Search & Rescue

Emerging technologies for the Early location of Entrapped victims under Collapsed Structures & Advanced Wearables for risk assessment and First Responders Safety in SAR operations

D2.4 Report on safety and security issues of emergency and crisis management field actors

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	SOFTWARE IMAGINATION & VISION S.R.L (SIMAVI)	Romania
	MAGGIOLI SPA (MAG)	Italy
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Executive summary

In the process of designing, testing and validating the products and technologies within the S&R project, creating a safe and secure environment for first responders is a must. This is all the more so since first responders represent a significant financial, technological and moral investment, both in terms of level of training and duration.

The purpose of the D2.4 deliverable is to increase emergency personnel (with priority for first responders) awareness by providing important considerations, relevant risks for the project Use Cases and mitigation measures that aims to improve participants' understanding, knowledge and skills in operational and strategic safety and security management so that they can be better prepared for field operations and also act as security advisers in a response team, providing them with the knowledge and skills needed to act appropriately on safety regulations.

Major relevant lessons and training material covering the thematic of the project Use Cases are also provided through an e-learning platform that has been developed as part of T2.4.

To this end, Chapter 1 (Literature review), subchapter 1.1 (Task Overview and scope) and subchapter 1.2 (Literature review process), summarizes the relevant specialist documents in the field of safety and security for first responders in the event of natural or man-made disasters.

Chapter 2 (Glossary of terms) defines the specialist terms used in the deliverable D2.4, in order to avoid misunderstandings or misunderstandings, taking into account the different approaches that exist in the legislation of EU countries.

In Chapter 3 (General considerations about S&R environment) analyzes risks and hazards where response team personnel conducting SAR and support activities are exposed to.

Following a catastrophe, rescue workers and emergency responders are the first to arrive on the scene, often in unfamiliar surroundings and adverse weather conditions, ready to save lives and secure the environment to help protect the lives of those to follow. Rescue workers and emergency responders may be involved in emergency medical operations involving victim rescue or body recovery around piles of rubble and other debris, collapsed structures or near structural steel.

Therefore, in subchapters 3.1-3.3 we analyzed Safety risks, External risks - related to incident environment, Internal risks - related to correct use of equipment.

Chapter 4 (UC analysis in terms of risks for safety and security of for first responders) analyzes the usefulness of using the risk matrix in the analysis of risks for safety and security of first responders (see subchapter 4.1 - Risk Identification - risk matrix regarding safety and security of first responder) and, based on questionnaires completed by end users of the S&R project (see Annex II), addressing the specifics of first responder through an online training platform aiming at ensuring their safety and security depending on the grouping by type of disaster of the scenarios of each UC (see subchapter 4.2 - Scenario description from a first responders safety and security perspective).

Chapter 5 (Risk mitigations regarding safety and security for first responders by online platform training) analyzes and proposes a MOODLE type e-learning platform (for text only training without the help of a trainer) for the first response in terms of safety and security (see subchapter 5.1) and the development of training materials (see model in Annex III) and organization of online platform training courses for first responder, both at operational level (see 5.2.1) and at strategic level (see 5.2.2). Annexes IV, V and VI include both computer-based and trainer-led courses (including text only) in order to provide the possibility to first responders in the S&R project for obtaining benefit and relevant training both from the computer-based content in the MOODLE e-platform and trainers that will be available on site for providing relevant training prior to the operationalization of a Use Case.

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Table 0-1: List of Abbreviations

Abbreviations	Definition
CM	Crisis management
PPE	Personal Protective Equipment
SDO	Standards Developing Organizations
S&R	Search and Rescue
SWOT	Strengths, Weaknesses, Opportunities, and Threats
UC	Use Case
US&R	Urban Search and Rescue
VR	Virtual Reality

1   Literature review

1.1 Task overview and scope

The scope of this action is to collect relevant information in order to better define and agree on the specific attributes/characteristics and capacities that mainly contribute in building "safety and security emergency personal", relevant for the content of deliverable D2.4 Report on safety and security issues of emergency and crisis management field actors.

Within the S&R project the use cases intended to validate the technologies and systems developed in the project are taking place in different countries which might have specific requirements in terms of safety regulations.

In order to precisely delimit the scope of the analyzed field, we remind that the objectives to be achieved in T2.4 are to:

- Provide a secure and safe environment to responders based on enhanced knowledge.
- Increase on-field personnel safety & security awareness.
- Enhance participants' understanding, preparation, knowledge, and skills in terms of safety and security management and relevant regulations at operational and strategic levels.
- Enable participants to act as advisors to other response teams.

In order to provide first-hand information to the partners in the S&R project on the issue of ensuring the safety and security of first responders in emergency management, a Canadian model (see LITERATURE REVIEW -IX) for risk management / risk matrix (Transition of matrix development specific elements of an S&R response) has been selected as a possible approach to assessing safe operating conditions for first responders.

1.2 Literature review process

The literature review was based especially on international recognized paper-works, guidelines, scientific/technical journal articles which addresses the issue of emergency management, with an emphasis on the management of search-and-rescue actions.

This has been primarily performed through a structured process based on a pre-defined template which is not just a descriptive list of the material available, or a set of summaries.

The key issues that we want to consider are:

- training for the purposes of reducing the risk exposure of the first responders.
- safety risk versus security risk.
- considerations about the S&R environment.

Below, Tables from 1-3 to 1-16 that summarize the main findings of the literature review.

An important note is that the terms used in the literature below, as well as in the contents of the entire D2.4 deliverable, are explained in the glossary of terms in Chapter 2 of this deliverable.

Table 1-1: Literature Review -I

Literature Review -I
SOURCE (CITATION) INFORMATION
Publication title: INSARAG GUIDELINES -2020 Volume II: Preparedness and Response

Manual A: Capacity Building	
Year/Month of publication: 2020	Publishing organization / authors: United Nations Office for the Coordination of Humanitarian Affairs
Type of publication: Operational manual	Relevant Link: https://www.insarag.org/methodology/insarag-guidelines/
	Level of source: International

STUDY BRIEF OVERVIEW

The manual approaches the process of identifying and supporting existing urban search and rescue (USAR) resources or developing new capacity through the creation of systems and processes, recruitment of suitable staff, the procurement of equipment, training of personnel and its integration into the existing legal framework for emergency management sufficient to support and sustain the capacity.

Relevant aspects for the project:	Type of S&R activities:
- Technical rescue Worldwide, fire services (volunteer and professional), civil defense, and militaries along with non-governmental organizations (NGOs) and charities have assumed a major role as primary responders to rescue incidents that involve, among other things, structural collapse, trench cave-ins, confined spaces, industrial and agricultural machinery water emergencies, and people trapped above or below grade-level. These emergencies are grouped into a category of rescue called technical rescue. **- Risk** Technical rescue incidents are often complex, requiring specially trained personnel and special equipment to complete the mission. Natural forces such as earth tremors, precipitation, extreme temperatures and swift water currents often complicate technical rescue incidents. The presence of flammable vapors and toxic chemicals can also increase the level of risk. **- Safety** The safety of teams conducting technical rescue operations is of a special concern. First responders throughout the world perform technical rescues on a daily basis. Some complex technical rescue incidents may last many hours or even days as rescue personnel carefully assess the situation, obtain and set up the appropriate rescue equipment, monitor scene safety, and remove hazards before they can finally reach, stabilize, and extricate the victims. The presence of hazardous substances or elements such as flammable vapors or dust often forces rescuers to take	Organized response typically provided by fire services, emergency medical services (EMS) personnel, civil defense units, police, and others.

additional precautions and time to ensure that operations are conducted safely. Experience has shown that hasty rescue operations can endanger the lives of both rescuers and victims.

A technical rescue team is a specialized group of personnel having advanced training and specialized equipment to conduct complicated rescue operations safely and efficiently.

Conducting technical rescue, like firefighting, is dangerous. Certainly, risks can be limited by providing proper training about safe rescue techniques and by purchasing equipment designed to make rescues safer.

Technical rescuers may face many risks including asphyxiation within a confined space, fall injuries from operating on ropes, and drowning while operating in swift water conditions.

One of the greatest mistakes made when forming a team is to think that the sponsoring organization can create a team without basic training and basic equipment. Some organizations have attempted to start a team or perform dangerous rescues without having even basic equipment or training. This is extremely risky from the standpoint of both the rescuers and the victims.

- **Training**

National training requirements must be considered when planning for a rescue team. Mandatory training requirements vary from country to country or even among localities. Most technical rescue training mandates are self-determined by a country or locality that may require the sponsoring organization to follow a particular standard of training.

The training to address each individual capacity competently and safely is intensive. The greater the number of specialties a technical rescue team assumes responsibility for, the more difficult is the task of bringing personnel up to the necessary training and skill levels.

In the planning stage, the sponsoring organization must identify what training it will need, what training is available, and how it will be delivered. Training needs will be determined by the team's focus. These needs will also be determined by any local or state training requirements (this is particularly important in states regulated by their ministry for occupational safety and health). When will the training be delivered? Who will deliver the training?

Main challenges for actors:
Emergency information provided in advanced English making it difficult for non-native English speakers to understand.

Study limitations:

The contents of the manual are intended to be considered as a guide. Therefore, each country adapted the contents of this manual to its needs. Consequently, there is a risk of procedural deviation from the manual for each country.

Table 1-2: Literature Review -II

Literature Review - II
SOURCE (CITATION) INFORMATION

Publication title: INSARAG GUIDELINES -2020
Volume II: Preparedness and Response
Manual B: Operations

Year/Month of publication: 2020	Publishing organization / authors: United Nations Office for the Coordination of Humanitarian Affairs
Type of publication:	Relevant link: www.insarag.org
Operational manual	Level of source: International

STUDY BRIEF OVERVIEW

The manual is targeted at the INSARAG Operational Focal Point, the Urban Search and Rescue (USAR) Team Management and Focal Point, and the INSARAG Secretariat with the purpose of providing guidance in the training, preparations and coordination of a USAR Team for national and/or international operations. It is based on the minimal standards and it describes the required capabilities for coordinated operations.

The manual describes the five components of USAR capability (Management, Search, Rescue, Medical and Logistics) within the USAR Response Cycle

Relevant aspects for the project:	Type of S&R activities:
- **Technical rescue** USAR Functions during deployment: - *USAR Team Management* The management component of a USAR team is accountable for all aspects of the USAR team's activities throughout the response cycle, including command and control, operations, assessments, coordination, planning, media, as well as safety and security. - *USAR Team Search* The Search component of a USAR team is responsible for the systematic application of technical and/or canine capabilities for the location of persons trapped as a consequence of a disaster. - *USAR Team Rescue* The Rescue component of a USAR team is responsible for the application of comprehensive suite of skills, techniques and equipment, including breaching, cutting, shoring, roping, rigging in order to resolve complex extrication situations. - *USAR Team Medical*	Organized response typically provided by fire services, emergency medical services (EMS) personnel, civil defense units, police, and others.

The Medical component of a USAR team is required to ensure the health, emergency care and well-being of the USAR team members, including the search dogs, and victims encountered during USAR operations.

- *USAR Team Logistic*

The Medical component of a USAR team is required to support and sustain the USAR team through all aspects of the USAR response cycle, including the management of the cache, Base of Operations, communication, and transportation

- **Risk**

Hazardous Materials Operations

USAR Teams locate, extricate, and provide emergency medical treatment to victims entrapped because of structural collapse. Operations involving collapsed buildings normally include some form of hazmat component – examples include, broken heating oil pipes, domestic or industrial refrigerants, broken sewerage pipes, body fluids, etc. USAR Teams should have the capability to deal with these issues as a normal part of SAR operations.

In some instances, structural collapse may involve the significant release of substances that have the potential to injure and/or cause death as well as resulting in significant environmental damage. These substances can include nuclear, biological, or industrial chemical contaminants. Hazmat incidents may also occur in conjunction with an explosive or incendiary device. In these cases, a strong relationship with the LEMA and/or local first responders are considered productive.

Light, Medium and Heavy USAR Teams are required to have a basic capability to detect and isolate hazmat and report the situation to the UCC. Teams locating a hazmat source must cordon off the area and mark accordingly to alert other rescuers of the danger. If there is a suspicion that contamination exists, treat the site as contaminated, until proven otherwise.

Main challenges for actors:
Emergency information provided in advanced English making it difficult for non-native English speakers to understand.

Study limitations:

The contents of the manual are intended as a guide. Therefore, each country adapted the contents of this manual to its needs. Consequently, there is a risk of procedural deviation from the manual for each country.
This manual takes into considerations only a few aspects of USAR activities and does not refer to training.

Table 1-3: Literature Review - III

Literature Review - III	
SOURCE (CITATION) INFORMATION	
Publication title: INSARAG GUIDELINES -2020 Volume III: Field Operational Guide	
Year/Month of publication: 2020	Publishing organization / authors: United Nations Office for the Coordination of Humanitarian Affairs
Type of publication: Operational manual	Relevant Link: www.insarag.org
	Level of source: International

STUDY BRIEF OVERVIEW

The INSARAG Guidelines, Volume III: Field Operational Guide targets all USAR managers and team members and is designed to be a quick-reference guide that assists with field and tactical information for all missions, exercises and training sessions.

This Field Handbook follows the five components of USAR capability: Management, Search, Rescue, Medical and Logistics. It also includes a section on Safety and Security.

Relevant aspects for the project:	Type of S&R activities:
- **Risk** *Hazardous Materials Operations* If a site is deemed contaminated teams should assess whether they have the means to safety work in this environment. Teams should not commit to a contaminated site without conducting a thorough assessment of their hazmat capability for short or longer-term operations. If it is deemed appropriate that a team can work in a contaminated environment the following should be considered: - Ensure a safe approach – always upwind and up-slope. - Ensure clear command and control arrangements are in place and well understood by all present. - Secure the site as best as possible to ensure the safety of others. - Attempt to identify the contaminant (UN Numbers, Dangerous Goods or Hazchem Codes). - Assess the potential harm and minimize, where possible, environmental contamination. - Call in assistance – expert advice/additional resources, if possible. - If within the teams' capability – render safe.	Organized response typically provided by fire services, emergency medical services (EMS) personnel, civil defense units, police, and others.

- Always assume the worst until proven otherwise.

