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Shelter in place: An exercise toolbox

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The goal of this thesis is to further support the universities and universities of applied sciences, in their development of shelter-in-place measures, which are a vital part of emergency planning and preparation required by the rescue act. Furthermore, this thesis elaborates more on the topic of shelter-in-place and various themes directly relating to it. The safety measure of shelter-in-place is a measure that is been in constant developing since 2007. To this end, the authors of this thesis sought to create a framework for anyone working with shelter-in-place in an education institutional environment, regardless of experience in the matter.

To spread the knowledge and expertise acquired by the authors of this thesis, we sought the Finnish security network of universities of applied sciences (Ammattikorkeakoulujen turvalisuuverkosto) as main beneficiary.

Understanding the human factors and the role of training, in situations when it is necessary to seek shelter-in-place, is the focus of this thesis. Literature, observations made during a shelter-in-place exercise and interviews with experts from the Finnish authorities make up for the input of this thesis.

Shelter-In-Place (SIP) can be a valuable safety measure to be used by universities and universities of applied sciences in their overall emergency preparedness. SIP can, when executed and trained properly, potentially save a lot of lives and protect students and staff alike. Among the critical success factors of SIP are: overall response time, the amount of public that needs to take shelter, possible toxic consistency of involved threat and the training of both staff and students.

In addition, based on interview results with authority experts, much can be gain by identifying suitable shelter rooms which provide both authorities and those taking shelter with enough protection and accessibility. Moreover, communication between the institute and the authorities is of grave importance and should be planned thoroughly beforehand.

Keywords: Campus Safety, Shelter-in-Place, Emergency Preparedness and Training

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Opinnäytetyömme tavoitteena on tukea korkeakoulujen valmiustoiminnan toimintamalleja sisälle suojautumisessa, joka on olennainen osa oppilaitosten Pelastuslain mukaista pelastussuunnitelmaa sekä omatoimista varautumista. Tämän lisäksi, opinnäytetyömme käsittelee sisälle suojautumisen periaatetta sekä siihen liittyviä ja sitä tukevia toimintoja. Ennen kaikkea työmme pyrkii luomaan kehykset sisälle suojautumiseen liittyviin käytännön harjoituksiin sekä valmisteleviin toimiin ja huomioimaan oppilaiden tai henkilökunnan vähäisen kokemuksen aiheesta.

Opinnäytetyömme asiakkaana on Ammattikorkeakoulujen turvallisuusverkosto.

Tämän opinnäytetyön keskeinen teema on ymmärrys inhimillisten tekijöiden vaikutuksesta ja koulutuksen roolin tärkeydestä tilanteissa, joissa on välttämätöntä turvautua sisälle suojautumiseen. Tätä teemaa tukee tutkimusvaiheessa läpikäymämme materiaali tilanteista, joissa on jouduttu turvautumaan sisälle suojautumiseen, tutkimustyömme käyttäytymisestä sisälle suojautumisen aikana sekä asiantuntijoiden haastattelut, jotka tukevat kirjallisten lähteidemme näkemyksiä sisälle suojautumisen harjoittelusta ja suunnittelusta.

Sisälle suojautuminen on tehokas suojautumiskeino osana korkeakoulujen yleistä varautumista riski- ja uhkatilanteissa. Asianmukaisesti toteutettuna ja harjoiteltuna sisälle suojautumista voidaan pitää toimenpiteenä, jolla on mahdollisuus pelastaa useita ihmishenkiä oppilaitoksissa. Onnistumisen kannalta kriittisiä tekijöitä ovat: vasteaika, suojautuvien henkilöiden lukumäärä, ulkoiseen uhkaan liittyvät mahdolliset vaaralliset aineet sekä henkilökunnan että opiskelijoiden perehdyttäminen.

Asiantuntijahaastattelujen perusteella oikean suojatilan identifioimisella sekä valinnalla on huomattava vaikutus varsinkin silloin, kun kyseessä oleva tila palvelee ominaisuuksiltaan niin suojautuvia kuin pelastajia. Tämän lisäksi viranomaisten ja korkeakoulujen välisen kommunikation sekä yhteistyön tärkeys korostui. Tähän osa-alueeseen, ja sen suunnitteluun, tulisi korkeakoulujen panostaa huomattavasti.

Asiasanat: Oppilaitosturvallisuus, Sisälle suojautuminen, Varautuminen ja valistus

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1 Introduction

Ever since 2007, universities and universities of applied sciences in Finland, started to develop their response capabilities towards external threats and hazards. Ten years later, this development is still on-going. During this time, several guidelines have been written and legislations passed to support the institutes in their endeavour to offer safe study environment to their students.

The goal of this thesis is to further support the universities and universities of applied sciences, in their development of shelter-in-place measures, which are a vital part of emergency planning and preparation required by the rescue act and other legislation. Furthermore, this thesis elaborates more on the topic of shelter-in-place and various themes directly relating to it. The Finnish security network of universities of applied sciences (Ammattikorkeakoulujen turvalisuuverkosto) is the main beneficiary of this thesis.

This thesis elaborates on the topic of shelter-in-place, and various themes directly relating to shelter-in-place. Moreover, it provides a framework for those involved with training and preparing for shelter-in-place, regardless of experience with the measure.

Understanding the human factors and the role of training, in situations when it is necessary to seek shelter-in-place, is the focus of this thesis. This was realized by reviewing past incidents, researching human behaviour in shelter-in-place situations and by interviewing experts to support the authors views on planning and training SIP actions. Based on these findings, the thesis aims to prove that the successful execution of shelter-in-place actions is the sum of thorough planning, communication, cooperation, training and understanding human behaviour under stress.

Apart from discussing the relevant research methods and results, this thesis will provide several recommendations. The recommendations range from conclusions drawn from the research performed, observations made during the shelter-in-place exercise as well as answers to pragmatic issues.

Finally, this thesis was written with the purpose of being a stepping stone for an actual toolbox. The toolbox was to be understandable for anyone who wants to train or prepare for shelter-in-place, novices and experts alike. Currently, these plans are pending funding from the authorities. To this end, however, a mock-up of the toolbox has been added in the appendices.

2 Background theory

This chapter will provide an overview of background theory relevant to the thesis. The theory topics are divided into individual sub-chapters to ensure readability as well as retrievability. Amongst an introduction to the topic of Shelter-In-Place an overview is created of what is a campus and what campus safety is. Finally, the legislation concerning the need for staff training is discussed.

2.1 Introduction to Shelter-In-Place

Shelter-in-place, or SIP, is a protective measure used during an external hazard or threat posing imminent or present danger to occupants of a building or facility. During SIP the aim is to seek shelter or protection inside a room or a building, for the purpose, of staying safe from violent activities or external hazards such as toxic gasses. SIP is used, or put in place, when moving students, staff or employees would endanger them more than staying indoors (Casserly, Bermudez). To simplify the term, it means to stay indoors or in surroundings that has a protective structure to give cover and an atmosphere that can be isolated to protect occupants from external hazards (Casserly, Bermudez).

In emergency situations there is often a decision to be made: Do we evacuate? Or do we take shelter inside the building? The decision to either evacuate or seek shelter-in-place is done based on the nature of the threat, possible risks from exposure and according to Casserly, Bermudez based on existing resources. Shelter-in-Place (SIP) uses a building to provide a safe place that separates the people inside from a dangerous situation outside. More precisely: the structure of the shelter building and the atmosphere inside protects the people from the hazard outside that threatens them. These resources can be such that affect for example, transportation of larger groups of people, lack of communication and structural endurance of the building in question.

SIP can be an effective way of protection against an outside hazard such as fires with more than average smoke plume, a chemical leak or gas cloud. Under certain circumstances elements of SIP might be used in a violent threat scenario, as will be discussed in a later chapter, but it is not its sole purpose.

As one of the main legislative acts in emergency preparedness, The Rescue act (2011/379) mentions the possibility of shelter-in-place, in chapter 3 section 9. It states that in case of an emergency, e.g. fire or other hazard, all persons should be able to leave the building “or they can be rescued using other means;” This is the only time, the possibility to shelter in place is referred to in the rescue act.

Evacuating or sheltering inside a building; both options have their own procedures, requirements and consequences. This is no different for higher educational institutes such as Universities and Universities of Applied Sciences (UAS). However, SIP in an educational environment, such as Universities and UAS, might bring about its own set of challenges. Students, however developed they might be, cannot always be expected to react the same as adults. In fact, elements that come even more into play with SIP on Universities and UAS are stress amongst the crowd as well as attitudes among students towards the SIP situation or exercise.

To provide higher education institutes with a uniform approach towards SIP and setting up SIP exercises, a toolbox was developed. The development happened with input from different experts from the emergency services field, the police and educational safety experts in Finland. Moreover, the procedures and guidelines in the toolbox were field tested on a UAS in the South of Finland.

In this thesis, the theoretical background of the toolbox is outlined. Moreover, this thesis present means of data collection, data analysis and information flowing forth which acted as a base for the toolbox set up. Furthermore, results of interviews, survey among UAS staff as well as the field testing of procedures is shown. Finally, based on all the aforementioned elements, a risk based analysis of SIP scenarios is presented.

2.2 University Campus & Campus Safety

The words university campus, college campus and campus are often used interchangeably. They usually refer to the grounds and buildings belonging to the University. Cambridge Dictionary defines it as following: “the buildings of a college or university and the land that surrounds them”.

The plans and processes of keeping the campus safe are often labelled ‘Campus Safety’. This includes the matters of fire safety, overall emergency preparedness as well as specific matters like evacuation and shelter-in-place. As a side note; campus safety usually refers to universities/colleges, while school safety usually refers to elementary-, high- and upper secondary schools. Such actions and duties are required by and presented in The Rescue act (379/2011), chapters 2, where appropriate, and 3. These duties are to be carried out by the facility owner or occupant, in this case referring to campus buildings and the universities and universities of applied sciences.

In both the ‘University Act’ as well as the ‘University of Applied Sciences Act’ one can find that ‘students have a right to a safe learning environment.’ (University Act 558/2009 & University of Applied Sciences Act 932/2014) Here one can find the so-called foundation of safety provided for students and staff. In the next chapter this topic will be elaborated more upon.

Inseparable with campus safety is often campus security. Campus security on the other hand, are those plans and processes targeted at keeping the university community secure. Campus security may include policies towards crime and how to act in case of its discovery but also pragmatic issues as camera surveillance. In general universities tend to form one department that tends to both campus safety and security.

This thesis will focus on the safety aspects on university and university of applied sciences campuses. No further discussion will be held on security topics.

2.3 Staff training in a higher education environment

As previous chapter showed, the foundation of campus safety can be found in both the 'University Act' as well as the 'University of Applied Sciences Act'. The right to study in a safe learning environment is discussed in these legislations (Respectively University Act & University of Applied Sciences Act). However, the right to safety and integrity, for everyone, goes back as far as to the Finnish Constitution. This might be considered, to be the true foundations of safety on University campuses.

To obtain a safe university environment for everyone in the university community, one must adhere to several other legislations. These, in term, describe and dictate what is expected for both universities and universities of applied sciences in terms of safety standards and staff training. In this chapter, we will discuss the different legislation in succession.

