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## Report of incident management in crisis

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# 1 Executive Summary

## 1.1 The project

The CascEff project started on April 1, 2014 and runs for 36 months. The project concerns modelling of dependencies and cascading effects for emergency management in crisis situations. The project aims to significantly improve the ability of Incident Commanders to manage complex incidents by improving our understanding of initiators, dependencies and key decision points through the use of the proposed Incident Evolution Tool.

The CascEff consortium consists of eleven beneficiaries, of which SP Sveriges Tekniska Forskningsinstitut AB (SP) is the lead beneficiary. Contributing beneficiaries are Lunds universitet (ULUND), Sweden; Myndigheten för samhällsskydd och beredskap (MSB), Sweden; Universiteit Gent (UGent) Belgium; Institut National de l'Environnement et des Risques (INERIS), France; Service Public Federal Interieur (KCCE), Belgium; Safety Centre Europe BVBA (SCE), Belgium; Université de Lorraine (UL), France; University of Leicester (ULEIC), United Kingdom; Northamptonshire County Council (NFRS), United Kingdom, and; E-Semble BV (ESM), Netherlands.

The CascEff project is divided into seven Work Packages (WPs). This is the second deliverable of WP1 and constitutes of a report on incident management in crisis.

## 1.2 Results

This deliverable builds on three data gathering efforts; a workshop on practices and variations<sup>3</sup>; a survey on intra- and inter-organisational enablers and challenges, and a questionnaire on legal and ethical aspects.

The results indicate that incident management share a number of commonalities and diversities generating generic enablers and challenges, both within and between organisations. Examples of enablers are social networks, working together on a daily basis and collaborative field work. Examples of challenges are joint perspectives, judgement, analysis, information management and a proactive approach. A few additional challenges seem to mostly affect work across organisational borders. These concern familiarity and knowledge about other organisations, and dealing with the incident in terms of information management and decision making.

The results further suggest that any incident can develop into displaying cascading effects. Such effects are highly probable during natural disasters and major accidents. Managing incidents with cascading effects involves modifying incident management. Such modification can be divided into two categories; before an incident has occurred concerning the risk for cascading effects, and during an incident concerning the risk for or actual cascading effects.

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<sup>3</sup> See CascEff deliverable D1.1



Challenges associated with cascading effects involve peoples' ability to identify, understand and deal with the unexpected in a proactive manner, as well as creating and maintaining regular and reliable incident command and training systems to support this ability.

A mechanism for collaborative and joint response exists in all countries described in the responses to the questionnaire about legal and ethical issues.<sup>4</sup> These mechanisms exist both between rescue agencies in different municipalities and within their own countries, as well as with neighbouring countries and other EU-member states. Legal and ethical issues are addressed in bilateral agreements, although the level of detail of these agreements may differ from country to country. Some of the responses to the questionnaire indicate language, common operating procedures and communication protocols as potential issues.

### **1.3 Conclusions**

Three conclusions are drawn concerning incident management in general. The first conclusion is that the total ability of the constellation of actors which in the end determines how successful incident management can be. The second conclusion is that such joint ability requires instant interoperability. The third conclusion is that in order to achieve such instant interoperability the community of incident management needs to embrace both standardisation and a culture of understanding the perspectives of others.

Three conclusions are drawn also concerning incident management involving cascading effects. The first conclusion is that actors need to be aware of the full picture to be able to prepare for and contribute efficiently to a joint effort of incident management. The second conclusion is that actors need to be prepared to considerably add resources to the monitor and communicate with other actors. The third conclusion is that crisis communication needs to be prepared to explain the rationale behind some measures, especially when measures may appear to be uncalled for.

Finally three conclusions are drawn with regard to collaborative and cross-country response to escalating incidents. First, in general countries seem to maintain the capacity for both providing and receiving assistance for escalating incidents, both from their neighbours and from other EU-member states. Second, the resulting command structures vary significantly between countries. Third, to the extent that practical, legal and ethical obstacles are seen to exist they are for the most part addressed pre-incident, for example in bilateral agreements, treaties and joint exercises.

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<sup>4</sup> Belgium, Finland, France, the republic of Ireland, Italy, the Netherlands, Poland, Sweden and the UK



## 2 Incident management practices

### 2.1 General

The term ‘incident management’ is widely used but not embraced by a widely shared understanding or common definition. The influential United States Federal Emergency Management Agency (FEMA) defines incident management as follows:<sup>5</sup>

*“The broad spectrum of activities and organizations providing effective and efficient operations, coordination, and support applied at all levels of government, utilizing both governmental and nongovernmental resources to plan for, respond to, and recover from an incident, regardless of cause, size, or complexity.”*

FEMA also defines an incident follows:<sup>6</sup>

*“An occurrence, natural or manmade, that requires a response to protect life or property. Incidents can, for example, include major disasters, emergencies, terrorist attacks, terrorist threats, civil unrest, wildland and urban fires, floods, hazardous materials spills, nuclear accidents, aircraft accidents, earthquakes, hurricanes, tornadoes, tropical storms, tsunamis, war-related disasters, public health and medical emergencies, and other occurrences requiring an emergency response.”*

This may be narrowed down to the following, which serves as a working understanding for the purpose of this report: Incident management are the activities and organisations which provide operations, coordination, and support in order to plan for, respond to, and recover from an occurrence that requires a response to protect life, environment or property.

Normally incidents are managed locally and at low levels of single, or a small number of, organisations. However, sometimes incidents are large-scale, complex and involve multiple actors on multiple levels in society.

The actors in incident management commonly have different objectives, cultures, terminology, resources, experience and methods. For example, the UK police silver command is typically off site, which is in contrast with the other two blue light services.<sup>7</sup> Some actors are used to working together on a daily basis, while others are not. Some actors are highly experienced whereas others may never have been involved in incident management. The end result is often a set of actors which is highly heterogeneous.

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<sup>5</sup> FEMA (2008): National Incident Management System, U.S. Dept. of Homeland Security, Washington, p. 140

<sup>6</sup> Ibid

<sup>7</sup> Silver command referring to the UK police system of gold, silver, bronze (GSB) command structure, also translated as strategic, tactical, operational (<http://www.app.college.police.uk/>)



To this actor heterogeneity added application differences, meaning both different compositions of actors and different adjustments made by actors in the situation at hand, due to contextual factors. Examples of such factors may be both internal and external to the actor. The end result is that almost every single case of incident management is unique in some significant way.

## 2.2 Commonalities

The details of incident management in practice thus depend both on the set of actors involved and the context at hand. However, during the Revinge workshop, incident management experts still found it possible to formulate some general characteristics for incident management.<sup>8</sup> Incident management is generally:

- Relying on plans - plans never survive, but planning is everything
- Preparation and knowledge rather than trial and error
- Depending on how the pre-incident phase is managed
- Time critical – must “catch and keep up” with the incident dynamic
- A process loop of planning, analysing and implementing
- A mix of different methodologies for the acute phase
- A question of understanding the processes of other actors
- To a great extent a question of information management
- Centralised management<sup>9</sup>.

As evident from the bullet point list above, whether incident management is to be successful or not is actually to a great extent determined before the incident, in terms of planning, preparation, training and anticipation. This in turn relies on efficiently managing lessons from previous incidents and exercises; identifying, learning and implementing these lessons in a continuous process.

The context in which these actors are to produce effects is almost always complex, dynamic and fraught with uncertainties. This means that decision making need to be able to deal with assumptions. In incident management there are no “good” or “bad” decisions during the response stage, but only more or less optimal decisions.<sup>10</sup>

In addition to the above, incident management typically involves four core actors: community care, rescue, medical care and policing. To these core actors are often added other actors such as infrastructure operators, the military and government representation from the municipal, regional and national level. In the context of incident management interoperability becomes crucial.<sup>11</sup>

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<sup>8</sup> CascEff workshop, Revinge, Sweden, June 2014

<sup>9</sup> However, strategic and tactical decisions are not necessarily made by the same group of people. Coordinated management may be a more appropriate term.

