AN ANALYSIS OF A PLANE CRASH TRAINING EVENT

AFTER ACTION REVIEWS

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ABBREVIATIONS

112	Emergency Management Services
AAIB	Icelandic Aircraft Accident Investigation Board
AAR	After Action Review
AEP	Airport Emergency Plan
ALO	Airline Organization
ARFF	Aircraft Rescue Fire Fighting
BAP	Body Assembly Point
CAP	Casualty Assembly Point
CISD	Critical Incident Stress Debriefing
CPRO	Coordination, Plan, Resources, Operation (Icelandic: SÁBF)
CM	Crisis Management
CT	Control Tower
EMT	Emergency Medical Transport
EOC	Emergency Operation Centre
HCP	Health Care Professional
HO	Health Organization
ICE-SAR	Icelandic Association for Search and Rescue
ISAVIA	Icelandic Airport Management Company (before Flugstoðir)
LSH	University Hospital of Iceland
MC	Medical Coordinator
NECC	National Emergency Coordination Centre
NECP	Civil Protection Act of State Police
OSC	On Scene Command
RC	Rescue Coordinator
RG	Response Group member
RAP	Relative Assembly Point
RT	Rescue Team
SÁBF	Icelandic: Stjórnun, Áætlun, Bjargir, Framkvæmd
SC	Security Coordinator
TC	Transport Coordinator
TT	Triage Team
WAP	Walking-wounded Assembly Point

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AN ANALYSIS OF AN AFTER ACTION REVIEW REPORT FROM A PLANE CRASH PRACTICAL TRAINING

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1. INTRODUCTION

Airport security risk management is organised according to specified Airport Emergency Plans (AEP) published for airports and flights over Iceland. ISAVIA, the Icelandic Air Navigation Service Provider, operates and develops all airport facilities and air navigation services as well as other aviation related operations in Iceland. Airport crisis management is one of ISAVIA´s main roles, assured by practical training of crisis response.

A plane crash practical training event was planned, prepared and lead by ISAVIA and advisors, professional specialists from Reykjavík and Akureyri, beside local people. Participants in the practical training were Response Group members (RG) assumed in the particular AEP which after the practical training held a large debriefing talk meeting. Afterwards, After Action Review (AAR) reports assessing and analysing the outcome and improvement opportunities were drafted by coordinators, advisors and other nominated participants.

This report represents an analysis of an AAR report from a practical training event that included AAR reports from nominated participants and AAR focus group meeting minutes. AAR reports are reviews of the outcome of a practical training event including positive and negative assertions regarding structure, quality and coordination besides proposals for improvements. The purpose of this analysis was to understand better the training process and the need for crisis management improvements. Furthermore the purpose was to analyse how AARs could be attractive tools for crisis response improvements. Table 1 is a list of the AAR reporters including participants only commenting during the focus group meeting (marked by asterisks - *).

Limitations of the AAR reports should be considered before their analysis. Unavoidably, the quality and detail of the AAR reports vary between reporters, depending on their experience, skills and openness towards improvements. Moreover, reporters adopted different style of reporting, some of them were active, others more passive, some were proactive and others more reactive.

Results from the AAR reports showed positive feedbacks on, the work of RGs, instructors and advisors, planning and preparing the training event. Collaboration and coordination of the crisis responses were good. Nevertheless, more practical training was preferred and more use of the AEP recommended during the practical training process. Mistakes in emergency calls led to statements emphasising the importance of merging AEPs and emergency call groups and updating emergency call lists regularly. Furthermore, EOC recommended standard templates for initial press-release for saving time of announcing the initial crisis responses. In addition to that, presupposed solutions as planning in advance for closed airport, due of disaster or weather, was emphasised as being important.

The results from AAR reports showed that the flow of information in many instances needs more training and operational improvements. The pathways were not clear enough and information about passengers, emergency flights, resources and manpower on scene was missing at EOC. In addition to that, telecommunication needs improvements. Pathways and processes were missing on the local and the national level. Practical training was preferred on TETRA telecommunication. Moreover, telecommunication especially needs more discipline and clear channels of information.

Furthermore, structure and coordination are basic factors of work processes that need constant observation. Improvements are needed on the crisis response work processes and clearer pathways on some work parts, on the local and the national level. Manpower shortage was influential at this practical training, e.g. caused confusion regarding roles and responsibility. Too many RTs were at same time busy working Emergency Medical Transport (EMT) and Aircraft Rescue Fire Fighting (ARFF) employees. Furthermore, keeping track on manpower was difficult due to inadequate registration in and out of scene. Finally, some practical issues need improvements, i.e. the inner area organization, technical device services and first aid inventories.

Plane Crash Practical Training Event	
Organizational Units Reporting AARs	
Emergency Operation Centre - (EOC) (HO director included)	Instructors / Advisors from Reykjavík, Akureyri and ISAVIA - (CM)
On Scene Command – (OSC)	Control Tower – (CT)
Rescue Coordinator – (RC) (Aircraft Rescue Fire Fighting (ARFF) included)	Emergency Management Services – (112)
Medical Coordinator – (MC) (Casualty Assembly Point (CAP) included)	Health Organization* - (HO) (HO Nursing Director)
Security Coordinator – (SC)	Civil Protection Act of State Police – (NECP)*
Transport Coordinator – (TC)*	Airline Organization – (ALO)
Triage Team – (TT)	Relative Assembly Point - (RAP)
Rescue Team – (RT)	Critical Incident Stress Debriefing – (CISD)

* Statements exclusively coming from focus group meeting minutes.

Table 1   Organizational Units Reporting After Action Reviews (AAR)

The following sub-section of this report is a description of the execution of air crash practical training events and after that is a sub-section about AEPs. The second section describes the method of the analysis. The third section of the report, describes the results of the analysis with sub-sections on results of data structure, i.e. who reported, subjects of statements and contents of text. The fourth section is a summary of the results of the contents of text. Those readers who are familiar with the AEPs and do not want to go into the details of the results, can go directly to section four. The fifth section is a discussion about the outcome of the AAR analysis and lessons learned from methods and processes used to analyse the report. The sixth section provides suggestions of future works for directors, practitioners and researchers. Abbreviations used in this report are listed in front of the table of contents.

1.1. Plane Crash Practical Training

Plane crash practical training events in Iceland are regularly organized by ISAVIA and executed according to congruent AEPs specified for each airport crisis response. The events receive deserved attention and high priorities are given to Response Groups (RG) located in certain areas. The aims of practical training events are to practice crisis responses, cooperation, and coordination of crisis management according to a particular environment, rescue, care, primary triage, transportation etc. (ISAVIA, 2010).

Furthermore, plane crash practical training events are supposed to be exploitable for other kinds of a crisis as fire, avalanches and bus accidents. Police chiefs at related areas are responsible for practical training crisis response every five year at minimum (Almannavarnadeild c, 2011). The Civil Protection Act of National Police of Iceland (NECP) web site represents a list of ten basic items and principles often forgotten to observe before practical training. One of the principles are processing and adopting lessons learned from practical training to rules of plans (Almannavarnadeild a, 2011). Referring to the purpose of the analysis, processing and adopting such rules to AEPs are consistent with the aims of making AARs attractive tools for crisis response improvements.

The main collaborators of ISAVIA are the State Police, the Red Cross, the University Hospital of Iceland (LSH), the Icelandic Association for Search and Rescue (ISE-SAR), the Fire Department of Akureyri, the Icelandic Aircraft Accident Investigation Board (AAIB), the Icelandic Coast Guard, the Bishop office and the Emergency Management Services (112), beside other alliances (ISAVIA, 2010).

1.2. Airport Emergency Plans

The Icelandic laws of protection acts, aeronautics and police pronounce that AEPs should exist for all airports in Iceland. AEPs provide instructions about executing and coordinating initial crisis responses. The purpose of AEPs is to secure timely and structured crisis responses for promoting best possible results of rescuing casualties and minimizing effects of harm according to an emergency in related areas. The AEPs have been modified according to the circumstances of each area and are meant as guidelines, for first crisis responses, rather than detailed prescriptions.

All AEPs of emergency operations on accident scenes in Iceland are modelled and based on an organization chart called SÁBF (Icelandic: Stjórnun, Áætlanir, Bjargir, Framkvæmd), in English CPRO (Coordination, Plans, Resources, Operation). The system structure was published by NECP in collaboration with the Directorate of Health, ICE-SAR, the State Police of Iceland, the Iceland Fire Authority and the Red Cross in Iceland. The aim of the CPRO (SÁBF) system is securing same structures and roles for all rescue teams wherever you are in Iceland (Almannavarnadeild c, 2011).

There are congruent AEPs specified for circumstances at each of the 15 official Icelandic airports, operating scheduled flights, managed by ISAVIA. In addition to those, there are 37 smaller airports (6 covered with asphalt, 29 with gravel and 2 with grass). Four of the official airports are international airports, a main airport in Keflavik and three alternatives in Reykjavík, Akureyri and Egilsstaðir (ISAVIA, 2010). NECP, ISAVIA and the Civil Protection Act of

the airport in question are responsible for publishing congruent and defined AEPs (Icelandic: Flugslysaáætlun). Moreover the National Emergency Coordination Centre (NECC) of Iceland publishes emergency response plans for responses to various life threatening events (Almannavarnadeild c, 2011).

2. METHODS

The input data to the research was an AAR final report from a plane crash practical training event (written in Icelandic called "Lokaskýrsla"). The document starts with an introduction, describing the air crash practical training execution in general, preparation and execution of particular event, RGs contribution and the aim of AAR reports. The aims are stated as, first and foremost, bringing out positive and negative crisis response outcome for learning and improvements. Furthermore, the introduction is including word definitions, a manuscript of the practical training event and a universal description of the progress of the practical training written by a practical training director.

The text that was analysed consists of individual AAR reports from nominated delegates and a focus group meeting minutes. AAR reporters and focus group meeting participants are listed in Table 1. The AAR reports were written in a word document template including five main parts stating: 1. Work team; 2. Work groups in same work process; 3. Location during the event; 4. State some items which leave room for improvement and make proposals for improvements (a. preparation and training, b. execution and solutions); 5. State some successful tasks (a. preparation and training, b. execution and solutions). Tables in the AAR report reporting the practical training process time and use of telecommunication by groups were not analysed.

The method used is a qualitative research method called grounded theory. The original version of grounded theory was about exploring an unknown field and then iteratively building a theory about this field which is opposed to the positivistic tradition of verifying a theory set up before data collection (Taylor & Bogdan, 1998, p. 137). Grounded theory researchers strive to generate comprehensive explanations that are grounded in reality with major component of discovering variables that are central to explaining what is going on in particular scene. The tradition seeks to describe and understand social settings through key social, psychological and structural processes (Polit & Beck, 2004).