The coming paragraph will further discuss the University Act and the University of Applied Sciences Act. As the University Act and the University of Applied Sciences Act show great similarities, both in layout and content, one can assume that the elements discussed count for both legislations, unless otherwise mentioned.

Apart from the right to safe learning environment, the legislation also describes disciplinary actions that can be taken against students. This encompasses situations where students disrupt activities, behaves threateningly or violently or endangers life and/or health of others. Furthermore, the legislation discusses contingency plans for exceptional and emergency situations.

However, no mention is made about how, and for what, to prepare staff of universities or universities of applied sciences. For details on staff training, other supportive legislation needs to be consulted. The Occupational Safety and Health Act 738/2002, further called OSHA, is one such act.

The OSHA (section 8) demands that employers take care of the safety and health of their employees. This includes:

- Preventing the creation of hazards and risk factors;

- Eliminating the hazards and risk factors or, if this is not possible, selecting a less hazardous or harmful alternative;
- Adopting safety measures which have a general impact before individual measures; and
- Taking account of technological developments and other available means.

Furthermore Section 14 states that “Employers shall give their employees necessary information on the hazards and risk factors of the workplace” as well as “the employees are given instruction and guidance in order, to eliminate the hazards and risks of the work and to avoid any hazard or risk from the work jeopardising safety and health”.

Finally, Section 45 dictates that “If the working conditions so require, workplaces shall be provided with the necessary alarm, fire safety, life saving and rescue systems and equipment”. Furthermore, the section states that “The employees shall be given necessary instructions on the use of such systems and equipment”.

In the University Act and the University of Applied Sciences Act one will find the foundation of students’ right to a safe learning environment. In the Occupational Safety and Health Act one will find the right of staff to safe workplace and workplace environment. Moreover, the need for emergency equipment and instructions is also defined in here. Staff instructions or training to prevent and eliminate the hazards of the workplace is mandatory as far the OSHA is concerned. It is the duty of an employer to provide this training for the staff. This stance is confirmed and supported by both the Rescue Act and the Chemical act.

The Rescue Act (379/2011), demands a level of preparedness of anyone, but especially of business and industrial operators and owners and occupants of buildings. It demands businesses and building owners to set up emergency planning, specifically for fire-safety and evacuations. Furthermore, the Act demands that as part of ‘Self-preparedness’ (section 14) that owners and occupants “prepare for the protection of persons, property and the environment in dangerous situations”. Training for shelter-in-place can be seen, as one such form of preparation, even though, as mentioned in chapter 2.2, the use of shelter-in-place is not stated and recognised by the rescue act. It is only mentioned (section 9) that if evacuation is not possible, other means to rescuing can be used. We see shelter-in-place as such a mean. Presenting this, can be done in detail, in the emergency plan required by the Rescue act section 15.

Finally, the Chemical Act (599/2013) provides a legal basis for those businesses working with chemicals. The Act demands that those working with chemicals take care of risk assessment of every chemical that is used as well as pragmatic issues as marking and storage of the chemicals itself. Moreover, the Act demands education of those handling and supervising the chemicals.

3 Methodology

Following the question: “What does a higher education institution need to develop their sheltering capabilities?” data was gathered from previously obtained results, different literary sources and interviews with different experts from the Finnish authority.

The following sub-questions were defined:

- What is Shelter-In-Place?
- What are the critical success factors of a SIP scenario?
- How do people behave during an emergency-situation?
- How does stress influence people’s behaviour in a crisis-situation and what can one do to influence this?
- How does stress possibly affect the SIP procedures?
- How can University and UAS staff manage people in an emergency-situation?
- How can participating staff members and student attitudes affect the training of a scenario?

The authors of this thesis, have taken into account that both novices and experts of the subject ought to be able to read this paper. To this end, basics of shelter-in-place and legislation were defined in the background theory. A more in-depth analysis based on literature was performed and can be found in the results chapter.

3.1 Previously obtained exercise results

The starting point of data analysis was previously obtained results from the monitoring of a SIP-exercise on a University of Applied Science (UAS) in South Finland. For anonymity, the report as well as the reports summary are omitted from this thesis.

Creswell (2013) states the following about case studies: “A case study as a qualitative research method involves the exploration of processes, activities, and events” The exercise results used in this thesis flow forth from a previous SIP exercise case that was documented and reported on. For this thesis, the report was used as a source to explore both staff activities as well as the different processes of a SIP-exercise. For us, the use of the exercise as a case study is justified based on the circumstances it was carried out. The staff were very little information on the date and actions that needed to be carried out. This made it, in our point of view, closest to observe a real-life shelter-in-place procedure.

More details concerning the circumstances of the exercise: The exercise occurred on a UAS in the South of Finland at the end of 2016 and happened without ‘refreshing education’ beforehand. This setup let to staff being caught ‘off-guard’ and having to rely on their general training in SIP. In addition, the staff was not given an exact time and date to which the exercise was to happen to provide an additional surprise effect. This lead to the exercise coming as close to an actual emergency situation as possible.

The information gathered from this exercise pointed out several issues to improve as well as other recommendations. After analysing the outcome of said exercise, various interviews with authorities were conducted. From these interviews were drawn: new insights, expert opinions as well as confirmations of the previously obtained information. Based on all gathered information, procedures and guidelines were drafted and recorded into the toolbox.

3.2 Literature review

“The literature review accomplishes several purposes. It shares with the reader the results of other studies that are closely related to the one being undertaken. It relates a study to the larger, ongoing dialogue in the literature, filling in gaps and extending prior studies. It provides a framework for establishing the importance of the study as well as a benchmark for comparing the results with other findings.” (Creswell, 2013)

This thesis has made use of the literature review to create an overview of prior studies and to integrate what experts have done and said regarding the themes that touch upon this thesis. By comparing the different studies, insight was gained to answer the sub-questions of this thesis. Overall the literature review assisted in identifying the central issues in relating themes as well as in helping to narrow down the issues.

Several sub-questions were bundled around a theme. Themes include: ‘shelter-in-place’, ‘human factors in emergency situations’ and ‘stress and stress factors during an emergency situations’. These themed questions in turn were answered by turning to existing literature.

For every theme a synthesis matrix was created to create a better overview and understanding of the topic. The matrix helped organizing the different ideas, as well as the agreements, different authors had on each subtopic.

The literature used in this thesis ranged from books on the topics involved, scientific articles as well as scientific journals and, in some cases, Finnish legislation. Furthermore, sources are made available through Google Scholar, Laurea’s Library and the various publicly available scientific journals.

3.3 Questionnaires and Interviews

When the decision is made to perform shelter-in-place, it is usually based on an order, or general instructions, given by either the emergency services or the police. To gain insight into the needs of the authorities, such as rescue services and police, several interviews were conducted among personnel involved with Shelter-in-Place incidents. As mentioned in the previous chapters, in a SIP exercise report, exercise carried out in November 2016, it was identified that practical knowledge in communication, planning, cooperation and preparedness was lacking. These points were used as the framework for the interview questions.

Cresswell (2013) states that interviews as a qualitative research method can have several forms and styles. The interview can be done in a structured or semi structured way and can be done face-to-face, by phone or email even. Furthermore the method is intended to evoke the views, opinions and possibly emotions from the participant.

The interviews in this thesis were held either face-to-face, skype or by phone. The interviews that were conducted followed a semi-structured trajectory, a template that had defined questions but gave the interviewees a possibility to give a broader view if needed. Also the possibility to explore any of the topics deeper or press further on certain matters. Moreover, holding the interviews face-to-face, skype or by phone allowed the interviewer to pick up certain nuances or intonations which would be otherwise lost. At first, the interviews were recorded, but based on received instructions from responsible lecturer in research methodologies, the recordings were not continued since it is not required in a bachelor level thesis.

To analyse the data from a qualitative research method such as interviews Creswell (2013) notes the following: "Organize and prepare the data for analysis. This involves transcribing interviews, optically scanning material, typing up field notes, cataloguing all of the visual material, and sorting and arranging the data into different types depending on the sources of information."

As a data analysing tool, a matrix for the interview findings was created. The matrix uses a linear method starting from the question, following with the received answers or possible identified problems according to the interviewees. These are followed by possible solutions based on the discussion done regarding given answers during the interview. After the interview, these sections are compared with existing source material or legislations and will be summed up in the last part to form deductions and final recommendations.

The following table describes the analysis matrix used.

Question	Answer of identified problem	Possible solution offered by interviewee	Existing source material or exercise experience	Existing legislation, if any	Deductions and recommendations
Interview question 1	Answer to question or a problem identified, within a suggestions of original question.	Solution offered based on interview discussion or directly to question	Comparing existing source material or exercise experience with given answer or solution	Comparing existing legislation, if existing on current topic with given answer or solution	Our final recommendations based on the sum of previous phases
Int. quest. 2					
Int. quest. 3					

Int. quest. 4					
Other re- marks					

Table 1: Linear method starting from left to right

Since the interviewees are operating in the emergency services field, they tend to work very irregular and often, work at different stations, or even regions. Therefore, some interviews were converted to a questionnaire, and the questionnaire template was sent by e-mail. After receiving back, the filled template, the interviewer could ask follow-up questions by email if needed. The questionnaire is added in the appendices together with the letter of intent.

The interviews were carried out in Finnish. This is based on the prominence of the interviewee's native language. Also, it gave them the possibility to use such language and terminology they were accustomed, to provide most accurate answers. Since it was not required, all interviews were translated by ourselves and not a translation service.

Interview process phases

Phase 1 - data collection

In this phase, the actual interview was carried out. The answers received were raw data and are not usable as such. They need to be analysed and linked to a substance.

Phase 2 - Translating interviews

As the interviewees were allowed to answer in their native language, they needed to be translated. This was done only by the person carrying out the interview. With such approach, it gave the person who was familiar with the situation and answers, possibility to do it in a way that the aforementioned nuances, or any key data, would not be lost.

Phase 3 - Analysing interview data

After the interview data was translated, it was analysed to identify similarities and to compare differences. The answers were also divided by point of professional view. It is noticeable that there are not much differences between point of views of the Police and Emergency services. In this and the following phase the matrix was used.

Phase 4 - Creation of recommendations

Based on the information, gathered by analysing the interview data, final recommendations are made by linking interview findings with existing information gathered from desk research and previous exercise reports.

The following graph is used to describe the interview process phases and their objectives.