<sup>10</sup> Ibid

<sup>11</sup> Ibid



## 2.3 Standardisation

A common response to the challenge of interoperability is standardisation. For example, FEMA offers the National Incident Management System (NIMS) which is a core set of concepts, principles, procedures, organizational processes, terminology, and standard requirements. These are to enable Federal, State, local government, nongovernmental organisations (NGOs) and the private sector in the United States to work together.

The philosophy behind NIMS is that such an approach improves coordination and cooperation between public and private agencies/organizations in a variety of emergency management and incident response activities.<sup>12</sup>

One actor on the scene of standardisation is the National Fire Protection Association (NFPA). The NFPA is an international non-profit organisation dedicated to provide and advocate consensus codes and standards, research, training and education. One such standard is the NFPA 1600: Standard on Disaster/Emergency Management and Business Continuity Programs.

The NFPA 1600 covers the development, implementation, assessment, and maintenance of programs for prevention, mitigation, preparedness, response, continuity, and recovery.<sup>13</sup> The NFPA 1600 has been adopted by the United States Department of Homeland Security as a voluntary consensus standard for emergency preparedness. The current edition is dated 2013 and planned to be replaced by a 2016 edition.<sup>14</sup>

Another example in line with the NIMS philosophy is the standard for emergency management issued by the International Organization for Standardization a few years ago: ISO 22320:2011(E), prepared by the Technical Committee ISO/TC 223.

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee.

International organizations, governmental and non-governmental, in liaison with ISO also take part in the preparation work. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

<sup>12</sup> FEMA (2008): National Incident Management System, U.S. Dept. of Homeland Security, Washington

<sup>13</sup> The NFPA 1600 document scope reads as follows: “1.1\* Scope. This standard shall establish a common set of criteria for all hazards disaster/emergency management and business continuity programs, hereinafter referred to as “the program.”  
A.1.1 The emergency management and business continuity community comprises many different entities, including the government at distinct levels (e.g., federal, state/provincial, territorial, tribal, indigenous, and local levels); business and industry; nongovernmental organizations; and individual citizens. Each of these entities has its own focus, unique missions and responsibilities, varied resources and capabilities, and operating principles and procedures.”  
(<http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=1600>).

<sup>14</sup> NFPA, <http://www.nfpa.org/>



ISO 22320:2011(E) aims to minimise the impact of disasters, terrorist attacks and other major incidents and help mitigate harm and damage and ensure continuity of basic services. ISO motivates the standard by today's worldwide governmental, non-governmental, commercial and industrial relationships and dependencies. These relationships and dependencies calls for a multinational and multi-organizational approach, which in turn requires interoperability.

The objective of ISO 22320:2011(E) is to provide a basis for such interoperability by enabling public and private incident response organizations to improve their capabilities in handling all types of emergencies (for example, crisis, disruptions and disasters). ISO 22320:2011(E) establishes standard requirements for command and control including organisational structures, procedures, decision support and information management. The standard also establishes requirements for cooperation and coordination. ISO 22320 is likely to be revised in 2015-2016.<sup>15</sup>

However, in practice incident management is not standardised. First, incident management in a normative sense (how it should be) differs between actors and domains. While standardisation efforts show evidence of influence, actors seldom embrace standards fully and to the letter. Instead, the end result is almost always an interpretation and adaption, guided by the actors' legislative environment, resources, core mission and culture. The reason for this slow progress of standardisation becomes more understandable when taking the aspects of culture into account.

## 2.4 Culture

The term 'culture' is often misused but appropriate in the context of incident management where people have to work together under demanding conditions. Views on what constitutes good practice and appropriate ethics, for example regarding command, control and coordination may differ considerably.<sup>16</sup> This has been a key issue in, for example, military coalition efforts and the military community has subsequently made a considerable effort to increase the knowledge on culture. One of the publications dealing with this is the NATO SAS-050 report.<sup>17</sup>

The NATO SAS-050 report adopts the common view that culture describes the learned patterns of behaviour and thought that helps groups adapt to their surroundings. According to this view culture unifies groups of people and distinguishes them from others. It is argued that since incident management almost always involves people within organisations the concept of organisational culture becomes important.<sup>18</sup>

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<sup>15</sup> ISO TC 223, [www.isotc223.org/Published-Standards1](http://www.isotc223.org/Published-Standards1)

<sup>16</sup> MSB *Bases for collaboration, command & control*, MSB Karlstad, 2014

<sup>17</sup> NATO (2008): *Multinational Military Operations and Intercultural Factors* TR HFM-120, NATO Neuilly-Sur-Seine

<sup>18</sup> Ibid



The report refers to Schein (1984) who defines organisational culture as follows:

*Organizational Culture is the pattern of basic assumptions that a given group has invented, discovered or developed in learning to cope with its problems of external adaptation and internal integration and that have worked well enough to be considered valid and therefore to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.*<sup>19</sup>

The NATO SAS-050 report argues that cultural differences impact considerably on the ability to work together. Among a number of conclusions on how to improve interoperability from a cultural perspective, one of the most compelling is the call for efforts to instil greater cultural sensitivity and awareness through pre-deployment programs and training for all military personnel. In the domain of incident management this translates to familiarity and working experience across organisational borders.<sup>20</sup>

In addition to cultural differences comes human nature in the form of the natural tendency of individuals to prefer collaboration within the own organisation before collaboration across organisational borders. Social Identity Theory frames this tendency as ‘in-group bias’, explained by individuals’ desire to achieve or maintain a positive social identity. The theory proposes that such a group context causes in-group favouritism, the preferential treatment of one’s in-group compared to a relevant out-group.<sup>21</sup>

In-group bias may impact on interoperability. The way to mitigate in-group bias is fairly straightforward; make sure that, as far as possible, people are familiar with each other across organisational borders or at least are familiar with other organisations in terms of their roles, mandates and perspectives. In addition to familiarity, also expectations of future interaction have also been shown to reduce in-group bias.<sup>22</sup>

## **2.5 Incident management in and between organisations**

To the challenges of contextual factors, actor heterogeneity and human social characteristics, incident command is often hampered by other challenges. The Revinge workshop indicated that, for example, it is not uncommon that incident command deviate from the process of “plan, analyse, implement” by skipping the analysis. Incident command may also lack situational awareness. In the aftermath of incidents, lessons are often identified but seldom actually learned.<sup>23</sup>

To learn more about incident management, the CascEff project conducted a survey during the fall of 2014. The aim of the survey was to investigate enablers and

<sup>19</sup> Schein, E.H. (1984). *Coming to a new awareness of organizational culture*. Sloan Management Review, vol. 19, p.4.

<sup>20</sup> NATO Research and Technology Organization (2008): *Multinational Military Operations and Intercultural Factors* TR-HFM-120, NATO Neuilly-Sur-Seine

<sup>21</sup> Tajfel, H., & Turner, J. (1986). The social identity theory of intergroup behavior. In S. Worchel & W. Austin (Eds.), *Psychology of Intergroup Relations*, Nelson Hall, pp. 7–24

<sup>22</sup> Av, O. B., & Pruitt, D. G. (1984). Resistance to Yielding and the Expectation of Cooperative Future Interaction in Negotiation. *Journal of Experimental Social Psychology*, (1965), 323–335

<sup>23</sup> CascEff workshop, Revinge, Sweden, June 2014



challenges within organisations as well as between organisations. The survey targeted incident management experts and asked for their views on 32 suggested enablers and challenges.

The survey resulted in 79 responses with a 38% response rate. The participants were predominantly British, Swedish, Belgian, Dutch and French, came mainly from the public sector and had an average working experience of 18.4 years.<sup>24</sup>

The results suggest that the following applies both *within* and *between* organisations:

- Dialogue works better between people who work together daily
- Social networks are necessary for success
- Common operational pictures are often incomplete
- Contacts between people at the field level work better than contacts between people higher up in the hierarchy
- Judgement and analysis are often based on sub-units “own information” rather than the aggregate of all units’ information
- Judgement and analysis often lack a joint perspective
- People tend to be reactive rather than proactive
- Communication is often lacking
- Problems with common operational pictures relate mostly to working methods and data sources.