In an inductive way, the Grounded theory method collects and analyses empirical data, attempting to gather meaning and explanation. As the objective of grounded theory is rather to uncover theory than have it preconceived, it is more likely to uncover what is actually going on. The analytical process of the methodology involves coding strategies, which is the process of breaking down data into distinct units of concepts or meaning and clustering into categories. Descriptive concepts are then re-evaluated for interrelationships and gradually classified into higher order of categories (Coleman & O'Connor, 2007).
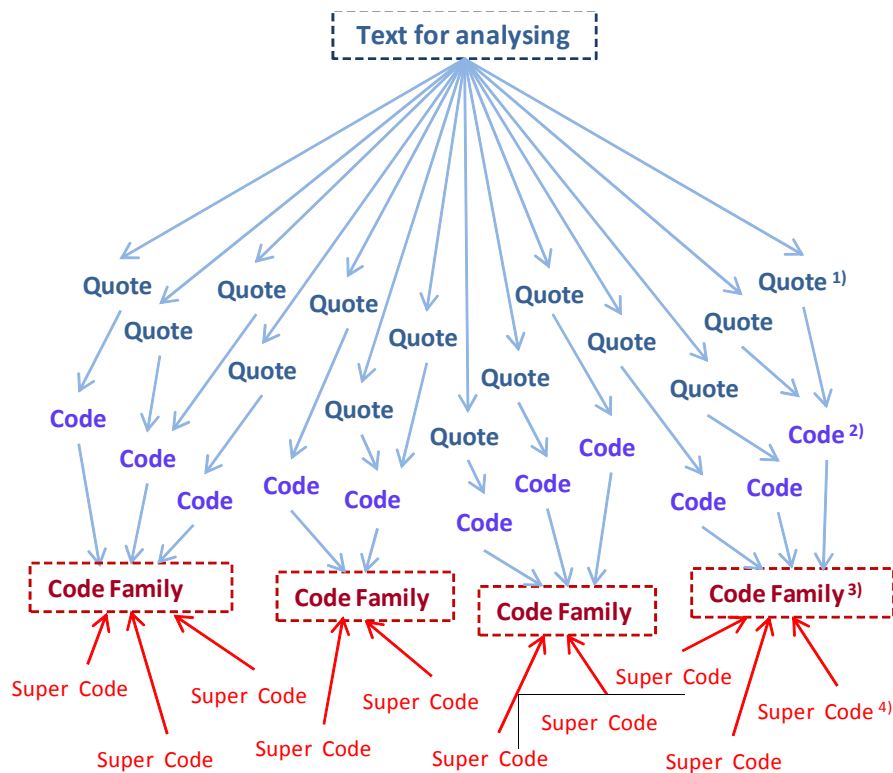
1. **A quote** (or quotation) is a selection of text for coding as data.
2. **A code** is associating code words with a quote.
3. **A code family** is a tool for classification of codes.
4. **A super code** is similar to normal code except that it is consisting of several combined codes (Code-Code-Relations), instead of "hardwired" quote connections.
   A super code is a tool used for further classification of codes within code families, network views and, last but not least, powerful operand allowing complex queries.

Figure 1 A Qualitative Grounded Theory Analysis made in the ATLAS.ti Software.

The software "ATLAS.ti, Qualitative Data Analysis" (version: WIN 6.2) was used to code, classify and organize the data. ATLAS.ti is a workbench in the category of coding and theory building software. The strengths of ATLAS.ti are visual and spatial representations of the data and the ability of creating hyperlinks to build non-hierarchical networks (Polit & Beck, 2004). Coding is the procedure of associating words with quotes. The association between a quote and a code is the foundation of coding in the framework of ATLAS.ti. Figure 1 shows the structure of data analysis of the AAR report, from selecting text (quotes) from a document, coding (codes) it, classifying (code families) and organizing (super code) as structured information. Coding selected quote content is made by making a code of a short description. Each quote has a unique code link of a "hardwired" quote-code connection. A code, on the other hand, can have more than one analogous quotes connected. A code family is a tool for categorising and connecting codes of a similar content. The same project can have several categories (types) of code families but each code is a unique code in each type of code families. Super codes are tools, storing a query to compute virtual references, used for organising and describing codes within code families.

2.1. Process and Classification

The final AAR report was loaded into the ATLAS.ti system. Text from reporters expressing assertions or suggestions and focus group meeting minutes, were analysed by allocating codes to quotations. Codes started with an abbreviation indicating reporter roles, hyphens and short selected text descriptions. For example, the code "EOC-Members of EOC needed instructions and practical training" is an example of a code made in the system, which refers to the assertion, "the EOC personnel must be trained and instructed", reported by EOC. ATLAS.ti allows for categorising codes into code families, as said before. Code families were defined for a set of codes and super codes were defined and created for further classification. For example, the mentioned code was classified in a code family called "IIa-Training-1WorkProcesses" and associated with a super code called "Coordination T1". Super codes are similar to normal codes, with the exception that the connections between quotes and the super codes store a query to compute their virtual references whenever needed. The meaning of code families and super codes will be described later in this section.

Codes were reviewed and similar statements merged as much as possible without losing content. Number of codes was 247 and number of quotes behind the codes, extracted from the text, was 301. Thus, some codes had more than one quote associated.

Five code families (categories) of operational or training factors were defined, set up in the system and then all codes classified accordingly. The meanings of these categories are described in detail in Figure 2. There were three main categories according to operational (I), training (II) and operational or training (III) factors. Operational codes refer to items which are due to the crisis management operation, but training codes are those that are due to the training of crisis management. Finally, codes in the third category are either operational or training, thus signifying that it was not possible to classify the code as either one exclusively. In addition there were two subcategories of operational (I.a, I.b) and training (II.a, II.b) factors to denote a difference between explicit statement and implicit interpretation of the text as operational or training.

Operational and training subcategories were defined and set up for classification aid, using categories of a (I.a, II.a) especially for two types of explicit reporter statements, positive assertions or suggestions. Subcategories of b (I.b, II.b), were on the other hand used for analyst interpretation relating statements about things not working as desired.

OPERATIONAL AND TRAINING FACTORS
I.   **Operational Factors**
I.a   **Operational Factors** Operational factors, are acknowledgements of a satisfactory operation or explicit suggestions by AAR reporters for improvements with the aims of best possible outcome of crisis response.
I.b   **Operational Factors – Analyst Interpretation** Operational factors - analyst interpretation, are factors not working as desired which, by analyst´s interpretation, could be improved operationally for the aims of best possible outcome of crisis response.
II.   **Training Factors**
II.a   **Training Factors** Training factors, are acknowledgements of a satisfactory training or explicit suggestions by AAR reporters about improvement of training skills required for the aims of best possible outcome of crisis response.
II.b   **Training – Analyst Interpretation** Training factors - analyst interpretation, are factors not working as desired which, by analyst's interpretation, could be trained for improvement of skills required for the aims of best possible outcome of crisis response .
III.   **Operational or Training Factors - Uncategorised** Operational or training factors are factors that, for the aims of best possible outcome of crisis response, either could be improved operationally or by training. Analyst does not have the premise to deduce whether the improvements are operational or training factors.

Figure 2 Code Families of Operational and Training Factors

Codes were reviewed for prevailing distinctive categories of crisis response. There were four main categories classifying characteristics of the crisis response act: 1. Work Processes, 2. Information Management, 3. Communication and 4. Resources. Crisis response categories were defined as code families in the system. Moreover, three subcategories were defined for each of the four crisis response categories, plus one sub-subcategory in resources, set up as super codes in the system and used for further classification. Figure 3 describes in detail the meaning of these crisis response categories, the four main categories (nr. 1, 2, 3, 4.) in the darker coloured spaces of the figure and the subcategories (nr. 1.1, 1.2, 1.3 etc.), including one sub-subcategory (nr. 4.1.1) in the lighter spaces. Structure (1.1) is an example of a super code belonging to Work Processes (1.).

CATEGORIES OF CRISIS RESPONSE

1. Work Processes

Work processes are functional structures of activities designed for producing specified outputs and best possible outcome, implying emphasis on how work is done in a specific order across time and place (Davenport, 1993).

1.1 Structure

Structure is concerning functional and organizational structure of progresses fulfilling crisis response as required.

1.2 Coordination

Co-ordination is an orderly arrangement of group efforts to provide a unity of action in the pursuit of common goals as required for crisis response (Reelay, 2009).

1.3 Role and Responsibility

Role is the state, quality, or fact of being responsible for overseeing progresses of projects and strategic problems as required for crisis response.

2. Information Management

Information management is concerning the progress of recording, maintaining, transmitting, retrieving and deleting data or information as required for crisis response.

2.1 Information Integrity

Information integrity is concerning quality or a state of consistency and correctness of information, at hand or missing, required for crisis response.

2.2 Flow of Information

Flow of information is concerning factors expressing transmission and organization of flow of information required for crisis response.

2.3 Technical Factors

Technical factors are concerning technical support of information management with Internet, software and communication infrastructure as required for crisis response.

3. Communication

Communication is the act or the process of transmitting, giving or exchanging, information with signals or messages, face-to-face or by telecommunication, as

3.1 Quality

Quality of communication is the state of being functional and successful, describing pathways, speed and balance as a set of functions or capabilities required for crisis

3.2 Lack of Contact

Lack of contact is concerning inadequate contact or communication coordinating required crisis response.

3.3 Telecommunication

Telecommunication is concerning factors expressing technology supported communication as required for crisis response.

4. Resources

Resources are concerning available and expected manpower and facilities required for

4.1 Human Resources

Human resources are concerning manpower available and expected for crisis response.

4.1.1 Shortage

Shortage is a factor within Human Resources concerning a lack of people required for

4.2 Facilities

Facilities are all sorts of lodgings and devices, excluding devices for transportation, required for crisis response e.g. medical and triage inventories.

4.3 Transportation

Transportation is concerning all resources required for transportation regarding crisis

Figure 3 Crisis Response Categories (Code Families and Super Codes)

Figure 4 is a definition of suggestions as extra explanatory super codes. Suggestion super codes were made for an extra classification besides other super codes within each of the four main crisis response categories. Note that, the classification of codes in suggestions and classification codes in the other three super codes in the main crisis response categories were independent.

EXTRA EXPLANATORY SUPER CODES IN CRISIS RESPONSE CATEGORIES

Suggestions

Suggestions are statements, emphasis or proposals, concerning factors required for crisis response improvements.
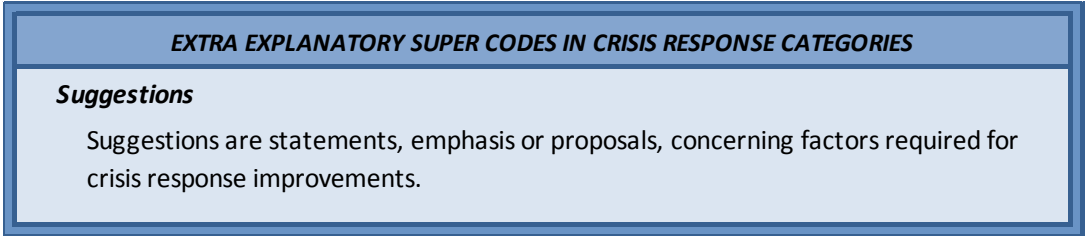
Figure 4   A Definition of Suggestions as Extra Explanatory Super Codes

After classifying codes according to operational or training factors and crisis response categories, twenty code families were set up for merging crisis response categories according to the classification of operational or training factors. Names of those code families reflected their content, e.g. "I-Operation-1WorkProcesses". Note that each code had a unique classification in each type of code families, i.e. could not appear twice in same type of code families. Code families are twenty nine, with five categories of operational or training factors, four crisis response categories and twenty categories representing the join of the former classification.

Crisis response subcategories in Figure 3 were imported as super codes in each of the joined categories, plus an extra super code of suggestions of in each. Two categories of training factors (IIa, IIb), information management and resources, were inactive because there were no codes in it. Thus, number of super codes was 67, with 17 in each of the operational (Ia and Ib) and operational or training factors and 8 in each of the training factors (IIa and IIb). "Structure O1" is an example of a super code in 1. Work Processes of operational factors, where codes concerning the crisis response structure in operational factors were classified.

Network views were created in the ATLAS.ti system for each of the joined code families and worked out by importing and sorting all "code family neighbours". The network views were used as an aid for classification and further reviews. Codes within each code family were classified by super code connections. Super code connections were variable, e.g. the code "ALO-Defining review of work process for ALO and ISAVIA" was connected the super code "Structure O1" by "is a part of", the code "ISAVIA-Recommending a card system for work processes, like the airport card system" by "is a" and the code "TT-Practical issues as casualty placement should be clear in advance" by "is associated with". Super codes of suggestions were implemented in all networks as an extra description, e.g. the code "ISAVIA-Recommending a card system for work processes, like the airport card system" was also connected by "is a" to a super code of "Suggestions O1". Furthermore, the network views are preferable as explanatory diagrams for code families, super codes and code-code relationships and give good grasp for reviewing codes and checking quotes if needed.

3. RESULTS

This section provides three subsections on results of the analysis. The first subsection is about the results of classification of codes and the second one is about results of codes divided, first, by organizational units and, second, according to the subjects of the statements. The third subsection gives a detailed account of the results according to the crisis response categories and subcategories within operational or training factors.