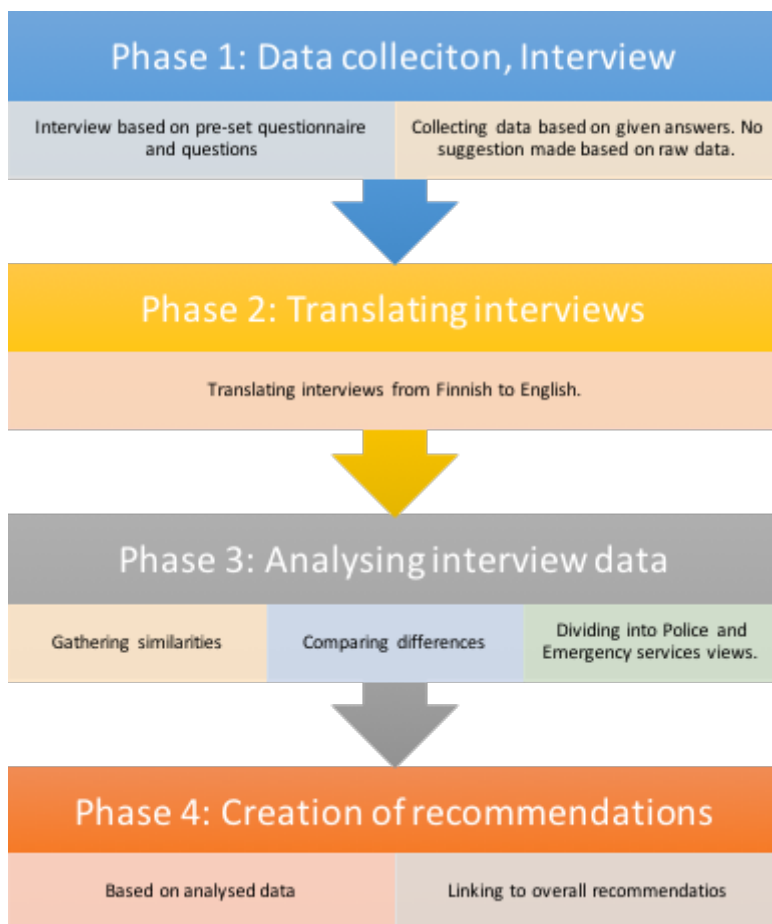


Figure 1: Interview process phases

4 Results

This chapter provides the results from the interviews and the questionnaires. For read convenience, the results have been divided into separate sub-chapters. First chapters will elaborate on the results of desk research. Results surrounding the themes of shelter-in-place and human factors in emergency situations will be discussed.

The second sub-chapter will go into detail about the results obtained from the interviews and questionnaires. The expert interviews, interviews with authorities and analysis of data from previous exercises shall be presented there.

4.1 Literature review results

This chapter will review the different sources used, compare them and evaluate their relevance to the thesis. Moreover, contrasts in opinion and methodology will be highlighted. The review has been done surrounding different themes that are relevant to the thesis.

4.1.1 Shelter-in-place

As seen in the introduction part of this thesis; Shelter-In-Place (SIP) is a measure that can be taken in certain emergency situations. Especially those situations where evacuating would cause more harm to the persons one tries to protect. This is where those in command may opt for the crowd to take shelter in place i.e. protecting the crowd by taking shelter in a location that is safe, or can be made safe, for an outside threat for a certain period of time.

Taking shelter from outside a threat is a measure that one can opt for, with the acknowledgement of the authorities. There are, however, certain factors that can influence the successfulness of the SIP measure. While some experts differ in opinion of the nature that these critical success factors, overall, they agree that they should be taken into account, preferably in the planning phase. When one is still drawing up the plans for the Shelter-In-Place measures, that is the moment when some of these factors should already be considered. However, altering one's plans to accommodate these factors will lead most likely to a higher success rate as well according to Casserly and Bermudez (2011).

Mannan and Kilpatrick (2001) mention several factors they deem of the utmost importance to factor in. They make a distinction between fixed factors, those that are, more or less constant, and variable factors, those factors which change with every incident. Mannan and Kilpatrick identified the following fixed factors as critical success factors:

- Education of staff
- Education of public
- Response time of all parties involved
- Population density

The level of education of both staff and public will heavily influence the outcome of the exercise or real life situation as stated by Mannan and Kilpatrick. It is of critical importance that the public knows what to expect of those who are in command and what they expect from them. Training for SIP is vital in this. Training for staff members to take the right measures, take control of situation, learning to direct the public and to overall reduce the response time. Training for the public would consist of learning where to find the safe location to take shelter and what additional measures they need to take once they are in shelter. Lastly, the population density factor influences the incident directly in matters of incident scale and how much public those in command need to shelter.

As variable factors Mannan and Kilpatrick identified the following:

- Chemical characteristics of the incident
- Release time
- Weather and meteorological conditions

As these factors differ in each incident, those in command, ought to anticipate on these, every time anew. Different chemicals react differently once airborne or once they come in contact with the public. Furthermore, the release time directly influences the overall question: Do we shelter or do we evacuate? As in some cases preparing for and taking shelter may take longer than getting the public out of harm's way. Lastly, the weather influences the incident directly in the way that for example winds may lead a gas cloud away from ones shelter or make it course directly towards it.

Returning to the work of Casserly and Bermudez (2011), the authors formulated several critical success factors as well. They are the following:

- Does the shelter itself provide adequate protection?
- Does the commander have enough info to make the decision between evacuation and SIP?
- Implementation time of the procedures
- Are the on-site responders occupied with controlling or managing the public?

One can see that the factors identified by Casserly and Bermudez have share some similarities of the factors identified by Mannan and Kilpatrick. Indeed, both seem to place value on the implementation time of the procedures and the direct relation to the successfulness of the SIP-measure. Casserly and Bermudez, however, add the notion that the implementation time is directly affected by the on-site responders not managing the public but instead still trying to control the situation. Indeed, the longer they take to get a grip on the situation, the longer it will take to successfully execute the SIP-measure.

In addition to this the authors question the shelter and the protection it can offer the public. Does it hold the amount of people that need shelter? Do we need to take additional measures to safeguard them or does the current shelter condition suffice? These are but a few questions one will need to ask oneself when preparing for SIP incidents but also during the incident itself.

Finally, Casserly and Bermudez ask the reader to consider if the commander has enough information in the first place to make an educated decision whether to take shelter or to evacuate. As mentioned before, SIP is not a measure that always ensures a favourable outcome. It is a measure that, in certain situations, is favourable over evacuation. To make that decision requires knowledge and experience.

What all authors agree on in their works is that the main factor is the public that needs to be managed. As Sorensen, et al. (2004) stated, the public tends to seek more information before agreeing and reacting to the Shelter-In-Place measure. It is the on-site responder's priority to show leadership, communicate clear and in a directive manner and manage the public as swiftly

as possible to the shelter. More on this topic can be found in next chapter 'human behaviour during emergency situations'.

Sorensen, et al. (2004) seem to agree on the importance of communication with the public and its direct effect on the successful outcome of the exercise or SIP-situation. They also recognize the importance of a critical look at the shelter area, identifying its usefulness in case of actual events. Overall, they take into account the following factors:

- Effective communication with the public
- Knowing when to terminate the protective action of SIP
- Chemicals involved
- Meteorological conditions
- Protective effectiveness of the structure
- Time available before public exposure
- Setting up the shelter

Clearly there is a large overlap between the factors Sorensen, et al. identified and the factors mentioned before. Sorensen et al. summarise that: "The decision to recommend evacuation or sheltering depends on whether (a) the affected people will have time to evacuate before the chemical plume arrives and (b) whether available shelters will prevent people from receiving a harmful exposure to the chemical."

For a more technical approach to what makes a shelter-in-place measure successful, we turn to Chan et al. (2007) in their two-part studies to the effectiveness of urban sheltering they looked at sheltering under ideal conditions and specialized in a follow up studies to residential areas. In their articles, they reach a conclusion on the technical success factors of sheltering:

- Toxic load
- Time scales associated with release duration, SIP implementation delay, and SIP termination
- Building air-exchange rates, including air infiltration and ventilation
- The degree of sorption of toxic chemicals to indoor surfaces; and
- Shape of the dose

Chan et al. conclude that the toxic load of the chemical that spilled is very important. The very nature of the chemical can have a wide range of effect on buildings, nature and humans alike. It can even lead to a SIP-measure being terminated and transformed to an evacuation measure, if the effects of the chemical are deemed that dangerous.

Secondly, Chan et al., much like the previous authors, agree that the time to implement the measure versus the release time of the chemical is crucial. If the chemical would reach the unprepared shelter, it may be favourable to evacuate. Also, taken into account by the authors, is the exchange rate. This is the time that it would take for a chemical to possibly infiltrate the shelter. This can happen through the surface of the building as well as the ventilation.

Lastly, Chan et al. mention that certain materials may react in an absorbing way with certain chemicals and that, depending on the chemical, should be considered when preparing as well as in incidents. The authors conclude their research with the thought that Shelter-In-Place is most effectively used in short-duration releases and not in long term incidents with long or multiple exposures. This, because of the fact, that regular shelters often do not have a ventilation system that allows for long sustained shelter.

4.1.2 Conclusion

Shelter-In-Place is effective under certain circumstances and if certain factors are taken into account. Factors include the structural integrity of the shelter structure, level of training staff and public received as well as communication with the public. Moreover, factors such as weather and chemical composition of involved toxins, should be considered, both in preparation phase as well as in the emergency-situation management.

The following list of critical success factors has been compiled from several expert sources. The list can be used both in the preparation phase as well as in the emergency incident.

Decision making	<ul style="list-style-type: none"> Does the commander have enough information to make the choice between sheltering or evacuating?
Shelter	<ul style="list-style-type: none"> Does the shelter itself provide adequate protection? Has the infiltration of the chemical through ventilation and building exchange rate been accounted for? Has the degree of sorption of toxic chemicals been accounted for? What is the maximum amount of time we can safely take shelter?
Staff	<ul style="list-style-type: none"> Is the staff prepared? Is the staff trained? Does the staff know how to take control of the situation? Does the staff know how to manage the public?
Process	<ul style="list-style-type: none"> Has the SIP measure been trained? Have the processes been optimised to reduce the overall implementation time?
Public	<ul style="list-style-type: none"> Has the public been trained? Has the public been informed? Is the public cooperating?
Incident	<ul style="list-style-type: none"> What are the weather conditions? What chemical is involved and how toxic is it? Are there any specific threats with involved chemical? How long until the public is exposed?

Table 2: Critical success factors for Shelter-In-Place

4.1.3 Human factors of Shelter-In-Place

There are many accounts of what happens during emergency situations and how people react accordingly. There are records of stampedes where people have tried to flee for their lives but got crushed along the way, as happened in the Hillsborough disaster (1989) or more recently in Turin (2017). Other incidents such as The Station nightclubs fire (2009) were filmed from minute to minute and show the gruesome reality of human behaviour in a real-life emergency situation.

Few people experience an emergency-situation or disaster personally. However, both Wraith & Gordon (1986) as well as Cocking et al. (2009) conclude that most people have the idea that during an emergency or disaster there is only wide-caused panic or mass hysteria and that people act only to save themselves. Possibly to blame are the Hollywood disaster movies and the way they depict human behaviour, as well as media coverage of earlier mentioned high-profile stories, which are often full of sensational news and horrific details.

Cocking et al. (2009), demonstrate that human behaviour during emergency situations is far from this sole image people have. In their studies, they interviewed various survivors of different emergencies, most notably survivors from the 7th July Metro bombings in London. There are several surprising conclusions drawn from the various interviews.

Survivors did mention the word panic often in their accounts, they were, however, often vocal expressions but no physical behaviour expressed by people around them. When discussed and analysed further, the behaviour of the individuals kept to themselves and did not cause a wide spread panic or mass hysteria. On the contrary, survivors account for people calming others down and assisting them where they can.

During many of the emergencies that the survivors experienced people acted in an orderly fashion and even openly challenged selfish behaviour in others. Survivors tell of an overall cooperative atmosphere with determination and meaningfulness in other people. Moreover, many of the survivors explicitly mention, often before being asked, that they felt a sense of unity among them and their fellow survivors as a result of the same fate they shared.