Prior to committing resources to a contaminated site, the following should be considered:
- A risk analysis should be conducted based upon hazard/risk assessment and the site survey
- Teams should evaluate the risk in relation to the rescue of viable victims versus recovery of the dead
- Teams should also consider other search and rescue priorities within the immediate vicinity

The following considerations may also affect the decision on whether to conduct search and rescue operations:

- Condition of voids – if the hazard can be easily isolated or mitigated and this is carried out, the situation is considered rendered safe, and operations are to continue.
- Time required to access victims – this will be an estimate of the time required to get to the first victim. It should include the time it would take to mitigate hazards, cut through floors, walls, roofs, etc., and to shore and brace the access route as well as relevant adjacent structures if required.
- Special occupancy information – increased attention and monitoring will be given to certain types of target hazards, especially those involving nuclear energy, radiological elements, specialized military facilities, chemical manufacture, and biological production or storage.
- Decontamination – careful planning is needed to ensure the team has procedures in place that provides adequate decontamination of members including search dogs.

 Go or No-go conditions – and subsequent risk assessments:

o Time required to complete the assignment.

o Protection and limitations of available personal protective equipment.

o Results of the risk-benefit analysis.

o Resource status.

o Security and safety considerations.

- **Safety**

Operational Worksite detection and monitoring should be performed by the assigned hazmat specialist in the team and include the following:

- Establishing safe perimeters of each assigned structure.
- Establishing clean entry points of each assigned structure.

- Plan for the need to monitor additional voids or potential spaces encountered during operations.
- Establishing decontamination-sites – including the appropriate disposal of contaminated run-off.
- Ensuring decontamination of assigned tools and equipment, including protective clothing.
- Ensuring decontamination of assigned transportation vehicles.

Safety during operational readiness Base of Operation (BoO):
   Activity
- Check own material on completeness and functionality.
- Sufficient illumination of BoO.
- Fire protection (smoke detector fire extinguisher).
- Weather forecast and resulting possible dangerous scenarios.
- Topography of operation area and possible resulting dangers (rivers, hillsides).
- Danger resulting from buildings around.
- Fix and sign Assembly point.
- Extraordinary smell.
- Discoloration of surfaces/plants.
- Conspicuous vegetation, local fall of leaves.
- Conspicuous behavior of animals, many cadavers, concentrated on a place or from a single animal species.
- Abnormal cumulative sickness symptoms of local population.

Security during operational readiness Base of Operation (BoO):
- Protection of BoO against intrusion from outside.
- Organize security patrols
- Suspicious persons/groups.
- Check possible endangering by riots, crime.

Safety on Worksite:
Possible dangers:
- Breathing toxins.
- Diffusion.
- Fear reaction.
- Fall.
- Radioactive/nuclear dangers.
- Biological dangers.
- Chemical dangers.
- Breakdown.
- Drowning.
- Illness.
- Collapse.
- Explosion.

- Electricity.

Safety related activities:
- Correct wearing of sufficient PPE.
- Control system for first responders, who are where.
- Endangerment by topography.
- Code of behavior in dangerous situations.
- Endangerment by buildings, debris, aftershocks, environment.
- Determine and communicate kind of marking/barrier on scene.
- Extraordinary smell.
- Discoloration of surfaces/plants.
- Conspicuous vegetation, local fall of leaves.
- Conspicuous behavior of animals, many cadavers, concentrated on a place or from a single animal species.
- Abnormal cumulative sickness symptoms of local population.

Security related activities
- Suspicious persons/groups.

Main challenges for actors:

Emergency information provided in advanced English making it difficult for non-native English speakers to understand.

Study limitations:

The contents of the manual are intended as a guide. Therefore, each country adapted the contents of this manual to its needs. Consequently, there is a risk of procedural deviation from the manual for each country.

Table 1-4: Literature Review -IV

Literature Review -IV
SOURCE (CITATION) INFORMATION
blication title: Proceedings of the Fourth International Symposium on Fire Economics, Planning, and Policy: Climate Change and Wildfires Mega Wildfire in the World Biosphere Reserve (UNESCO), Torres del Paine National Park, Patagonia – Chile 2012: Work Experience in Extreme Behavior Conditions in the Context of Global Warming

Year/Month of publication: August 2013	Publishing organization / authors: General Technical Report PSW-GTR-245 (English) **René Cifuentes Medina** Forestry Technician, Department Head, Fire Management, National Forest Corporation, Punta Arenas, Chile

| Type of publication
Conference | Relevant Link:
https://www.fs.usda.gov/treesearch/pubs/44244 |
| | Level of source: International |

STUDY BRIEF OVERVIEW

Mega wildfires are critical, high-impact events that cause severe environmental, economic and social damage, resulting, in turn, in high-cost suppression operations and the need for mutual support, phased use of resources and the coordinated efforts of civilian government agencies, the armed forces, private companies and the international community.

| Relevant aspects for the project: | **Type of S&R activities: Fire Fighting** |
| | |

Relevant aspects for the project:

- **Technical rescue**

The fire spread quickly due to constant strong winds, abundant and dry organic fuel present throughout the park, area conservation efforts and a prolonged drought,
resulting in a high rate of spread, high resistance to control and long-distance emission of firebrands leading to multiple spot fires.
The considerable resources and means required, the level of complexity involved in firefighting operations, the presence of extreme behavior factors, the great logistical deployments required due to the remoteness and inaccessibility of the site and the numerous complications that had to be solved, necessitated implementing a complex extended attack structure

- **Risk**

Due to particular regional conditions which limit the effectiveness of fighting wildfires, it is clear that it is only possible to achieve an effective response through proper planning based on an assessment of the occurrence and the losses caused by wildfires, by means of a proposal outlining prevention, prognosis and suppression measures that effectively control the initiation and spread of fire

Type of S&R activities: Fire Fighting

Main challenges for actors:
Emergency information provided in advanced English making it difficult for non-native English speakers to understand.

Study limitations:

The content of the paper refers to the strategic aspects of the fire-fighting activities. Therefore, there are no safety and training issues approached for operational activities.

Table 1-5: Literature Review -V

Literature Review -V
SOURCE (CITATION) INFORMATION
Publication title: Emergency Services: A Literature Review on Occupational Safety and Health Risks, ISBN 978-92-9191-668-9, 10.2802/54768

Year/Month of publication: 2011	Publishing organization / authors: Malgorzata Milczarek - European Agency for Safety and Health at Work (EU-OSHA) / Angelika Hauke, Paraskevi Georgiadou, Hannu Kallio, Sirpa Lusa, Johanna Malmelin, Anne Punakallio, Rauno Pääkkönen, Sylvie de Meyer, Georgiana Ioana Nicolescu
Type of publication: European Agency for Safety and Health at Work study	Relevant Link: https://www.certifico.com/component/attachments/download/1108
	Level of source: International

STUDY BRIEF OVERVIEW
The study makes an analysis of the literature that includes specialized works in the field of emergencies that address the impact of the risks of natural or industrial disasters on the physical and mental health of first responders, focusing on methods to prevent and treat them. These methods are a guide to improving the level of safety and security for emergency personnel.

Relevant aspects for the project:	Type of S&R activities:
- **Population of emergency workers** The study summarizes the specific differences in emergency personnel specific to the emergency systems of different EU countries, focusing on Fire-fighters, Emergency medical service, Police, Body handlers, Special Forces for disaster control, Providers of psychological first aid and Gender aspects. To explain these specific systemic differences, a statistical analysis of the destructive effects of emergencies and disasters in some EU countries was presented in the areas of natural disasters, industrial accidents, communication accidents, terrorism and criminal attacks and events. major public. - **Occupational health and safety risks for emergency workers** The typology of the physical and emotional overloads to which the emergency personnel is subjected both in the case of natural disasters and of the disasters generated by the human action was analyzed. The	Organized response typically provided by fire services, emergency medical services (EMS) personnel, civil defense units, police and others ensuring, at the same time, safety and security of emergency personnel.

negative impact of the inefficient use of available human and material resources was mentioned.

- **Health and safety outcomes on emergency personnel**

  In this chapter, the impact on the safety and security of emergency personnel was analyzed in the following areas: fatalities, violence at work, accidents and injuries, musculoskeletal disorders, negative health outcomes for mental health, negative health outcomes of radioactive exposure, negative health outcomes related to chemical risks and negative health outcomes related to biological risks.

- **Preventive measures**

  The measures for the protection of emergency personnel were analyzed, with special emphasis on the evaluation of information received from the area affected by the disaster, training of emergency personnel, provision of protective and ergonomic equipment appropriate to the operational situation in the field, methods of primary and secondary prevention. of mental health problems and long-term-care and health surveillance.

Main challenges for actors:
Adapting the specialized terms from the study to the terminology used at national level to avoid misunderstanding of some concepts, principles or methodologies.

Study limitation:

The contents of the manual are intended as a guide. Therefore, each country adapted the contents of this manual to its needs and specific national legislations.

Table 1-6: Literature Review -VI

Literature Review -VI	
SOURCE (CITATION) INFORMATION	
Publication title: PROTECTING EMERGENCY RESPONDERS, VOLUME 3, SAFETY MANAGEMENT IN DISASTER AND TERRORISM RESPONSE	
Year/Month of publication: DHHS (NIOSH) Publication No. 2004-144 RAND Publication No. MG-170	Publishing organization / authors: National Institute for Occupational Safety and Health - RAND Science and Technology/ Brian A. Jackson, John C. Baker, M. Susan Ridgely, James T. Bartis, Herbert I. Linn

| Type of publication:
Operational report | Relevant email address:
- pubstaft@cdc.gov
- http://www.rand.org/ |
| | Level of source: International |

STUDY BRIEF OVERVIEW

The focus of the study was to develop recommendations directed at the strategic goal of improving safety management.

An analysis of the practical details of how each recommendation should or might be implemented is beyond the scope of this project and requires consideration of regional- and locality-specific factors.

For example, the safety and security of first responders raised a number of technical issues during the research—specific concerns about protective equipment, problems with communications interoperability, specific techniques for monitoring hazards, and individual technical solutions for management issues.

Relevant aspects for the project:	**Type of S&R activities:**
From the fields approached in the study, following the consultation of the specialized literature from the moment of its elaboration, those that are relevant for the achievement of the D2.4 objectives, can be grouped as follows:	Organized response typically provided by fire services, emergency medical services (EMS) personnel, civil defense units, police, and others.

- **Protecting Responder Safety Within the Incident Command System**

In this context, reference was made to major disasters which represent major challenges regarding the management of safety and security, the specifics of people affected, injured or killed, the variety of hazards, their geographical scale and their duration, the capabilities needed to limit the destructive effects of disasters. on critical infrastructure, the involvement of risk management in emergency situations.

The information obtained was capitalized on proposals for "Safety Within the Incident Command System", which also aims to improve the safety and security of emergency personnel.

- **Gathering Information**

In this field, the importance of obtaining and processing information from areas affected by natural or industrial disasters was studied.

The study of these issues has led to the development of a series of recommendations, of which the recommendation on" Develop Minimum Standards for Safety and Health Training for All Responders Involved in Disaster Response Operations."

- **Taking Action**

In view of the above recommendations, a number of operational recommendations have been developed, including those on the training of emergency personnel and the improvement of the medical protection of first

responders (with an emphasis on ensuring their mental health).

- **Integrated, Incident-Wide Safety Management**

In this perspective, emphasis has been placed on conducting Joint Exercises and Training by Incorporating, developing a Common Terminology for Disaster Safety and developing a Mechanism to Address Inherently Multiagency Safety Issues.

- **Moving Forward: Improving Preparedness Efforts for Responder Safety**

The study is completed with a series of proposals on the use of future opportunities whose implementation, from the perspective of ensuring the safety and security of intervention personnel, which focuses on a core Group of Major Disaster Safety Managers and integration of Safety into Disaster Exercises.

ain challenges for actors:

Adapting the specialized terms from the study to the terminology used at national level to avoid misunderstanding of some concepts, principles or methodologies. It should be noted that the existence of a glossary of terms in such works is absolutely necessary.

Study limitation:

The contents of the report are intended as a guide. Therefore, each country adapted the contents of this manual to its needs. Consequently, there is a risk of procedural deviation from the manual for each country.

Table 1-7: Literature Review –VII

Literature Review –VII	
SOURCE (CITATION) INFORMATION	
Publication title: Interventions for the prevention and management of occupational stress injury in first responders: a rapid overview of reviews	
Year/Month of publication: 2020	Publishing organization / authors: Antony et al. Systematic Reviews (2020) 9:121 / Jesmin Antony, Raman Brar, Paul A. Khan, Marco Ghassemi, Vera Nincic, Jane P. Sharpe, Sharon E. Straus and Andrea C. Tricco
Type of publication: Overview of reviews - Research article	Relevant Link: https://doi.org/10.1186/s13643-020-01367-w

	Level of source: International

STUDY BRIEF OVERVIEW

Emergency personal a high-risk population for occupational stress injuries as they often encounter prolonged stress within their line of work. The aim of this rapid overview of reviews is to summarize existing evidence on interventions for the prevention and management of occupational stress injury (OSI) in first responders.

Relevant aspects for the project:	**Type of S&R activities:**
MEDLINE, EMBASE, PsycINFO, CINAHL, Web of Science, and Cochrane Library were searched for systematic reviews examining the impact of prevention, rehabilitation, and resilience-building strategies targeting frontline community safety personnel in February 2019.	Organized response typically provided by fire services, emergency medical services (EMS) personnel, civil defense units, police, and others.

To ensure a rapid overview process, the search strategy was limited to the last 10 years, quality appraisal of reviews and abstraction of study-level data was completed by one person and verified by another, and the quality of the individual primary studies was not appraised. The findings were summarized descriptively.

A total of 14 reviews with 47 unique primary studies were found after screening 1393 records. A majority of studies targeted OSI in police officers (78.7%), followed by firefighters (17%) and correctional officers (4.3%). Of the 47 included primary studies, 24 targeted preventions of OSI (i.e., resilience training, stress management, suicide prevention, and other health promotions) and 23 targeted rehabilitations (i.e., drug therapy, psychotherapy, and other therapies). Prevention strategies including resilience training programs had positive outcomes, while suicide prevention and psychotherapy interventions reported mixed results.

The results from this overview suggest that potentially effective prevention and rehabilitation strategies exist targeting emergency personal at high-risk of developing OSI.

Thus, it is ensured, by increasing the resilience to the action of mental stressors during the intervention, a better safety of the emergency personnel, at mental level.

However, further investigation is needed before the interventions can be implemented within specific first responder populations, especially correctional service workers and coroners. Our findings will serve as a basis

for the MCSCS to develop an evidence-based strategy to tackle OSI in frontline community safety personnel and emergency personal responders.