3.1. Results of Classification

This section describes the results of the classification of codes in numbers of codes by categories. The findings of code numbers are given in Table 2 by operational or training factors (I.a, I.b, II.a, II.b, III) and crisis response categories (1, 2, 3, 4), with main findings of the three categories of operational or training factors

Number of Codes by Operational or Training and Feature Categories						
Code Families	**I. a. Operational**	**I. b. Operational - Analyst**	**II. a. Training**	**II. b. Training - Analyst Interpretation**	**III. Operational or Training**	**Total of Codes**
1. Work processes	25	8	39	1	24	**97**
2. Information Management	9	5	0	0	17	**31**
3. Communication	7	2	22	21	25	**77**
4. Resources	13	19	0	0	10	**42**
Total of Codes	**54**	**34**	**61**	**22**	**76**	
Total by I, II and III	**88**		**83**		**76**	**247**

Table 2   Number of Codes by Operational or Training and Crisis Response Categories

Table 2 shows a division of codes into operational or training factors and there under crisis response categories (i.e. Work processes, Information management, Communication and Resources). Most of the codes (88) were operational factors (I) with many more on work processes (33) and resources (32) than on information management (14) and communication (9). Somewhat fewer (83) training factors (II) probably could be explained by no codes in information management and resources opposite with 14 and 32, respectively, in operational factors. Finally, with over 31% of the codes classified as either operational or training factors indicate how conjunctive operational and training factors can be for crisis response improvements.

The distribution on crisis response categories shows the largest part of codes (97) on work processes (1.) with a rather even division in operational and training factors. This is not unexpected because work processes, weighing much through all processes constructed in AEPs, are a basis of structured crisis response (Almannavarnir d, 2009). Moreover codes on work processes were concerning roles, responsibility and coordination of group effort.

Communication (3.), a key factor serving as an engine activating processes, comes next (77) with training factors (II.a and II.b) as being most prominent. Common discussions about communication probably can be explained by its basis for collaboration and coordination of

crisis response processes. For example, AEPs publish specific basic telecommunication plans for connecting all teams working on crisis response (Almannavarnir d, 2009).

Resources (4.), concerning available and expected manpower and facilities, are mainly operational factors (32), few operational or training factors but no training factors. This could be explained by operational factors of a human resource shortage and facilities not working as required as being influential. Problems with keeping track on resources and securing triage card fastenings are examples of codes either of operational or training factors.

Information management (2.), concerning data, information and knowledge, is more confined but extensive influential spectrum (31 code) with no codes in training factors. Reasons for information management is not exclusively classified as training factor could be explained by the fact that techniques and processes are conditional upon operational factors and knowledge and training prerequisite for processing reliable information. Unclear pathways and inadequate flow of information were influential operational or training factors.

As mentioned before, codes can have one or more identical references to selections of text (quotes) from different parts of the analysed document. Most of the codes (215) have one quote behind them, 25 have two, 9 have three, and one has four and one five quotes behind. The code with five quotes behind was remarking "a lack of RTs on scene" and the code with four quotes "a lack of RTs to take care of casualties on scene" was characteristic for the influences from manpower shortage on this particular event. It should be noted that, as codes were not merged across reports from organizational units, there could be more than one code about same facts coming from several reporters. The total number of quotes from the analysed document is 301.

3.2. Results by Reporters and According to Subjects of Statements

The distribution of the codes was analysed according to who reported and which organizational units were the subject of the statements. The variance on number of codes by reporters and subjects of statements could be related to factors affecting the reporter. Convenient form of reporting, time of reporting, active reporter and reporter position according to how easy it is for him to evaluate the process, are examples of probable factors of influence. These are factors desirable to have in mind when interpreting who reported and which of the organizational units were the subjects of the statements.

Table 3 shows AAR reporters by numbers of statements reported and organizational units as subjects of statements. Five organizational units distinguished themselves from others in more of subject statements about than others. Apart from CM, which stands for crisis management in general, EOC was the highest in the range of subject statements (34). All subject statements about EOC, except one from TT, were reported by EOC themselves. RC (31) was next as a subject in number of codes, then MC (29) and RT (21).

Number of Codes by Organiztional Units as Reporters and Subjects of Statements		
Organizational units	**By Reporters**	**By Subjects of Statements**
CM [1]	23	40
EOC [2]	58	34
RC [3]	27	31
MC [4]	12	29
RT	18	21
CISD	12	13
TT	12	10
112	15	10
OSC	22	9
HO [5]	10	9
NECC	-	9
RAP	10	7
ALO	9	7
SC	6	5
CT	6	5
TC	3	4
Red Cross	0	3
NECP	4	1
Total	**247**	**247**

1) Crisis Management; Reported by advisors from Reykjavik, Akureyri and ISAVIA; Statements about instructors, advisors or several crisis response organizations; 2) EOC including HO director; 3) RC and ARFF (same reporter); 4) MC, CAP included; 5) HO nursing director;

Table 3   Number of Codes Organizational Units as Reporters and Subjects of Statements

The Emergency Operation Centre (EOC) reported 58 codes, the Rescue Coordinator (RC) 27, the On Scene Command (OSC) 22, instructors and advisors as a part of Crisis Management (CM) reported 20 codes and Rescue Team (RT) 18 codes. Other organizational units reported fewer codes, the emergency service, 112, reported 15, Medical Coordinator (MC), Triage Team (TT) and Critical Incident Stress Debriefing (CISD) reported 12, Health Organization (HO) and Relative Assembly Point (RAP) reported 10 and others reported fewer codes.

Count of codes reported could partly be explained by how active and responsible the roles were on the scene. EOC is responsible for organizing, prioritising and coordinating crisis response, OSC is the police chief representative organising and coordinating the rescue work according to the CPRO (SÁBF) system and the others reporting many statements serve as key parties in the crisis response process. That many reporters stated only few comments is worth further investigation. Furthermore, it should be noted that NECC and NECP, key organizational units in crisis response, were among the low numbers of codes. An explanation of the low numbers for NECC and NECP is that neither NECC nor NECP were nominated reporters and NECP expressed their statements at focus group meeting.

One explanation for the high number of codes (58) from EOC can be that it had two reporters, the EOC coordinator and the HO delegate (HO director) in EOC, with both of them participating in the focus group meeting. Second, as mentioned before, the role of EOC, being responsible for organizing, prioritising and coordinating crisis response, has a good overview of the rescue work as a whole. Moreover, the EOC functions as a coordinator and a communication centre can be an explanation for the high number of codes. The second highest number of codes by RC reporting 27 codes, both for RC and ARFFs, probably can be explained by its key role of organizing and coordinating rescue and fire fighting on the scene (Almannavarnir d, 2009).

Following is a discussion on the number of codes about the five groups which were stated most frequently (Table 4, Table 5, Table 6, Table 7 and Table 8), arranged by operational or training and crisis response categories. Table 4 shows the number of codes on the subject of the EOC work team, by operational or training and crisis response categories. Most of the codes about EOC were, due to training or operational factors (20), undividable to either training or operation. Codes exclusively training factors (8) and operational factors (6) were much fewer.

Number of Codes About the Emergency Operation Centre (EOC) Work Team						
Code Families	I. a. Operational	I. b. Operational - Analyst Interpretation	II. a. Training	II. b. Training - Analyst Interpretation	III. Operational or Training	Total of Codes
1. Work processes	1	1	3	0	3	8
2. Information Management	0	0	0	0	10	10
3. Communication	2	1	1	4	7	15
4. Resources	1	0	0	0	0	1
Total of Codes	4	2	4	4	20	34

Table 4   Number of Codes about EOC by Operational or Training and Crisis Response Categories

Most of the statements about EOC were on Information Management (10) and Communication (15). From the statements we see that several elements of EOC and NECC teamwork need improvements. Furthermore, division of labour, telecommunication and communication regarding air lift connections, resources and processing were tasks needing improvement for better teamwork. Special orders from EOC regarding emergency flights were lacking. The role of EOC as a backup for OSC was emphasised. Moreover, task and role confusions concerning HO, NECC and RC were expressed.

Emphases on information management (10) were consistent with EOC's role of coordinating crisis response operations as a whole. Despite good planning and collaboration, the flow of information to and from EOC needed improvements in many instances. EOC had difficulties getting passenger lists, both due to technical reasons and participants' lack of motivation. Information about emergency flight plans, transport ability, expected assistance, manpower and resources on the scene was lacking. EOC lacking information about emergency flights explains why they did not fulfil special requests in that regard. Moreover, there was a lack of information regarding triage and counting of casualties from the Casualty Assembly Point (CAP) and about resources and requests for help from the OSC. Inadequate check-in on the scene and hence lack of information about RGs on the scene caused uncertainty. Finally, EOC

recommended that a passenger list and a standard template for initial press-releases were available.

Communication was the most prominent crisis response category stated about EOC (15), which is consistent with EOC's role of activating work teams and securing communication with key parties off the scene. Telecommunication of the EOC needs to be sharpened. Processes on change of frequencies are needed. Air lift contact with NECC was strange intermittently. Problems when EOC contacted RC caused a lack of information about manpower on the scene. Furthermore, RGs simulated "on paper", due to a lack of manpower, caused wrong messages from EOC regarding primary triage reinforcements.

A number of statements will motivate further training. EOC preferred more instructions and practical training, without saying which factors in particular. However, telecommunication between EOC and NECC did not work as desired and would benefit from better training. EOC and NECC teamwork lacked a common comprehension of the tasks and the situation. Furthermore, confusions in communication and work processes caused misunderstandings causing delays of EOC requesting assistance on the scene and at CAP from other more remote health organization. Finally, first alarm and announcements were unclear.

Operational factors about EOC (6) are in all crisis response categories except information management. Telecommunication inside EOC and some CPRO (SÁBF) system work parts need pathways on the local and the national level. EOC, which initially got overloaded, needed a spokesperson and they needed TETRA devices and headsets for all EOC members for listening. Furthermore, EOC recommended having doorkeepers on all their workplaces. The HO delegate, with a specific role as a part of EOC, needed assistance from a spokesperson and for using the computer.

Number of Codes About the Rescue Coordinator (RC) Work team						
Code Families	**I. a. Operational**	**I. b. Operational - Analyst Interpretation**	**II. a. Training**	**II. b. Training - Analyst Interpretation**	**III. Operational or Training**	**Total of Codes**
1. Work processes	4	1	5	0	4	**14**
2. Information Management	0	0	0	0	0	**0**
3. Communication	0	0	1	3	2	**6**
4. Resources	4	7	0	0	0	**11**
Total of Codes	**8**	**8**	**6**	**3**	**6**	**31**

Table 5   Number of Codes about RC by Operational or Training and Crisis Response Categories

Table 5 shows the number of codes stated about the RC work team arranged by operational or training factors and crisis response categories. Half of all the codes were operational factors (16) but training factors were nine and codes which are either operational or training factors were six. No issues at all were on Information management and resource issues are only due to operational statements.

The practical training worked well, except for minor task and role confusions. Practical training of ARFFs in advance went well. RC got positive feedback on rescue work and primary triage on and off the scene. For example, a search group, manned within few minutes, found one man injured off the scene. Telecommunication, on the other hand, failed in some instances. RC lacked contact with people on scene and a lack of contact caused ARFFs to

arrive at closed gates on their way to the scene. Instructions for RGs on how to select or change channels in telecommunication were recommended. OSC recommended RC, or his delegate, guiding the groups arriving on the scene to the right telecommunication channels.

Operational factors, which were exclusively resources (11) and work processes (5), were consistent with RC's role of organizing and coordinating fire fighting and rescuing on the scene. A card system ensuring clear roles worked very well. Applying scissors for rescuing went well. The transport of casualty over the river worked well, but it was a hard work and floating outfits were missing in rescue boats. In that context, a little walk bridge was recommended over the river. Moreover, RC's role of delegating HCPs got confusing. A lack of RTs taking care of casualties on scene and a lack of EMTs and RGs for primary triage were prominent problems. Finally, a lack of EMTs and ambulances was supposedly a problem in real world accidents.