Cocking et al. conclude their studies with the notion that standard mass hysteria triggered in emergencies is largely based on myth and have little evidence to back up the theory. Also, that the term is neither a helpful nor accurate description of human behaviour in emergencies. Cocking et al. seem to draw the same conclusions as Wraith and Gordon (1986) that people do behave according to the knowledge they have of the emergency, the physical layout of the area and that they will actively try to update this information during the incident.

This last element of the study is an important one. If mass panic is not the main drive of a crowd but it rather an organised and cooperative unit that wants to do best under the circumstances, it should be treated more as such when planning for an emergency.

On the topic of panic, Saari (2000, 41) notes that the concepts of shock and panic are often used as synonyms for each other. While, in fact, only very few people in psychological shock will actually panic. The number of individuals that panic may seem large, but this is because panicking people are very visible and audible.

Two recent studies, one performed by Haghani & Sarvi (2016) and the other by Moussaïd, Kapadia, Thrash, Sumner, Gross, Helbing, and Hölscher. (2016) both make use of digital simulation of an emergency situation to map and analyse human behaviour during an incident.

Haghani & Sarvi (2016) looked into the 'herding' factor of humans during emergency situations, whether individuals tend to follow the crowd or avoid them. They based their model on real human behaviours. To accomplish this, they set up several initial experiments with simulated emergency in which the participants were asked to choose an emergency exit in rooms that offer multiple exits. Out of these simulations a model was formulated, digitized and tested.

The most important results of their studies suggest that individuals, prefer exits that are close by and the least congested, thereby dismissing the 'herding' theory for the most part. Also, individuals who are offered a choice between multiple exits, tend to go for the exits which are directly visible for them. This shows that individuals prefer a definite exit over the uncertainty of other possible exits in other directions even though they might be less crowded.

Haghani & Sarvi (2016) conclude that individuals mostly rely on the physical factors of the environment to make their decisions in an emergency situation. While, their actions and decisions may be influenced by the behaviour of others, other factors such as distance, route visibility and the information available to the individuals have a larger impact on the decision they make during an emergency.

A different conclusion is reached by Moussaïd et al. (2016) in their simulation of human behaviour in emergency preparedness. In their studies, they used real individuals who were asked to navigate through a virtual world simultaneously. In this world, the subjects were asked to perform emergency evacuations under different circumstances and different world layouts. To add a certain competitive factor, a reward system was introduced. The points could be exchanged for money after the experiments. Furthermore, certain individuals were shown correct escape routes, or had other sort of information about how to escape.

In a relative low stress environment people acted in a calm matter and avoided physical contact with other subjects for the most part. In an orderly fashion participants made their way through the virtual world. In a high stress environment, where a time pressure was introduced on top of the reward system as well as low visibility and flickering lights and alarms, participants huddled together and formed densely packed bottlenecks.

Especially dangerous places in the high stress levels turned out to be the areas where participants needed to make a decision and stalled the flow of the crowd. Moreover, people cluttered around the exits creating bottlenecks again halting the flow of the crowd. Finally, in dead-ends participants who were making their way back from the dead-end were halted by the flow of those moving in the opposite direction, creating a deadlock as it were.

In conclusion Moussaïd et al. (2016) note that under high stress situations herding can happen, as individuals think other might have more or better information regarding a safe exit route. Lastly, they conclude that it seems clear that bottlenecks and lack of information can often lead to dangerous outcomes in emergencies.

It is rather difficult to study panic, mass hysteria and herding behaviour in emergency situations. Questioning survivors after real-life emergencies and disasters gives some insights but might not be as complete as a laboratory experiment. Setting up real-life emergencies in a laboratory environment, of course, would pose several safety and ethical dilemmas.

The use of computer simulations to imitate these situations is a good alternative. Emergency situations are however enormously complex and several factors come into play. Both Haghani & Sarvi (2016) and Moussaïd et al. (2016) note that in their simulation, they could not include in all of the possible factors and that their simulation could benefit from further improvement. However, a shared conclusion is reached that the information available to the individual in an emergency situation has severe impact on his or her decision making.

In the previously mentioned studies the popular view of mass panic was dismissed and several high impact factors on the decision making of an individual were identified. Information available to the individual, upon which he can make a decision, seemed to be unanimously important in all studies. All these studies were held involved emergency situations but not specifically Shelter-in-Place (SIP) situations. How do students behave in a SIP situation, is a rather specific question.

In 2016, Johnson and Frick set out to answer this question, specifically focussing on millennials and their behaviour during SIP. In their experiment a fictive masked gunman had committed robbery, in the vicinity of, a mid-sized south-eastern United States public University. Possibly the gunman had fled towards the University. The University campus was real, the gunman was not. When the University Police Department was made aware of the incident, they activated the university's emergency notification system immediately and instructed the campus community to take shelter-in-place. During the SIP period, they issued 4 warning to the community to shelter-in-place. After this time, the supposed robber was arrested inside the university's student centre.

Data was collected through a survey after the incident. The results indicated that, while a credible threat forced the community into shelter-in-place, students tend to dismiss the situation. The authors go as far as calling the behaviour documented a concern for the University's administration and staff. They found that a significant portion of the students complied and performed the shelter-in-place activities, that were expected from them, but many them, however, did not or too short term:

“While the majority of students (63%) engaged in the desired behaviour of sheltering-in-place until an all clear notice was issued, a significant number of students (22%) chose to either shelter-in-place for a short period of time and then resume normal activities before the all clear notice or not shelter-in-place (15%).” (Johnson & Frick 2016)

The authors attested this behaviour to several factors. The most important being age of the students and the characteristics this brings with it. First year students are likely to follow the instruction of authorities and engage in protective behaviour, more so than students of higher years. These students seek more guidance from an authoritative figure and are less likely to question the information that is given to them. More mature students tend to question the information that is given to them more, and make a decision based upon that.

Secondly, the authors theorize that because millennials were raised in a distinctive protective manner, this may limit their fear of becoming a victim of crime. As a result, millennials may overvalue their capabilities and downplay their vulnerabilities when assessing an emergency situation.

Lastly, because the university itself is an environment where all information should be questioned, interpreted and valued, it is only logical that students do the same when new information presents itself.

4.1.4 Conclusion

People react differently in an emergency. They do, however, not automatically act in a blind panic and selfish way. In different emergency situations accounts have been given that the crowd was calm and almost as if acting like in a fire drill. Moreover, they were actively helping each other and trying to calm others down.

Factors that seem to affect the individuals in an emergency situation are situationally dependant. Physical factors, such as visibility and venue layout, do have an impact on decision making of individuals. Moreover, the availability of information seems to be a key factor that returns in many studies.

Higher education students seem to, perhaps due to their age and the environment they work in, have a tendency to question new information given to them, even if it comes from authoritative figures. This seems to progress along the students' career, with mature students more often questioning instructions given to them.

For University administration, this will have implications in how to deal with and plan for emergencies. Information is a key factor for any individual in an emergency situations. It is therefore imperative that when planning for an emergency and how to cope with it, a University will remember this. How to communicate with students, what platform, and how to distribute the information should be incorporated in the strategic emergency preparedness plan.

Secondly, when dealing with students, University staff should remember that first year students are more likely to comply with instructions given to them. Mature students might question them more and staff must be prepared to explain and clarify information. As Johnson & Frick (2016) mention that in order, for students to understand what behaviour is expected of them, Universities must also be prepared to offer continued dialogs with students about threats, vulnerabilities, and protective behaviour outside of training moments. Hosting meetings, lessons or a presentation done by government authorities can be a starting point. The idea is that students can share experiences, ask questions or anything that makes them help them process the information about the necessity of shelter-in-place and the importance of compliant behaviour during a SIP situation.

4.1.5 Stress and stress factors during emergency situations

In the previous chapter the topic human factors during an emergency was presented. From different survivor accounts as well as other academic sources it was shown that individuals that find themselves in emergency situations do not automatically succumb to hysteria or to selfish behaviour. In fact, crowds tend to do the best they can under the circumstances. But what of the stress experienced by the individuals, how does this impact on their behaviour?

Being exposed to an emergency situation, where the individual is on some level experiencing threat to life, can bring about a freeze, fight or flight reaction in the body as it thinks it is under attack, as argued by Hobfoll, S.E. Gerhart, J.I. and Canetti, D. (2015). This primary reaction to threat is lodged into the autonomic nervous systems of animal and man, and was first documented by Walter Cannon in 1915. Behaviour shown is often a combination of instinctive freezing and hypervigilance (a state of heightened senses). This is in turn followed by flight attempts in order, to get away from the situation or by engaging in combat to overcome the situation with aggression.

Cannon further argued that the freezing response in combination with the state of hypervigilance may have helped our distant ancestors to avoid being seen by attackers or predators. At

the same time both the fight and flight responses were ready to kick in any moment to facilitate a quick getaway or to prime the body for fighting. Hobfoll et al. (2015) offer further insight into the changes in the human perception. Specific reactions and experiences include:

- Experiencing intense fear, horror or rage;
- Experiencing a sense of helplessness;
- Experiencing tunnel vision focussed on the threat;
- Dulling of hearing;
- Feeling that the situation is surreal and the individual watches it all as if watching a movie.

The first phase of an emergency situation, or crisis situation, was also described by Saari (2000). She characterizes the phase in her works as the 'psychological stress phase'. During this phase people tend to still keep their capability to function and maintain composed. Their goal is to find safety or cover from harm. In this phase people might appear emotionless and solely focused on the act of saving themselves.

Furthermore, Saari (2000, 41) mentions the state of 'freezing' of individuals during an emergency. Saari mentions that about 20% of people experiencing an emergency situation might experience a state of panic, as state of hysteria or experience a form of apathy and 'freeze'.

Finally, Saari also notes a correlation between people freezing and the perceived chances of escape by these individuals. If the individuals perceive the conditions such, that there is no chance of escape, the number of people who 'freeze' will also increase. (Saari 2000, 41)

Individuals who experience stress as a result from an emergency situation can do so regardless of the length of the situation. Indeed, Cherry (2015) suggest that an emergency can be short or long lasting, unexpected or anticipated, resulting from forces of nature or made by man, or a combination of all. In our current geo-political climate, emergency situations can imaginably be more complex, especially if influenced by political, cultural or military factors.

The amount of stress experienced by an individual during an emergency, depends not only on the resilience of the individual, Hobfoll et al. (2007) argue. Certainly, some individuals show great resilience during such situation, some individuals have even accounted that they have taken something positive out of the emergency situation. However, for many others being exposed to those situations, it may be so overwhelming that it has long-term effects on the individuals.

Cherry (2015) notes, much like Hobfoll et al., that the objective nature of the emergency situation and an individual's resilience are not the only factors contributing to the experience of the situation. Other factors that contribute to an individual's experience during an emergency situation include:

- Type of emergency
- The intensity of the emergency situation
- Previous experiences;
- How well an individual is anticipated to cope;
- Available respond resources
- The level of readiness to respond to the situation of the individual as well as others who are affected by the situation.

Moreover, they conclude that the more an individual is exposed to stressors during an emergency situation, the more likely it is that the individual will develop mental-health issues as a result. Negative impact on mental-health is possibly the most extensive consequence of experiencing disasters, traumatic events and emergency situations.