Main challenges for actors:
The information provided by the article is more difficult to understand for staff who do not work in the field of emergency medicine and psychology.

Study limitations:
Although efforts were made to conduct a methodologically rigorous overview, there were some unavoidable limitations. The major limitation was the time constraint to meet the needs of the knowledge user, allowing only for an overview of reviews as opposed to a systematic review and meta-analysis. Thus, only primary studies found in published reviews were included and potentially relevant primary studies not contained in systematic reviews would not have been captured in our synthesis. As a result, although this overview was the first to identify a broad range of interventions in the literature for frontline community safety personnel, our results should be interpreted with caution.

Table 1-8: Literature Review -VIII

Literature Review -VIII	
SOURCE (CITATION) INFORMATION	
Publication title: Protecting Emergency Personal, Volume 2, Community Views of Safety and Health Risks and Personal Protection Needs	
Year/Month of publication: 2003	Publishing organization / authors: RAND's Science and Technology Policy Institute / Tom La Tourrette, D. J. Peterson, James T. Bartis, Brian A. Jackson, Ari Houser
Type of publication: Research study	Relevant Link: http://www.rand.org/
	Level of source: International
STUDY BRIEF OVERVIEW Emergency responder organizations and specialties represented in this study include firefighting, law enforcement, emergency medical services, hazardous materials response, urban search and rescue (USAR), anti-terrorism, special weapons and tactics (SWAT), bomb squads, and emergency management. Note that this study did not include several actors that often serve in an emergency response capacity during particularly large events or when specialized expertise is required. Those actors may include municipal agencies and private organizations responsible for transportation, communications, medical services, public health, disaster assistance, public works and engineering, construction, and wildlands firefighting, as well as military elements such as the National Guard and the Army Corps of Engineers. Federal emergency response organizations were contacted to help provide background information on personal protection policy and technology research and development.	

Relevant aspects for the project:	Type of S&R activities:
- **OVERVIEW OF THE EMERGENCY RESPONDER COMMUNITY** The study addressed issues arising from the need to provide protection to emergency personnel (fire services, emergency medical services (EMS) personnel, law enforcement responders and hazmat and anti-terrorism responders) in the event of operational accidents affecting their safety and security. Solutions to limit destructive effects on the physical and mental integrity of emergency personnel have been discussed. - **PROCUREMENT AND LOGISTICS** In this field, from the perspective of end users, the fundamental issues that must underlie the purchase of technologies or devices to ensure the safety and security of emergency personnel at tactical and operational level were analyzed. Special emphasis was placed on the issues of certification, standardization, storage and maintenance of technologies and devices used in emergency situations. - **PUTTING COMMUNITY VIEWS TO WORK** In this area, the approach that local communities can take to ensure the safety and security of emergency personnel, in particular to reduce physical stress, ensure comfort, improve communications and protection against disease, was analyzed.	Organized response typically provided by fire services, emergency medical services (EMS) personnel, law enforcement responders and hazmat and anti-terrorism responders.

Main challenges for actors:
A challenge of the study is related to the fact that the study refers only to the US national emergency system, some of its recommendations having to be adapted, where possible, to other emergency systems or cannot be applied.

Study limitations:
Such an approach has significant limitations, particularly within the context of using the views of the community to inform the higher-level objective of defining research and development (R&D) priorities for personal protective technologies. While we have taken steps to mitigate these limitations, they nonetheless must be kept in mind when interpreting our findings. One limitation is the qualitative nature of the input. Because of the broad scope of the discussion protocol, the wide range of types of agencies and organizations included in the study, and the individual nature of the discussions, the information collected from the discussions covered a vast range of topics and typically could not be quantitatively classified in certain ways, such as according to the exact number of participants or departments expressing a particular view. Another related limitation is the degree of reproducibility of the findings. Despite our use of a discussion protocol and our efforts to maximize consistency among RAND discussion leaders, each discussion was unique and depended on the roles and experience of the individual participants. We attempted to mitigate this effect by sampling a large number and wide range of organizations. However, it is possible that a different sample or discussion approach would have yielded somewhat different findings. Another limitation is the inherent incompleteness of and bias in the information that can be obtained solely from the viewpoint of the emergency responder community. Emergency responder organizations in the United States are very decentralized, and many agencies, particularly the smaller ones, may not be aware of certain initiatives or resources that are available to address various problems.

Table 1-11 Literature Review -IX

Literature Review -IX	
SOURCE (CITATION) INFORMATION	
Publication title: **PROVINCIAL SEARCH AND RESCUE OPERATING GUIDELINES- BRITISH COLUMBIA, CANADA**	
Year/Month of publication: January 2021	Publishing organization / authors: **Emergency Management BC, Canada Public Safety and Solicitor General**
Type of publication: Operational guidelines	Relevant Link: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/emergency-preparedness-response-recovery/embc/volunteers/sar_safety_program_operating_guidelines.pdf
	Level of source: Local – British Columbia, Canada

STUDY BRIEF OVERVIEW

The Search and Rescue Safety Program Provincial Operating Guidelines is a collection of procedures that first responders are encouraged to follow in case of emergencies.

The procedures are dedicated to the whole range of personnel involved in crisis management and include firefighting, law enforcement, emergency medical services, hazardous materials response, urban search and rescue (USAR), anti-terrorism, special weapons and tactics (SWAT), bomb squads. Each procedure is addressing a single type of incident in order to maintain a low level of complexity making the manual very accessible to any kind of personnel.

For example, the procedure for the protection of emergency personnel in areas affected by epidemics or epizootics refers to proper protective equipment, including the wearing of latex gloves and face/nose/eye/mouth protection, will be utilized at all incidents where exposure is possible.

EMBC will provide Hepatitis B vaccine injections to volunteers who face the risk of exposure to body fluids during GSAR operations If exposure occurs, the volunteer will follow proper first aid treatment including identifying the source, if possible, and recording all pertinent data as it relates to the incident. Notify the GSAR leader immediately of the incident, who will report the incident to EMBC. The First Aid Reporting Form will be completed by the GSAR leader and EMBC will complete the Employer Report before forwarding to WorkSafe BC.

Any GSAR volunteer who is exposed to communicable diseases will be offered testing and treatment by a responsible medical authority.

Relevant aspects for the project:	Type of S&R activities:
- **Safety Officer** - Purpose: To provide guidance on the role of Safety Officers in ensuring the health and safety of all GSAR personnel during training, practice and response GSAR Leaders are responsible for the safety of GSAR volunteers participating in training, practice or response. During a response, part of the SAR Manager's role is to act as the Safety Officer unless that position is filled by an appropriately qualified individual. It is recommended, if possible, that a Safety Officer other than the SAR Manager be appointed. The role of a Safety Officer is to monitor safety conditions and develop measures for ensuring the safety of all assigned GSAR responders. The Safety Officer will: • Obtain task briefing from the SAR Manager. • Participate in incident planning sessions and review the Incident Action Plan for safety implications. If proposed tactics are potentially unsafe, assist in identifying safer options. • Identify hazardous conditions or environments associated with the incident. Undertake formal risk assessment, utilizing the Response Assessment and Decision-Making Support (RADeMS) tool. • Create and maintain the Safety Plan (ICS305), identifying hazards and mitigations. • Review and approve the Medical Plan prepared by Logistics. If necessary, assign a Rapid Intervention Team (RIT). • Supervise general responder care, including access to nutrition, hydration, rest, etc. Particular attention must be given to responder fatigue. If necessary, because of dangerous animals, supervise armed escorts. • Ensure basic personal protective equipment (PPE) is available and being used by all field members. In the event of a known hazard, ensure task-specific PPE (e.g., PFD) is available and volunteers are qualified in its use. • Ensure responders have appropriate training, skills and equipment for their assignment prior to field deployment. This is especially important when personnel are from an outside resource or convergent volunteers. • Ensure safe practices are being followed in the field. If it is not feasible for the Safety Officer to attend, assign an Assistant Safety Officer (ASO) to ensure safety at remote sites. If an ASO is needed, a suitably qualified member should be assigned this role. • Multiple high-risk operations may require ASO's at each site.	Organized response typically provided by fire services, emergency medical services (EMS) personnel, law enforcement responders and hazmat and anti-terrorism responders.

• In the case of imminent danger, both the Safety Officer and ASO have emergency authority to immediately terminate unsafe acts.

• Ensure the unsafe situation is corrected immediately. If this is not possible, other mitigation strategies must be discussed with the SAR Manager and the Operations Chief.

- **Safety Briefings/Debriefings**

PURPOSE: To enhance GSAR volunteer safety through ensuring effective communication of potential hazards, and the tracking of any concerns to assist in improving the SAR Safety Program.
Safety will be part of a briefing provided to GSAR volunteers by GSAR leaders prior to deployment, the debriefing of GSAR volunteers following completion of team assignments, and during the review at the end of a GSAR response.
During a briefing of GSAR volunteers being deployed, the GSAR leader and or manager will provide:
• Any specific hazards identified during the risk assessment.

• Protocols to advise of any safety concerns, threats, or need to evacuate.

• Communication frequencies and emergency protocols.

• Reminder of safety priorities.
When debriefing GSAR volunteers, returning from team assignments, the following will be discussed and reported to the GSAR leader and or manager (if not reported as a threat already):
- Any hazards identified, e.g., signs of bears or cougars in area or dangerous terrain.

- Any safety concerns over assignment.

- Recommendations for further team assignments.

Risk Assessment

- PURPOSE: To ensure GSAR volunteers are aware of their role in safety by providing guidance on assessing risk during training, practice and response.
The goals of the British Columbia Emergency Management System (BCEMS) are to be considered at all times. These are;
• Provide for the health and safety of all responders

• Save lives

• Reduce suffering

• Protect public health

• Protect government infrastructure

• Protect property

• Protect the environment

• Reduce economic and social losses

MATRIX DEVELOPMENT TRANSITION TO SPECIFIC ELEMENTS OF A S&R RESPONSE				
	GO	**MUST MANAGE TO GO**	**NO GO UNTIL MANAGED TO GO**	**NO GO**
Activity	**No Risk**	**Low risk**	**Moderate risk**	**High risk**
Natural Hazards	No danger to personnel	Some danger to personnel	Danger to personnel	Significant danger to personnel
Personnel Skills & Experience	No danger to personnel	Some danger to personnel	Danger to personnel	Significant danger to personnel
Personnel Mental	Strong Team	Issues to address	Significant Concerns	Dysfunctional Team
Personnel Emotional	Strong Team	Issues to address	Significant Concerns	Dysfunctional Team
External Influences	Insignificant external pressures on decision making	Noticeable external pressures on decision making	Significant external influences on decision making	Loss of control of some decision making
Urgency	Very urgent response required	Urgent response required	Some urgency required in response	No urgent response required
Equipment	Excellent equipment and use knowledge	Good equipment and good use knowledge	Fair equipment or fair use knowledge	Poor equipment or poor use knowledge
Planning	Extensive time to plan	Adequate time to plan	Minimal time to plan	No time to plan

Main challenges for actors:
A challenge of the paper is related to the fact that the guidelines refer only to British Columbia, Canada. Some of the procedures have been observed as best practices and recommendations, having to be adapted, where possible, to other emergency systems or cannot be applied.

Study limitation:
The risk assessment procedure used to be the Canadian authorities is a good starting point for the training of the personnel based on risk identification. Such an approach could have significant limitations,

particularly within the context of each national or European legal framework. One limitation is the qualitative nature of the input.

Table 1-12 Literature Review -X

Literature Review -X	
SOURCE (CITATION) INFORMATION	
Publication title: **First Responder Operations Participant Guide,** June 2014, United States Edition	
Year/Month of publication: June 2014	Publishing organization / authors: **International Association of Fire Fighters**
Type of publication: Course materials	Relevant Link: https://www.iaff.org/hazmat-training/
	Level of source: International

STUDY BRIEF OVERVIEW
The IAFF developed First Responder Operations (FRO) for those fire, rescue, emergency medical service (EMS) personnel and other personnel who may respond to incidents involving hazardous materials (hazmat's) and/or weapons of mass destruction (WMDs).
This course will focus on enabling participants to:

- Protect their health and safety before, during and after responding to potential or actual hazmat/WMD incidents
- Acquire the knowledge and skills needed to recognize and identify the clues that determine the presence of hazmat's/WMDs
- Learn how to research and evaluate technical information
- Practice making decisions and executing responder actions in a team-based learning environment

Responding to hazmat/WMD incidents will require emergency responders to systematically apply a specific decision-making process for safely operating at hazmat/WMD incidents. This course articulates a decision-making process, relating how to think, along with what to do and what not to do.

As an emergency responder, fire fighters will respond to a variety of incidents that may initially appear routine, but subsequently turn out to involve hazardous materials or WMDs which will require special handling. With respect to hazardous materials, is important to keep the following factors in mind:
- Hazardous materials are virtually everywhere—from the overturned tanker to the EMS call. Furthermore, many substances become hazardous when heated or combined with other substances— factors commonly encountered during emergency incidents.
- Hazardous materials do not frequently raise concern, because typically they are contained or enclosed. They become dangerous when they threaten to, or actually get out of their containers (exposing the public and potentially causing harm to life, property and the environment).

- An understanding of hazardous materials and how they can affect you improves your ability to take the proper precautions to guard against being exposed to them.
- If you do not take the proper safety precautions, you will put health and safety at risk—your own, and that of others.

Relevant aspects for the project:	Type of S&R activities:
RISK MANAGEMENT **APIE: A Risk-Based Response Process** • Analyze the problem Identify the problem and behavior of hazardous materials. • Plan the response Develop and communicate an incident action plan. • Implement the plan Observe operations and outcomes. • Evaluate the progress Assess response effectiveness. National Fire Protection Association (NFPA) defines risk-based response as a "systematic process by which responders analyze a problem involving hazardous materials/weapons of mass destruction (WMD), assess the hazards, evaluate the potential consequences, and determine appropriate response actions based upon facts, science, and circumstances of the incident.". The Federal Emergency Management Agency (FEMA) states that "by following a set of logical steps that includes gathering and analyzing information, determining operational objectives, and developing alternative ways to achieve the objectives, planning allows a jurisdiction or regional response structure to work through complex situations" A Risked-Based Response Process is a logical, analytical, problem-solving process that can be applied to any type of emergency. The goal of APIE: A Risk-Based Response Process is safe, competent response aimed at mitigating emergencies while minimizing hazards that can result in exposure, injury and fatalities. Responders should consider the facts, science and the circumstances at each step, and take actions or make decisions based on risk-benefit analysis. Exposure Exposure is the process by which people, animals, the environment and equipment are subjected to, or come in contact with, a hazardous material (a contaminant). Exposure can enable a toxic chemical, infectious material or radioactive agent to enter the body.	Organized response typically provided by fire services, emergency medical services (EMS) personnel, law enforcement responders and hazmat and anti-terrorism responders.