Technical devices for fire fighting failed in some instances; hence, ARFFs had troubles with technical functions which needed repair. A monitor on a fire truck did not work, a fire truck foam system and a high and low compression needed repair and hand lines (Icelandic: handlínur) were recommended. The necessity of preparing fire trucks, minimally a truck and a man ready for servicing, was emphasised. The reasons for no codes about RC in information management (0) probably can be related to RC focusing on work processes, communication and resources. Their only information management task is on confirming counts of casualties.

On the operational or training level, difficulties came up in keeping track of the number of casualties. Referring to an account before, after successful rescue work on the other side of the river this was stated as a matter of grave. For intensity of first responses, ARFFs were urged to immediately contacting RC as their first task when arriving on the scene. Finally the same VHF frequency was preferred for ARFF and ISAVIA.

Number of Codes about the Medical Coordinator (MC) Work Team						
Code Families	I. a. Operational	I. b. Operational - Analyst Interpretation	II. a. Training	II. b. Training - Analyst Interpretation	III. Operational or Training	Total of Codes
1. Work processes	1	0	4	0	6	11
2. Information Management	2	2	0	0	2	6
3. Communication	0	1	1	1	4	7
4. Resources	1	2	0	0	2	5
Total of Codes	4	5	5	1	14	29

Table 6   Number of Codes about MC by Operational or Training and Crisis Response Categories

Table 6 shows the number of codes on the subject of the Medical Coordinator (MC) team according to operational, training and crisis response categories. Nearly half of the codes about MC were due to training or operational factors (14), undividable to either training or operation.

Training factors (6) were positive feedbacks on tasks and telecommunication. Health Care Professionals (HCP), RTs and Red Cross solved tasks of mass care very well. Primary triage and counting from scene and in and out of CAP were praised. Nursing at CAP was good. However, nursing at CAP probably was not real as it was, due to lack of manpower, simulated with

doctors and nurses "on paper". Furthermore, the telecommunication between MC and other coordinators was praised. However, OSC was questioning MC's need for contacting him in addition to a designated EOC person.

Operational factors (9) about MC were urgent structure, resource and registration improvements. The CAP organization needs reviewing. Quite a lot of RTs are needed at CAP, noting again the process not as a real one with nurses and doctors "on paper". Transportation from CAP lacked resources The Red Cross people at CAP lacked markings. The registration out of CAP was less than desired; it had unclear and missing statements about how and where casualties had been transported. To remedy this, the registration paper form at CAP needs improvement. Finally, simultaneous connection to ICE-SAR's database was preferred in order to help CAP and TT with counting.

Work processes (11) were more than one third of the codes about MC. In addition to positive feedbacks and needs for improvements discussed before, there were confusions regarding tasks, roles and count of casualties. Role confusions came up regarding the Red Cross at CAP. The doctor directing on scene was busy triaging, and thus he lost overview of primary triage and counting and could not prioritise transport of casualties as he was supposed to. Counting casualties was confusing and the counting out of CAP was wrong. Inaccurate counting of primary triage and casualty fate was stated as mostly caused by wrong registration out of CAP. The doctor directing at CAP lacked training, his role emphases at CAP according to the MC role were unclear. However, some statements about MC were mismatching. On the contrary to, before stated, wrong counting, inadequate registration and unclear work processes, MC got positive feedbacks on processing as working well and quickly, with counting from scene and in and out of CAP included.

Information management (6), communication (7) and resources (5) were even in number of codes about MC. In addition to statements mentioned before, the pathways for flow of information, communication and delegation need improvements. The flow of information was stated as unclear. More training was recommended on who sent which information to whom and when. NECC asked MC, instead of EOC, about transport of casualties hence MC spent too much time on informing NECC. Furthermore, MC telecommunication with EOC and NECC and communication between the doctor directing on scene and MC need improvements. Finally, the importance of initially manning CAP adequately with HCPs and then tracking casualties was emphasised. Use of RGs trained for care was recommended at CAP on demand.

Table 7 shows the number of codes stated about RTs, arranged by operational or training and crisis response categories. Training factors (6) were exclusively on work processes and communication. RTs got positive feedback on coordination on scene. However, more training on table-top was recommended. When arriving on the scene, some RTs were unlabelled and did not contact RC. Furthermore there was a lack of telecommunication between RTs and RC.

Operational factors (6) stated about RTs were e.g. regarding improvements of emergency calls, resources, RT shortage and RC contact. That no codes were classified as work process could be related to the fact that RTs mostly work more individually on scene. Since a rescue team, including 80 members got no emergency call, it was suggested that it be on a specific call list at 112. There was a lack of RTs on scene. Many RTs were EMT and ARFF employees and, therefore at same time working as such. Moreover, in addition a burden of manpower

shortage, there was an emergency call on adding RTs and airplane for searching for casualties outside the scene. Finally, RGs at the district were encouraged to bring with them first aid resources as oxygen, transfusion and bandages on their way to the scene.

Number of Codes about the Rescue Teams (RT)						
Code Families	I. a. Operational	I. b. Operational - Analyst Interpretation	II. a. Training	II. b. Training - Analyst Interpretation	III. Operational or Training	Total of Codes
1. Work processes	0	0	3	1	4	8
2. Information Management	1	1	0	0	2	4
3. Communication	0	0	0	2	2	4
4. Resources	1	3	0	0	1	5
Total of Codes	2	4	3	3	9	21

**Table 7   Number of Codes about the Rescue Teams
by Operational or Training and Crisis Response Categories**

Training or operational factors (9) about RTs mostly concerned roles and coordination. Improvements are needed on the coordination of RTs working on scene. RTs were urged to work further on the next level of tasks if RGs were missing in the crisis response process. However, arranging RTs as directors on scene caused confusion of roles and other RTs expressed statements about RTs roles first and foremost being on the scene for searching and rescuing, and not as directors. Furthermore, the importance of initially announcing arrival on scene and the Transport Coordinator (TC) keeping track on the manpower was emphasised. On communications, RTs agreed to the use of VHF telecommunication internally in the group with only one or more of them contacting RC and other coordinators through TETRA.

Number of Codes about Crisis Management (CM)						
Code Families	I. a. Operational	I. b. Operational - Analyst Interpretation	II. a. Training	II. b. Training - Analyst Interpretation	III. Operational or Training	Total of Codes
1. Work processes	7	0	13	0	3	23
2. Information Management	2	0	0	0	0	2
3. Communication	0	0	6	3	3	12
4. Resources	2	1	0	0	0	3
Total of Codes	11	1	19	3	6	40

**Table 8   Number of Codes about Crisis Management
by Operational or Training and Crisis Response Categories**

Table 8 shows the number of codes about CM arranged by operational or training and crisis response categories. Codes about CM were about instructors, advisors, across organizational units, i.e. not particular to one unit. Training factors (22) about CM were more common than the other groups discussed previously. The training factors were exclusively in work processes (13) and communication (9). Resource issues are probably mostly bound to specific organizational units and although there were information management issues across organizations, this has been stated about a specific unit as a source or receiver of that information.

Training factors about CM were positive feedbacks and useful improvement proposals worth further exploration, especially regarding the organization of the training event. The instructors and advisors were praised for good preparation, planning and cooperation. RG collaboration and coordination was thought to be good. Furthermore, the work on scene, assistance at CAP and markings on the scene were praised. However, preparing the practical training and finishing the AEP was preferred to start earlier. The importance of repeated stimulus before practical training was stated as underestimated. Furthermore, securing actors' safety was emphasised as very important. Several reporters recommended that a practical training director would have the responsibility of steering how the practical training event progressed and timing of individual events, such as resource and emergency flight arrivals.

Furthermore, TETRA telecommunication needed reviewing and more discipline and practical training telecommunication was recommended. RC and ARFF VHF telecommunication and the TETRA contact between RC and other organizational units on the scene was a success. A lot of shouts and long talking caused RGs urging avoidance of group overlaps in TETRA. ISAVIA telecommunication got confusing because of active group scanning and problems came up when choosing or changing telecommunication frequencies. Furthermore, comments regarding responsibility of guiding RGs on right telecommunication channels caused the 112 delegate making statement about that coordinators on scene should guide them, not 112.

Operational factors (12) about CM were mostly work processes (7), including important suggestions regarding planning and organizing, besides few comments regarding information and resources. Proposals were made about standardizing the airport card system, e.g. for work processes and resources at CAP. Casualty placement and inner area organization, such as the placement of Body Assembly Point (BAP) and Walking-wounded Assembly Point (WAP), needs reviewing. Suggestion was made about that practical issue such as casualty placements should clear in advance. As mentioned before, since groups were missing on emergency call lists at 112, ensuring all RGs on the lists, securing clear responsibility of reliable emergency call lists at 112 and merging and coordinating AEPs and emergency call groups are urgent improvements. Furthermore, a lack of participants, especially RTs and HCPs, were prominent problems. Finally, it was stated that coordinators need better labelling.

Operational or training factors (6) stated about CM were also mostly concerning improvements of organizing and planning in advance. Directors were encouraged to have the AEP finished earlier than the current practice is and to use it more in the training process. Planning in advance, local persons responding to crisis were encouraged to immediately restraining according to available flight plans and transport ability. Presupposing solutions for a closed airport, caused by disaster or weather, were suggested. Processes and pathways for telecommunication, including processes securing TETRA patches, were recommended. Moreover, it was proposed that EOC or other directors in crisis response would announce through transceivers when changing channels.

Number of Codes by Most Frequent Subjects of Statements and Crisis Response Categories					
Organizational Units	**1. Work processes**	**2. Information Management**	**3. Communication**	**4. Resources**	**Total of Codes**
Emergency Operation Centre (EOC)	8	10	15	1	**34**
Rescue Coordinator (RC)	14	0	6	11	**31**
Medical Coordinator (MC)	11	6	7	5	**29**
Rescue Teams (RT)	8	4	4	5	**21**
Crisis Management (CM)	23	2	12	3	**40**
Total of Codes	**64**	**22**	**44**	**25**	**155**

**Table 9   Numbers of Codes by Most Frequent Subjects of Statements
and Crisis Response Categories**

Table 9 shows an overview of the number of codes of the five organizational units which had most statements about them. These organizational units have 63% of the codes. Most of the codes were in work processes (64) and communication (44) but there were fewer codes in resources (25) and information management (22).

Codes in work processes, with structure and coordination as the base of management issues, were most about CM (23). Codes in communication were most prominent about EOC (15) and CM (12), both being centrals of coordinating crisis response. EOC (10), the information central, was striking in information management. Work processes (14) and resources (11) about RC reflected emphasis of their role in rescue and fire fighting on the scene rather than coordination. That there were no codes on information management about RC is interpreted as there were no major issues. Codes about MC and RT were more evenly distributed.

Note that codes about OSC, a central coordinator on the scene, have not been included in the discussion above. As said before OSC, the police chief representative organising and coordinating the rescue work according to the CPRO (SÁBF) system, reported 22 codes but there were much fewer (9) codes stated about them than those five organizational units. This is said for pointing OSC out as one of key roles in the crisis response process. OSC was the subject of urgent improvement factors on a contact surface with the others, i.e. OSC placement and overview on the scene, diverse problems in telecommunication and a lack of information about resources.

Number of Codes by Most Frequent Subjects of Statements and Operational or Training Factors						
Organizational Units	**I. a. Operational**	**I. b. Operational - Analyst Interpretation**	**II. a. Training**	**II. b. Training - Analyst Interpretation**	**III. Operational or Training**	**Total of Codes**
Emergency Operation Centre (EOC)	4	2	4	4	20	**34**
Rescue Coordinator (RC)	8	8	6	3	6	**31**
Medical Coordinator (MC)	4	5	5	1	14	**29**
Rescue Teams (RT)	2	4	3	3	9	**21**
Crisis Management (CM)	11	1	19	3	6	**40**
Total of Codes	**29**	**20**	**37**	**14**	**55**	**155**

**Table 10 Numbers of Codes by Most Frequent Subjects of Statements
and Operational or Training factors**

Table 10 shows the number of codes, but now by operational or training factors. Operational factors, in total 49, were most prominent about RC (16) and 22 training factors about CM out of 51 in total.