Finally, Cherry (2015) takes special note that situations involving (mass) violence are more likely to result in higher levels of stress and mental-health impairment. Individuals that were exposed to violence or terrorism during an emergency, were shown to have experienced serious impairment. Some individuals experienced as much as twice the levels of stress or mental-health impairment compared to individuals who were exposed to events of a natural or technological nature.

What can be done to reduce the levels of stress experienced in emergency situation? For answers, we look to training and a resilient attitude.

In their studies towards human behaviour in emergency situations Cocking et al. (2009) mention the accounts from various survivors of emergency situations. Several of these accounts go into detail how attitude of others strongly contributed to the calmness of the situation. A survivor from the 7th July Metro bombings mentioned the following:

“It was so calm it was almost like a fire drill. Everyone was sat down and the driver was saying ‘you might as well sit down as there’ll be a bit of a wait till we get out’ and ... some people trying to get a bit further along the line but there was no-one desperately running along the train, it was a very relaxed calm evacuation, and I think the atmosphere and the instructions from the driver because he was very calm about the whole situation obviously ... he’d seen the blast from his carriage but he was calm and I think his calm instilled calm throughout the whole train yeah there wasn’t it wasn’t a panic really bolt for the door by any means” (2009, 8).

The person accounting their experience in the metro station was in one of the direst emergency situations imaginable. Yet, she felt calm. They specifically mention this being due to the calm demeanour of the driver, an authority figure on that moment. Saari (2005, 112) also points out that victims of emergency situations often talk about the effect of authority figures had on them. Often these are members of the emergency services or the police but also others who

rose to the challenge in the situation. They made them feel safe by being calm in the situation, or just listen to their reaction.

Whether the driver had trained for this situation or rose to the challenge remains unclear. It is, however, a crucial aspect in the way he chose to defuse the situation. Calmness, instructing others and being informative. The latter being an aspect already deemed crucial in the last chapter.

Training for emergency situations is of the utmost importance. During training one realises the various aspects that come into play during such situation. It is also why professional responders to emergency situations are less effected by the events they witness and can focus more on the task at hand. Saari (2005, 214) elaborates on six factors that help professionals deal with emergency situations:

- Self-selection. The idea that people seeking these kind of jobs, have often a high stress tolerance and can cope better in emergency situations
- Training. Training for emergency situations helps prepare the professionals for their duties and the effects these situations might have on their mental health.
- Experience. Naturally, when one gains experience of a variety of incidents, one's perception is affected. Because of this, professionals usually act with a certain calmness and are less affected by the situation.
- Practise. Preparedness comes from practising with drills or exercises. When difficult situations are rehearsed, they will be less stressful in the future.
- Preparation. When they respond to an emergency situation, professionals usually receive some background information about the nature of the situation. With this they can form a plan in their head as well as mentally prepare themselves for the task at hand.
- Professional role. The professionals set their own perceptions and emotions temporarily aside to fully concentrate on the task at hand. This protects them in the moment. When they set aside their professional role, it is often in that moment and place that they let out their own emotions.

Adopting some of these factors as one's own can be a way to provide the person with more resilience against the impact of the emergency situation. Especially those of becoming more prepared through training and exercises coupled with a professional attitude.

To help individuals cope after they experienced a traumatic event, there is a form of debriefing, specifically Critical Incident Stress Debriefing (CISD). The CISD model has been in development by Mitchel since the beginning of the 1980's. This debriefing process is widely used around the world by professionals in emergency response, disaster management and crisis intervention. In Finland emergency professionals as well as volunteer aid workers have adopted the method

(Saari, 121). As Mitchell calls it himself: “it is a structured group story-telling process combined with practical information to normalize group member reactions to a critical incident and facilitate their recovery” (2014)

Mitchel (2014) states that there are a few conditions that apply to the group:

- The group must not be too big, maximum around 20 people
- The group must be homogenous
- The group is no longer involved in the situation i.e. their part in the situation is complete or the situation has passed its acute phase
- Group members have been exposed to this situation in a similar manner
- The group should be ready to participate i.e. not too tired or overcome by the situation so they cannot participate

Preferably the debriefing takes place directly following the incident with a maximum of 72 hours after the incident. Once the group is formed the debriefing should be led by an experienced and trained team of minimal two people. During the debriefing, several phases will come to pass. In each phase, different aspects of the situation will be reviewed with the participants.

The team that leads the debriefing will go over:

- Introductions
- Quick facts of the situation
- First thoughts of the participants
- Participants reactions
- What have participants been dealing with
- Explaining reactions, symptoms and stress management
- Final statements and thoughts

After the debriefing, there can be follow up group- or even one-on-one sessions. Mitchel (2014) notes that it is important to realise that the debriefing is a form of discussion, not a therapy form, and should not be treated as such.

4.1.6 Conclusion

During emergency situations, it is likely that individuals will experience a freeze, flight or fight reaction, triggered by stress. This can happen for anyone, student or University staff alike. However, trained staff can make a significant difference during an emergency.

As stated in this chapter, authority figures often have a big impact on individuals in emergency situations. It is when they are instructive, informative and calm that they have the biggest positive impact on individuals. When university staff adopts this attitude during exercises as

well as real-life situations they should be affecting students and other individuals in the best way they can.

Just as with professional emergency responders, when staff is trained in handling emergency situations, they will have this practise to fall back on when the situation arises. Preparation and training will give them focus on the task at hand, as well as a professional attitude. They will know what to do. Knowing what to do will boost their confidence, which in turn will help with the instruction of people during exercises as well as real situations.

While training and preparation is important, aftercare is too. Debriefing after exercises as well as real situations. After conducting a SIP exercise, a rudimentary form of the Critical Incident Stress Debriefing (CISD) might suffice. While there is no real traumatic experience, elements of it can be used to make a debriefing a successful discussion of the exercise and its results.

Debriefing after an exercise has several benefits. On a practical level, shortcomings can be noted and anticipated in the future. If necessary, protocols and processes can be reviewed and altered in favour of a positive outcome. Moreover, senior management should always be notified of the outcome of both exercises and real situations.

On a personal level, debriefings provide a space for personal experience as well as emotional release. In the role of authority figure that instructs others, there may not be room for personal emotions and perceptions as staff will be handling the situation. In a debriefing, there is however space for them to offload.

However, debriefing after a real-life situation will require special care and trained staff. The University should wager whether a team will be trained from members of University staff or that they hire an external team to lead these debriefings.

4.2 Interviews and questionnaires

This chapter will deal with the results received from field research part of our thesis. Results obtained based on the interviews and questionnaires will be presented in this sub-chapter and in its sub-chapters. This chapter is divided in sub-chapters based on the questions presented to the interviewed experts. Background and the expected gain for the specific questions will be explained within each respective chapter.

As mentioned in chapter 3.2, some of the interviews were carried out via email. When comparing these answers received by email to the ones collected in interviews, there is no noticeable difference between the answers. The major differences are based on the background profession on the interviewed person. As an example, point of view can be different when the person is working within an operational capacity, as fire officer, or if he or she is working within a preparedness planning branch, as a fire inspector.

4.2.1 Question 1: Communication

The question:

“How should the communication between the schools and authorities be arranged during Shelter-in-place (later SIP) situations? What would be the most beneficiary / optimal method? Should the schools have access to TETRA-network?”

Background and expected gain:

During a Shelter-in-Place exercise it was monitored that an existing communication link between the officials outside was not existing. If during a SIP situation the school needs to contact the entity in charge, there is no direct link. This communication would most likely happen via emergency call centre by dialling the national emergency number 112.

The aim of this question was to identify possibilities for fixed or standardised communications method, between universities, universities of applied sciences (later UAS) and the authorities that would be most optimal and beneficiary for both parties. A question regarding access to TETRA-network was also added. TETRA-network is a digital and coded network used by the emergency services, police and other society support entities that is normally out of reach for other actors. This access would give the emergency services and police direct and secure contact to the universities and UASs.

During the Shelter-in-place exercise, it was noted that internal communication had issues. This issue is not part of these questions. This point will be covered in later chapters where recommendations are presented.

Answers / Results:

Several possible problematic issues were identified by the interviewees. Most of them saw the possibility of the mobile network to be overrun during a SIP situation. Since there is no way to limit the use of mobile phones by students and staff, this was seen to be quite possible outcome by both Emergency services and Police. If the universities and UASs depend solely on mobile network to communicate, this will cause an issue and even possibly endanger the staff and students. A suggestion was made to place a landline in the school command centre and in the shelter rooms. This is a system that will not be affected by overrun mobile networks and could be reserved solely to the purpose of communication during SIP.

The access to TETRA-network was seen mostly as problematic. As mentioned, this would give a direct communication link between the authorities and the universities and UASs, but the costs to acquire such radio terminals would be expensive. The durability of the devices, when not used regularly, was perceived as a problem. Many of the interviewees noted that these

devices should be maintained and used and the staff should be familiar with them. One of the major issues was that the schools should be able to guarantee the TETRA-network coverage within the vicinity and inside their buildings.

Some of the interviewees saw the communication between schools and students homes as more important than the actual communication link between the schools and emergency services and police. This question had a noticeable variable between the operational staff and planning staff. Operational staff saw it as more important to be able to communicate with the school while the planning staff saw the communication between schools and homes as more important. This was both within the police and emergency services. Still both views supported a possibility to appoint a liaisons person to communicate with the police and emergency services during the planning phase and possibly during a SIP situation.

4.2.2 Question 2: Shelter-In-Place rooms

The question:

“What should be taken into consideration when choosing designated SIP rooms? What elements should be taken into consideration? Floor, windows, AC, alternative way to exit or enter the room (also from outside the building. For example, letting paramedics or Police into the room)”

Background and expected gain:

The aim of this question was to identify points regarding access and structural issues with shelter rooms that could donate and support to the overall shelter-in-place planning process. It is noted that especially structural issues cannot be affected in existing buildings, but when deciding what room should be selected as a designated shelter room, these points can be taken into consideration.

Answers and results:

When taking shelter from a gas cloud or other toxic smoke formation due to a fire, a key issue is the possibility to control air condition and ventilation in shelter rooms and areas. From mainly the emergency services side this point was raised in several answers. It was suggested that the shelter rooms should have the possibility to operate separately from the rest of the air condition and ventilation in the facility or even have an independent ventilation system. Even if these systems can be separated to work independently, there would also need to be a possibility to mechanically, or manually, close or block ventilation conduits to prevent passive airflow. When such measures are taken, it is also imperative to pre-calculate the number of persons is one shelter room to be aware of the time this room can stay sealed from air flow. It needs to be recognised that at some point shelter-in-place will become more dangerous than evacuation. This could be avoided with the possibility to over-pressurise the rooms. This would guarantee

a continuous airflow into the room while simultaneously preventing toxic gases to reach the shelter area.

Both point of views, the police and emergency services, raised the issue in their answers for two separate exits from the shelter rooms. This answer was supported by the example of the need to move quickly from one shelter room to another, or to be able to exit via a secondary route, without exposing the secure area to external threats or hazards if possible. Depending on the location of the shelter rooms, a window could also be used in this purpose.