In addition to these, five challenges emerge in the results as applicable only *between* organisations:

- Between organisations, responsibilities, roles and mandates are unclear
- Between organisations, people are not familiar with each other’s responsibilities, roles and mandates
- Between organisations, people do not know what others need and can contribute with
- Between organisations, common operations pictures are often lacking
- Between organisations, concrete recommendations for decisions are often missing.

This result suggests two key differences in collaboration across organisational borders compared to working within ones’ organisation. The first difference concerns knowledge about other organisations. This relates to the planning and preparation associated with the pre-incident phase, which makes its mitigation a structured long-term character. The second difference concerns dealing with the incident. This relates to the acute phase, which makes its mitigation a more dynamic, complex and opaque character.

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<sup>24</sup> See Appendix 1 for a detailed description of the survey



## 2.6 Summary

To summarise this chapter, incident management displays commonalities as well as diversities.

Commonalities are evident in the relative constants of the role of preparation, planning and plans, basic processes, time criticality, importance of information management and need to know and understand others. In the interest of using societal capabilities efficiently there are also long-term efforts to standardise incident management for greater interoperability. These efforts have had mixed results.

Diversities are evident in several dimensions. One of these is actor heterogeneity in terms of e.g. differences in goals, logistics, capabilities, training, equipment, terminology language, leadership and cultural practices. Another is incident uniqueness. Each incident is different due to variation in a number of variables, such as occurrence agent and magnitude, incident dynamic, number of societal systems affected, risk for escalation, composition of stakeholders and responding agents.

Incident management commonalities and diversities appear to create a generic set of enablers and challenges, both within and between organisations. Examples of enablers are social networks, working together on a daily basis and the socially unifying effect of collaborative field work. Examples of challenges are joint perspectives, judgement, analysis, information management and a proactive approach. A particularly important challenge concerns lessons – their identification, learning and implementation.

A few additional challenges seem to mostly affect work across organisational borders. These concern familiarity and knowledge about other organisations, and dealing with the incident in terms of information management and decision making.



## 3 Incidents with cascading effects

### 3.1 Working definition

As previously mentioned, sometimes incidents are large-scale, complex and involve multiple actors on multiple levels in society. In addition, an incident often has the potential to escalate and through cascading effects evolve into something much greater than its initiating event might suggest. Within the CascEff project, the working technical definition of cascading effect is as follows:

*Cascading effects are the impacts of an initiating event where:*

1. *System dependencies lead to impacts propagating to other systems, and;*
2. *The combined impacts of the propagated events are of greater consequences than the root impacts, and;*
3. *Multiple stakeholders and/or responders are involved.*

### 3.2 Identifying cascading effects

The Revinge workshop concluded that cascading effects can be potentially triggered by any incident but are highly probable during natural disasters and major accidents. With potential in all incidents for cascading effects, the CascEff Revinge workshop suggested that incident managers have two chances to identify such effects; before or during an incident.

Identifying cascading effects *before* an incident is the most desirable and efficient alternative. This can be done by analysis, identification, planning, simulation and intuition. These break-down of these strategies is as follows (bullet points not in any particular order):

- *Analyse*
  - Historical & statistical data
  - Risks (incl. risk mapping and changeable risks, e.g. hours, weekday, season etc.)
  - Worst case scenarios
  - Reports (e.g. safety reports), lessons learned, case studies
  - Policies and management systems (management factor)
  - Safety culture (human factor)
- *Identify*
  - Hazards followed by risk assessment
  - Critical infrastructures (e.g. blackout) or systems in which failure may trigger cascading effect with high probability
  - Possible domino effect - mandatory identification of possible domino effects in establishments with significant major accident potential (chemical nuclear industry, transport of dangerous substances incl. pipelines)



- *Plan*
  - Using all-hazards risk based-approach
  - Working out and permanently keep updated plans (e.g.: rescue, crisis response, emergency management)
  - Securing horizontal (inter-agency) and vertical (local, regional, central) integration of plans
- *Simulate* – looking for weakest points as triggers for cascading effects
- *Intuition* – professional experience (“artists” vs. “craftsman”).

The second chance is to identify cascading effects *during* an incident. This is the last chance to avoid or reduce harm and damage and is done through operational picture indications, through reports showing first-order effects propagating to secondary and tertiary effects. This process also includes differentiating between:

- Cascading effects related to system design only (tightly coupled systems) with no human error in incident management and
- Cascading effects through a combination of concurrent failures in technology in combination with human performance (failure to understand system interdependencies).

Paradoxically it may often be easier to identify cascading effects in more hazardous systems/areas, such as air transport, SEVESO<sup>25</sup> plants, nuclear industry and pipelines.

In practice, identifying cascading effects involves noticing when the initial incident escalates and transforms from routine to disaster and overloads some system or organisation in the community. This in turn requires access to information, methods to analyse the information and competence to interpret the results.

### 3.3 Cascading effects influence on incident management

When cascading effects have been identified, incident management needs to be modified. What this involves depends on the phase of the incident – in advance or during the acute phase. The CascEff workshop in Revinge indicated that modifying incident management in advance *before* cascading effects occur involves (bullet points not in any particular order):

- Identifying, reducing or eliminating shortfalls that exist between estimated requirements, standards, and performance measures and the actual response and short-term recovery capabilities using all-hazards risk based-approach
- Verifying existing plans and if necessary procedures
- Organizing training and practical exercises (incl. inter-agency harmonizing ones)
- Safety checks and inspections

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<sup>25</sup> The SEVESO Directive is the main piece of EU legislation which deals specifically with the control of on-shore major accident hazards involving dangerous substances. The current SEVESO II Directive is to be replaced by SEVESO III in June 2015.



- Reducing or eliminating risks
- Strengthening the safety culture (human factor).

Modifying incident management *during* the acute phase, after cascading effects have been triggered, involves (bullets not in any particular order):<sup>26</sup>

- Expand the command structure
- Activate higher level (strategic) incident management with decision power over more resources
- Enhance reporting to superiors and enhance briefing within and between actors
- Organise incident operation, planning (including anticipation) and logistics
- Collaborate with key actors and stakeholders for advice
- Gather pre-defined crisis/emergency management team
- Involve pre-identified experts and liaison personnel from useful agencies/institutions
- Put in place information management processes to improve situational awareness at all levels
- Verify tactical assumptions
- Consider using a “Devils Advocate” as a safeguard against misjudgement
- Determine rescue priorities (considering “cost-effect” approach)
- Divide into operational sectors and functional groups
- Closely monitor system parameter evolution (process, installation, meteo)
- Isolate the affected portions of the system
- Model secondary/tertiary effects
- Take decisions to protect people, environment and assets in secondary effect zones well ahead of time (time to resource availability)
- Consider evacuation carefully
- Re-connect the affected portions of the system in a controlled manner
- Organise demobilisation of resources
- After incident: ensure that lessons identified also become lessons learned.

The bullet list above is long and broad. Available time and resources will not always allow addressing all points. The relative importance, chronological order and detailed content of each of them depend on the situation at hand, and have to be analysed before taking action. However, most of them can and need to be prepared in advance.

A further point is that efficient incident management during natural disasters and major accidents, including avoiding cascading effects, is possible only if based on a major effort during pre-incident planning stage. Finally, as has been mentioned before, after the incident organisations should ensure that lessons identified also become lessons learned.

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<sup>26</sup> Some of the identified modifications are not limited to incidents with cascading effects but applicable to all major incidents.