Toxins are able to enter the body through:
Inhalation
Absorption: skin and eyes
Ingestion
Injection or puncture
Both hazardous materials and WMD incidents involve substances (either matter—solid, liquid or gas—or energy) that, when released, are capable of creating harm to people, the environment and property.
     Incidents occur when those substances have the potential to be, or have been, released.
The main difference between a hazardous materials incident and a WMD incident is the presence of criminal intent.
     Since, as a first responder, you will rarely know the intent behind a release, the use of safe response practices such as APIE is the best form of protection. Additionally, you may need to be familiar with local procedures for evidence preservation to ensure your actions do not disturb or destroy valuable evidence.	

Main challenges for actors: The challenge of the review is related to the fact that as a training course the structure of the information presented follows a certain pattern which in the context of the project is no relevant. The selection of the relevant information requires a supplementary effort that can lead to a misunderstanding of the main activities during operations.	
Study limitations: As a training course, the paper is focusing on the topics related to the domain referred in the objectives of the course, that is the training of fire fighters for in case of hazmat and WMD incidents. The extension of the pattern used in risk management is useful for approaching the whole spectrum of search and rescue operations.	

Table 1-13 Literature Review -XI

Literature Review - XI	
SOURCE (CITATION) INFORMATION	
Publication title: "Impact of The HEROES Project on First Responders 'Well-Being"	
Year/Month of publication: 2020 April; 5(1):8-14	Publishing organization / authors: Journal of Community Safety & Well-being / Daniel M. Blumberg, Luciano Giromini, Konstantinos Papazoglou, and A. Renee Thornton
Type of publication: Academic article	Relevant Link: https://doi.org/10.35502/jcswb.116

	Level of source: International

STUDY BRIEF OVERVIEW

The article focuses on the detrimental impact of occupational stress on mental health and well-being of first responders and how it can be mitigated by employing certain type of training.

The article uses the HEROES Project (https://psycnet.apa.org/record/2019-78445-009) as a case study.

Studies show that psychological training has positive effects. However, the effects tend to diminish over time which suggests that activities should be continuous rather than in a form of a one-off event.

Institutional support in terms of reinforcing good practices is necessary to maintain results. Instead of developing single skills the focus should shift to more holistic set of skills that ensures healthy functioning.

The article reports on the results of the HEROES Project. The abbreviation stands for "Hope, Efficacy, Resilience, Optimism, Empathy, and Socialization". It is a "self-driven wellness program" that aims at providing holistic, "anonymous and private self-care" that spans over 8 weeks.

The program has a component of developing but also practicing certain skills over a longer period of time.

The authors argue that it is this approach that delivers sustainable effects.

The study examined effects of training two years after it took place.

It showed a significant decrease of the levels of stress, depression and anxiety and an increase of the general well-being (psychological capital).

First responders experience a myriad of stressors (e.g., operational, organizational, personal) over the course of their career.

An abundance of empirical evidence shows that the impact of those stressors on first responders' health, well-being, and performance can be detrimental.

Nevertheless, previous research has mainly focused on the role of a specific technique (e.g., mindfulness, breathing exercises, psychoeducation) towards the promotion of well-being among first responders.

This allows us to explore the role of a single technique in supporting first responders.

However, given the complexity of stressors experienced by this population, it appears that a synergistic role of multileveled intervention is imperative to promote lasting improvement in first responders' well-being.

To this end, The HEROES Project, an eight-week online training program, was developed to address the aforementioned gap in the literature.

They were assessed before and after completion of the program, and then follow-up measurements were obtained for two years following the baseline assessment.

Results showed that participants with higher distress and lower psychological resources before the training benefited most from

The HEROES Project, but that the training significantly improved psychological capital and reduced stress, depression, anxiety, and trauma symptoms for all participants.

Clinical and training implications as well as future research directions are discussed.

Relevant aspects for the project: - Safety and well-being of first respondents First respondents are regularly confronted with extremely difficult and dangerous situations. This has a negative impact on their mental health by increasing levels of anxiety, stress and depression. If these issues are not addressed, first respondents might find it difficult to continue working and even functioning properly. - Type of training Research suggests that training for first responders should be holistic rather than focusing on developing specific techniques. There should be an element of practicing and not just developing certain skills. Institutional support that aims at retaining skills is indispensable. - Risk It is not possible to remove the element of risk from the first respondents work and therefore the impact of the events on their mental health. Therefore, developing ways for ensuring well-being of first responders is crucial.	Type of S&R activities: Organized response typically provided by fire services, emergency medical services (EMS) personnel, civil defense units, police, and others.
Main challenges for actors: Maintaining the results of psychoeducation, providing institutional support, motivating first responders to use the educational resources.	
Study limitations: The study had quite a limited sample of 124 first respondents. They were predominantly men with women underrepresented. No information was collected on the ethnic and racial characteristics. The study was also geographically constrained.	

(SAN contribution)

Table 1-14 Literature Review -XII

Literature Review – XII	
SOURCE (CITATION) INFORMATION	
Publication title: "Humanitarian Aid Workers: The Forgotten First Responders"	
Year/Month of publication: 2021, 36(1), 111-114	Publishing organization / authors: Prehospital and Disaster Medicine, Cambridge University Press / Macpherson, R., & Burkle, F.
Type of publication: Special report	Relevant Link: https://doi.org/10.1017/S1049023X20001326

Level of source: International

STUDY BRIEF OVERVIEW

The report focuses on humanitarian aid workers who are referred to as "forgotten first responders".

While it became a norm in the field of crisis/disaster management that maintaining first responders' mental health is an issue that should be addressed, it is often not recognized in the NGO sector that provides humanitarian aid.

There is certain stigma and fear regarding sharing mental health issues with one's employer.

As a result, a large percentage of NGO workers experience depression, anxiety, severe stress and PTSD.

The article discusses ways of addressing this problem.

Humanitarian aid workers are an overlooked population within the structure of posttraumatic stress disorder (PTSD) research and assistance. This negligence is an industry-wide failure to address aid workers' psychological health issues.

The suspected numbers of death by suicide, diagnosed PTSD, depression, anxiety disorders, hazardous alcohol and drug consumption, emotional exhaustion, and other stress-related problems are impossible to quantify but are considered endemic.

Tools for establishing organizational frameworks for mental health and psychosocial support are readily available. However, the capacity to implement this assistance requires the creation and practice of an open and non-judgmental culture, based on the realistic acceptance that aid work has become inherently dangerous. The possibility of developing a psychological problem because of aid work has increased along with the rise in levels of disease, injury, kidnapping, and assault.

As a result, expressions of traumatic stress have become the norm rather than an exception. This commentary outlines the essential steps and components necessary to meet these requirements.

Relevant aspects for the project:	Type of S&R activities:
- Recognizing humanitarian aid workers as first responders (role of civil society in crisis management) Humanitarian aid workers seem to operate in a vacuum. Despite operating in the circumstances of war or a natural disaster and being exposed to extreme suffering and therefore extreme stress, they are often not recognized as first respondents. This means that the field standards do not apply to them which has serious consequences with a majority of them experiencing some mental health issues. To mitigate this problem the role of NGO staff as first responders has to be recognized. - Safety and well-being of humanitarian workers as first responders First respondents are regularly confronted with extremely difficult and dangerous situations. This has a negative impact on their mental health by increasing levels of anxiety, stress and depression. If these issues are not addressed, first respondents might find it difficult to continue working and even functioning properly. - Addressing mental health issues Framework for psychological care should not only be theoretical and top-down but also practical. This requires direct involvement of the workers who could share their experiences and needs. Line managers need mental health training and employees need to know that they can trust them. There have to be protocols, standards and guidelines that are regularly modified based on feedback with an aim of creating culture of resistance in an organisation. This should apply not only to international staff but also national workers who are particularly vulnerable and at risk, as well as to volunteers and consultants. - Risk It is not possible to remove the element of risk from the work of the humanitarian aid staff and the impact of the events on their mental health. Therefore, developing ways for ensuring their well-being is crucial.	Organized response typically provided by humanitarian aid workers.
Main challenges for actors: Recognizing humanitarian aid workers as first responders and developing appropriate frameworks. Developing bottom-up solutions and trust. Creating culture of resistance. Overcoming stigma associated with mental health issues.	

Study limitations:
Limited capabilities to quantify the problem.

(SAN contribution)

Table 1-15 Literature Review -XIII

Year/Month of publication: March 2020	Publishing organization / authors: IEE Transactions on Intelligent Transportation Systems. Zhiyong Wang and Sisi Zlatanova
Reference citation: Vancouver citation style Wang Z, Zlatanova S. Safe Route Determination for First Responders in the Presence of Moving Obstacles. *IEE Transactions on Intelligent Transportation Systems.* 2020; 21 (3): 1044-1053	Relevant Link: **DOI:** 10.1109/TITS.2019.2900858
Type of publication: Journal Article	Level of source: International

STUDY BRIEF OVERVIEW

The article focuses on path routing during disasters though moving obstacles such as fires, plumes, and floods. It proposes algorithms to minimize the risk and increase the safety for first responders in reaching the disaster site. Current dynamic routing systems depend on real-time information on roads that do not consider the change of obstacles in terms of position, shape, properties in the near future. The strength of the developed algorithm is that it takes these properties into consideration to develop customized routes for responders.

Relevant aspects for the project:	**Type of S&R activities:**
Risk and Safety: **Safe Route Planning** 1. Categorizing Risk Levels: For each type of disaster (plume, fire, flood), different types of obstacles are categorized according to their characteristics, i.e., plume concentration, or water depth, and then assigned a risk level. This process allows for the calculation of safe routes. 2. Deriving Speed Factor: When rescue vehicles move through the obstacles, their speed is reduced. The algorithm calculates the minimum and maximum speeds influenced by the hazard. 3. Defining Safety Status: Distinguishing between road segments and junctions as non-safe, partial safe, or full safe. The type of vehicle is also considered.	Disasters such as fires or floods involving various types of first responders.

4. Path Planning: which indicates the time intervals when roads are accessible for responders.

Technical Component
The algorithm is an adaption of, and follows the basic principle of, the Dijkstra algorithm. The study conducts simulations to test the effectiveness of the algorithm.
The approach is generic and applicable to other disasters, such as urban or forest fires.

Main challenges for actors:
N/A

Study limitations:
1. The study was aimed at minimizing risk and it cannot be applied to scenarios where time is a critical factor. For situations where the quickest route is required, a different algorithm is needed.
2. Because responders from different organizations may use different PPE and vehicles, further investigation is needed to determine the risk level and quantify the influence of obstacles on the speed of the vehicles.
3. Simulators are used to generate the synthetic data of the hazards. The connection with different hazard simulation models would be required when the proposed approach is employed in real disaster situations.
4. It is assumed that a wireless sensor network in available, while in a disaster situation this network may be damaged.
5. The study uses the case of one vehicle for one destination. For cases where multiple vehicles are involved, a different algorithm is needed.

(SAN contribution)

Table 1-16 Literature Review -XIV

SOURCE (CITATION) INFORMATION

Publication title: Mixed e-learning and virtual reality pedagogical approach for innovative hydrogen safety training of first responders	
Year/Month of publication: 2017	Publishing organization / authors: International Journal of Hydrogen Energy / Tretsiakova-McNally, S., Maranne, E., Verbecke, F., and Molkov, V.
Reference citation: Vancouver citation style Tretsiakova-McNally S, Maranne E, Verbecke F, Molkov V. Mixed e-learning and virtual reality pedagogical approach for innovative hydrogen safety training of first responders. International Journal of Hydrogen Energy. 2017; 42 (11): 7504-7512	Relevant Link: https://doi.org/10.1016/j.ijhydene.2016.03.175

Type of publication:	Level of source: European
Journal Article	

STUDY BRIEF OVERVIEW

Fuel cell and hydrogen (FCH) technologies and applications in transport are being increasingly used in S&R operations, however, currently European fire authorities and first responders have limited knowledge of these new technologies. To enhance knowledge in this new area, the European Commission-funded project (HyResponse) has developed a comprehensive training programme for first responders to provide them with accurate and up-to-date knowledge on hydrogen safety basics and essential practical skills on how to deal with potential incidents or accidents involving FCH systems or infrastructure, as well as how to protect the general public. The training programme is based on a combination of lectures, operational exercises, and virtual reality (VR).

Relevant aspects for the project:	**Type of S&R activities:**

Risk and Safety:
 	
Training
 	
The educational material described below can be found on this link: http://www.hyresponse.eu/
 	
1. International Curriculum: The HyResponse project developed a comprehensive International Curriculum (IC) based on a thorough review of 400 literature and web-based sources that reflect the state-of-the-art in hydrogen safety science and engineering. The IC tackles all topics relevant to first responders in this area and is divided into three sections. The first is basics of hydrogen safety. Second is regulations, codes and standards. The third is intervention strategies and tactics for first responders. Moreover, the educational materials are very interactive with the majority of lectures containing a number of videos or animations that help visualize some scenarios and catastrophic events, and clarify some technically difficult concepts.
2. Virtual Reality: The virtual reality (VR) component of the training has four main purposes:
   A) To validate emergency plans and to validate the effectiveness of the IC during and after training sessions.
   B) To enhance the competencies of first responders and provide them with the practice needed to carry out their roles in the area of FCH, as well as in relation to the standard operating procedures.
	Safety of hydrogen fueled S&R vehicles, with a focus on first responders including fire-fighters, field operators to high-level incident commandment, police forces, paramedics, vehicle recovery personnel, site operators, among others

C) To enhance understanding of organizational roles, as well as risks, inter-relationships, and interdependencies related to FCH.

D) To test the established procedures in the aera of FCH.

3. Operational Exercises: Allows first responders to practice what they have learned in class, to simulate interventions, and to test and implement operational response strategies.
.

Main challenges for actors:
Fuel Cell and Hydrogen transportation is a new development in S&R, therefore a lack of understanding around it poses a risk to the safety of first responders, as well as the wider general public.

Study limitations:

The study aimed to described the various training and educational material developed in the HyResponse project, as well as the pedagogical approach underpinning this material, and this was well-elaborated therefore there are no limitations to report.