As a separate point mentioned by the police, there should be a possibility to easily lock and unlock these doors from inside. This would be especially important in the case when there is possibility of marauding violent attacker. Even though a fast locking mechanism was suggested, the use of dead-bolts should be avoided. If this is not possible, then a secondary exit should be available for fast evacuation or entry. When presenting this point to representatives of emergency services, especially the operative officers supported an idea of a separate 'attack route' that could be used by firemen, paramedics or police to enter the building. This would not need to fill necessary requirements for emergency exits, since it would not be classified as such but only a point of entry. This would also prevent the situation where exiting masses would block the way of entering emergency services or police. As already mentioned, the fact is recognised that such suggestion cannot be carried out with existing buildings, this can still be taken into consideration when planning SIP procedures and selecting shelter rooms.

If the shelter room has systems in place that rely on electricity, failsafe systems and backups should be considered. Either a backup generator for the whole facility or one just to provide support to the shelter areas. If it would require an independently working electricity system was a point that is not covered in our interviews. For that reason, this topic was not researched further in this thesis. It has been mentioned as possible future research subject in the respective chapter.

4.2.3 Question 3: Plans on school site and planning

“Would it be beneficial to have up-to-date SIP plans available for authorities to be used in such situations (Maps with safe rooms, procedures, communication and command structures)? Would it be beneficial for the authorities to participate in making these plans?”

Background and expected gain:

It was noted before, also after the Shelter-in-place exercise, that the plans in place were solely made by officials at that university of applied sciences. Due to this fact, some key elements in planning was missing. For example, updated maps of shelter room locations, lack of up-to-date information on the procedures to guide students and the lack of maps that would show the location of these rooms to the emergency services and police.

The question aims to confirm the importance of cooperation with emergency services and the police during planning and what would be, in their point of view, most useful information to be made available during a SIP situation.

Answers and results:

As one of the most important points, and it was mentioned in several interviews, and in our previous chapters, it is the responsibility of the owner or occupant of a building to create such plans. These emergency preparedness responsibilities, of the building or facility owners, are stated in the Rescue Act chapter 3 in sections 14 and 15. Even though the responsibility falls to the occupant or owner, local authorities should always be consulted when drafting or re-modelling a plan. This supported by fact that there is different, specialised information, that would be useful for the responding authorities. These are e.g. structural information of the rooms, accessibility to the proximity of the buildings with heavy appliances, elevation of windows and layout of the building interior. The minimum information required in the plan is stated in the Rescue act section 15. All this information, according to the interviewed experts, would support response efforts from both emergency services and police.

There were clearly two different points of view regarding the use of electronical plans and maps. One of the views were that the authorities would have, at their disposal, maps in their own databanks for each individual site in their responsible region. The argument against this was based on the experience the interviewees had concerning lack of updating the material. Also, one issue could be the possible availability during a SIP situation. Since this information would not be pre-printed, but would need to be requested or organised separately, it would not be convenient and support the actual rescue efforts.

A clear agreement in the opinions were, that emergency services, by some means, should have access to this information. Some suggestions were made about having the material available at the premises. Similar package that are used in maritime emergency management, a single folder containing all necessary response related information and available in a pre-designated location. It was also noted that if these maps and plans would be available on site, and would have multiple laminated copies, these could be easily distributed to the responding units on site.

Clearly all interviewed parties agreed that a bare minimum form of cooperation should be an appointed contact or liaisons person to whom they can be in contact and who is responsible for updating this material, whether it is on site or in electronic form. This answer supports strongly the views to appoint a liaison, as presented also in chapter 4.2.1 concerning the need for a person to manage communication during SIP situation.

4.2.4 Question 4: Tools

“What actual tools e.g. flash lights, first aid kit, would you recommend or would be useful in an SIP kit?”

Background and expected gain:

This question was purely aimed to produce answers concerning equipment. Based on the report done on the shelter-in-place exercise, it was noted that there is a need to develop the actual equipment available for SIP procedures. During discussions concerning previous answers, a specific tool or piece of equipment was mentioned. The interviewees were made aware that these topics would be addressed in this question.

We wanted to utilise the professional expertise of our interviewees and gain better insight in pieces of equipment that are recommended and have been found useful based on their experiences during a SIP situations.

Answers and results:

Mentioned previously in chapter 4.2.2, the Rescue act chapter 3 in sections 9 to 12, states the duties of building owners also concerning emergency equipment in shelter areas. The issue with material and equipment is that the more you have it, the higher possibility there is it will become obsolete and outdated. Still, this concern does not take away the responsibility from schools to be prepared for every plausible scenario and to be equipped at least according to minimum standards. To make the preparedness efforts minimal, simple solutions should be prioritised. The discussion on identified tools and pieces of equipment will be presented in the Recommendations chapter of this dissertation.

4.2.5 Question 5: Other remarks

This section in the interview was reserved for other remarks. This included issues that arose during the conversation, which were not identified within the questions but were deemed noteworthy. For this reason, there are no exact gains presented in this chapter, only answers and results.

Answers and results:

Several key issues were raised that could have an effect, on how successful a shelter-in-place procedure or training could be. One of these addresses existing attitudes towards such measures, including evacuation exercises and other similar safety and security related issues. One of our aims for this dissertation is to present these issues in a positive way. Education,

awareness and training will play an important role in forming these attitudes. It was also stated by the interviewees that raising this awareness needs a time-wise commitment from the schools and their staff.

Even though planning and cooperation was discussed in-depth previously in chapter 4.2.3, it was pointed out that all the pre-planning and mitigation procedures supporting the forming of a first phase situational overview, is considered important and such planning should follow an active information sharing with the staff. When everyone is aware what the aim is, when drafting a situational overview, they are more likely to contribute in this task by being aware what type of information can be useful and vital.

As mentioned in chapter 4.2.2, the method of target hardening was mentioned by some interviewees. We recognise that this is a possibility for future studies and will not discuss it further.

An interesting point about using existing bomb shelters as designated shelter rooms was raised. This issue is also recognised as a possibility for future studies and will not be discussed further in this dissertation.

5 Conclusions & Recommendations

In this chapter, we present our overall conclusions as well as recommendations based on this thesis' research. Moreover, we will present several tools that could let to more effective SIP-training as well as training modules for SIP-exercises that may prove supportive for the overall objective of the training.

5.1 Conclusions

Shelter-In-Place (SIP) can be a valuable safety measure to be used by universities and universities of applied sciences in their overall emergency preparedness. SIP can, when executed and trained properly, potentially save a lot of lives and protect students and staff alike. The decision whether to evacuate or take shelter is one that ought to be taken based on solid information, and must have been trained beforehand.

There are a few critical factors when making the choice to take Shelter-In-Place. These factors may even make the commander or authorities reconsider the SIP measure and opt for an evacuation instead. Factors such as *response time* of staff and authorities, the *amount* of students and staff that will need to take shelter as well as *chemicals* involved can be used in the designing and exercising phase of SIP to train for the best possible outcome.

Training for SIP would mean to train the SIP measure itself but also a few important and competencies necessary. These skills would include some of the basic emergency skills such as first

aid, fire extinguishing and communication with authorities. But, since universities and universities of applied sciences have a rather unique public to take care of, some investment should be made accordingly.

People in emergency situations tend to react on a primal level that has but one goal: survive. Fight, freeze or flight behaviour of humans in emergency situations has been well documented over the last decades. For University and UAS administrations this will have implications in how to deal with and plan for emergencies. Information is a key factor for any individual in emergency situations. It is therefore imperative that when planning for an emergency and how to cope with it, a University will remember this. How to communicate with students, what platform, and how to distribute the information should be incorporated in the strategic emergency preparedness plan.

Secondly, when dealing with students, University staff should remember that first year students are more likely to comply with instructions given to them. Mature students might question them more and staff must be prepared to explain and clarify information. In order, for students to understand what behaviour is expected of them, Universities must also be prepared to offer continued dialogs with students about threats, vulnerabilities, and protective behaviour outside of training moments. Hosting meetings, lessons or a presentation done by government authorities can be a starting point. The idea is that students can share experiences, ask questions or anything that makes them help them process the information about the necessity of shelter-in-place and the importance of compliant behaviour during a SIP situation.

Furthermore, authority figures often have a big impact on individuals in emergency situations. It is when they are instructive, informative and calm that they have the biggest positive impact on individuals. When university staff adopts this attitude during exercises as well as real-life situations they should be affecting students and other individuals in the best way they can.

In addition, based on interviews with authorities one can conclude that Shelter-In-Place has both perks and cons, knowing these will give the user a certain advantage in real life emergencies as well as training for them. Also, recommendations and insight from the authorities' point of view during SIP situations were obtained. Keeping these recommendations in mind, both during the emergency situation, as well as planning and preparing for them, might make the cooperation with the authorities more efficient and effective.

Noteworthy issue, and underlined by all interviewees is the presence of a liaison the moment authorities arrive on the scene. This liaison will be the main communicator between the university and the authorities during the situation. Also, this person will be the one who has the SIP plans of the school and hands them over to the authorities.

Finally, when planning the shelter the authorities seem to agree on a couple of critical points. First is that of air flow. The shelter should be able to contain a certain amount of people for a certain amount of time while continuously provide clean air to breathe. Furthermore, two exits are recommended in case of cave-ins as well as to present the authorities with an alternative route of attack. Lastly, electricity to the shelter should be on a separate circuit or generator to guarantee flow of current.

5.2 Recommendations

The coming subchapters will provide a deeper insight and knowledge of the briefly listed recommendations presented here in chapter. The recommendations are based on literary research as well as interviews held with authorities. The authors identified a few overall recommendations for those involved with SIP:

1. **Creating a university community where safety is the norm.**

As a long-term goal one should aspire to a university community where safety is seen as a positive issue and implemented in everything one does. By acknowledging safety issues and talking about them in one's community, safety issues might turn from scary to something one can openly talk about. Education, awareness and training will play an important role in this change of attitude. Part of this will be open communication with- and the involvement of students and staff about topics as fire safety, first aid, evacuation and shelter-in-place exercises.

2. **Clear plan.**

Drafting a rescue plan of which the shelter-in-place measure is a part of, is foremost the responsibility of the university or university of applied sciences. However, it is highly recommended to seek active cooperation with local authorities when drafting it and implementing it. Since these plans are required by law, the authorities are usually willing to give assistance.

3. **Training of staff and students.**

It is of the utmost importance to have trained staff when preparing and training for shelter-in-place. Those who are training for commanding roles should be clear on the defined conditions when SIP is chosen over evacuation. Furthermore, one of the identified success factors is having pre-defined roles for staff to assume. Having staff that knows what to do in the role they will perform will likely make them confident in their performance and actions they take. This, in turn, will directly affect the students they are managing in a positive way. Finally, instructing students, but also debating and evaluating in a participating way will make students, aware and involved in the process.

4. Appropriate shelter.

Much can be gained by identifying suitable shelter rooms early on in the planning phase. While not all institutes will be able to reconstruct current rooms to meet the prerequisites set by authorities in this thesis, it is important that one aspires to get as close to them as possible. The shelters should provide both authorities and those taking shelter with enough protection and accessibility.

5.3 Suggested shelter-in-place roles and tips

This chapter will discuss the different roles for staff to assume during an SIP situation or exercise. The roles have been defined based on the earlier mentioned exercise, literature and legislation as well as input from authorities in the interviews. Also, an example of communications diagram has been provided.