### 3.4 Challenges related to cascading effects

The CascEff workshop in Revinge also revealed a set of challenges associated with incidents with cascading effects. The result can be divided into three categories: *before* an incident has occurred, *during* and *after* an incident. These categories are presented below (bullet points not in any particular order):

#### *Pre-incident*

- Train personnel to be able to deal with the unexpected: go beyond patterns based on previous experience
- Organise regular and reliable incident command system and training systems, especially on the strategic level, catering for not only knowledge and skills but also “wisdom” (ways of thinking, approach), using the same tools as used on a regular basis during normal operations
- Acknowledge risk, respond to call for immediate action, achieve early warning
- Understand interdependencies, e.g. relating effects to root cause
- Evaluate incident management beyond obvious causes to also include opaque root causes on different system levels
- Ensure appropriate experience of incident commanders
- Manage the complexity of achieving a holistic view over all possible scenarios
- Develop real case training modules to be used by the personnel for dealing with the unexpected – go beyond patterns based on previous experience
- Evaluate incident management beyond obvious causes to also include opaque root causes on different system levels
- Predict as much as possible in advance (planning), during pre-incident stage, to avoid occurrence of cascading effect - difficult but possible task
- Strengthen safety culture (human factor - a very unreliable element).

#### *During an incident*<sup>27</sup>

- Understand the interdependence characteristics and criticalities (most connected infrastructure related to primary needs)
- Alert public and private decision makers with personalised messages
- Contain the primary incident
- Understand interdependencies, e.g. relating effects to root cause
- Estimate the impact of second and third order effects on service delivery
- Monitor assumptions in the decision making process and adjust for errors
- Evaluate incident management beyond obvious causes to also include opaque root causes on different system levels.
- Quantify societal aspects of the effects of the incident and incident management
- Integrate information from different sources/agencies to avoid misunderstandings, avoid ignoring key data and avoid uncoordinated activities
- Manage crisis communication to the public so that messages from different sources/actors are coordinated and not contradicting.

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<sup>27</sup> Some of the identified modifications are applicable to all major incidents.



### *After an incident*

- Refine and compile information from scattered and specialized systems (e.g. GIS, data basis, plans, computer models, remote detection systems, social media etc.) very often, as post-event analysis of different types of disasters show that all data to avoid the tragedy was available (data was misinterpreted, uncorrelated, and people could not interpret them quickly and make correct and effective decisions)
- Ensure that lessons identified also become not only lessons learned but also lessons implemented.

As has been mentioned before, the last bullet point is perhaps one of the more important in the list above. Lessons are often identified. However, the path from identifying lessons, via learning lessons, to lessons implemented is often interrupted. At best the path is long and difficult. This is not limited to cascading effects, but failure to manage lessons may have greater consequences in incidents with cascading effects.

Also the above bullet list is long and broad. It is also different from the list of challenges related to generic incident management. Importantly however, these lists of challenges are neither absolute, nor do they replace each other depending on whether the incident displays cascading effects or not. The lists represent the result of expert reflections, not to be interpreted as absolute or exhaustive. Subsequently, all challenges on both lists may become salient in any incident.

### **3.5 Summary**

To summarise, while any incident can develop into displaying cascading effects, such effects are highly probable during natural disasters and major accidents. Managing incidents with cascading effects involves modifying incident management. Such modification can be divided into two categories: before an incident has occurred concerning the risk for cascading effects, and during an incident concerning risk or actual cascading effects.

Before an incidents has occurred cascading effects may be identified by analysis, identification, planning, simulation and intuition. Modifying incident management then involves reducing risk and increasing resilience through training, exercises, revised plans and procedures.

During an incident cascading effects may be identified through operational picture indications. Modifying incident management then involves activating, expanding and reinforcing command & control and collaboration structures. These structures are to monitor and predict incident development, isolate and later re-connect affected portions of the system in a controlled manner.

Challenges associated with cascading effects involve peoples' ability to identify, understand and deal with the unexpected in a proactive manner, and creating and maintaining regular and reliable incident command and training systems to support this ability.



## 4 Inter-agency and cross border collaboration

### 4.1 Introduction

This section presents a cross-sectional view of the different aspects associated with inter-agency and cross border response to crises in Europe. It is based on the responses to a questionnaire which was circulated to the CascEff EEAB and partners. The objective of the questionnaire was to gather information about incident management procedures in the European Union member states which are represented within the project. In particular, the questionnaire focused on enabling an understanding of the legal and ethical issues with regards to incident management and the capacity for involvement of other agencies or rescue services, both within municipalities and across internal regional borders as well as across national borders.

The responses covered the following countries: Belgium, Finland, France, the republic of Ireland, Italy, the Netherlands, Poland, Sweden and the UK.

For ease of reading, the text will in the following refer to these responses as national, referring to countries. However, it is important to note that these responses have no governmental status but reflect the best understanding of partners and the associated individual completing the questionnaire at the time of responding.<sup>1</sup>

### 4.2 National collaboration and cooperation

All countries were asked which agencies were available nationally to provide emergency response and assistance in times of crisis:

- In general the responses indicate that all countries have the same composition of the three main emergency response agencies: police force, fire and rescue service, and the ambulance service. Some countries also described additional rescue agencies including the coast guard, air sea rescue, border guard or customs, water rescue, mining rescue, mountain rescue and other activity specific SAR<sup>28</sup> agencies.
- In addition to these expected emergency services, most of the respondents provided details of other political offices and non-governmental agencies which are able to contribute to the response of crisis scenarios. For example various government departments who may assist directly in large scale incidents such as departments for social welfare and individual offices which are tasked with coordinating response to large scale incidents.
- In France various directorates (such as for roads) and energy companies are listed as being able to or required to participate in emergency response, dependent on the incident and what infrastructure is involved. The same applies to Poland which also lists the state agency of atomic energy, the state inspectorate for environmental

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<sup>28</sup> Search and Rescue



protection and the institute of Meteorology & Water Management as being able to assist in the response to large crises.

- NGOs are also listed as being able to contribute to crisis response by some countries, including for example the Red Cross and, in Sweden, the POSOM organization.<sup>29</sup> The Netherlands also lists similar support for victims of crises.
- In most of the responses received, the respondents indicated that the military is also able to contribute to emergency response and crisis management activities in instances where the incident response exceeds the capacity of the civilian services.

All countries were asked what levels of government were responsible for providing the emergency services. For example, some countries may have a fire and rescue service which is provided and administered at a local level whereas some may have this service provided at a national level.

- The level of government responsible for provision of the different emergency services varies significantly across the responding countries, as well as by emergency service.
- In Finland and France, the level of government responsible is noted as depending upon the scale of the incident; although for small incidents provision of emergency services is reportedly on a local or municipal level.
- A summary of the provision of emergency services is shown in figure 1. This does not provide a complete picture and is shown to give an indication of the level of government responsible for the different services. For example, city police are noted as being provided on a local level in Poland, although a national police service is also present.

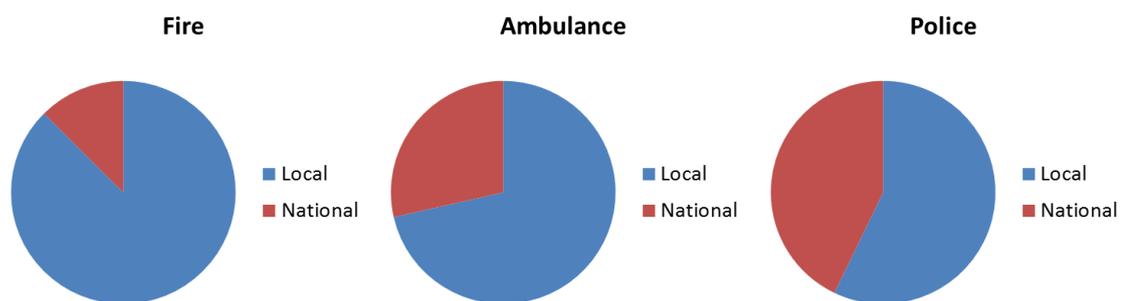


Figure 1. Summary of level of government responsible for the provision of emergency services based on an average of all responding countries (note that the Netherlands has both national and regional police forces)

<sup>29</sup> POSOM is a voluntary organisation for crisis management, aiming to contribute towards the psychological and physical wellbeing of victims, families and relatives of those involved in crises and accidents. The POSOM network of resources contains priests, psychotherapists, psychologists, crisis trauma- and care personnel ready to deploy with short notice. POSOM members consist of companies, authorities and organisations (<http://www.posom.se>).