(SAN contribution)

2 Glossary of terms

The purpose of Chapter 2 is to propose a glossary of terms in the field of " promoting safety and security of emergency personnel" which is the subject of deliverable D2.4.

It contains a list of terms specific, directly, or indirectly, to the above-mentioned field, together with their definitions.

Terms used are those that are found in the deliverables validated in the project until the date of completion of the deliverable D2.4.

The aim was to strike a balance between general terms and specific terms used in S&R operations.

The motivation for compiling this glossary of terms is the need to harmonize terms that may have not fully convergent meanings in the legislation of the S&R project partners.

A

Acceptable risk = the level of potential losses that a society or community considers acceptable given existing social, economic, political, cultural, technical, and environmental condition. (INSARAG_Guidelines_V2_Chapeau__Manual_A_-_Capacity_Building1.pdf)

Asynchronous learning = students learn the same material at different times and locations such as self-guided lesson modules, streaming video content, virtual libraries, posted lecture notes, and exchanges on discussion forums or social media platforms. (https://worldscholarshipforum.com/ro/ce-este-%C3%AEnv%C4%83%C8%9Barea-sincron%C4%83-%C8%99i-asincron%C4%83)

C

Capacity (or capability): the combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals. (INSARAG_Guidelines_V2_Chapeau__Manual_A_-_Capacity_Building1.pdf)

Community =
- Interaction-based community (network of interactions between people; social groups and civil society organizations). (Räsänen A, Lein H, Bird D, Setten G. Conceptualizing community in disaster risk management. Int J Disaster Risk Reduct. May 1; 45:101485. 2020)
- Community is a group of people who may or may not live within the same area, village or neighborhood, share a similar culture, habits and resources. Communities are groups of people also exposed to the same threats and risks such as disease, political and economic issues and natural disaster (International Federation of Red Cross and Red Crescent Societies (IFRC). The IFRC and Community Resilience. Communication guidance for National Societies. 1310400 11/2016.)

Community resilience =
- an ongoing process of adaptation, the simple absence of negative effects, the presence of a range of positive attributes, or a mixture of all three. (DOI: 10.1371/journal.pone.0118456. [27] Patel SS, Rogers MB, Amlôt R, Rubin GJ. What Do We Mean by 'Community Resilience'? A Systematic Literature Review of How It Is Defined in the Literature. PLOS Currents Disasters. 2017 Feb 1. Edition 1. doi: 10.1371/currents.dis.db775aff25efc5ac4f0660ad9c9f7db2)
- A resilient community has the opportunity, capacity and capability to identify and mitigate hazards and risks, absorb the effects of disruptive events, adapt or transform in anticipation or response to disruptive events and return to a functioning state. (Australian Institute for Disaster Resilience (AIDR). Community engagement for disaster resilience. Handbook. 2020.)

Critical facilities = the primary physical structures, technical facilities and systems which are socially, economically or operationally essential to the functioning of a society or community,

both in routine circumstances and in the extreme circumstances of an emergency. (INSARAG_Guidelines_V2_Chapeau__Manual_A_-_Capacity_Building1.pdf)

D

Disaster risk management = the systematic process of using administrative directives, organisations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster. (INSARAG_Guidelines_V2_Chapeau__Manual_A_-_Capacity_Building1.pdf)

DSS = a decision support system (DSS) is a computerized program used to support determinations, judgments, and courses of action in an organization or a business. [Decision Support System (DSS) Definition (investopedia.com)]

E

E – learning platform = is a webspace or portal for educational content and resources that offers a student everything they need in one place: lectures, resources, opportunities to meet and chat with other students, and more. It is also an excellent way for the student and the teacher to monitor student progress. (What are Online Learning Platforms? - MyComputerCareer).

Within the deliverable D2.4 of the S&R project, an e-learning MOODLE platform (for text only courses) will be developed to improve the understanding, knowledge and skills of the participants regarding safety and security management at the operational level and strategic levels so that they can be better prepared for field operations and also act as security advisors in a response team that provides them with the knowledge and skills necessary to act appropriately in accordance with safety regulations.

Emergency management = the organization and management of resources and responsibilities for addressing all aspects of emergencies, in particular preparedness, response and initial recovery steps. (INSARAG_Guidelines_V2_Chapeau__Manual_A_-_Capacity_Building1.pdf)

Emergency personnel = any employee or volunteer of an emergency services provider who is engaged in providing or supporting firefighting, dispatching services and emergency medical services. (https://www.lawinsider.com/dictionary/emergency-services-personnel)

Exercise = a controlled, objective-driven activity used for testing, practicing or evaluating processes or capabilities. (D8.1 S&R Pilot guidelines and User's Handbook, p.12)

Exercise aim = a statement of intent that gives direction to what will or is desired to be achieved by the exercise. (D8.1 S&R Pilot guidelines and User's Handbook, p. 17)

Exercise general idea = a broad statement of background information designed to provide exercise participants with the knowledge that would be available during a real event or emergency (D8.1 S&R Pilot guidelines and User's Handbook, p. 29)

Exercise plan = to outline the method by which the exercise will be designed, conducted and evaluated. (D8.1 S&R Pilot guidelines and User's Handbook, p. 43)

Exercise scope = describes the boundaries in which the exercise will be conducted. (D8.1 S&R Pilot guidelines and User's Handbook, p. 19)

Exposure = People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses. (INSARAG_Guidelines_V2_Chapeau__Manual_A_-_Capacity_Building1.pdf)

F

First responders = A first responder is a person with specialized training who is among the first to arrive and provide assistance at the scene of an emergency, such as an accident, natural disaster, or terrorism (e.g., Fire and rescue brigade, Emergency medical services, Civil

protection, police-law enforcement personnel, Coast guard / Border security, bystander individuals). (First responder - Wikipedia)

H

Human interoperability = the interrelationship between the social system network and the technological system that would provide interoperability across diverse organizational domains to establish sustainable human networks that are reliable, effective, and trusted. (Holly Handley, "A Network Model for Human Interoperability," The Journal of the Human Factors and Ergonomics Society, March 2014)

I

Interoperability =
- ability of diverse systems and organizations to work together, as this is more comprehensive in what regards entities participating, which are of various origins: technical, human, organizations, social, political and others. ([ISO 22300:2018, 3.128])
- the task of building coherent services for users when the individual components are technically different and managed by different organizations. ("Interoperability - Wikipedia," [Online]. Available: https://en.wikipedia.org/wiki/Interoperability. [Accessed 11 06 2021]).

K

Knowledge management (KM) = the process of capturing, developing, sharing and using organizational knowledge. [Dorasamy, M., Raman, M. & Kaliannan, M. (2017). Integrated community emergency management and awareness system: A knowledge management system for disaster support. Technological Forecasting and Social Change, 121, 139-167]

M

Mixed Reality (MR) = a particular subset of Virtual Reality related technologies that involves the merging of real and virtual worlds somewhere along the "virtuality continuum", … which connects completely real environments to completely virtual ones. [Milgram, P., & Kishino, F. (1994). A taxonomy of mixed reality visual displays. IEICE TRANSACTIONS on Information and Systems, 77(12), 1321-1329]

O

Operational level = deals with "doing it" in an incident. The actors in this level work within a functional and a geographical area of responsibility to implement the tactical plan as defined in Tactical level. They must have a clear understanding of the tactical plan and have access to the information which is crucial for the execution of it. [Azadehdel, R., Ahmadi, K. D., Azadehdel, M., & Enami, N. (2012). Effective model based on the role of leadership structure and information system in the field of crisis management. African Journal of Business Management, 6(5), 1967-1983]

Organizational resilience = the ability of an organization to absorb and adapt in a changing environment to enable it to deliver its objectives and to survive and prosper. (ISO 22316:2017 - Security and resilience — Organizational resilience — Principles and attributes)

P

Personal data = any information relating to an identified or identifiable natural person ('data subject'); an identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person. (https://gdpr-info.eu)

PPE = Personal protective equipment, commonly referred to as "PPE", is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. (Personal Protective Equipment - Overview | Occupational Safety and Health Administration (osha.gov))

Preparedness: deciding, creating and testing plans, conducting training, educating and sharing information to prepare communities should an emergency eventuate. These are also actions, and they are happening all the time. (D1.3 Definition, evaluation and refinement of the S&R CM governance model, p.42 – S&R project)

Prevention/Mitigation: any action or sustained effort aimed at reducing risk, undertaken in advance. Prevention or mitigation can be structural or non-structural.
(D1.3 Definition, evaluation and refinement of the S&R CM governance model, p.42 – S&R project)

Privacy by design = refers to data protection through technology design. Article 25 of the GDPR refers to the technical and organisational measures that should be implemented through data processing procedures so as they comply with the regulation and protect the rights of the data subjects/ participants. (D2.1 PIA report for the S&R design and development, pilots and platform, p. 23 – S&R project)

Public awareness: The extent of common knowledge about disaster risks, the factors that lead to disasters and the actions that can be taken individually and collectively to reduce exposure and vulnerability to hazards. (INSARAG_Guidelines_V2_Chapeau__Manual_A_-_Capacity_Building1.pdf)

R

Recovery: the coordinated process of supporting emergency-affected communities in reconstruction of physical infrastructure and restoration of emotional, social, economic and physical wellbeing. Usually measured in months and/or years. (D1.3 Definition, evaluation and refinement of the S&R CM governance model, p.42 – S&R project)

Resilience =
- The intrinsic ability of a system to adjust its functioning prior to, during or following changes and disturbances, so that it can sustain required operations under both expected and unexpected conditions. [RESOLUTE - Resilience management guidelines and Operationalization applied to Urban Transport Environment. Reports (D2.1, D 3.5, D 3.6). Grant Agreement ID:653460 (2015-2018)]
- The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management. [UNDRR (2017) https://www.unisdr.org/we/inform/terminology#letter-r accessed July 31, 2020]

Response: the assistance and intervention during or immediately after an emergency. Focus is on saving lives and protecting community assets (buildings, roads, animals, crops, infrastructure). Usually measured in hours, days or weeks. (D1.3 Definition, evaluation and refinement of the S&R CM governance model, p.42 – S&R project)

Risk = the chance of something happening that will have an impact on objectives. (D8.1 S&R Pilot guidelines and User's Handbook, p. 38)

S&R CM concept = allow for a wider definition which includes the capability to (a) collect static and dynamic data on the basis of standards and protocols and (b) all relevant static and dynamic data suppliers that are relevant to various disaster types. (D1.3 Definition, evaluation and refinement of the S&R CM governance model, p. 12 – S&R project)

S&R Emergency Management System (EMS) = develop a Decision Support System (DSS) to improve preparedness and interoperability of medical services during an emergency which

affects the health of the population at local, regional or cross-border level. (Concorde EMS [FP7-SEC-2013-1])

S

Safety regulations = A principle or regulation governing actions, procedures or devices intended to lower the occurrence or risk of injury, loss and danger to persons, property or the environment**.**

Safety of emergency personnel is a state in which hazards and conditions leading to physical, psychological or material harm are controlled in order to preserve the health and well-being of individuals and the community. Is the condition of being protected from or unlikely to cause danger, risk or injury.

Safety risks = unsafe working conditions that can cause injury, illness, and death. (6 Types of Workplace Safety Hazards — Safety Line Lone Worker)

Security of emergency personnel = Protection of emergency personnel against the threat committed directly or through direct communication. It is also achieved through protection against hitting or any other acts of violence, as well as through bodily injury.

Security risk = Is a quantified measure of the possibility that a key asset will suffer some degree of harm or loss; more specifically, that a defined thread will target and successfully exploit a specific vulnerability of a key asset and cause a given set of adverse consequences generally resulting in a loss, a injury of some kind.

Situation(al) awareness = the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and a projection of their status in the near future. (Endsley,1988).

Synchronous learning = This means that your classmates and your instructor interact in a specific virtual place, through a specific online environment, at a certain time. (https://worldscholarshipforum.com/ro/ce-este-%C3%AEnv%C4%83%C8%9Barea-sincron%C4%83-%C8%99i-asincron%C4%83/)

Standardization or **standardization** = the process of implementing and developing technical standards based on the consensus of different parties that include firms, users, interest groups, standards organizations and governments. The idea of *standardization* is close to the solution for a coordination problem, a situation in which all parties can realize mutual gains, but only by making mutually consistent decisions. Standardization is creating emotional balance, conventional detail, a universal familiarity and natural definition to a concept based on physical or emotional comfort and acceptance by changing societal behaviors and developments. (*Xie, Zongjie; Hall, Jeremy; McCarthy, Ian P.; Skitmore, Martin; Shen, Liyin (2016-02-01). "Standardization efforts: The relationship between knowledge dimensions, search processes and innovation outcomes". Technovation. Innovation and Standardization. 48–49: 69–78. doi: 10.1016/j.technovation.2015.12.002*)

Strategic level = defines "what to do" in an incident. In this level the involved actors have the overall command and responsibility for an incident. They determine the policy, the overall strategy, the resource deployment and the parameters within which commands will operate in lower levels. [Azadehdel, R., Ahmadi, K. D., Azadehdel, M., & Enami, N. (2012). Effective model based on the role of leadership structure and information system in the field of crisis management. African Journal of Business Management, 6(5), 1967-1983]

T

Tactical level = defines "How to do it" in an incident. The actors in Tactical level determine tactics in an incident within the strategy. The Decision Making in this level needs to identify and evaluate options which necessitates an analytical approach but pressure and changing of

circumstances may force an instinctive approach. [Azadehdel, R., Ahmadi, K. D., Azadehdel, M., & Enami, N. (2012). Effective model based on the role of leadership structure and information system in the field of crisis management. African Journal of Business Management, 6(5), 1967-1983]

Training level =

- <u>Awareness Level</u>: This level represents the minimum capability of organizations that provide response to technical search and rescue incidents

- <u>Operations Level</u>: This level represents the capability of organizations to respond to technical search and rescue incidents and to identify hazards, use rescue equipment, and apply limited techniques specified in this standard to support and participate in technical search and rescue incidents

- <u>Technician Level</u>: This level represents the capability of organizations to respond to technical search and rescue, and/or USAR incidents and to identify hazards use rescue equipment, and apply advanced techniques specified in this standard necessary to coordinate, perform and supervise technical search and rescue incidents. (INSARAG_Guidelines_V2_Chapeau__Manual_A_-_Capacity_Building1.pdf)

V

Volunteering = A solidarity activity that takes place, for a period of up to 12 months, as a voluntary unpaid activity that contributes to the achievement of the common good. (D7.7 S&R Legal and Security infrastructure 1st Version, p. 88)

3 General considerations about S&R environment

Search and rescue are of the most dangerous types of emergency response activities that can be performed. It exposes the team members to many hazards for which they have little training and virtually no experience to manage. The application of the most current SAR techniques and safe methods of operation are vital to the accomplishment of that mission.