- **Commander:**
The commander will reside in the command centre and keep the overview of the situation as well as take the necessary decisions. He or she will also assign the roles to other staff members that announce themselves at the command centre.
- **Shelter manager:**
The shelter manager will reside at the shelter rooms and keep overview of the situation at the shelters. He or she will coordinate the necessary precautions to take at the shelters and communicates directly with the commander about any changes in the situation.
- **Liaison:**
The liaison will be the main communicator between the commander and the authorities. He or She will also provide the authorities with the shelter plans and reside at the authorities' command centre or base of operations during the SIP situation.
- **Door and hallway guards:**
Door guards will be assigned to the exits of the campus, assess the situation at present and order to get inside and take shelter. Hallway guards will be in place on tactical positions to guide students and staff onwards in the right direction of the shelters.
- **Shelter guards:**
Shelter guards will coordinate the sheltering at the shelter location. They will count how many persons enter the room before sealing it off and moving on to the next one. Furthermore, the shelter guards inside the shelter rooms will assist in taping and sealing off the windows and the AC-vents.

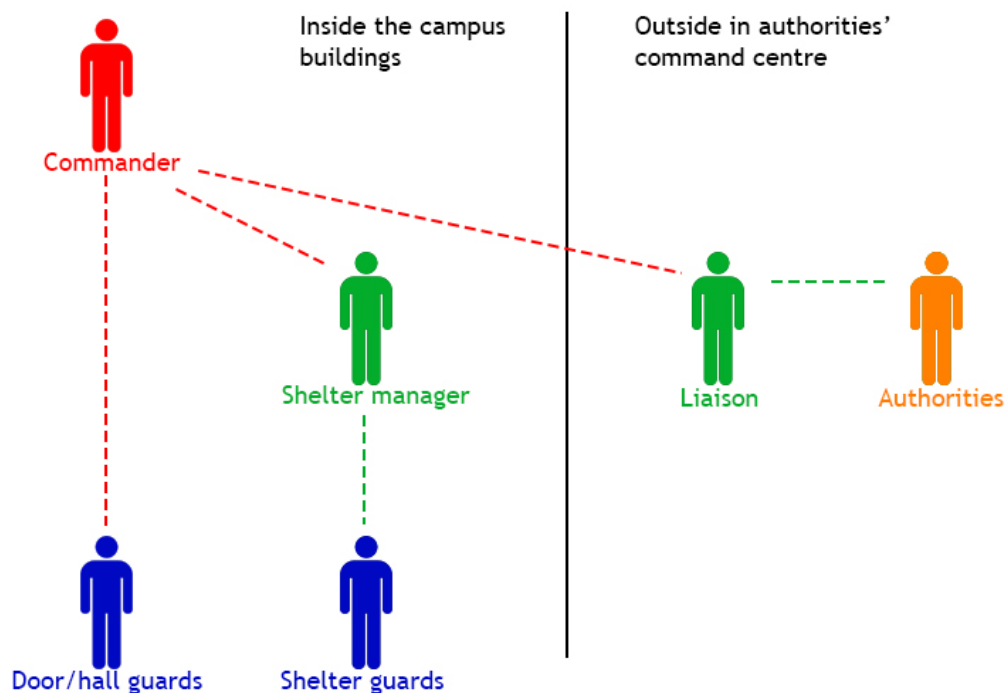


Figure 2: Communications during SIP situations

Based on observations during a shelter-in-place exercise we also recommend the following:

- Pre-assembled kits per role will save a lot of time when setting up the command centre.
- Make use of the 'inspected and vacant' tags. Be sure there are enough tags for each room. Preferably have several door tags for every role in their designated kit.
- Keep radio communication short and to the point. It is recommendable to train the use of walkie-talkies and concise radio communication beforehand.
- Have all shelter rooms clearly designated as such.
- Have a standard protocol for counting people entering each shelter room. An example could be to have at least two teachers / staff members into each shelter room. One only does the counting of students as they are coming into the room. One controls the protection measures and one calming the students if needed. When students are counted, the counting teacher informs this to the sheltering manager which relays the information to the commander.

- Have all shelter rooms equipped with a material box or cabinet. Once rooms are sealed there will be no possibility to exit the room for material.

5.4 Training modules

In this chapter, six modules to train activities during shelter-in-place are presented. These modules are based on recommendations and needs, which were identified during a previous SIP exercise and discussed with the experts during the interviews.

These modules will be presented as recommendations by substance and will not refer to any specified pedagogical method. E.g. for first aid training, there will be only a referral to national guidelines to be used. The modules are presented in separate tables.

Even though it is not separately mentioned in the modules, as a general training goal for all modules is the understanding of each task and with this, the possibility to switch between tasks if needed during a shelter-in-place situation.

5.4.1 First aid

The training module in this chapter refers to first aid administered by non-professionals, students or staff alike. It does not take into consideration any training requirements for professional medical staff, such as the school nurse or health care professionals working as teachers.

Module name	First aid training
Target audience	Staff, selected key staff members
Module substance	<p>Training basic lifesaving first aid. Training should be carried out according to national regulations or guidelines. Minimum standards according to those guidelines should be met in the training.</p> <p>Training could also be tailored to accommodate treatment of special needs students or focus on special situations e.g. marauding violent attacks.</p>

Module objectives	<p>Training objectives are defined by the training entity based on the national regulations or guidelines. Recommendation is that following objectives should be reached:</p> <ul style="list-style-type: none"> • To be able to administer lifesaving first aid e.g. CPR and treat life threatening wounds / bleedings. • Familiarise staff with first aid material and location. • Familiarise staff how to carry out equipment checks on pre-determined intervals.
Training entity	Training should be carried out by a licenced first aid training entity.

5.4.2 Fire-extinguishing

Module name	Fire-extinguishing
Target audience	Staff, selected key staff members
Module substance	<p>The training would consist of three parts. Simulation exercise, safety walk to familiarise locations of fire-extinguishing equipment and a theoretical part.</p> <p>Simulation exercise should consist of training with similar equipment than is available at the premises and simulations should be designed so, that the material and items should be identical. E.g. how to extinguish a trash bin fire or furniture that has been set on fire in public areas or lecture rooms. Since this part would exceed the minimum standards for regular fire-extinguishing training, the planning needs to be done in close cooperation with local emergency services. Such trainings are required to be carried out by the Rescue act chapter 3 in section 14.</p> <p>The safety walk should be carried out in a way, that the locations of the firefighting equipment becomes familiar to the staff. It should be done in small groups so there would be an opportunity to try how to open firehose cabinets open, how to remove fire extinguishers from wall mountings.</p> <p>It should also consist a small theoretical part explaining the effects of fire and fire gasses such as carbon monoxide. This would also include demonstration segment on how to protect oneself from fire. Treatment of burns and fire related injuries would be addressed in the first aid training. These points can be refreshed during the theoretical part.</p>

Module objectives	<p>Training objectives are defined together with the training entity, most likely the local emergency services, based on the national regulations or guidelines. Recommendation is that following objectives should be reached:</p> <ul style="list-style-type: none"> • Training with fire-extinguishing equipment similar than those located in the school premises. • Familiarise staff with the location and functionality of fire-extinguishing equipment in place. • Understand the effects of developing fires and caused hazards by fire and fire gasses. • How to protect oneself from fire and the effects of fire.
Training entity	<p>Training should be planned in cooperation and carried out by the local emergency services. Fire-extinguishing trainings cannot be carried out by non-licenced entities.</p>

5.4.3 Communication

Module name	Communication
Target audience	Staff and Selected key staff members
Module substance	<p>The training is divided into two parts based on the target audience.</p> <p>Normal communication tools and equipment e.g. radios, should be trained and familiarised by every staff member. This training would address the use of the equipment, how to check them and basic maintenance such as changing the battery or charging them. This training is aimed for internal communication only.</p> <p>The selected key staff members should be trained also in command centre communication and external communication with the authorities during and while preparing to SIP procedures and with other external entities e.g. students' homes. The aim of the training would be to familiarise staff with existing standard operating procedures on external communication, meaning what and when can be communicated outside, set in place by their respected universities or universities of applied sciences.</p>

Module objectives	<p>Training objectives are defined in two parts based on the training audience. The general training objectives are:</p> <ul style="list-style-type: none"> • Familiarising the standard operational procedures in internal communication. • Familiarising with radio language. • Training with communication equipment. • Familiarise staff with the communication equipment. • Train equipment maintenance and trouble shooting. • For the selected staff, objectives are: • Familiarising the standard operational procedures in external communication. • Train in command centre communication procedures and tools. • Managing internal communication and alarm / all clear procedures.
Training entity	<p>Training can be arranged internally by appointed university or UAS staff.</p> <p>External equipment training can be requested from supplier of communication equipment.</p> <p>External communication training can be requested from emergency services' training divisions or experts in crisis communication.</p>

5.4.4 Guards

To clarify the term guards used in this chapter, that it does not refer or have any similarity to stewards or professional guarding personnel. The term refers to an assigned task oriented position during shelter-in-place. This position is carried out by school staff members. There is no assumption that these persons would or are needed to act in the role of security guards within the school premises. In this context, the term guard refers to a member of staff who has been assigned to control school entry and exit points, carry out final checks to make sure all rooms are empty and to be the responsible staff member in shelter areas.

Module name	Guards
Target audience	Staff

Module sub-stance	<p>The main aim of this module should be in familiarising the staff in the importance of this task. To understand time management when carrying out final checks throughout the facility. It is their responsibility to make sure all the rooms are empty and guide all the students to the shelter areas.</p> <p>As another important part of these duties is to make sure nobody will be able to leave the school, especially when there is an external hazard. These guards are in key role when the human factors are considered mentioned previously in chapter 3.1.2. For this reason, they should be aware and trained to handle people under stress.</p> <p>The third part of this training should be concentrate solely working in the shelter rooms. This part of the module would need to focus on the issues mentioned also in chapter 3.1.3 on stress accumulation and effects of stress in confined spaces.</p> <p>Due to the importance of the substance, this module should be divided into two segments. First part should be practical training. Familiarising staff with techniques and school layout. Second part should be purely theoretical focusing on human and stress factors during shelter-in-place situations.</p>
Module objectives	<p>The general training objectives are:</p> <ul style="list-style-type: none"> • Familiarise with rapid search techniques. • Familiarise with school layout and technical solutions e.g. locking systems and location of shelter area. • Understanding possible human and stress factors and be familiar with common stress relief and management methods.
Training entity	<p>Training can be arranged internally by appointed university or UAS staff. As a recommendation, practical part can be carried out by the superintendents.</p> <p>For stress management, the training can and should be arranged by the resident psychologist or be coordinated by him or her.</p>

5.4.5 'Shelter preparation

In this chapter, the preparation tasks or those that are carried out by the staff before and during shelter-in-place situations. It does not deal with issues concerning selection of shelter rooms or areas. These issues will be addressed in chapter 5.4.2. Selecting the shelter rooms.