It was asked of the responding countries what provision there is for cooperation between different emergency services responding to a crisis:

- All of the responding countries indicated that there is some provision for cooperation between emergency services.
- Italy and the UK returned additional information as to the legal basis for this cooperation. For example in Italy the National Department of Civil Protection requires cooperation between agencies on a national level and the C.O.C. (Centro Operativo Comunale – Municipality level) and the C.O.M. (Centro Operativo Misto – Provincial Level) require cooperation on a local level. In the UK the Civil Contingencies Act requires Category 1 (emergency service) responders to work together in planning and responding to incidents. This has led to the JESIP (Joint Emergency Services Interoperability Programme) being adopted across all emergency services, which promotes joint risk assessment, decision making and messages between emergency services.
- Both the Netherlands and Belgium indicated that the cooperation between emergency services also has a legal basis once an emergency situation has been declared.

The respondents from the different countries were asked for information about who has responsibility for holding the Incident Commander role under cooperative response:

- The majority of the responding countries reported a similar structure whereby one individual has the overall responsibility for incident command. Under this individual there may be commanders of the individual rescue services. Here Italy and Sweden are exceptions; all emergency services retain their own incident commander and command structure although they are required to collaborate during the execution of the response.
- In France it is reported that the mayor of the precinct retains a role offsite as an operational director. Most countries require a local commander on site but for very large incidents this person may answer to an off-site commander.

The questionnaire asked if there was some formal mechanism for sharing of information between the different emergency services. All respondents indicated that there is some means for sharing information between the emergency services, although in not all cases is this a formalized system. In France, for example, information is shared via an operational centre which is responsible for gathering and distributing all information to the different responders. In Ireland a task force is put in place at the national coordination centre for managing of information, although a more formalized incident management information technology communications system is under development. In Italy, a number of different means of collating and sharing information exist, dependent upon the type of incident.

It was asked who was responsible for involving additional emergency service agencies from the same region. The responses suggest that there are generally two possibilities of



persons who are responsible for involving other emergency services within the different countries. In France for example it is done via the operational director. In Italy it is also done at a higher level, at the prefect level although the prefect does not maintain direct control over the incident as the mayor does in France. In all other countries who responded, the decision to involve other agencies is, at least practically, taken by the incident commander on site.

The responding countries were asked if there was a possibility for involving additional agencies from neighbouring regions, how this affects both the person responsible for managing the response to the current crisis and how it may affect the command structure of the responding agencies; and finally if there were any specific legal or ethical issues with such collaboration:

- In all responding countries there is provision for involving agencies from neighbouring regions when the incident crosses borders or when the incident grows in scale. In all instances reported, the incident commander retains control of the incident, although for example in the case of Belgium the coordination may be scaled up. In some countries communication and liaison between the different services is handled at an administrative level. Responsibility for requesting assistance or for notifying of incident spread across the border remains with either the incident commander or with the local government administration.
- In most cases the command structure of each of the responding agencies stays the same although the overall incident commander is typically either from the original region, appointed by agreement between the counties, or appointed from a higher level of government.
- There are no specific legal or ethical issues reported for collaborative response between regions. In fact, in all instances reported collaborative response is a requirement where the scale of the incident calls for it. The UK has a formalised arrangement for recouping costs associated with the collaborative response action.
- France and Sweden both have provisions of a governmental representative (in France the mayor or operations director; and in Sweden the TiB or Tjänsteman i Beredskap) who is responsible for liaison between regional borders. The Netherlands relies on the mayoral office to invoke actions between municipalities. All other countries who returned responses rely on incident commanders to inform neighbouring regions.

Finally, the countries contributing to the exercise were asked if there was a mechanism which may enable large scale evacuation of regions where this was necessary. All countries who responded to this question reported that large scale evacuation is possible. However, there is not always a formalised plan for this.

### **4.3 International collaboration and cooperation**

All of the responding countries were asked if they maintained links with neighbouring countries for collaborative response to large scale or cross-border crises:



- All of the responding countries indicated that their emergency services maintained links with neighbouring countries' emergency services. These links are either centralised in the case of Finland or maintained by individual municipalities which are adjacent to border in the case of all other responding countries (multiple distributed links). All countries have centralised links with Brussels and are able to request support for crisis response from European countries through this link.
- Mutual aid within the EU is managed by the relative office in Brussels, which also coordinates individual member states requests for assistance.
- Specific items of infrastructure, such as the Channel tunnel, Maastricht airport or the Mont Blanc tunnel have resulted in the need to prepare specific response arrangements. Other notable agreements also exist, for example between the UK, the Netherlands and Belgium who maintain an agreement for sea rescue cooperation.
- In all cases where a response was given, the respondents indicated that joint exercises were undertaken to test the cooperative ability of the rescue agencies.

Given the presence for agreements for involving agencies from across national borders for collaborative or joint response, the responding countries were asked details of responsible persons for requesting such assistance. The responding countries were also asked for details of how such a collaborative response may affect the command structure:

- The person responsible for involving rescue agencies from other countries is without exception the incident commander. An additional formal request may be made via alternative channels, but this is made at the same time as the request for assistance between incident commanders. In the Netherlands requests for support are handled on the ministerial level via the national operational coordination centre (LOCC).
- In all cases the countries involved in the response maintain their own command structure, although the two senior persons responsible maintain close communication and collaborate on the response. In the majority of cases the original incident commander retains control of the incident, although in Finland it is by prior agreement between the cooperating countries who is in control of the response action; and in Italy, Poland and Sweden each agency retains some responsibility for their own areas of action.

The respondents from the different countries were asked if they were aware of any specific communication, protocols, and legal/ethical issues associated with international response which may provide a hindrance to the collaborative response action:

- Language is highlighted by the Italian response and the UK response as a potential issue in managing collaborative response actions. In the case of Italy, this issue can sometimes hinder joint action as a result of time taken to interpret incoming information. In the case of the UK, using the planning for the channel tunnel as an



example, all response procedures are documented in both English and in French. Language is also highlighted as a minor potential issue in the Dutch response, and this is managed through ensuring that teams and sectors all speak a common language.

- In the case of Poland, details are provided of very clear agreements with Slovakia with respect to contact points; agreed locations for border crossing; list of equipment available for joint operations; maps of bordering areas as well as a Polish-Slovakian dictionary of basic rescue vocabulary.
- The respondent from Italy indicated that they manage any potential legal or ethical issues in cross border cooperation by means of retaining command over their own agencies. In the case of the UK, legal and ethical issues are managed through the declaration of a bi-national incident, i.e. where all countries involved agree that the emergency impacts upon them. In Poland potential issues have been managed through the signing of agreements on cooperation and mutual assistance with its neighbours.
- Liability with regards to joint or cooperative response actions is usually handled in agreement through very specific cases, or in mutual assistance agreements for general cooperation in advance. For example in Belgium, employees have no civil liability and bilateral agreements exist preventing any injured party from claiming damages from an assisting party.
- The respondent from Belgium highlighted a non-uniformity in communication and operating procedures as creating possible issues for collaborative response.

The responding countries were asked if there were any constraints to international assistance and cooperation. The responses indicate that constraints with regards to assistance and cooperation are regulated by the mutual agreements between the different countries where applicable. In the case of many countries, if the rescue agencies are required they will be recalled to handle incidents on home soil.