Following a catastrophe, rescue workers and emergency responders are the first to arrive on the scene, often in unfamiliar surroundings and adverse weather conditions, ready to save lives and secure the environment to help protect the lives of those to follow. Rescue workers and emergency responders may be involved in emergency medical operations involving victim rescue or body recovery around piles of rubble and other debris, collapsed structures or near structural steel. Response team personnel conducting SAR and support activities are exposed to many risks and hazards including, but not limited to:

- Damaged infrastructure
- Air transportation
- Secondary collapse from aftershock, vibration, and gravity, and explosions.
- Unfamiliar surroundings
- Unstable structures
- Fall or tripping hazards
- Falling material or flying objects
- Exposure to hazardous material
- Decontamination
- Exposure to smoke, dust, etc.
- Fire and explosion
- Excessive noise

Potential Hazards for Rescue Workers and Emergency Responders:

- Exposure to blood or body fluids, or pathogens from sewer system breaks.
- Damaged utility services, including downed electrical cables, overhead power lines, broken gas lines, steam and water mains, or compressed gas cylinders.
- Piles of construction and other types of debris, including over-hanging debris.
- Airborne smoke and dust (asbestos, crystalline silica, etc.) and possible eye and skin injuries from dust and flying debris.
- Confined spaces (limited openings from entry or exits), possible hazardous atmospheres, including possible flammable or toxic environments.
- Slips, trips or fall hazards from holes, protruding rebar, etc.
- Dangers due to proximity to heavy machinery, e.g., cranes, loaders, debris-hauling trucks, etc.
- Handling a variety of sharp, jagged materials.
- Potential for secondary collapse of unstable structures.
- Excessive noise from rescue/ventilation or other heavy equipment, including generators.

General Precautions Personal Protective Equipment:

Hand Protection. When handling potentially infectious materials, use appropriate barrier protection including latex and nitrile gloves (powder-free latex gloves with reduced latex protein content can help avoid reaction to latex allergies). These gloves can be worn under heavy-duty gloves which will, in turn, protect the wearer from cuts, puncture wounds, or other injuries that break the skin (caused by sharp environmental debris or bone fragments). A combination of a cut-proof inner layer glove and a latex or similar outer layer is preferable.

Foot Protection. Footwear should similarly protect against sharp debris.

Respiratory Protection. Use respiratory protection to combat effects from breathing dust and hazardous atmospheres which might contain some, or all, of the following: freon, carbon monoxide, hydrogen sulphone, asbestos, carbon dioxide, ammonia, and welding gases.

Hearing protection. Hearing protection is extremely important, particularly around saws, earth-moving equipment and hydraulic tools.

Eye Protection. Protective eyewear (safety glasses with side shields, at a minimum), is necessary personal protective equipment.

Fall Protection Equipment. Use fall protection equipment, with lifelines tied off to suitable anchorage points (e.g., bucket trucks), whenever possible.

3.1 Safety risks

SAFETY PLANNING: The multi-hazard safety plan is a guide to the basic elements of safety for a variety of incidents. The acronym is" **LCES"**, which stands for **L**ookouts, **C**ommunications, **E**scape routes, and **S**afe zones. In any operations scenario these areas must be addressed to ensure the safety and accountability of all response team members.

L – Lookouts

This is normally the function of the dedicated Safety Officer. That person is the objective observer not involved in the "hands on" portion of the operation. They are free to watch over the entire operation identifying potentially dangerous situations and mitigating them before they become disastrous.

· Several categories of Safety Officer exist.

· One is the overall Safety Officer for the response team.

· A second one is a site-specific Safety Officer how may be a person or team assigned to a single location to monitor the existence of a special hazard. (*Some examples of the latter might be one person designated to stand guard over an electrical box while rescue workers operate in a confined space; or a two-person team tasked with hiking up slope to serve as early warning for rescuers working below a dam during earthquake aftershocks*.)

· Safety Officers or Lookouts work from a position of safety and clear visual access just outside of the direct work area.

They should not become involved with the actual "hands-on" portion of the operation. To do so would possibly limit their ability to be that objective observer capable of identifying hazards. They should be readily identifiable to all, by their radio designation and by wearing a Safety Officer vest or in a small group identified during the safety briefing.

Team members tasked with this responsibility must resist the temptation to become involved in the tactical operations itself. This requires extreme self-discipline. Remember though that the direct success of the mission depends upon the ability to counteract hazards before they become problems.

C – Communication

The formal communications plan will be developed by the Communications Specialist. This plan will identify the Command, Tactical, and Special radio channels. These are the operations personnel's lifeline to the outside for resources, support, and safety. This plan will be provided as part of the Response Team Action Plan. The following Emergency Alerting System is to be used in the event of problems at the work site:

- Evacuate -3 short blasts (1 second each)

- Cease Operations - 1 long blast (3 seconds duration)

- Resume Operations -1 long and 1 short blast

The method of delivery may vary depending upon the device available. As an example, by placing two radios together, speaker to microphone, and depressing the transmit buttons a loud tone is heard on all other radios tuned to that frequency. Air horns, car horns, whistles, the P.A.S.S. device and clear

text over the radio are all excellent methods for signaling. The point is that during the safety briefing, before beginning to work, identify the specific methods of signaling that will be used at the work site should a problem arise during that operational period.

E - Escape Routes

An escape route is a pre-established path to an area of safe refuge. The safest method of exiting an area may not be the most direct route. As an example, after an earthquake structural column may still be standing but subject to collapse during an aftershock. The most direct route to safe refuge may lie directly in the collapse path of the column. The route giving the column a wide berth will be the safest. Another consideration is to remain in place. If the working area has been shored and leaving this area exposes the rescuer to a variety of hazards, stay put. The rescue situation if often dynamic, constantly changing. This can occur as a result of external forces or as a result of the rescuer's action. The escape plan should be constantly updated to reflect changes in situation. -As a new plan is developed, each team member must be made aware of the change in operation. An acknowledgement of understanding must also be received from each team member. If the order is not repeated, the new plan is probably not clear to each member of the team. The result can be injury or death.

S - Safe Zones

Also referred to as "safe havens" are the preestablished areas of safe refuge, safe from hazards. This could be a designated area outside the hot zone or agreed upon safe areas within the hot zone. If the safe zone is within the hot area, rescuers may have to construct that area around the victim and for rescuers themselves. An example of this is when a victim is trapped inside a collapsed structure and rescuers crib and shore the immediate area. In this case, the proper response for rescuers would be to hold their position during an aftershock. Part of the Safety Plan should provide for a designated Safe Zone where a team "head count" is taken. This count should be immediately communicated to the next in the chain-of-command to provide for 100% accountability in the event of an emergency.

3.1.1 Risk assessment components

Damaged infrastructure (infrastructure, including communications, roadways, bridges, railroads, air traffic control) = Assume all infrastructure has been compromised even though prior intelligence may have stated otherwise. Although telephone and cell systems may have survived the disaster intact, they will soon be overloaded by responder and/or public demands. · Traffic congestion will always occur following a disaster. The affected public will be evacuating the area as responders are moving toward the disaster. US&R vehicles must be clearly marked, and warning lights should be used to facilitate arriving at target sites. Assessment vehicles must be equipped with four-wheel drive. Standard vehicles will have difficulty traversing terrain while getting to and around work sites. Consider using ATVs as mules.

Air transportation = One method of travel frequently used by response teams is helicopter.
A word of caution: be sure to receive a prefight safety briefing before boarding and follow instructions furnished by the pilot or loading supervisor. Remember, following a disaster unusual hazard may exist that the pilot may not be familiar with.
Unsafe acts on the part of the pilot and crew can also be a problem. Some of the issues to be concerned with include overloading, proper clearances for take-off and landing, rotor wash, security around the helicopter, and adequate intercom capabilities so that team members can communicate during flight. Example: Philippines Assessment Flight.

Secondary collapse from aftershock, vibration, gravity, and explosions = With the constant threat of terrorist attacks, it is essential that response teams pay special attention to a very new and potentially deadly threat. Secondary explosions are becoming common techniques used to cause

serious injury and possibly mass death for response teams.

Everyone has to heighten their awareness to their surroundings. There are no second chances when explosions are used for this purpose. It is safe to assume that a secondary devise is involved, unless proven otherwise.

Earthquake's aftershocks = Severe aftershocks following a major earthquake are common and can create additional injuries and fatalities. Unstable structures including bridges, overpasses, high rises and water towers may suffer further collapse as a result of aftershocks.

First responders must be constantly aware that they may be affected by such events and take necessary precautions while conducting their operations. Many injuries and deaths of first responders could be prevented if more precautions against additional shock waves were taken.

Unfamiliar surroundings = Traffic directional signs and other landmarks may not survive the disaster impact. Traditional road maps are not valid following a major disaster.

Extra care to avoid accidents must be taken because the "new" landscape is distracting and may be confusing. Team members should not conduct assessments and drive a vehicle at the same time. A designated driver with no other responsibility must be assigned to provide transportation for the team.

Unstable structures = Injuries to emergency responders, in many cases, are the result of falling debris and compromised surfaces. Team members must take extra precautions to minimize injuries by wearing the required safety gear when working in the affected area.

An injury during the mission becomes a team liability, which may prevent the completion of the entire assessment task.

Fall or tripping hazards = Trip hazards are a common cause of falls resulting in injuries. This problem or hazard is commonly found in the Base of Operations (BoO) and work site. In most cases these problems can easily be mitigated once identified. Some common trip hazards are: Downed wire, Electrical cord, Holes, Uneven sidewalks/roads, Protruding rebar, etc.

Falling material or flying objects = Displaced material may be everywhere - aftershocks or winds may cause displaced objects to become airborne. Eye and head protection are essential.

Eye injuries are especially painful and immediate treatment will be required to prevent further injury. Eye and head injuries are a liability to the team and may even require aerial medical evacuation. Contact lenses wearers are especially vulnerable. Responders with contact lenses should bringing an extra pair of glasses.

Exposure to hazardous material = There is a significant risk of exposure to hazardous material during the mission. There are two kinds of exposure to be consider prior to entering the impact area: direct exposure from an area that has been contaminated and indirect exposure from moving water or a cloud/vapor plume moving through or beyond the impact area. Most facilities (major targets) such as hospitals, labs, universities, manufacturing plants and warehouses have a broad array of hazardous material on site. Other major sources of hazmat's are underground pipelines, railroad cars, and trucking companies. Displaced power line transformers may also pose a significant risk to assessment teams.

Decontamination= When initiating patient care or working around body fluids, use all proper protective equipment. This includes at least gloves, mask, and eye protection. The Team member should remove gloves carefully in order to prevent contamination. All medical waste should be properly disposed of in devices such as sharps containers and Biohazard bags. If possible, wash hands thoroughly after each victim contact. Clean all equipment not discarded as soon as possible. Ensure canine are decontaminated.

Electrical hazards Response teams have to be especially aware of electrical hazards that are commonly found during disaster response operations. There are many electrical related fatalities associated with disaster response operations. Some of the things to consider are:

-   Re-energizing power grids

- Improper electrical cord for current requirements
- Jury rigged connective boxes
- No weather protection
- Power line back feed (generators).

3.2 External risks (related to incident environment)

Taking into account the UCs scenarios in the S&R project, the S&R Manager begins the dynamic risk assessment process even before arriving on-scene, considering factors such as:
- Number and profile of subjects
- Type of assistance requested (search; recovery; medical rescue; etc.)
- Location of incident, including any known site-specific hazards
- Current and forecast weather conditions
- Anticipated equipment requirements, including PPE for responders
- Availability of S&R personnel, including specialized resources if required (RR; SRT; etc.)
- Condition of access and egress routes for historic response areas, including areas of safety
- Any special transportation requirements (helicopters, boats, ORV's, etc.)

Rescue scenes are often remote from the S&R command post. On-scene risk assessment should be conducted by an experienced and competent S&R leader, to identify potential hazards such as:
- fall risk for responders, including crevasses, cornices, cliffs, river banks, etc.
- caves or confined space conditions
- avalanche terrain/conditions
- wildlife or other animal threats
- chemicals or other hazmat concerns, including smoke from fires
- lakes, rivers, swift water

Next, major features pertaining to the Use Cases are analysed.

3.2.1 Collapsed Structures

Collapsed structures are a common result of earthquakes. Rescue workers, engineers and emergency responders may have to enter collapsed structures to perform search and rescue activities, and all possible safety and health precautions should be taken to ensure they can perform their duties safely. When internal load-bearing structural elements fail, a building will collapse into itself, and exterior walls are pulled into the falling structure. This scenario may be caused by construction activity, an earthquake or fire and may result in a dense debris field with a small footprint. Alternatively, if the structural failure is caused by an explosion or natural forces such as weather, the building may collapse in an outward direction resulting in a less dense and scattered debris field.

3.2.1.1 Incident Command System

Once the incident command system is established at a collapsed structure, the incident commander maintains accountability for all response personnel at the scene. A safety officer may also be mobilized and report directly to the incident commander. The safety officer is responsible for monitoring and assessing the safety aspects of the responders during the collapsed structure event. The safety officer's responsibilities may include:
- Overseeing all safety and health aspects of response personnel
- Assuring that optimal safety and injury prevention is practiced
- Investigating and documenting all response team injuries and illnesses
- Preparing and maintaining entry permits
- Ensuring that appropriate personal protective equipment (PPE) is used
- Developing and implementing daily health and safety plans which address (1) sanitation, (2) hygiene, (3) PPE, (4) Decontamination, (5) work/rest cycles, (6) acute medical care, etc.
- Interviewing off-going shifts to assess developing hazards
- Assessing risk for the identified hazards

- Training in hazard awareness and use of PPE
- Assessing structural instabilities

3.2.1.2 *Who enters a collapsed structure?*

Following a catastrophic failure of a structure, rescue workers and emergency responders may be required to enter the collapsed structure. Emergency responders include firefighters, police officers, emergency medical technicians, construction workers and government representatives. Emergency responders may be responsible for assisting survivors, extinguishing fires, shutting off utilities, assessing structural instabilities, shoring-up safe paths into the structure and assessment of other hazards such as airborne contaminants. Rescue workers such as Urban Search and Rescue Teams focus on finding survivors and later removing fatalities from collapsed structures.