Module name	Shelter preparation
Target audience	Staff

Module sub-stance	<p>The training is divided into two, based on different phases of shelter-in-place procedures.</p> <p>First part should focus on preparedness. This should involve training and theoretical part on how to check the shelter room equipment periodically, how to carry out maintenance if needed of how report in a possible need for maintenance or replacement of any tools or equipment. This will depend on the operating procedures in place within the university or university of applied sciences in question. Some equipment might need a specialist e.g. fire extinguishers or first aid kits.</p> <p>The second part should focus on actions done during shelter-in-place situation. What tasks should be carried out after the alarm and during. Such tasks can be e.g. how to manually close the ventilation, as regarded important in the answers given in chapter 4.2.2.</p> <p>The training should contain a segment where the staff would familiarise themselves with all shelter rooms, locations of sheltering kits and any special characteristics of a shelter room.</p>
Module objectives	<p>Training objectives are divided by phases.</p> <p>Preparedness phase objectives are:</p> <ul style="list-style-type: none"> • How to carry out equipment checks. • How to carry out maintenance or how to report the need of or replacement. • Familiarise with tools and equipment in use. • Familiarise the location of equipment kits. <p>Shelter-in-place phase objectives are:</p> <ul style="list-style-type: none"> • How to act correctly or what appropriate measures to take concerning the hazard or threat. • Selecting and using the right equipment.
Training entity	<p>Training can be arranged internally by appointed university or UAS staff.</p> <p>Special tasks, e.g. closing the ventilation, might require outside expert to provide training. In these cases, it could be advisable to train one or two staff members who then will give trainings internally.</p>

5.4.6 Command centre

This chapter addresses training issues concerning command centre set-up by the school to manage internal operations and communication, both internal and external. This chapter does not address issues concerning possible joint coordination cells set-up by the emergency services or police to manage situations externally. Training communication issues between these two entities is presented in chapter 5.3.3.

Module name	Command centre
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Target audience	Selected key staff members
Module substance	<p>This training should be aimed at selected key personnel, both teaching and support staff.</p> <p>Since this module would be aimed mostly to the staff involved in planning and who are in key positions related to the facility or organisation, the module should address issues relating the legal responsibilities of the schools (University Act 558/2009 & University of Applied Sciences Act 932/2014).</p> <p>The module should address issues relating incident management, situational awareness and damage control. All command centre tasks should be clearly presented, trained and familiarised by the staff involved.</p>
Module objectives	<p>Training objectives for this module are:</p> <ul style="list-style-type: none"> • Time management. • Staff management. • Familiarising with incident command methods. • Command centre structures. • Setting up the command centre.
Training entity	<p>Training can be arranged internally by appointed university or UAS staff.</p> <p>External incident command training can be inquired by local emergency services' training divisions.</p>

5.5 Implementing tools

The authors of this thesis recognise that some of the recommended trainings or planning points cannot be carried out by the school staff themselves. For this reason, we will offer suggestions based on our results and existing information available. In each training module, possibilities for training entities have been mentioned. For this reason, we will not list them again in this chapter in such detail. Also, there are several points that can be implemented internally by the school staff. For schools to have this understanding of the capabilities of their staff, an assessment of expertise should be carried out within their respective organisations.

5.5.1 External facilitators of training and knowledge

Due to liability and legislative issues, first aid training and fire-extinguishing training needs to be carried out by licenced trainers. These trainings can be arranged and organised by the schools but such trainings are only creditable when they are taught by professional and accredited training facilitators. Due to the curriculum of some universities of applied sciences and universities, there might be teachers with such certificates. In these cases, the use of external facilitator can be decided by the schools themselves. Such external facilitator could be the

local fire department. Usually these are entities capable of offering training in both first aid and fire-extinguishing.

As one of the main points of our thesis, is the understanding of stress and human factors during shelter-in-place situations. We have made recommendations to train stress awareness and how to manage stress during SIP situations. It is our recommendation that effort will be put into finding a proper training facilitator. Due to its nature, stress coping mechanism trainings are not regulated in a same way as trainings for first aid and fire-extinguishing are.

Several issues and topics mentioned can be trained internally within the schools, using the knowledge and expertise of the staff. These issues are related mostly to technical solutions in place, such as operating the air-condition and ventilation systems in the shelter rooms, issues related to internal guidelines and issues related to the buildings themselves. It is important for the school emergency management team, or similar entity creating training plans, to assess and recognise the capacity of expertise within their own organisation. As an example, the superintendent would be the most likely person to have knowledge about school security systems, the school maintenance person would then again have the required knowledge on the ventilation systems or at least would have information about the company installing such devices and what could be contacted to request a user training.

As mentioned in several previous chapters, during the planning phase of the shelter-in-place process, a close cooperation and communication should be carried out with the local authorities. This cooperation was especially supported by the answers presented in chapter 4.2.1. There are also several private companies offering expertise within this topic. Both, of these different entities can support, and offer up-to-date information on how to carry out successful SIP actions. The benefit of communicating directly with the local authorities is that they make sure the plans are interoperable with emergency services and the police.

5.5.2 Selecting the Shelter room/location

Since in chapter 4.2.2, detailed answers were presented in issues relating to the selection of the shelter rooms. These details will not be listed in depth again in this chapter. We recognise that the selection of shelter rooms is not as flexible in old and existing buildings as it is with newly constructed or buildings still in planning.

The selection should be done in cooperation of either a structural / building engineer, fire inspector, police or with all of them. Each of these entities would have the needed expertise to support the schools in their selection of a shelter area.

Based on our research and results, our recommendation is that the selection of shelter room should be based on thorough planning, communication, cooperation and understanding the purpose of taking shelter-in-place.

Possible further studies supporting the selection of shelter rooms are presented in chapter 5.7.

5.6 Validity and Reliability - Discussion

The use of previously obtained exercise results of an anonymous university of applied sciences did not pollute the thesis in the opinion of the authors. The exercise results could have come from any UAS in Finland as it was a momentary recording of how the staff handled a shelter-in-place exercise without previous 'refreshing' instructions or specific time information. The obtained results provided the authors with an objective context that could possibly get as close to a real situation without an actual incident.

As a research method, interviews can be considered, to be full of opinions, and not facts. Such prejudices can hinder the reliability of a research where interviews are used. This was an issue the authors had clearly defined and recognised in their plan. Since the question topics were more related to standard practices, legislation and issues directly related to safety, complications and interjection of hindering opinions were considered minimal.

We were confident on the quality of collected data, since the interviewees were selected from authoritative organisations and are known experts in their respected fields within the emergency services and police. For us, the reliability was supported by the uniformity of the answers. The only variability came within the background of the interviewee. This fact supported our trust towards the collected data.

5.7 Recommendations for future research

Finally, during the research phase several topics for further analysis presented itself. This chapter provides an overview of these topics.

Early warning system for schools

Based on the issues raised in chapter 4.2.1, more studies should be carried out to find out would it be beneficial to put in place an early warning system. To give school facilities and their staff a 'heads up' in situations that could possibly develop further and would demand to seek shelter-in-place. Such a system could reduce the preparation time of the SIP measures and the whole process could benefit from this. Since this was not research by us within the framework of this thesis, it is our suggestion that future research could be done on this subject and the system itself.

Emergency electrical systems for shelter areas

As a point raised in chapter 4.2.2 concerning shelter room electrical failsafe systems and back up, raised a question should there be an independent electrical back up system for the selected shelter rooms. Since this is something that can be easily done through design in new buildings, could something similar be installed to old school buildings? Since this issue is more relevant to studies carried out in the field of engineering, we withhold in studying this point further. We feel that the subject is interesting and could offer solutions to issues concerning the security of electricity supply during a shelter-in-place. It is our recommendation that such issues could be research further within its respected field of study.

Use of existing bomb shelters as shelter rooms

It was presented briefly in chapter 4.2.5 the possibility to use existing bomb or fallout shelters as designated shelter areas. Since this is not their assigned purpose, more study in this field should be carried out before any sound recommendations could be made. In our opinion, based on the interviews carried out, such solutions would be very beneficial. These areas are already designed structurally to fill all necessary requirements, but the possibilities for the legal and the suitability from a design point of view should be studied more.

School buildings and target hardening

In interviews, especially by the interviewees from the police, the term target hardening was mentioned. As mentioned several times during the thesis, such issues are easy to address when designing and planning new buildings. With existing structures and buildings, such methods could prove to be difficult to put in place. Since this is a fairly new approach in school planning, it should be studied further, if and how target hardening could be implemented into existing schools. Such a study could be carried out within the field of security management.

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Appendix 1: Letter of intent and questionnaire

Letter of intent

Dear recipient,

We are looking for interviewees for our Thesis.

Background:

We are doing our Bachelors Thesis in the subject of Shelter-in-place for Laurea University of Applied sciences - degree program in Security management.

Our goal is to develop a uniform toolkit that can be used by Universities and Universities of Applied Sciences, later UAS, when training and preparing for shelter-in- place as well as dealing with real life scenarios.

The toolkit will have different materials providing guidelines to work by, as well as a booklet explaining the human behaviour in emergency situations and needs for indoor sheltering exercises.

As for now, there are no universal tools for Shelter-in- place for institutions of higher education in Finland. It has become clear in our preliminary discussions with Laurea's Safety and Security Director, Mrs. Tiina Ranta, that there is a genuine need for improvement in this field.

In our thesis, we will be focusing for the major part on emergency situations but, to form a complete package, also information about violent attack scenarios is given. Emergency scenarios will be situations involving e.g. fire or other hazard near a school or the area. Violent attack scenarios will include possible marauding violent attacks, in and outside the school premises, carried out by an individual or a group.

The training manuals and handbook developed, as a vital element of the toolkit, will be based on behavioural science i.e. focusing on human behaviour during emergency situations as well as coping with acute stress.

One of the goals, after finalizing the development, is to distribute the toolkit amongst the different Universities and UAS in Finland, through the safety & security network they cooperate in.

Before dissemination amongst other universities and UAS, the toolkit will have its trial at Laurea UAS campuses.

Best regards,

Mikael Mattila & Mike Ros

Degree program in Security Management
Laurea University of Applied sciences

Questionnaire

The questionnaire can be filled anonymously. No names will be published in the thesis report. Please fill in at least your first name, so we can keep track of the sent and received questionnaires. Please also provide your organisation and rank in the organisation.

Name:

Organisation:

Rank (can be filled in Finnish):

Questions:

Q1: How should the communication between the schools and authorities be arranged during Shelter-in-place (later SIP) situations? What would be the most beneficiary / optimal method? Should the schools have access to VIRVE-network?

Q2: What should be taken into consideration when choosing designated SIP rooms? What elements should be taken into consideration? Floor, windows, AC, alternative way to exit or enter the room (also from outside the building. For example, letting paramedics or Police into the room)

Q3: Would it be beneficial to have up-to-date SIP plans available for authorities to be used in such situations (Maps with safe rooms, procedures, communication and command structures)? Would it be beneficial for the authorities to participate in making these plans?

Q4: *(This is an extra question. No recommendations will be done directly based on the answers provided. The aim of question 4 is to check the existing material lists and compare them with answers received.)* What actual tools e.g. flash lights, first aid kit, would you recommend or would be useful in an SIP kit?

Other remarks:

Please return to:

mikael.mattila@turku.fi

Thank you.

Appendix 2: Mock-up of Toolkit



**A toolbox for universities and
universities of applied sciences**

**Mikael Mattila
Mike Ros**



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