The respondents were asked who had responsibility for notification of incident spread across borders

- In all cases reported, the incident commander maintains responsibility for notifying foreign rescue agencies of the spread of an incident over a border. This is with the exception of Italy and the Netherlands, where it could happen at a national governmental level in addition to the operational level. In Belgium the notification of an incident spread across borders goes via both the incident commander and at a ministerial level.
- Where assistance in responding to a large incident is required then this is requested via the same channels as notification of incident spread, or through the EU's relative offices in Brussels.



Some of the respondents volunteered information about the capability for pooling of resources in the event of an incident. The majority of respondents indicated the possibility for pooling of resources with neighbouring countries but only through prior agreement. In the case of Italy, formal arrangements are being developed although they are not yet ready.

#### **4.4 Summary**

In general the composition of emergency response agencies throughout Europe is similar, comprising certain key agencies - notably police, ambulance, fire and rescue, and the military. Certain key agencies were omitted from the majority of answers such as coast guards and border patrols although these may form a part of the other agencies. Provision of these services is dependent on the country, with some agencies being provided regionally and others nationally. It is more common for fire and rescue services to be provided on a regional basis.

In addition to these key agencies, respondents also listed certain other agencies as being able to assist in the response to crises. Examples of such agencies are the Red Cross, certain governmental departments, energy and road authorities. Specific examples in this case are generally country specific.

In all cases there is provision for interagency and inter-regional response within countries. Typically the command structures are similar and it seems to be most common that either the original agency retains control as incident commander when an incident escalates or that the command of the incident is handed over to a governmental department such as a mayor. When this type of thing happens, incident command usually migrates from a local position to a remote location.

Similarly, the majority of respondents have indicated that there is provision for interagency response and cross border collaboration in the event of very large incidents or when incident cross borders. In such cases, however, the incident command is usually handled by the two countries agencies acting collaboratively rather than through appointment of one incident commander. Exceptions to this do exist, notably where preplanning and mutual agreements are made for example with relation to certain items of infrastructure such as the channel tunnel.

Obstacles to cross border collaboration include language, which may delay action while information is interpreted. Legal and liability issues are typically handled in advance via mutual agreement.



## 5 Discussion

### 5.1 Incident management

Chapter 1 describes incident management in general. This description portrays incident management in terms of commonalities, diversities, enablers and challenges.

To recap, commonalities are evident in the relative constants of the role of preparation, planning and plans, basic processes, time criticality, importance of information management and need to know and understand others. In addition, the need to manage lessons seems to be universal to the community. Diversities are evident in several dimensions such as actor heterogeneity and the uniqueness of incidents. This appears to create a generic set of enablers and challenges.

These commonalities, diversities, enablers and challenges mean that each actor's level of preparation, knowledge, readiness and resilience determines the actor's individual ability. However, today's highly interconnected and tightly coupled society means that incidents often develop faster and affects greater portions of society compared to 10-20 years ago. As a result, actors are today more dependent on each other than before, and incident management are today multi-actor affairs as a general rule.

This leads to three conclusions.

The first conclusion is that actors' individual ability is not enough. Instead it is the total ability of the constellation of actors which in the end determines how successful incident management can be. Crucial in this joint ability is likely the ability to view incidents from a systems perspective, in other words understanding not only which parts of a system are involved but also how these different parts relate to each other and function as a whole.

The second conclusion is that such joint ability requires instant interoperability, the ability to cooperate and collaborate with very short notice. The dynamic of incidents of today means that interoperability does not have a great deal of time to develop in the face of an incident. Instead, interoperability needs to be up to speed from the beginning. Such instant interoperability can be realised in at least two ways; standardisation and understanding the perspectives of others. However, neither of these are unproblematic, which leads to the third conclusion.

The third conclusion is that the community of incident management needs to embrace both standardisation and a culture of understanding the perspectives of others. This conclusion requires a more comprehensive explanation.

Standardisation, for example in terms of terminology, operational picture formats, technical interfaces, information management strategies and decision making processes, has been pursued for long but so far have had mixed success. However, the increasing impact of the EU on national legislation may open up for more efficient standardisation if initiated from Brussels. Such efforts should be aligned with e.g. the work of ISO.



Understanding the perspectives of others, meaning accepting heterogeneity and instead focus on learning and understanding the different perspectives of the set of actors involved, can never be complete. The dynamic of today's incidents means that it is impossible to predict the set of actors which will be involved in the next incident, As a result it will never be possible to have a complete pre-developed understanding of all actors. Any pre-developed understanding thus needs to be coupled with openness, sensitivity and reflection during the acute phase of managing incidents.

Based on the above it appears that incident management community needs to embrace both standardisation and understanding the perspectives of others. It is not a question of choice. Both of these strategies for interoperability need to be part of the fundamental culture of incident management.

## 5.2 Cascading effects

Chapter 2 describes cascading effects in terms of identifying, modifying incident management, challenges, legal and ethical aspects.

To recap, all incidents may develop into displaying cascading effects but the risk is often high in the natural disasters and major accidents. Managing incidents with cascading effects involves modifying incident management. Such modification can be divided into two categories; before an incident has occurred concerning the risk for cascading effects, and during an incident concerning risk or actual cascading effects.

Identifying risk for cascading effects *before* an incident has occurred means modifying incident management to focus on reducing risk and increasing resilience. Identifying cascading effects *during* an incident means modifying incident management to focus on ensuring appropriate command & control and collaboration structures which in turn are to monitor, predict, isolate and re-connect affected portions of the system.

Challenges associated with cascading effects involve peoples' ability to identify, understand and deal with the unexpected in a proactive manner, and creating and maintaining regular and reliable incident command and training systems to support this ability.

This leads to three conclusions.

The first conclusion is that actors need to be aware of the full picture to be able to prepare for and contribute efficiently to a joint effort of incident management. The composition of stakeholders and responders are not likely to have consensus on whether cascading effects are likely or already a fact. The reasons for this is that actors' different objectives and foci lead to operational pictures with different content, which in turn lead to diverging indications and subsequently different analysis outcomes for the actors. Indications of cascading effects may thus be strong for some actors but non-existent for others. This raises the need to clearly communicate between actors their respective analysis outcomes in terms of cascading effects, in addition to contributing to a shared operational picture.



The second conclusion is that cascading effects increases the need for communication between actors. During an incident, some parts of the societal system may display the threat of cascading effects, or display actual cascading effects, while others do not. This means that some actors will modify their incident management while others will not. As some actors scale up and other not, the resulting differences will create modified lines of communication and methodologies, adding a component of novelty and unfamiliarity in the joint system of actors. To be able to deal with this actors need to be prepared to considerably add resources to the monitoring of, and dialogue with, other actors to ensure efficient coordination of effort. Important ingredients in this are a truly joint perspective and proactive approach.

The third conclusion follows from the aim to counter cascading effects during the pre-incident stage combined with the risk associated with time management during an incident. Both of these increase the probability for measures which are likely to be perceived by others as uncalled for. This increases the importance of efficient crisis communication. This conclusion is elaborated below.

First, the aim to counter cascading effects during the pre-incident stage means implementing measures before anything has actually happened. Since measures are almost always associated with cost, the ability to quantify and communicate risk becomes crucial. This is not unique for cascading effects, but due to the characteristics of cascading effects, where second and third order effects may occur, the logic behind measures may be particularly opaque to the observer, e.g. politicians or the public.

Second, during an incident time is always a scarce commodity. To avoid incident management falling behind the dynamic of the incident, decisions will often be taken based on assumptions. Some assumptions will inevitably prove to be false. This means that some decisions will turn out to be wrong, regardless of how carefully they have been taken. Similarly, during incidents with cascading effects the risk for second and third order effects likely increases the number of assumptions involved in decisions and thus also the risk for making less optimal decisions.<sup>30</sup>

The above increases the importance of crisis communication. As always, crisis communication during incidents with cascading effects needs to contain clear, rich, coordinated consistent information about the incident and what is expected from the receiver. However, crisis communication also needs to be prepared to explain the rationale behind some measures and why they are motivated even though they may appear to be uncalled for.