3.3. Results from Codes

Following is a detailed account of the content results of the codes analysed in this project. The results are described according to crisis response categories and subcategories within operational and trainings factors. Note that results are discussed by the three main operational or training factors, i.e. I.a and I.b are discussed as I (operational factors) and II.a and II.b as II (training factors)

3.3.1. Operational Factors (I)

Work Processes (1)

Structure (1.1)

The organization of the assembly points on scene caused reflections. The event advisors suggested about CAP organization needing reviewing. MC suggested about a need for reviewing the inner area plan, BAP placement should be guarded because casualties were defenceless at WAP beside a big window and WAP placement was questioned if too far away for TT. Referring to ARFF meeting closed gates when arriving on the scene, TT questioned if the inner and outer cordons should have been closed or not. TT proposed practical issues such as casualty placement to be clear in advance. A delegate from the rescue team suggested about OSC placement, too far from scene, partly causing OSC lacking overview on the scene. Improvement of OSC overview on scene was proposed by his placement closer to the action points.

ARFF rescue work by cutting was successful and the rescue work and transport from the other side of the river as well. Transport over a river was a hard work and a proposal concerning that was recommending a little walk bridge over the river.

Workflow and work processes needed sharpening, especially named at EOC. EOC recommended reviewing single work parts of the CPRO (SÁBF) system. The HO nursing director suggested about that NECC needed reviewing their routes of seeking information. MC reported good experiences of the airport card system, working well in delegation by ensuring clear RG roles on scene. A Control Tower (CT) delegate discussed how to renew the airport traffic plan, thought the sign system designed by BW (?) was a brilliant system for securing delegation and solving chaotic situations.

An ISAVIA delegate recommended a system like the airport card system for work process improvements. The Airline Organization (ALO) delegate made proposals of standardizing and adjusting the ALO and ISAVIA card system and discussed how to define delegation for improvements of the efficiency at ALO and on scene. ALO moreover reported about their work on work process improvements after the practical training, by working out conflicts and using a card system for securing traffic control.

Coordination (1.2)

Participants got positive feedbacks on their work on scene. The Security Coordinator (SC) praised good rescue work outside defined emergency scene. Moreover, collaboration of the priest and Red Cross got positive feedbacks. Coordination on scene was put on a test when TC was too late on scene and a man from CT started patrolling at gate instead of him. Unfortunately, the CT man could not leave the gate as he was supposed to because TC was too late, later than resources from ARFF. Moreover, the HO nursing director reported about that the HO inside management was known in advance as a weakness.

Role / Responsibility (1.3)

Some confusion came up regarding roles and responsibility concerning emergency call lists at 112. Groups supposed to be on emergency call lists were missing. The importance of clear responsibility statements about maintaining the emergency call lists was emphasised. NECP confirmed that the responsibility of selecting groups on emergency call lists at 112 is their telecommunication department role in collaboration with 112.

EOC emphasised NECC role of immediately sending airplanes, including triage team, HCPs and devices required for first crisis responses. NECC was proposed to first send an airplane from the closest place and then from Reykjavík. EOC moreover recommended the huge task of planning emergency flight receptions as a part of the NECC role. EOC initially got overloaded; the HO delegate in EOC, which has a separate role in EOC, was proposed to need a contact person, a computer work assistant and a headset for telecommunication.

A new CT card system for delegating, marking centrals and patrolling was successfully used for delegation on scene. The airport janitor role in crisis response was discussed, being familiar with the airport area and having keys he was proposed to be placed at the airport terminal. The janitor was suggested to be able to work both in and out doors in addition to assisting with markings and resources.

Information Management (2)

Information Integrity (2.1)

The crisis alarm did not reach all RGs as planned, police, one priest and a RT at more distance, including 80 members, got no calls. The reasons were that these people were missing on emergency call lists adjusted to the AEP. The RT delegate emphasised that the emergency call should come from 112 where all emergency call lists should be secured. The CISD team moreover made proposals of using SMS messages for priests.

The importance of merging and adjusting emergency call groups to appropriate AEPs was emphasised. Furthermore, the urgent tasks of regularly updating and securing all nominated RGs on emergency call lists was emphasised, independent of whose duty it was.

Statements about improving casualty registrations were prominent. MC complained about unclear process of registering casualties, said the registration paper form missing statements about where to, when and with whom casualties were transported. Proposals for improvements were about adding columns for statements missing on the registration form.

Technical Factors (2.3)

NECC delegates had technical problems with logging in to the central database and got wrong date and time on their computers. Suggestions, in that context, were about securing NECC connection to the central database and tuning same date and time on all computers. Furthermore, EOC made proposals about a same time connection to the ICE-SAR database for CAP and TT for securing continuity of counting with as consistent and reliable information as possible.

Communication (3)

Quality (3.1)

The first alarm messages from CT to 112 were stated as clear. Activating the airlift connection was reported as easy, unless change of ALO phone numbers. The Relative Assembly Point (RAP) delegate considered on the positive side about that the communication with EOC was good and the communication and collaboration with priests was admirable.

Telecommunication (3.3)

EOC emphasised TETRA transceivers as required for all EOC members for listening.

Resources (4)

Human Resources (4.1)

Crisis response requires quite a lot of RGs at CAP as well as other assembly points. A lack of manpower caused them delegating by use of "RGs on paper". RAP recommended responding to the shortage of manpower by using more of people from other Red Cross departments. SC reported manning a search group within a few minutes and finding one casualty injured succeeding in spite of poor manning. Furthermore EOC suggested about them needing doorkeepers at all workplaces.

The report showed, in some instances, numbers of RGs attending / responding to the practical exercise. ARFF consisted of 11 people, including one diver, remarking many RTs at the same time busy working as EMT and ARFF employees. There were five people from ALO and 29 actors in addition to six dolls as surrogates for passengers. HCPs participation was little, but there were more of standby volunteers. The CISD consultation group included no health care delegates for the sake of a shortage of people on scene.

Shortage (4.1.1)

Shortage of manpower was a prominent issue in this practical training. There was a lack of participants, RGs and actors including actors as relatives. A shortage of RTs, HCPs, and EMTs caused problems especially regarding primary triage and casualty transport within CAP. A lack of RTs on scene was partly caused by too many RTs at same time busy working as EMT and ARFF employees. The same persons also got a call for help on searching casualties outside the scene. A lack of RTs to take care of casualties on the scene and transportation within CAP had a further chain effect on the process.

Facilities (4.2)

The ARFF delegate reported some troublesome technical issues of the fire work. The monitor on fire truck 1 did not work. The high and low compression and the foam system of the fire truck needed repairing and hand lines (Icelandic: handlínur) were recommended. Suggestions were made about the urgency of preparing fire trucks for flights by securing one truck and one man fully prepared.

A tower truck was recommended for improvements of OSC overview on scene. The coordinators on scene needed better labelling and Red Cross RGs at CAP as well. Furthermore, floating outfits or life-vests were missing in the boats ARFFs used for the rescue work on the other side of the river. Triage card fastenings came loose which caused some of them lost.

HO inventory, as medicine and transfusion, was almost given away within a short period of time. The nursing director encouraged RGs from the district bringing resources as oxygen, transfusion and bandage with them on their way to scene when responding to crisis like that.

Transportation (4.3)

Referring to the EMT shortage, there was also a lack of ambulances for transportation which caused poor transport ability from CAP. This was stated as a problem in general, not only in a crisis of large scale but also for regular operations.

A "Ramp" was preferred for all emergency transport. TC pointed out that a ramp for all emergency transport would keep ambulances farther away from the scene and then require more of porters.

3.3.2. Training Factors (II)

Work Processes (1)

Structure (1.1)

Primary triage went well although first responses were in some incidents not as planned in advance. RT director was unmarked and did not contact RC as required when arriving on scene. Things worked well and the process overview improved when the practical training proceeded. The ARFF delegate suggested about the importance of RGs initially contacting RC when arriving on scene. Moreover ISAVIA instructor emphasised the importance of securing the passenger surrogate safety (actor volunteers).

The practical training instructors and advisors got praises from EOC regarding good preparation, planning and cooperation at the event. Training ARFF in advance helped a lot, e.g. regarding the fire work and the CPRO (SÁBF) system.

EOC preferred a meeting before such practical training events, which was due to a cancellation of a planned meeting. The CT and RC representatives made suggestions about that preparing and finishing the airport emergency plan should have started earlier.

Crisis response within HO needed more practical training. EOC preferred more practical training and a rescue team at more distance recommended more on-desk training. Furthermore EOC emphasised that the importance of repeated stimulus before practical training was underestimated.

CISD reported alarming as working well. CISD almost made on-desk training and debriefings together with mass care people from Red Cross. CISD used free time working on instructions and registration papers and recommended combining their education with other district for economic reasons.

Coordination (1.2)

RGs coordination got in many instances positive feedback. RT them self-praised the coordination of RTs on scene, said it worked well. Advisors were satisfied with collaboration of the groups. They praised HCPs, RTs and Red Cross people for very well solved tasks of mass care and stated nursing at CAP as good. Furthermore MC gave ISAVIA, ALO and Red Cross positive feedback on their work on scene, labelling and assistance at CAP.

Volunteers at RAP got positive feedback on their work. MC and OSC were satisfied with the work on primary triage despite a lack of resources for nursing and transportation. SC appreciated processing counting from scene and in and out of CAP as working well and quickly. EOC on the other hand made suggestions about that EOC and NECC lacked common comprehension of solving tasks and problems.

Many groups working on CISD used the training event for getting important contacts. CISD had regular status meetings and informed their consultation group there about. Moreover CISD used the opportunity for coordinating debriefing among participants from the church, Red Cross and health care.

Role / Responsibility (1.3)

The report included a time table (page 40) reporting the progress of the practical training (not analysed here). Referring to that time table, suggestions were made about assigning a practical training director which role should be directing the progress of such training events by reporting a lack of work processes, allocating resources and timing event progresses as RG arrivals, emergency flights etc.

Communication (3)

Quality (3.1)

The first crisis alarm from CT to 112 went well in spite of inexperienced CT employee. CT initially got no answer due to a same time real world load disturbing the TETRA connection. The 112 delegate therefore emphasised the importance of waiting few seconds if no answers were received and calling again. CT was suggested desirable to initially give more information to 112.

The emergency call alarms and first announcements were reported as not clear enough. EOC made statements about that the alarm did not work as desired, because it was late to police and some RTs were excluded. The 112 delegate emphasised that 112 should exclusively make the alarm initially and after that the responsibility would get over to the coordinators.

NECC got positive feedbacks from 112 regarding the air lift connection. Communication between the organizational units of EOC, MC and HO worked well. Telecommunication between OSC and other coordinators (RC, SC and TC) was good. OSC on the other hand was

questioning if MC being in good contact with identified person in EOC needed communicating with him as well.

Telecommunication needed more discipline for avoiding shouts and long talking. EOC reported about that inappropriate communication from NECC to MC made undesired irritation on scene. The responsibility of the doctor directing on scene and his need for contacting health care organizations was discussed. Furthermore misunderstandings and confusing communication with HO at more distance caused delay of EOC requesting help from them.

Lack of Contact (3.2)

Telecommunication contact was inadequate in some instances. There was a lack of contact between OSC and MC and the telecommunication between RC and ARFFs, RTs and people working on scene was inadequate. Furthermore ARFFs had problems with telecommunication which caused them meeting closed gate when arriving on the scene. Neither did telecommunication between EOC and NECC work as desired.

Telecommunication (3.3)

The CT delegate found that the TETRA telecommunication worked well and that the contact of telecommunication groups from ISAVIA was good in all. MC also got positive feedback on his telecommunication with the other coordinators. Furthermore VHF contact between RC and ARFF and TETRA telecommunication between RC and OSC, SC, TC and MC worked well.

Problems came up for groups changing channels from TC to RC. ISAVIA telecommunication got confusing for the sake of active TETRA patches. The doctor directing on scene forgetting changing frequencies also caused telecommunication troubles. OSC reported that having the Red Cross on same AV_AL_1 wave was disturbing for OSC and EOC. EOC made warnings of avoiding TETRA group overlaps for not disturbing the others.

