our community. We care about the health of our children, youth, families, senior, community supporters. We look after each other so everyone is better off. We share resources fairly, cooperatively and for the greatest good.	Industry & Community Leaders Success Teams Regional & national financiers, Market leaders Community leaders Labour Leaders	National & regional government leaders Mayor Regional & national financial markets Industry Leaders Org. Leaders Regional bankers Industry
7	We take responsibility for the health of our food system and how it contributes to local and global health. We take responsibility for looking after ourselves and all the related organizational systems of which our organization is part of so both our local and global systems can survive and thrive.	Regional & national industry leaders, financiers, Market leaders Regional and national Community Coalitions Labour Leaders	Global Media National & International Industry Leaders Engineering Professions Community Coalitions
8	We share our knowledge, experience and research about what makes the world a healthier place. Let's look after each other on an organizational and governance system level so we can harmonize global systems for the greatest global good.	Regional & national ecologists, industry leaders, financiers, Market leaders Regional and national Community Coalitions Labour Leaders	Global Media Global economic forums, Ecology Leaders International Industry Leaders Engineering Professions Global Communities of Practice/ Interest International Faith Leaders

Appendix C2b: Industry /Economy Key Questions @ 8 Levels of Complexity

Level of Complexity	Key Questions	Respondents	Inquirers
1	Who is doing the science on this situation? What do we know about the microbe? Who is doing the Petri dish work?	Org Scientists Internal & External	Org Leaders Industry Media
2	How can we contain the microbe? What do humans do to protect themselves? Who needs emergency services? How will this affect citizens, clients, markets? Who knows about this? Who should know about this?	Chief veterinarian; Food Inspection Agencies; Disease Study Centres Water, electrical infrastructure engineers Org Scientists Internal & External	Org Leaders Industry Media Mayor Councilors Media
3	What are our key assets? Where is the damage? How bad is the damage? What are our most pressing organizational needs? How can we keep spirits high?	Industry Community Leaders Team Leaders Water, electrical infrastructure engineers	Industry Leaders Org. Leaders
4	How can we restore infrastructure services? How can we restore production? How can we ensure labour supply? How can we restore order? How is the peace being kept?	Managers Supervisors Team Leaders Labour leaders	Industry Leaders Org. Leaders Local bankers Industry
5	How can we improve economic functioning? What markets have been affected? What financial compensation do we need? How do we support the labour/ knowledge markets? What can we do to prevent this another time?	Managers Supervisors Team Leaders Labour leaders Employees Engineers	Industry Leaders Org. Leaders Local bankers Industry Engineering Profession
6	What can we do to celebrate the whole industry in this community? How can we recognize our accomplishments in face of the crisis? How can we put safety nets in place to look after the common good better?	Industry & Community Leaders Cross-sectoral Partnerships Local financiers, Market leaders Community leaders Labour Leaders	National & regional government leaders Regional & national financial markets Industry Leaders National/internati onal bankers
7	How can we look at this situation systemically? What Vital Signs Monitors need to be in place? What does organizational health look like on a	Regional & national ecologists,	Global Media Ecology Movements

	global basis?	industry leaders, financiers, Market leaders Regional and national Community Coalitions Labour Leaders	National & International Industry Leaders Engineering Professions Community Coalitions
8	What Global Vital Signs Monitors need to be in place? Who has responsibility for VSM? How do we maintain whole system global health ?	Bio-Regional & national ecologists, global industry leaders, financiers, Bio-Regional and international Coalitions Human systems experts	Global Media Global economic forums, Ecology Leaders International Industry Leaders Engineering Professions Global Communities of Practice/ Interest / Faith