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<sup>30</sup>Important assumptions should therefore be tracked until they can be translated into verifications, at which point associated decisions should be revisited in the light of these verifications. This may be done by (1) quantifying the importance of the assumption and the degree of certainty behind it, (2) identifying when complementary data will be available, and (3) at that point in time check available information and see if the assumption was correct or not. Decisions are then changed if necessary. In reality, this could be as simple as a list on a whiteboard, to be monitored and ticked off in a continuous process.



### 5.3 Collaborative response

Information on collaborative response was gathered through the distribution and completion of a questionnaire by all of the countries represented in CascEff and by some of the countries represented by the projects EEAB. This allowed a picture of collaborative response throughout Europe to be created which is based on a useful cross-section of different countries and cultures.

In general, it can be seen that the different countries responding have the same or similar composition of rescue services, although these are provided on a different level by the different countries. This similar composition allows for a good potential collaboration and cooperation between countries; however the different levels from which these are provided as well as structural differences between the different agencies causes some issues both within countries (which are easily addressed) and between countries (which are less easily addressed) does have the potential to cause problems.

Practically: language, differences in operating procedures and communication, as well as structural differences are reported to cause the biggest issues with regards to collaborative response and action. Having said that, these challenges are never surmountable and solutions to them are often built into response plans and bilateral agreements. For example joint exercises and joint planning through infrastructure assets allows for frequent testing of collaborative response capability.

Legally and ethically, there were surprisingly few issues reported. As with practical issues, the majority of these are taken care of through bilateral agreements. For example agreements may be made to remove liability of assisting rescue agencies in other countries.

All of this points to a strong potential for collaborative action throughout Europe as well as a strong culture of addressing any potential issues which may arise through preplanning.



## 6 Conclusions

Three conclusions are drawn concerning incident management in general:

- The total ability of the constellation of actors which in the end determines how successful incident management can be
- Such joint ability requires instant interoperability
- In order to achieve such instant interoperability the community of incident management needs to embrace both standardisation and a culture of understanding the perspectives of others.

Three conclusions are drawn also concerning incident management involving cascading effects:

- Actors need to be aware of the full picture to be able to prepare for and contribute efficiently to a joint effort of incident management.
- Actors need to be prepared to considerably add resources to the monitor and communicate with other actors.
- Crisis communication needs to be prepared to explain the rationale behind some measures, especially when measures may appear to be uncalled for.

Finally three conclusions are drawn with regard to collaborative and cross-country response to escalating incidents:

- In general countries seem to maintain the capacity for both providing and receiving assistance for escalating incidents, both from their neighbours and from other EU-member states.
- The resulting command structures vary significantly between countries.
- To the extent that practical, legal and ethical obstacles are seen to exist they are for the most part addressed pre-incident, for example in bilateral agreements, treaties and joint exercises.



## 7 Appendix

### 7.1 Online survey: enablers and challenges in incident management

#### *Background*

A description of incident management needs to include the challenges that professionals associate with the domain. While incident management in practice is distinctly heterogeneous, as described earlier in this report, discussions in the early stages of the project indicated that many challenges may be generic. A recent report from the Swedish Civil Contingencies Agency (MSB) supports this notion.<sup>31</sup> In 2013 MSB reviewed 20 governmental reports from 2004-2011 on major incidents, crises and exercises in Sweden, looking for patterns in the descriptions of management challenges between organisations.

The review resulted in 16 specific enablers and challenges. This list was tested in a number of discussions with experts during 2013-2014, which suggested that these enablers and challenges were valid for the Swedish context. However, the discussions also suggested two possibilities. First, the enablers and challenges may be applicable not only *between* organisations but also *within* organisations. Second, the enablers and challenges may be generic across national borders.

For the purpose of CascEff, it was decided to investigate the degree to which these two possibilities were supported within the parts of the incident management community available to the CascEff consortium.

#### *Method*

The instrument for the investigation was an online survey<sup>32</sup> with full anonymity. The survey presented the sixteen enablers and challenges as 32 statements, 16 with the prefix “Within organisations” and 16 with the prefix “Between organisations”. For each statement, participants were asked to consider if the statement fitted with his/her experience or not and then mark one of five response options; “Strongly agree”, “Agree”, “Undecided”, “Disagree” or “Strongly disagree”.

The design effectively made the instrument a closed-ended question type survey collecting participant attitudes. Such a design has the benefit of enabling statistical analysis and avoiding the need for interpretation<sup>33</sup>. Participant data was collected in terms of nationality, gender, title and years of working experience.

The survey informed the participant of how personal data would be stored and treated, and asked the participant to agree to the conditions. The survey also informed of the following:

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<sup>31</sup> MSB (2013): Challenges in the management of accidents and crises: analysis of 20 reports from exercises and live incidents 2004-2011, MSB Karlstad

<sup>32</sup> hosted by SurveyXact

<sup>33</sup> Vitale, D. C., Armenakis, A. A., and Field, H. S. (2008): Integrating Qualitative and Quantitative Methods for Organizational Diagnosis: Possible Priming Effects? In: Journal of Mixed Methods Research, Vol. 2, pp. 87-105



*“Incident management often mean working under difficult conditions. This voluntary survey is part of a research effort aiming to learn more about challenges in incident management. It will take approximately twenty minutes of your time.”*

No further information was given on the scope and purpose of the study.

### *Procedure*

A link to the online survey was distributed to the partners in the CascEff consortium. The objective for the consortium partners was to distribute the link to known incident management experts. The stated ambition was to gather responses from at least five experts of each of the nationalities represented in the consortium.

The online survey was open for responses during six weeks (fall of 2014). At least one reminder was sent out by the consortium partners. A total of 209 links to the survey were distributed. Of these, 79 were completed which gives a 38% response rate.

The survey participants were distributed as follows:

- *Gender*: female 7%, male 93%
- *Employment*: public 86%, private 11%, Voluntary 4%
- *Nationality*: British 21%, Swedish 18%, Belgian 16%, Dutch 13%, French 7%, Other 25%
- *Working experience*: mean 18,4 years, median 17 year, mode 15 years

### *Data treatment*

The survey data are seen to represent subjective self-assessments rather than absolute measurement<sup>34</sup>. The responses are subsequently viewed as ordinal data, valid for non-parametric methods of analysis. These methods normally focus on median and mode values and rely on inferential tests such as Pearson’s chi-square. However, the limited number of participants risks individual characteristics skewing the results to the point where such calculation-based conclusions cease to have analytical value.

For studies where the same individuals are measured in several dimensions it is possible to use tests comparing paired proportions, such as McNemar’s test and the Wilcoxon test. However, these tests require matched pairs of data. In this case these pairs do not exist, since participants had the option to choose “undecided”.

Instead the R. A. Fisher’s Exact Test is used. The Fisher’s Exact Test calculates the significance of the deviation from a null hypothesis and provides an exact p-value (hence its name). The test is argued to be suitable for small, sparse or unbalanced data<sup>35</sup>.

The Fisher test requires data to be collapsed into 2 x 2 tables. Therefore participant data is collapsed into “Agree” (including both “Strongly agree” and “Agree”) and “Disagree

<sup>34</sup> Dittrich, R., Francis, B., Hatzinger, R. and Katzenbeisser, W. (2007): A Paired Comparison Approach for the Analysis of Sets of Likert-Scale Responses, in Statistical Modelling, Vol. 7, pp. 3-28

<sup>35</sup> Bower, K. M. (2003): When to Use Fisher’s Exact Test. In: American Society for Quality, Six Sigma Forum Magazine, Vol. 2, No. 4, pp. 35-37



(including both “Strongly disagree” and “Disagree”). The resulting set of 2 x 2 tables are subjected to the Fisher test and calculated for statistical significance with a 95% confidence interval (two-tailed p-values).<sup>36</sup>

Since the Fisher’s Exact Test is designed for two independent groups there is a risk that the algorithm skews the results. As a control measure the Fisher’s Exact Test is therefore complemented with the sign test, also a non-parametric test for binominal distributions. As for the Fisher’s Exact Test, the sign test is calculated for statistical significance with a 95% confidence interval (two-tailed p-values).