The 112 delegate suggested about the duty of coordinators on scene directing RGs to right channels/frequencies. OSC made suggestion about RC, or his delegate, guiding RTs to identified telecommunication groups on scene and the role of TC instructing them on frequencies when arriving on scene. OSC reported initial difficulties with managing coordinators to let their people work on own frequency.

More practical training was preferred on TETRA telecommunication. The NECP delegate encouraged practical training on TETRA and airport guards reminded their lack of instructions on TETRA transceivers before the training event. HCPs lacking more practical training were known in advance as a weakness. The HO delegate made suggestion about telecommunication as very important and confirmed HCPs lacking training. Furthermore it should be notified that the report included table about the use of TETRA groups during the practical training, which was not analysed here.

3.3.3. *Operational and Training Factors (III)*

Work Processes (1)

Structure (1.1)

Count of casualties and primary triage appeared to be confusing. RC, OSC and SC had difficulties keeping track of counting and SC supposed this mainly was due to lost triage cards.

EOC made suggestions about presupposing solutions regarding first responses, by emphasising local persons immediately planning in advance and restraining themselves according to available flight plans and transport ability. Furthermore EOC emphasised the importance of presupposing solutions regarding closed airport, due to weather conditions or the disaster itself, hindering the rescue work. RC, reporting difficulties of transporting people over a river, further made suggestion about presupposing solutions for fire and rescue work on the other side of the river as a matter to put in a contingency plan.

Coordination (1.2)

RGs had to coordinate their work due to lack of people on scene. RAP made proposals of reviewing and improving their coordination. OSC recommended reviewing the coordination of RTs work on scene. People at RAP contacting EOC caused conflicts between RAP and OSC. Furthermore special orders were lacking from EOC regarding emergency flights.

Role / Responsibility (1.3)

Delegation and coordination of tasks and roles got confusing. HO roles on one hand and NECC roles on the other hand were discussed. The doctor directing on scene was busy making primary triage himself which caused him losing overview for prioritising casualty transports. The HO delegate in EOC made suggestion about that only the doctor directing on scene should decide transport of casualties. Role confusions came up at CAP regarding Red Cross people working there. The emphases of the doctor work at CAP were discussed afterwards; TT said the doctor at CAP priorities needed more attention.

The role and task delegation according to the AEP was changed in some instances. RTs were arranged in roles as directors on scene (not stated which roles) due to a lack of people. Suggestions related to that were about that RT roles should first and foremost be searching and rescuing people on the scene. EOC emphasised own role to be a backup for OSC if needed and emphasised RTs working further on next level of tasks if resources were missing.

Information Management (2)

Information Integrity (2.1)

EOC made proposals of crisis response improvements by requesting ready-made standardized forms for initial press-release for filling it out and saving time for airplane crash first responses. Suggestions were made about RTs living at more distance being on a specific emergency call list at 112.

A lack of information about the manpower at hand on scene caused uncertainties disappointing EOC. The reason partly was that some RGs did not check in on the scene as required. Suggestions were made about the importance of RGs registration when arriving on

the scene. Furthermore TC role of keeping track of manpower working on the scene and informing EOC there about was emphasised.

Referring to information consistency, problems came up regarding inaccurate counting of casualties mostly supposed to be caused by wrong registration out of CAP.

Flow of Information (2.2)

The flow of information between working points was, despite good planning and collaboration, not as desired in many instances. OSC, EOC and HO lacked information about emergency flight plans, mainly concerning its location, transport ability and assistance expected. Information about primary triage and count of casualties was not flowing from CAP as desired. Referring to that, information routes were lacking. MC complaining about unclear information preferred more training regarding registration of casualty transport which was not stating whom to send, when and where to.

OSC lacked information about manpower resources on the scene which caused continuing effect on EOC and RTs lacking information about need for more of resources and assistance on the scene. Furthermore the continuing effect was on inadequate flow of information within and from EOC. The importance of RGs registering in and out of the scene and keeping track of and informing EOC there about was emphasised. Moreover EOC reported a man from NECC telecommunicating for gathering information already available in the database.

Technical Factors (2.3)

EOC had troubles with getting passenger list, both due to technical problems and a lack of collaboration. EOC made a request in that context of ensuring secure passenger lists.

Communication (3)

Quality (3.1)

Communication had both positive and negative outcomes. Advisors emphasised telecommunication in general to be reviewed. They also remarked doctor directing on scene and MC needing improving their communication and MC fixing factors of contacting EOC and NECC.

EOC made suggestions about their need for sharpening telecommunication skills. EOC and NECC needed revising their telecommunication and division of labours. Moreover EOC and NECC communication needed reviewing regarding air lift connection, resources and processing. EOC also made proposals about designating a NECC person for them communicating and cooperating with.

There seemed to lack understanding regarding flow of information. MC spent too much time on informing those asking him instead of EOC. MC, already overloaded, was interrupted by NECC asking about casualty transport. RT directors at the district were wondering to what end HCPs needed special frequencies for directly contacting the scene, said this was disturbing RTs on scene. The HCP delegate role in NECC was explained; he was supposed to need information at first hand being responsible for informing EMTs and health care organizations.

The rescue work progresses at Cap were not real because "nurses and doctors on paper" (hidden people) were also used due to HCP shortage. The use of "hidden people", supposed

to work on primary triage and later at CAP, caused misunderstandings and wrong messages from EOC and confusion regarding expected help from external triage teams.

Lack of Contact (3.2)

There was a lack of telecommunication contact in some incidents. The EOC air lift contact was strange in between. Troubles in connecting EOC and RC caused EOC lacking information about resources and manpower on the scene. The importance of ARFF immediately being in contact with RC on the scene was emphasised. CISD reported about the church emergency act committee not getting their request for more of priests.

Telecommunication (3.3)

Problems came up when choosing or changing channels/frequencies in TETRA telecommunication. HO and NECC had troubles with their telecommunication and troubles with frequencies also hindered TT in contacting the HO. TT made suggestions about that EOC or other organizational units should announce in transceivers when changing frequencies.

Pathways and processes were needed for changing channels/frequencies and securing TETRA patches. ARFF preferred the same VHF frequency as ISAVIA. A RT delegate emphasised RT members using inside VHF telecommunication and restricting only one of them (or more) using TETRA for contacting RC or other coordinators on the scene. OSC made suggestion about that Red Cross needed separate frequency for contacting EOC. Moreover the RAP delegate made proposal about that RAP should be a part of the telecommunication plan.

Resources (4)

Human Resources (4.1)

A lack of RGs and actors as relatives caused RAP using on-desk training. There showed on the other hand to be strength in many groups of active CISD professionals at the district. The ALO delegate made proposals, as a response to RGs shortage, of announcing the accident at the airport for searching HCPs or other RGs. He suggested that probably around 70 people being there at the moment.

OSC suggested about the necessity of initially keeping track of RGs on scene and informing TC thereon. TT emphasised the importance of initially manning CAP well with HCPs which then would further follow casualties in their process. The HO nursing director recommended CAP using RGs trained for care if needed.

Facilities (4.2)

The triage cards were lost in some cases. EOC made suggestions about requirements of securing triage card fastenings to help with and securing casualty counting. Moreover OSC made suggestion about the importance of fastening triage cards and securing on casualties through all transport.

Transportation (4.3)

Suggestions were made about preferring emergency transport not driving too close to the scene for preventing danger and damage of investigations.

3.4. Severity of Codes

Until now, the discussion of results has mentioned that statements were both positive and negative. Therefore, the code results were analysed and coded by assessments or suggestions, with statements which were meant to maintain prevailing work methods coded as assessment and suggestions exclusively being proposals of modification to work. After dividing the statements to suggestions and assessments, the assessments were coded by severity of positive (two levels: + or ++), negative (two levels: - or --) or neutral.

It should be noted that as the analysis until now, the severity coding is a highly subjective one. It has been shown to be evaluator dependent. Nonetheless, it gives an indication of the seriousness of the comments and their magnitudes.

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Severity of Codes by Organizational Units as Subjects of Statements							
Organisations	Suggestions	Negative - -	Negative -	Neutral	Positive +	Positive + +	Total of Codes
CM [1]	4	8	18	3	2	5	40
EOC [2]	1	22	9	0	1	1	34
RC [3]	1	13	7	1	3	6	31
MC [4]	0	16	8	0	0	5	29
RT	0	8	11	0	1	1	21
CISD	1	3	2	0	5	2	13
TT	0	5	4	0	1	0	10
112	0	4	3	0	0	3	10
OSC	0	5	3	0	0	1	9
HO [5]	0	4	5	0	0	0	9
NECC	1	4	2	0	1	1	9
RAP	0	3	1	0	0	3	7
ALO	3	0	2	1	1	0	7
SC	2	2	0	1	0	0	5
CT	1	0	1	0	0	3	5
TC	0	2	2	0	0	0	4
Red Cross	0	1	2	0	0	0	3
NECP	0	0	1	0	0	0	1
Total	**14**	**100**	**81**	**6**	**15**	**31**	**247**

1) Crisis Management including advisors, instructors or more than one crisis response organization;
2) EOC including HO director; 3) RC and ARFF; 4) MC and CAP; 5) HO nursing director;

Table 11 Number of Codes about Organizational Units by Severity

Table 11 shows the results of the severity assessment of the codes. About 73% (181) of the 247 codes were negative statements, 19% (46) were positive and 2% (6) neutral. Suggestions, which were not classified by severity, were 6% (14) of total the codes.

Again, the five organizational units which had over 20 codes stated about them were striking with 19 to 31 negative codes each, in all 118 codes. The other organizational units got from 0 to 9 negative codes stated about them. Positive codes were more evenly distributed to the organizational units, with 0 to 9 codes stated about each of them.

EOC as a prominent reporter got most negative statements (31), most of them stated by themselves, but fewest positive, or 2. MC got 24 negative statements. CM also got 24 negative statements, got 7 positive and 3 neutral. RC got 20 negative statements, 9 positive and 1 neutral. Finally RT got 19 negative and 2 positive statements.

4. SUMMARY OF RESULTS

4.1.1.   Operational Factors (I)

Work Processes (1)

The assembly point organization needs reviewing. Suggestions were made there about, as the base of structured work flow on the scene. **The inner area, CAP and BAP placement,** were deemed needing improvements and **WAP placement** was thought to be too far away. Practical issues such as **casualty placement** were emphasised being clear in advance. **Closed gates** were occasions of **guarding secure arrivals** on the scene and **questioning if inner and outer cordons should be closed or not**. Furthermore **OSC** was due to a lack of overview proposed to **be placed closer to the action points**.

Participants got positive feedback on their work on scene, **collaboration** and **rescue work** outside defined emergency scene. Coordination was put on a test when TC was too late on scene and a man from CT started instead of him as a patrol at gate. **The rescue work got praises,** both by cutting and rescuing outside defined emergency scene. Expressing the transport over the river as working well, it was stated a hard work and proposals made about a little walk bridge over the river.

Confusion concerning roles and responsibility was regarding **alarming and emergency call lists at 112**. Emergency call lists were missing. The **responsibility of NECP deciding groups to be on the lists at 112** was confirmed. The **importance of clear roles and responsibility** was emphasised. The **airport janitor,** being **familiar with the airport area**, was considered to be a **key person** in guiding and assisting with markings and resources.

Workflow and work processes, including EOC and the airport traffic plan, **needed sharpening**. Single CPRO (SÁBF) system work parts and CAP organization were **processes pointed out for reviewing. NECC** was suggested needing reviewing their **routes of seeking information**. Management inside HO was known in advance as a weakness.

Card systems already in use, all with same aims of improving efficiency on the scene, **gave good experiences**. One of them was pointed out as **excellent for chaotic situations** and another **for delegating, marking centrals and patrolling**. **The airport card system** was praised and **recommended** for improving work processes. **Proposals were made of standardizing and adjusting the** ALO and ISAVIA **card system**. ALO reported about their work on reviewing conflicts and traffic control afterwards.