3.2.1.3 *Potential Hazards*

Response and recovery work in earthquake-impacted areas presents safety and health hazards that should be properly identified, evaluated, and controlled in a systematic manner to reduce or eliminate occupational safety and health risks to response and recovery workers. The following hazards should be considered in order to protect rescue workers and emergency responders when preparing to enter a collapsed structure:

- Water system breaks that may flood basement areas
- Exposure to pathogens from sanitary sewer system breaks
- Exposed and energized electrical wiring
- Exposure to airborne smoke and dust (asbestos, silica, etc.)
- Exposure to bloodborne pathogens
- Exposure to hazardous materials (ammonia, battery acid, leaking fuel, etc.)
- Natural gas leaks creating flammable and toxic environments
- Structural instability
- Insufficient oxygen
- Confined spaces
- Slip, trip or fall hazards from holes, protruding rebar, etc.
- Struck-by hazards from falling objects
- Fire
- Struck by heavy equipment such as cranes or excavators
- Sharp objects such as glass and debris
- Secondary collapse from aftershock, vibration, and explosions
- Unfamiliar surroundings
- Adverse weather conditions
- Noise from equipment (generators/heavy machines)
- Workplace violence from robbing and looting

3.2.1.4 *General Precautions*

- Only trained personnel should be involved in search and rescue or demolition and clean-up operations.
- Continue to monitor your local radio or television stations for emergency information.
- Be aware of possible structural, electrical, or gas-leak hazards.
- If such hazards are identified, report them to the proper local authorities and/or utility.
- Do not touch downed overhead lines or objects in contact with downed power lines.
- Wear proper protective clothing when walking on or near debris, including boots and gloves.
- Be careful around sharp objects, including nails and broken glass.

- Use the proper safety precautions when operating generators, chainsaws, or other power tools.
- Take steps to prevent cold injuries or heat illnesses and dehydration.
- Avoid contact with wild or stray animals.

3.2.2 Heavy storms

Response and recovery work in heavy storms areas presents safety and health hazards that should be properly identified, evaluated, and controlled in a systematic manner to reduce or eliminate occupational safety and health risks to response and recovery workers. Some of the specific hazards associated with working in the aftermath of tornadoes include:

- Hazardous driving conditions due to slippery and/or blocked roadways
- Slips and falls due to slippery walkways
- Falling and flying objects such as tree limbs and utility poles
- Sharp objects including nails and broken glass
- Electrical hazards from downed power lines or downed objects in contact with power lines
- Falls from heights
- Burns from fires caused by energized line contact or equipment failure
- Exhaustion from working extended shifts
- Heat and Dehydration.

3.2.2.1 *General Precautions*

- Continue to monitor your local radio or television stations for emergency information and the potential of additional storms. Be aware of possible structural, electrical, or gas-leak hazards.
  - If such hazards are identified, report them to the proper local authorities and/or utility.
  - Do not touch downed power lines or objects in contact with downed power lines.
  - Wear proper clothing when walking on or near debris, including boots and gloves.
  - Be careful around sharp objects, including nails and broken glass.
  - Use the proper safety precautions when operating generators, chainsaws, or other power tools.
  - Take steps to prevent heat illnesses and dehydration.

3.2.3 Forest fire

In the aftermath of a wildfire, workers may be involved in a variety of response and recovery operations. Some operations, such as utility restoration, cleaning up spills of hazardous materials, and search and rescue, should only be conducted by workers who have the proper training, equipment, and experience.

3.2.3.1 *What to do during a Wildfire*

In the event that there is not enough time to evacuate or if workers are caught in circumstances where they cannot follow the evacuation plan, the Ready.gov - Federal Emergency Management Administration (FEMA) website offers guidance on what to do during a wildfire if in a vehicle, in a residence, or out in the open.

3.2.3.2 *Hazards*

Wildfires may create a variety of hazards for workers involved in cleanup operations as well as for workers in affected communities. The following resources address common hazards associated with wildfires and highlight useful precautions for workers:

- electrical hazards

- carbon monoxide poisoning
- lifting injuries
- heavy equipment
- extreme heat
- unstable structures
- hazardous materials response
- fire
- confined spaces
- worker fatigue
- respiratory protection
- rodents, snakes, and insects
- downed electrical wires
- working outdoors
- slips, trips, and falls

3.3 Internal risks (related to equipment)

3.3.1 Potential Hazards for Rescue Workers and Emergency Responders

Following a catastrophe, rescue workers and emergency responders are the first to arrive on the scene, often in unfamiliar surroundings and adverse weather conditions, ready to save lives and secure the environment to help protect the lives of those to follow. Rescue workers and emergency responders may be involved in emergency medical operations involving victim rescue or body recovery around piles of rubble and other debris, collapsed structures or near structural steel[1]. Potential Hazards for Rescue Workers and Emergency Responders are:

- Exposure to blood or body fluids, or pathogens from sewer system breaks.
- Damaged utility services, including downed electrical cables, overhead power lines, broken gas lines, steam and water mains, or compressed gas cylinders.
- Piles of construction and other types of debris, including over-hanging debris.
- Airborne smoke and dust (asbestos, crystalline silica, etc.) and possible eye and skin injuries from dust and flying debris.
- Confined spaces (limited openings from entry or exits), possible hazardous atmospheres, including possible flammable or toxic environments.
- Slips, trips or fall hazards from holes, protruding rebar, etc.
- Dangers due to proximity to heavy machinery, e.g., cranes, loaders, debris-hauling trucks, etc.
- Handling a variety of sharp, jagged materials.
- Potential for secondary collapse of unstable structures.
- Excessive noise from rescue/ventilation or other heavy equipment, including generators.

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[1] https://www.osha.gov/sites/default/files/publications/search_and_rescue.pdf

Figure 3-1: Example equipment

General Precautions Personal Protective Equipment (see Figure 3-1):
- Hand Protection. When handling potentially infectious materials, use appropriate barrier protection including latex and nitrile gloves (powder-free latex gloves with reduced latex protein content can help avoid reaction to latex allergies). These gloves can be worn under heavy-duty gloves which will, in turn, protect the wearer from cuts, puncture wounds, or other injuries that break the skin (caused by sharp environmental debris or bone fragments). A combination of a cut-proof inner layer glove and a latex or similar outer layer is preferable.
- Foot Protection. Footwear should similarly protect against sharp debris.
- Respiratory Protection. Use respiratory protection to combat effects from breathing dust and hazardous atmospheres which might contain some, or all, of the following: freon, carbon monoxide, hydrogen sulphide, asbestos, carbon dioxide, ammonia, and welding gases.
- Hearing protection. Hearing protection is extremely important, particularly around saws, earth-moving equipment and hydraulic tools.
- Eye Protection. Protective eyewear (safety glasses with side shields, at a minimum), is necessary personal protective equipment.
- Fall Protection Equipment. Use fall protection equipment, with lifelines tied off to suitable anchorage points (e.g., bucket trucks), whenever possible.

3.3.2 Personal protective equipment

Rescue Services must ensure that any personal protective equipment provided is fit for purpose and meets all required safety standards. When choosing suitable protective garments, the standard of clothing worn beneath the specialist personal protective equipment should also be taken into account. Consideration should also be given to the selection of suitable sizes and gender specific requirements of personal protective equipment.[2]

Personal protective equipment should also take account of the need for rescuers to be visible against the operational background including night working and for the Incident Commander and other managerial and functional roles (defined in the national incident command system) to be distinguishable.

All personnel must use appropriate levels of service provided personal protective equipment and respiratory protective equipment as determined by the safe system of work.

When working with machinery there is a significant risk of contamination from a leakage of hydraulic

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[2]
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/877030/GRA_2.6_archived.pdf

fluid. Individual Rescue Services should determine the level of personal protective equipment that may be required to perform this task.

If personal protective equipment or individuals are contaminated by body fluids or come into contact with human or animal excrement, the Rescue Service's procedures for dealing with contaminated and soiled personal protective equipment should be followed.

If there is any doubt regarding the level or degree of contamination, appropriate scientific or medical advice should be sought.

3.3.3 Measures to help eliminate or remove risks after an incident

The following measures should be considered to help eliminate or remove risks after an incident, as appropriate to the nature and scale of the incident (see Table 3-1):

- any safety events; personal injuries, exposure to hazardous substances or near misses should be recorded, investigated and reported in line with legislative requirements.
- arrangements should be in place to either remove all contamination from personal protective equipment or to ensure it's safe and appropriate disposal and to check that personal protective equipment maintains the agreed levels of integrity and protection for the wearer throughout its lifecycle
- as appropriate, occupational health support and surveillance follow up
- conduct a de-brief to identify and record any "lessons learned" from the incident. De-briefs will range in complexity and formality, proportionate to the scale of the incident and in line with individual Rescue Service's procedures
- consider any changes required to safe systems of work, appliances, or equipment in the light of any lessons learned from debriefs or from safety events
- consider the need to review existing information held on a premises or location, or the need to add a new premises or location into future preplanning e.g., by adding to visit or inspection programme
- staff should be supported and monitored to identify whether they are experiencing any adverse effects and to check whether they would benefit from accessing counselling and support services

Table 3-1: Summary of Generic Risk Assessment

Ref. No.	Task	Hazard	Risk	Persons at risk	Control measures
1.	Access to and egress from the scene of operations	Restrictive access to scene Complex design and minimal space, in and around machinery Uneven/ slippery surface	Manual handling injuries whilst carrying equipment to scene of operations particularly if climbing machinery Injury caused by coming into contact with power source Slips, trips and fails	Operational personnel other emergency service personnel Public	Operational procedures as per Rescue Service policy Appropriate supervision Crews to liaise with occupier to determine safe route and isolation of machinery Provision of suitable lighting.

2.	Working within the inner cordon	Insufficient scene management Power to the machinery Noise created by machinery	Personnel trip over badly placed equipment or machinery components Electric shock pneumatic/hydraulic injury Crush injuries Impact Injury or cuts and contusions by moving machinery Not hearing safety	Operational personnel other emergency services personnel	Operational procedures as per Rescue Service policy Command and control Strict control of incident scene Identify equipment pool and area to store removed items from the machinery Provision of suitable lighting. Close liaison with owner/occupier, on-site engineer or technical advisor, to identify isolation devices prior to entering the risk area and before start of operations Personal protective equipment Persons/other agencies to have
3.	Restricting the access of unauthorized persons to the intervention area	Unauthorized persons	Overcrowding causing confusion Slips, trips, falls cuts, bruises, fractures Psychological stress Post traumatic stress disorder		Cordon control – Booking in and out system Adequate numbers of personnel to log and monitor Police interaction.
4.	Dismantling machinery/ removing safety guards	Lack of control or coordination as parts are passed Heavy items being moved in confined spaces	Sharp/dangerous parts of machinery contacting personnel Cuts as machinery parts are passed to other personnel	Operational personnel other emergency services personnel Casualty	Operational procedures as per Rescue Service policy Ensure sufficient personnel are utilized and controlled Cover exposed areas of danger with suitable temporary measures, particularly if personnel, or the casualty, will need to move in the area Secure moving parts Correct personal protective equipment to be worn at all times.
5.	Working within a confined space	Asphyxiant and toxic gases	Overcome by fumes (asphyxiation/toxic poisoning)	Operational personnel and other emergency services personnel Casualty	Rescue Service personnel to be aware of the contents of Generic Risk Assessment Confined spaces Rescue Services to prepare a standard operating procedure for working in confined spaces Where it is necessary to enter a confined space to carry out rescues the Incident Commander should deploy the minimum number of personnel and equipment required to complete the task. A thorough safety brief prior to deployment of personnel within the hazard zone must be carried out Before undertaking any operation that involves working within the confines of the machinery, a full appreciation of the workings of the machine must be obtained. The history of its movement (and subsequent entrapment of the casualty) should be investigated by consultation with the owner/ occupier/casualty Confined working/rescue conditions may result in crews becoming quickly fatigued.

					Incident Commanders should consider frequent rotation of personnel to ensure their welfare Use of breathing apparatus Operational procedures to identify possibility of irrespirable atmosphere Equipment to identify lack of O_2 etc Personal protective equipment.
6.	Working in confined spaces	Unable to adopt correct ergonomic position	Manual handling injuries	Operational personnel other emergency services personnel	Frequent rotation of personnel.
7.	Working within proximity of hot/cold machines and adjacent hazards	Contact with extreme temperatures which may be the normal operating temperatures of the machine	Burns Heat exhaustion	Operational personnel other emergency services personnel	Operational procedures to indicate assessment of machine involved or adjacent machines Isolate power supplies and allow cooling if possible Use appropriate personal protective equipment Frequent rotation of crews Mechanical ventilation (positive pressure fan).
8.	Supporting casualty	Casualty falling as machinery is dismantled	Further injury to casualty Injury to rescuers, either attempting to support the casualty or working below	Operational personnel other emergency services personnel Casualty	Assess area of operation and position of casualty. Use all available information form on-site expertise and medical colleagues Consider use of support from below if available and as appropriate.
9.	Removal of small items (e.g., rings, handcuffs etc.)	Insufficient clearance to use larger cutting equipment No further dismantling possible, therefore cutting is the only method to be adopted.	Cuts and contusions to casualty or fire service personnel	Operational personnel Casualty	Correct choice of removal method. Fully assess and pre-plan method to be adopted Keep persons informed of activity at all times, never leave them alone. Reassure, monitor, review, well-being.

		Incorrect item of small gear utilized			
10.	Assessment and dealing with casualty/ first aid	Infected casualty	Contamination by blood/air borne infections	Operational personnel other emergency services personnel	Correct personal protective equipment worn at all times (e.g., surgical gloves, eye protection etc). Suitable respiratory protection used.
11.	General exposure to severely injured casualty	Exposure to view of casualty suffering severe injuries.	Psychological stress (post-traumatic stress disorder)	Operational personnel other emergency services personnel Public	Critical incident debriefing.
12.	Fire service operations	Violence from crowd/ bystanders (Rescue Service operations may be complex and slow and may require the waiting for assistance of specialist equipment Public/bystanders/ crowds unaware of circumstances therefore abuse/ become violent to emergency service personnel Public/bystanders/ crowds unaware of circumstances therefore abuse/ become violent to emergency service personnel	Cuts, bruises, swelling Unconsciousness	Operational personnel other emergency services personnel	Crowds/bystanders to be removed and kept at a safe distance Personnel should not enter into dialogue or exacerbate situation for crowd/public control Training/awareness.