The calculations show that both tests mirror each other fairly well. However, the Fisher’s Exact Test proves to be slightly more conservative and offers lower p-values than the sign test. The results of the Fisher’s Exact test is therefore used for the conclusions.

The response data and resulting p-values are presented in the table on the following page.

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<sup>36</sup> One row of the 2x2 tables is made up by the aggregate of responses (e.g. 39/26). The other row of the 2x2 table is made up by a dummy variable constituting a perfect random outcome (in this case  $(39+25)/2=32/32$ )



Table 1. Online survey results

Statement 1-16 Within organisations / 2-32 Between organisations	Within org. agree/disagree	Between org. agree/disagree	Within org. p: Sign test	Within org. p: Fisher's test <sup>37</sup>	Between org. p: Sign Test	Between org. p: Fisher's test	Within/ Betw. org p <sup>38</sup>
1/17 [Within/between organisations,] people are not familiar with each other's responsibilities, roles and mandates	29/38	56/12	0,1642	0,4917	<0,0001*	0,0001*	<0,001*
2/18 [Within/between organisations,] people do not know what others need and can contribute with	33/31	52/9	0,9007	1	<0,0001*	<0,0001*	<0,001*
3/19 [Within/between organisations,] peoples responsibilities, roles and mandates are unclear	25/39	52/14	0,1034	0,2859	<0,0001*	0,001*	<0,001*
4/20 [Within/between organisations,] communication is often lacking	43/16	52/14	0,0006	0,0142*	<0,0001*	0,001*	0,5304
5/21 [Within/between organisations,] dialogue works better between people who work together daily	65/5	60/6	<0,0001*	<0,001*	<0,0001*	0,001*	0,7593
6/22 [Within/between organisations,] contacts between people at the field level work better than contacts between people higher up in the hierarchy	45/12	49/10	<0,0001*	0,0016*	<0,0001*	0,0002*	0,6399
7/23 [Within/between organisations,] social networks are necessary for success	48/10	44/14	<0,0001*	0,0003*	0,0001*	0,0068*	0,4923
8/24 [Within/between organisations,] social networks are lacking when people do not work together daily	28/28	29/23	1,1061	1	0,4885	0,6946	0,5688
9/25 [Within/between organisations,] common operations pictures are often lacking	37/25	52/7	0,1619	0,3670	<0,0001*	<0,0001*	0,0004*
10/26 [Within/between organisations,] common operational pictures are often incomplete	46/10	57/5	<0,0001*	0,0006*	<0,0001*	<0,0001*	0,1658
11/27 [Within/between organisations,] problems with common operational pictures relate mostly to working methods and data sources	36/12	43/9	0,0007*	0,0198*	<0,0001*	0,0008*	0,4619
12/28 [Within/between organisations,] problems with common operational pictures relate mostly to technical interoperability	20/25	34/16	0,5515	0,6732	0,0153*	0,1033	0,0241*
13/29 [Within/between organisations,] judgement and analysis are often based on sub-units' own information" rather than the aggregate of all units' information	51/15	58/10	<0,0001*	0,0019*	<0,0001*	<0,0001*	0,2718
14/30 [Within/between organisations,] judgement and analysis often lack a joint perspective	47/13	54/9	<0,0001*	0,0021*	<0,0001*	<0,0001*	0,3485
15/31 [Within/between organisations,] concrete recommendations for decisions are often missing	39/26	48/14	0,1360	0,2935	<0,0001*	0,0026*	0,0379*
16/32 [Within/between organisations,] people tend to be reactive rather than proactive	49/16	50/10	<0,0001*	0,0037*	<0,0001*	0,0002*	0,378

<sup>37</sup> P-value for the ratio agree/disagree for "within organisations" compared to a 50/50 dummy variable (random outcome)

<sup>38</sup> P-value for the ratio agree/disagree for "within organisations" compared to "between organisations" in respective twinned statements (1 vs. 17, 2 vs. 18, 3 vs. 19 etc)

## Comments

The objective of the survey was to investigate if the 16 enablers and challenges identified by MSB for the Swedish context may be (1) applicable not only *between* organisations but also *within* organisations, and (2) if they may be generic across national borders.

The results offer mixed support for “within organisations”. Only nine of the 16 enablers and challenges appear to apply<sup>39</sup>. These are, in falling order of statistical significance<sup>40</sup>:

- Dialogue works better between people who work together daily
- Social networks are necessary for success
- Common operational pictures are often incomplete
- Contacts between people at the field level work better than contacts between people higher up in the hierarchy
- Judgement and analysis are often based on sub-units’ “own information” rather than the aggregate of all units’ information
- Judgement and analysis often lack a joint perspective
- People tend to be reactive rather than proactive
- Communication is often lacking
- Problems with common operational pictures relate mostly to working methods and data sources.

In contrast, the results offer strong support for the enablers and challenges in relation to “between organisations”. Of the 16 enablers and challenges, 14 appear to apply between organisations. The average statistical significance is clearly stronger compared to “within organisations”. These 14 challenges are, in falling order of statistical significance:<sup>41</sup>

- People do not know what others need and can contribute with
- Common operations pictures are often lacking
- Common operational pictures are often incomplete
- Judgement and analysis are often based on sub-units’ “own information” rather than the aggregate of all units’ information
- Judgement and analysis often lack a joint perspective
- People are not familiar with each other’s responsibilities, roles and mandates
- Contacts between people at the field level work better than contacts between people higher up in the hierarchy
- People tend to be reactive rather than proactive
- Problems with common operational pictures relate mostly to working methods and data sources
- Responsibilities, roles and mandates are unclear
- Communication is often lacking
- Dialogue works better between people who work together daily
- Concrete recommendations for decisions are often missing
- Social networks are necessary for success.

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<sup>39</sup> Statistically significant, with a p-value less than 0,05, meaning that the possibility that the result is a random outcome is less than 5%.

<sup>40</sup> See table

<sup>41</sup> See table

### *Validity*

This survey was distributed to selected experts rather than a random sample of the European population. The criterion for selection was individuals who could be regarded as experts in the domain of incident management. No particular profession, societal sector, age group or organisational segment was targeted. As a result, the group of participants is heterogeneous. This adds a subjective dimension to the selection, which is reinforced by the fact that the selection was made by different individuals in the CascEff consortium.

On the other hand, a purposeful selection of participants allows for including individuals with particularly rich experience, or from relevant organisations or levels in society. This may be especially important for the highly professionalised but diverse area of incident management. Thus, targeting a broad range of key individuals should allow for a richer set of data. Support for this may be seen in the average working experience of 18,4 years.

In addition to the subjective element the form of survey distribution and response (web-based) means that the response process is uncontrolled in terms of how and when the survey is completed. While this is generic for all distributed surveys it makes it more difficult to compare individual responses.

The survey seems to have been perceived by the participants to be both relevant and understandable. The indication of relevance is drawn from the 38% response rate, which is a reasonably good result considering the means of distribution and response (web-based). The indication of being possible to understand comes from the distribution of responses. Of all the responses from all of the participants, the response alternative “undecided” only represents 16%, which suggests that it was in general possible to relate to the statements.

In addition, the overall distribution of responses appears to be equally free from stereotypical patterns in late responses compared to early responses. This could be seen to suggest that the participants did not suffer from “survey fatigue” but considered all 32 statements similarly.

Overall the 32 statements on challenges within and between organisations were supported by the participants. Of all the responses from all of the participants, the response alternative “agree” and “strongly agree” represents 62%, while the response alternative “disagree” and “strongly disagree” only represents 22%. While there is always a risk for “researcher pleasing” or bias, meaning that participants answer what they think is expected or socially accepted, in this particular case the risk may be small since the 32 statements represent what should by most seen as negative or undesired phenomena.

Taken together, the survey results should be possible to generalize to a broader context within the domain of incident management, at least within the EU.