Planning emergency flight reception was suggested to be a huge task, desirable as NECC role. NECC was supposed **to immediately send airplanes** from the closest place **including resources required for first responses**. EOC initially got overloaded and the HO delegate in EOC needed a designated contact person and TETRA headset devices.

Information Management (2)

The **importance of keeping complete and regularly updated emergency call lists** was emphasised. Moreover **merging and adjusting appropriate emergency call group lists and AEPs** was emphasised as an urgent information management task because of the **alarm not reaching all RGs as planned in advance.** A group of eighty people was missing on the emergency call lists at 112. Suggestions were made about **securing all emergency call lists at 112 as required**.

The casualty registration was a prominent factor needing improvements. The **registration paper form**, missing statements about where to, when and with whom casualties were transported, was named **to be improved**.

Some **technical computer problems** were proposed to be improved. Examples of that are that **logging in to central database failed** and **wrong time/date** on NECC computers. Suggestions were made about **same time connection to the ICE-SAR database** for CAP and TT, for securing information about counting as reliable as possible.

Communication (3)

Kick off announcements, the first messages from CT, were stated as **clear** and the activation of the **air lift connection went well**. **Communication between organizational units** as EOC, MC and HO got positive feedbacks and between RAP and EOC and priests as well. **TETRA transceivers** were emphasised as required **for all EOC members**.

Resources (4)

Quite a lot of RGs are required. Manning a search group within few minutes succeeded in spite of poor manning. Referring to the shortage of people, a request of guards at EOC is supposed to be of low priority. Numbers of RGs participating the practical training were reported in some instances, e.g. about ARFFs, ALO, actors and HCPs.

A lack of manpower is an urgent factor for watching at small places, where such cases require all resources available. **The RTs, HCPs, and EMTs shortage caused problems,** e.g. regarding primary triage, caring and transport of casualties. This is easier to say than carrying out because, e.g. a lack of RTs on scene was partly caused by **too many RTs at same time busy working EMT and ARFF employees. HCPs participation was little**, but there were more of standby volunteers. **Training all RGs available at small places is therefore an urgent task for solutions**.

Some specific technical fire and rescue work devices were out of order and needed checking. A foam system and high and low compression of a fire truck needed repair and hand lines (Icelandic: handlínur) were recommended. **Securing one truck and one man fully prepared** was recommended as a **minimum requirement**.

Placing a tower truck for OSC on the scene was recommended to improve his overview on the scene. Better labelling was needed for the coordinators and Red Cross people at CAP. **Floating outfits or life-vests were missing** in a boat used for the rescue work. **Triage card fastenings came loose;** some of the cards were lost which caused confusions in counting.

Responding to a big accident requires a lot of inventories, sometimes much more than small places can afford. **HO inventories,** as medicine and transfusion, were **almost given away** in a short time. The nursing director emphasised RGs at the district **bringing resources as oxygen, transfusion and bandage with them** from other areas when responding to crisis like that.

EMT shortage and a lack of ambulances, a matter of grave concerning real world accidents, caused **poor ability for casualty transportation**. A **"ramp" was preferred** for all emergency transport but keeping ambulances further away from the scene was remarked as requiring more of porters.

4.1.2. *Training Factors (II)*

Work Processes (1)

The work of **primary triage and counting got positive feedback and things worked well** when the training proceeded. **Discipline and structured work processes** are important characteristics in crisis response. More discipline was needed, e.g. by **securing own labelling and contacting coordinators** and/or team leaders when arriving on scene. The importance of RGs **fulfilling registration principles and entrance control on scene was emphasised. Securing the actor safety** was also remarked as very important.

The practical training instructors and advisors were **praised for good preparation, planning and cooperation**. **Training on fire work** and CPRO (SÁBF) system **in advance helped a lot**. Yet the preparation of the practical training **was proposed to be improved with more of meetings.** Moreover, **finishing the AEP** was suggested to start earlier.

More practical training was recommended **at HO on first responses**. EOC preferred more practical training and the RT delegate recommended **more on-desk training**. **The importance of repeated stimuli** was emphasised as being **underestimated. Combining education** with teams **in neighbouring communities** was recommended for economic reasons. EOC delegate made statements about **EOC and NECC lacking more common comprehension,** an important task for solutions.

Participants got **positive feedback on their coordination.** The volunteer work at RAP got positive feedbacks. The **collaboration was good.** Tasks of **mass care were well solved**, especially by HCPs, RTs, Red Cross, priests and Red Cross in CISD. Nursing at CAP was also stated as good which was not real because "RGs on paper" were used due to a lack of manpower. ISAVIA, ALO and Red Cross also got **positive feedback on their work on the scene,** with labelling and assistance at CAP included. Furthermore, RTs were satisfied with their coordination on the scene although OSC suggested about their need for working on it.

CISD reported alarming working well. CISD practical training was almost on-desk training except regular status meetings and debriefings. **CISD used free time** working on instructions and registration papers and coordinate debriefings. The event opportunity was also used for **strengthening important contacts**.

The time table, reporting the progress of the training event, **gives useful information**, both for time reviewing and planning in advance. The progresses of the event inspired ideas of assigning a **specific practical training director**, e.g. for timing incidents, tasks and resources available.

Communication (3)

The first alarm from CT to 112, a source of an airplane accident response, **went well although 112 preferred more information from CT as kick off announcements. Unexpected incidents** as a parallel load from the real world and inexperienced CT employees **could be seen as good learning tests. The 112 delegate emphasised specified rules when responding to overloaded system.** NECC activated the **air lift connection** which **proved fairly well**.

The alarm and first announcements were stated not clear enough. EOC stated the alarm not working as desired because police and a group of eighty RTs were missing. The **alarm** was emphasised **exclusively initially coming from 112** and after that belonging to the responsibility of coordinators.

Telecommunication required more discipline due to inappropriate communication making undesired irritation and probably misunderstandings. **This underscores the importance of clear pathways securing everyone as well informed as possible.** NECC unnecessarily interrupting MC is an example of **wrong pathways or inexperienced people** causing confusion at EOC. The responsibility of the HCP delegate in NECC and doctor directing on scene on scene, of **informing EMTs and health care organizations,** was discussed.

Key roles, such as coordinators and OSC, **managed TETRA telecommunication well working.** CT reported well working contact and telecommunicating with ISAVIA. The VHF contact between RC and ARFF got positive feedback as well. MC being in good contact with EOC was questioned if needing to communicate with OSC.

Inadequate telecommunication was dominant **causing serious problems as shown by delayed requests for help. A lack of contact stopping or slowing down processes** can be fateful, e.g. as **causing closed gates** for ARFFs arriving on the scene. There was also a lack of contact between OSC and MC on the one hand and RC and ARFFs, RTs and RGs on the scene on the other hand. Furthermore the **telecommunication between EOC and NECC needed revision**.

Choosing, changing or even forgetting to change channels/frequencies caused **frequent problems**. Groups had troubles, e.g. with changing channels from TC to RC and doctor directing on scene forgetting changing frequencies. **Active TETRA patches were disturbing** ISAVIA telecommunication and Red Cross being on the same wave as OSC was remarked as disturbing EOC. **As stated, overlapping groups in TETRA telecommunication should be avoided for not disturbing. Understanding each ones needs and responsibility probably** might remedy this.

Pathways were needed to confine communication between RTs and coordinators on the scene and customise inside VHF telecommunication for RTs. Suggestions were made about **which role and duty it was directing RGs to the right channels/frequencies** when arriving on the scene. Coordinators were suggested to be **responsible for guiding them.** OSC reported difficulties initially managing coordinators to let their people work on own frequency and made suggestion about guiding channels as RC and TC duty.

Proposals were made about **urgent tasks of specific pathways for changing channels/frequencies besides reviewing and training telecommunication.** NECP encouraged for **more practical training on TETRA telecommunication in general**. HCPs and airport guards lacking more training were known in advance.

4.1.3. *Uncategorised - Operational or Training Factors (III)*

The results of classification showed over 30% of the codes being either operational or training factors. The main reason for such grouping was that identifying those codes as solely operational or training factors was not possible. One example of that is, "primary triage needing improvements". Primary triage is a work process based on structure, skills and knowledge. Instructions and structure of work processes are on the one hand operational factors probably needing improvements and on the other hand training factors probably needing educational improvements regarding responder skills and knowledge. Prioritising such operational or training factors would need further exploration.

Work Processes (1)

Primary triage and counting are examples of factors needing more discipline and structured work processes. **Difficulties in keeping track of counting** were a source of a chain effect causing failures through all the counting processes.

Planning presupposing solutions in advance was stated as important. Orders of local people **immediately constraining** their **work to flight plans and transport ability** were examples of that. Using **weather conditions** as the frame of reference, **OCS placement**, **closed airport** and a fire and rescue work on the other side of the river were also remarked as tasks for presupposing solutions. RTs were praised for difficult work of rescuing and transporting casualty over the river.

RGs were proposed to **coordinate their work due to a lack of people**. The **RT work coordination** on scene was proposed to be reviewed. RAP proposed improvements of their coordination. Conflicts came up between RAP and OSC regarding telecommunication pathways. Moreover statements were made about **a lack of special orders regarding emergency flights**.

The shortage of manpower caused changes and probably confusions in delegating and coordinating tasks and roles on the scene. HO and NECC roles and responsibilities got confusing. The **role of the doctor directing on the scene** was discussed, needed more attention because he lost his overview on scene and **could not prioritise and decide transport of casualties** as required. **The role of the doctor at CAP,** according to MC, was also discussed afterwards as needing more attention. Moreover **role confusion** came up regarding Red Cross people working at CAP.

Manpower shortage was a test on participant flexibility and coordination. Hence, RTs had to **change roles and coordinate** their work **due to the shortage** when some RTs were **arranged in roles as directors** on the scene. This caused discussions about RTs primarily roles of searching and rescuing. Moreover in that context, **RTs were encouraged working further on next level of tasks** if resources were missing and the role of **EOC being a backup for OSC** was emphasised.

Information Management (2)

Alarms and first announcements require consistent crisis response information. Proposals were made regarding **initial press-releases by standardising ready-made forms for filling out**

and saving the first crisis response time. **Rescue teams at more distance** were supposed to be at **specific emergency call lists at 112**.

Scarce information about manpower was relating **RTs not checking in on scene as required**. The **TC responsibility of keeping track of manpower** on scene was stated as very important, **not least for security reasons**. **Inadequate RG registration** caused confusion influencing flow of information to OSC and EOC. **A lack of information** from OSC and EOC **caused continuing effect** regarding information about resources and a need for help on the scene. **The importance of RGs registering in and out of scene** was emphasised.

Keeping track of **casualty count up** is crossing both crisis response in work processes and information management. **Inaccurate counting** could be related to a lack of basic information in **passenger lists and the process of casualty registration,** which mostly was caused by **wrong registration out of CAP**. **Troubles with getting passenger lists**, both for technical and collaborative reasons, were disappointing and emphasised to be improved.

Pathways of flow of information were a base needing sharpening. Information about **plans of emergency flights** was missing. **Information about triage and count of casualties** was not flowing as desired and information about transport of casualties was unclear. **Reasons for inadequate flow of information** were stated as **both operational and a lack of training**.

The importance of keeping track on and informing EOC about passenger lists, manpower on scene and emergency flights was emphasised. A **lack of understanding information pathways caused a valuable time was spent** on those asking wrong persons and a computer novice asking for information already available in database.

Communication (3)

Telecommunication needed improvements in general despite both positive and negative communication outcomes. Doctor directing on scene and MC were **especially named** in that context besides factors of telecommunication between MC, EOC and NECC. Problems in connecting EOC and RC **caused a lack of information about resources.** EOC emphasised their need for **reviewing communication and sharpening telecommunication.** Furthermore communication between EOC and NECC needed improvements **regarding air lift connection, resources and processing**.

There seemed to be a **same trend in comprehension of communication pathways as of roles and responsibilities**, i.e. there was **a lack of understanding each other's roles**. MC was supposed to spend too much time on those asking him instead of EOC. **RTs lacked understanding of the HCP delegate role in NECC,** which as being responsible for informing health care organizations and EMTs needed information directly from the scene. EOC and NECC moreover needed revising telecommunication and **division of labours**.

A use of **"RGs on paper" caused confusion and misunderstanding** with continuing effect on information about resources available. This could be seen as a good point for learning without worries of a real world crisis.

A lack of telecommunication contact caused troubles. Contact through air lift was intermittently strange. **Troubles in connecting EOC and RC** caused a lack of information about resources on the scene. HO and NECC had **troubles in contacting**, TT could not contact HO

and **RC lacked contact** with the people working **on scene**. Proposals of improvements were to announce change of frequencies through transceivers. Furthermore a request for more of priests for CISD did not attend due to a lack of contact.

Choosing and changing frequencies caused frequent telecommunication problems. The importance of **ARFF immediately contacting RC** was emphasised. **Proposals were made about pathways for telecommunication.** ARFF preferred the same VHF frequency as ISAVIA. **RTs** were **proposed to have an inside group** with one of them contacting RC. OSC requested a separate frequency for Red Cross contacting EOC. EOC requested TETRA transceivers for all EOC members. Furthermore RAP/Red Cross emphasised them being a part of the AEP telecommunication plan and suggested about their need for separate frequency for contacting EOC.

Resources (4)

The shortage of people was prominent, especially concerning primary triage, care and transport of casualties. Shortage of actors as relatives caused RAP using on-desk training. Differently there was **strength in many professional CISD groups** which probably could be used as manpower on the scene. **Announcing the accident at the airport,** for searching HCPs or other RGs, **was an important probability** not to overlook.

The necessity of **initially keeping track of RGs** on the scene and **informing TC** thereon was emphasised. Furthermore, the importance of **initially manning CAP** with HCPs, or RGs trained for care, which after that should follow casualties further in their process was also emphasised.

Loose of triage card fastenings caused problems despite good work on primary triage. The importance of fastening and securing triage cards throughout all transport was emphasised as a **requirement for secure casualty counting**.

The **emergency transport** was preferred to be **not too close to the scene,** especially for the reasons of danger on the scene and protecting investigations.

5. CONCLUSIONS

AAR reports are important tools for crisis response improvements. The AAR report has been analysed by coding and classifying the text as data. Results regarding classification of codes, from the perspective of who reported them and about whom they were reported, have been discussed. Concept results were summarised in the same order as the classification of codes without precisely stating who reported or about whom they were stated.

Grounded theory proved to be an effective way of analysing the AAR report. Using this method for the first time was a good learning experience and many lessons were learned from it. Nevertheless, it demanded a lot of time for continuous interplay of collecting, analysing and clustering concepts into descriptive categories, besides re-evaluating and interpreting the data (Coleman & O'Connor, 2007). Exploring an unknown field for generating comprehensive explanations and striving for an outcome grounded in the reality demands constant revision. Making clear selections of text (quotes) as data was in between a bit complicated. Duplicates or many persons reporting about the same things were among the

difficulties. Such report characteristics could on the other hand reflect on the urgency to analyse the AAR report process itself. Afterward, probably the positivistic tradition of verifying a theory set in advance would have been an easier and sooner finished but presumably the outcome would have been more questionable (Taylor & Bogdan, 1998).

In the future, analysing similar reports using this method should be easier and less resource demanding. Classifying codes by operational or training factors was difficult because initially the approach was too comprehensive. Creating subcategories for analyst interpretation was a success and actually helped with the operational vs. training categorization. Classifying codes by crisis response categories, i.e. work processes, information management, communication and resources, seemed to be much easier which is probably due to the similarity of the CPRO (SÁBF) system structure which includes coordination, plans, resources and operation. After testing the classification of codes on a shortened edition of a similar AAR report, the analyst's conclusion on the process of analysing the report is that it probably would be easier to first classify by crisis response categories and then by operational vs. training factors.

The analysis revealed the challenge of making AAR reports to be better tools for crisis response improvements. The purpose of better understanding of the practical training process is closer now when the results have been analysed. Somewhat fewer training factors could be explained by less specific statements about training than operational factors and no training factors in information management and resources opposite with 14 and 33, respectively, in operational factors. Furthermore, over 30% of the codes classified as either operational or training factors indicate how conjunctive crisis response improvements can be regarding operational and training factors.

As this is a qualitative analysis of an AAR report, the number of codes should be interpreted with care. In particular, the reported statements will depend on a number of things, such as the reporters, their experiences, their openness and their recollection of the training. Influences of external factors, such as variable requirements or points of view regarding desirable crisis responses and proactive vs. reactive RGs, are also important to keep in mind. Moreover, many reporters with different knowledge, skills and experiences are likely reasons for some statement mismatching. Positive feedbacks on primary triage, care and count of casualties on one side and negative statements regarding confusion and wrong count of casualties, mostly caused by unclear work processes and inadequate registration paper form at CAP, were such examples.

The practical training proved to be praiseworthy and well made in many ways. Participants got positive feedback on coordination and collaboration. Work on primary triage, care and RTs rescue work in and outside the scene were praised and also count of casualties, despite negative statements. In addition, RGs were reminded of securing casualty (volunteer) safety which was emphasised as very important. Finally, instructors and advisors were praised for good preparation, planning and cooperation.

More practical training on crisis response was recommended besides more use of AEPs in the process. TETRA telecommunication and EOC work processes was especially mentioned in that context. Furthermore, several reporters recommended a practical training director for timing the event progresses as incidents, tasks and resources available. This is something worth

exploring and observing. There could be variable reasons for the stated need of a director, e.g. a lack of contact and common comprehension.

Many lessons, worth further exploration, were learned from this practical training. Roles and responsibility were not clear enough and there was a lack of understanding each other's roles which caused some task and role confusions. Work processes and work flow needed improvements. Some CPRO (SÁBF) work parts needed clear pathways, on the local and the national level. The airport card system was proposed to be standardized, e.g. for work processes and resources. EOC, the key role of utilizing all rescue groups and contacting NECC, recommended team work improvements. Furthermore EOC and NECC, the coordinator on a national level, needed improvements on their common comprehension of solving tasks and problems, division of labours and telecommunication.

Alarms and first responses need improvements. Alarms were stated as intermittent and unclear. Some emergency calls failed. The AEP was missing an emergency call list which caused a group of eighty people not getting a call. In that context, clear responsibility of reliable emergency call lists at 112 was emphasised and rescue teams at more distance were proposed to secure specific emergency call lists at 112. Moreover, there were urgent and very important reminders of merging AEPs and emergency call groups. Finally, standard templates for initial press-releases were recommended for EOC for speeding up the first responses.

The practical training was characterized by problems due to a lack of manpower. A lack of RGs was influential on primary triage and care of casualties on the scene. RTs were, due to that, arranged as directors on the scene which caused other RTs stating their roles first and foremost searching and rescuing on the scene, not directing. Some RTs were EMT and ARFF employees servicing several roles which probably caused more influential problems than stated. Furthermore, there was too little participation of HCPs in this practical training compared to standby volunteers. Those are considerations worth further observation regarding real world accidents.

Flow of information, a basic factor of crisis response, needs improvements, either by training or operational measures. Despite good planning and collaboration, the information was not flowing as desired. Information pathways were not clear enough and some information was missing. A lack of common comprehension regarding the pathways caused a valuable time was spent on those asking wrong persons. The process of registration by primary triage, counting and transport of casualties needed improvements. In that context, a same time connection to the ICE-SAR's database was recommended for CAP and TT to help with counting.

Furthermore, the flow of information to and from EOC was inadequate. EOC, the coordinator of the operation as a whole, had troubles getting passenger lists and information about manpower, resources on the scene, emergency flight plans, transport ability, and assistance expected. The lack of basic information as passenger lists and inadequate registration form were factors causing a serious chain effect regarding the flow of information. Scarce information about manpower was partly due to RTs not checking in on the scene as required. Finally, keeping track of manpower on the scene was emphasised as very important, not least for security reasons.

Communication was a prominent factor underscoring the importance of clear pathways securing everyone as well informed as possible. Telecommunication needs more training and reviewing in all. Moreover, telecommunication requires more discipline. Pathways and processes are needed for securing frequencies, on the local and the national level. Consistent with the role of EOC activating team work and securing contact with key parties off the scene, communication was the most prominent crisis response category where EOC was the subject of statements. Telecommunication at EOC and communication between EOC and NECC regarding air lift connections, resources and processing need improvements. Hence, there seemed to be a same trend in comprehension of communication pathways as of roles and responsibilities, i.e. there was a lack of understanding each other's roles.

Some practical issues were remarked for important improvements and being clear in advance. The organization of the inner area needs reviewing. Improvements are needed on OSC, BAP and WAP placement and the CAP organization. Technical fire fighting devices need improvements. Furthermore, RGs responding to crisis at the district were encouraged to take first aid resources as oxygen, transfusion and bandages with them on their way to the scene because the HO inventories were almost given away in a short time.

Crisis response requires presupposing solutions regarding variable locations and conditions. In that context, planning in advance closed airport due to disaster or weather was emphasised as important. The local people were encouraged to immediately restraining according to available plans of emergency flights and transport ability, when responding to crisis. Finally, announcing the accident and searching HCPs or other RGs at the airport was recommended as an important probability not to overlook.

6. FUTURE WORK

Evolution of practical training of crisis response and AAR reporting remain challenging. The most urgent tasks of operational and training improvements should be prioritised. Making AAR reports more attractive tools for crisis response improvements is one of those, referring to the principles of processing and adopting lessons learned to rules of AEPs.

The purpose of analysing the AAR report's structure should make them more interesting as evolutionary tools. Document forms specially made for reporting AARs need improvement (Almannavarnadeild b, 2004; Almannavarnadeild a, 2011). In that context, a list of short and focused premade positive and negative statements, for grading or as a questionnaire for comments, are considered as preferable. Time stamps of major events in the practical training process can be useful. Listing in advance all valuable type of incidents which can be time-stamped could be of help and thus standardising its registration for more reliable comparison to AEPs or analysis of the progress of crisis response.

Reporting immediately after practical training is preferable for more reliable and exact information about the crisis response process and the outcome as a whole. Online AAR questionnaire software, accessible immediately after practical training, is another possibility worth exploring. Structured and coded questionnaire would be of help with immediately processing the outcome and adopting lessons learned to rules of crisis response.

Furthermore, results from such structured data would give more valuable and reliable information for future evolutions as the computer simulation of the CRISIS project.

For directors, prioritising desirable correspondence between crisis responses and AEPs is emphasised. This is not least important for following up the process of the practical training relating the CPRO system work processes, than exploring the outcome afterwards. Furthermore, verifying the AAR reporter nomination, i.e. which roles should report, how and when, would be preferable. In this case, influential organizational units, NECC, NECP and TC, were missing as specified reporters. Those are important units in the chain of crisis response which probably would have given useful information from their sight on the progress.

For practitioners, the results, reported here, can yield an important tool for prioritising crisis response improvements. Improvements of more disciplined work processes, work flow and flow of information are on-going tasks for all involved crisis response. Discipline in communication and pathways were factors especially pointed out for further training, referring to reporter statements about never underestimating repeated stimulus by practical training.

Considering that the CRISIS project is developing software solutions for crisis management training this report can be an input into such development. The results for CRISIS can be useful mainly by further investigating the following questions related to training, after action reviews and crisis response improvements:

1. Which training outcomes (i.e. need for training) in this report could be trained using a software simulator?

2. How can a simulator be used for training RGs living in scattered areas?

3. Which is the most practical way of reporting AARs immediately after practical training in a software simulator?

   Additionally, questions motivated by the results on operational factors can be the following:

4. Which is the most practical way, from RGs point of view, of using software solutions for reporting AARs immediately after practical training events?

5. How to use software for improving registration and keeping track of manpower in crisis response?

6. How to use software for improvements of delegation and prioritisation on scene in crisis response?

7. How to use software for improvements of primary triage and count of casualties in crisis response?

8. How to use software for improvements of maintenance and availability of resources, such as equipment, in crisis response?

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