3.3.4 Ensuring Safety of Personnel from COVID-19

Coronaviruses (COV) are a large family of viruses that cause illness ranging from the common cold to more severe diseases such as Middle East Respiratory Syndrome (MERS-COV) and severe acute respiratory syndrome (SARS-COV). A novel coronavirus (nCOV) is a new strain that has not been previously identified in humans.
Coronaviruses are zoonotic, meaning they are transmitted between animals and people. Detailed investigations found that SARS-CoV was transmitted from civet cats to humans and MERS-COV from dromedary camels to humans. Several known coronaviruses are circulating in animals that have not yet infected humans.

Common signs of infection include respiratory symptoms, fever, cough, shortness of breath and breathing difficulties. In more severe cases, infection can cause pneumonia, severe acute respiratory syndrome, kidney failure and even death.

3.3.4.1 *Transmission*[3]

In the case of COVID-19, as reported by the World Health Organization (WHO) "Situation Report—12", the modality of transmission can be similar to the previous epidemics caused by other coronaviruses (MERS, Middle Eastern Respiratory Syndrome, and SARS, Acute Respiratory Syndrome), for which human-to-human transmission occurs through droplets, aerosols and direct contact.

In particular, the droplets, generated during speaking, coughing and sneezing by symptomatic patients, can spread up to 1–2 m; a recent study demonstrated that the infection can also occur from asymptomatic people and before the onset of symptoms (see Figure 3-2).

Another mode of transmission is enabled by the inhalation of aerosols, which are microparticles with a diameter smaller than 5 m, containing pathogens, which after having been released in the air, are transported by the flow of the air current, thus being able to cause diffusion even at a considerable distance (with reverse ratio due to their dilution).
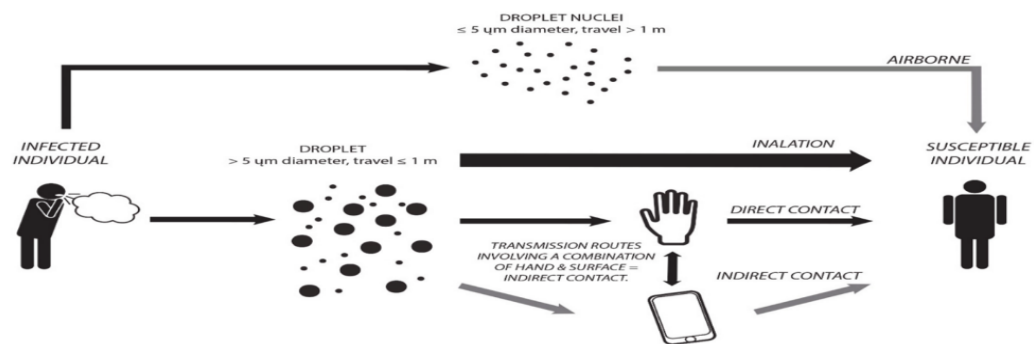
Figure 3-2: Transmission ways of COV-19

Finally, SARS-CoV-2 can also be transmitted through direct or indirect contact with infected people or by depositing droplets containing the virus on any person (handshake, greeting, hug) or inanimate surface; these droplets can contaminate the hands of other subjects by subsequently entering the body through access routes such as the oral cavity, the nasal cavity, the eyes and other mucous membranes.

3.3.4.2 *Organizational Measures*

The measures to be taken are:
- Blocking all trips to and from all areas defined as "red", in which cases of COVID-19 infections have already been ascertained
- Possible 10-day home quarantine for those who live, work or return from these areas.
- Selective control and measurement of body temperature of all suppliers and external collaborators
- Reduction of the number of operators within each confined environment.
- Prioritize, where possible, work from home (smart working).
- Composing, if possible, two or more closed and independent working groups, to be alternated every 14 days to work in the company or in smart working.
- Predisposition and maximum adherence to PPE dressing and undressing protocols.

[3] Huang, C.; Wang, Y.; Li, X.; Ren, L.; Zhao, J.; Hu, Y.; Zhang, L.; Fan, G.; Xu, J.; Gu, X.; et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet 2020, 395, 497–506, doi:10.1016/S0140-6736(20)30183-5.

3.3.4.3 *Environmental Measures* [4]

Environmental measures are aimed at reducing the risk of transmission of SARS-CoV-2 infection to individuals through contact with infected subjects, with objects, equipment, or contaminated environmental surfaces.

Even if there are no disinfectants registered specifically as active on SARS-CoV-2, viruses with similar biochemical and physical properties are inactivated with detergents and disinfectants commonly used in hospitals; this ensures a low or intermediate disinfection, following the manufacturer's instructions and the technical data sheet regarding dilution, contact time and handling.

In the literature, various evidence has shown how coronaviruses, including the viruses responsible for SARS and MERS, can persist, in optimal conditions of low humidity and low temperature, for up to 9 days on the inanimate surfaces of all shared rooms, especially bathrooms, changing rooms, canteens, rooms with distributors, smoking areas, and offices shared with several people. A role of contaminated surfaces in the transmission of SARS-CoV-2 infection is therefore to be considered as being possible, even if not yet demonstrated.

At the same time, available evidence has shown that the aforementioned viruses are effectively inactivated by adequate sanitization procedures, which include the use of disinfectants based on sodium hypochlorite (0.1%–0.5%), ethanol (62%–71%) or hydrogen peroxide (0.5%), for an adequate contact time, providing adequate ventilation of closed rooms; or through the use of physical means such as ultraviolet irradiation (UV). Therefore, extraordinary cleaning and sanitization procedures must be adopted using the appropriate disinfectants/disinfectants (see Table 3-2) and remembering to pay the utmost attention to the removal of any organic residues, intensifying the frequency with which these activities are normally carried out.

Table 3-2: List of disinfectants active on viruses and their related areas of application

DISINFECTING SUBSTANCE	APPLICATION SCOPE
Alcohol	Cutaneous antisepsis Disinfection of small surfaces
Chlorine compounds (chloramine, hypochlorite)	Cutaneous and wound antisepsis Water treatment Surface disinfection
Glutaraldehyde	Disinfection of inanimate objects
Hydrogen peroxide	Cutaneous antisepsis
Iodophors	Skin and wound antisepsis
Acetic acid	Disinfection of inanimate objects

3.3.4.4 *Personal Protective Equipment (PPE)*

3.3.4.4.1 Gloves

Use devices that comply with the requirements of the technical standard EN 374, classified as third category PPE for protection from microorganisms (a CE certification must have been issued by the notification body for the manufacturer certifying the CE marking as PPE).

The disposable protective nitrile gloves are made of a composition based on butadiene and acrylonitrile, which give it the characteristics of high comfort, ergonomics, elasticity and mechanical

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[4] Van Doremalen, N.; Bushmaker, T.; Morris, D.H.; Holbrook, M.; Gamble, A.; Williamson, B.; Tamin, A.; Harcourt, J.L.; Thornburg, N.J.; Gerber, S.; et al. Aerosol and surface stability of HCoV-19 (SARS-CoV-2) compared to SARS-CoV-1. N. Eng. J. Med. 2020, doi:10.1101/2020.03.09.20033217.

resistance, both to perforation and also if put in contact with some chemical substances. Finally, their hypoallergenic characteristic compared to latex gloves should not be underestimated.

Indications for the use of gloves:

- Must be clean gloves and they must cover the wrist well;
- Must be removed immediately after completing the procedures that they were used for; in particular, great care must be taken not to touch clean surfaces with contaminated gloves;
- Must be absolutely changed if dirty or not perfectly intact;
- Glove decontamination prior to glove removal with hypochlorite, after every contact with different inanimate surface, and during doffing procedures;
- Must not be reused or washed.

3.3.4.4.2   Disposable Masks/Respirators

Respiratory particles can be classified as droplets or aerosols based on the size of the particles and in particular in terms of their aerodynamic diameter.

Both types of particles, droplets and aerosols, are generated by coughing, sneezing, speaking or simply exhaling; while droplets settle quickly, small aerosols can remain suspended in the air and can be transported over long distances by the air flow.

Compared to droplets that cause infection at a distance of less than one meter, aerosols can cause contagion at greater distances, but with a ratio inversely proportional to the space covered and the dilution suffered.

3.3.4.4.3   Filter Masks

The principle on which these masks are based is to adhere to the face by creating a slightly negative pressure inside the mask and thus filtering the incoming air.

In order for these devices to actually protect those who use them, it is essential to plan and implement a training program related to the use of them.

The average filtering power offered by respirators with an N95 facial filter against particles in the range of tested sizes is about 8-12 times greater than that provided by disposable surgical masks, whose filtering powers varied widely in the various studies, depending on the model and size of the aerosol particles (1.3 to 6.5 pm).

This result is superimposable to that obtained by other studies, which claim that the protection provided by respirators with an N95 facial filter is approximately seven times greater than that of surgical masks. The N95 respirators with an exhalation valve are designed to facilitate breathing. The results of the literature analyzed by us have shown that the respirator with an N95 facial filter and exhalation valve does not lose its ability to protect the wearer from exposure to airborne particles in the range of bacterial and viral dimensions. The aerosol penetration through the exhalation valve was also studied for negative pressure respirators, reaching the conclusion that the penetration values were about 0.03%-0.04% with no valve fault.

3.3.4.4.4   Disposable Surgical Masks (Facemasks)

Facemasks (surgical masks), with disposable fabric or not, are formed by four layers (type II or IIR): external, which is filtering; central, which is impermeable to liquids but air permeable; the internal layer, which is in contact with the hypoallergenic skin, with upper deformable nose bar to conform perfectly the face mask and with fastening system formed of ties or elastic bands.

They protect the nose and mouth from contamination with particles with an average diameter of 4.5 pm. While originating from the need to protect the patient (surgical interventions, aseptic maneuvers), they constitute an effective barrier system for potentially infected liquids even for those who use them.

The use of the surgical mask is recommended:

• For those who work in contact with subjects with suspected airborne disease (flu syndrome, chicken pox, measles);

• In activities for which there is the possibility of generating splatters or splashes of blood or other body fluids;

• In technical and administrative support activities;

• By doctors, nurses, biologists, midwives and all healthcare personnel;

• By the staff of contracting firms (e.g., cleaning);

• By public assistance staff.

Data indicate that a surgical mask reduces virus exposure 1.1 to 55 times (on average six times), depending on the mask designbookmark89. They are currently indicated to be worn by the potentially infected subject.

Disposable surgical masks can confer a significant degree of protection, although less strong than FFP2 masks. However, surgical masks suffer less from limited supplies and do not need additional resources to supply on a large scale.

Indications on the use of the facemasks:

Of course, no mask, be it the tight-fitting NIOSH-approved N95 respirator mask or the loosely worn surgical mask, provides perfect (100%) protection. But imperfect protection does not mean "completely useless".

In case of difficulty in finding the filter masks described above, surgical disposable masks can be used; even if with the limitations related to the imperfect adherence to the face, depending on the different design of the models on the market; these devices are to some extent protective, above all in preventing close contact with droplets, and even more effective if associated with other PPE (nitrile disposable gloves, protective glasses).

3.4 Security risks

Don't always count on a disaster area being secure. In many cases one may find civil disturbance is jeopardizing response initiatives which further complicates the mission. These areas must be avoided until conditions are sufficiently safe for team members to perform their tasks. Area security is a State/local government's Responsibility. In some cases, police escort may be necessary.

Again, in these situations, uniformed personnel may be targeted by undesirables seeking to take advantage of the damaged infrastructure. The work site may be a target of armed thieves and looters. Individuals may represent themselves as local rescue workers and blend into the operation. Watch for suspicious behavior. Irate relatives may also be present. Emotions may be high and abnormal behavior can occur. Look out for potential hostile situations.

3.4.1 Overview

Several tragic events happened in last decades involved emergency personnel subject to threats specific to terrorist or terrorist related actions. First responders have a vital role in such situations and, obviously, ensuring their integrity in action is first demand for their ability to act according to their important role facing specific hazards, terrorist or related. With this demand, as central requirement enabling responders' operations, both safety and security features of first responders' organizations and dedicated personnel have to be designed, planned and put into action of fighting against disasters consequences and to be able for response in further possible attacks or provocative actions.

Definitions and theories around meaning of safety and security find their applicability in real world in a multitude of situations first responders are acting in.

The possibility of terrorist (or assimilated to terrorism) action in time of emergency personnel intervention is put under discussion and consideration. A wide range of most possible hazards is

briefly presented and consequences they may determine. In many cases one may find civil disturbance is jeopardizing response initiatives which further complicates the mission. These areas must be avoided until conditions are sufficiently safe for team members to perform their tasks. In some cases, police escort may be necessary, in these situations, uniformed personnel may be targeted by undesirables seeking to take advantage of the damaged infrastructure.

The last section outlines measures to counteract hazards and risks the emergency personnel is facing when acting at the disaster scene, following a terrorist or terrorist assimilated action, identifying the management decisions needed to be taken to ensure personnel safety and security. The risks and their management are jointly analyzed, considering that it is a close intercorrelation between typology of a certain hazard, its severity and the way in which the dedicated personnel, from decision makers to intervention staff is controlling and acting to diminish the consequences of the hazard.

3.4.2 Hazards needing security actions

Chemicals could be toxic, explosive, flammable, self-reactive, oxidizing, or corrosive, generating health hazards, after inhalation, skin contact or ingestion. Intervention personnel and all the responsible organizations need to be aware and endowed with adequate technology on the type of hazards possibly being produced by the chemical substances, to plan the adequate response and for personnel protection. To mention that specialized civil protection organizations must have databases with such hazardous substances, their effects in time and typology of curing at different instances.

Biological hazard at the site of disaster intervention, may be detected by several footprints like bioterrorism evidence, symptoms diagnosis and bio agents' identification. In case of some pathogen agents like anthrax or smallpox, the infected persons might not feel sick in the incubation period which could take up to several days, depending on the type of pathogen and time of exposure. Public health personnel is most recommendable to intervene in such situations and to detect the pathogen and proceed to the first medical actions. In particular, in case of anthrax the symptoms include fever, chest discomfort, shortness of breath, nausea vomiting or stomach pains, sweats, and extreme tiredness. Gastrointestinal anthrax symptoms can include swelling of abdomen, flushing and red eyes, diarrhea, vomiting, fever, and chills. Cutaneous anthrax symptoms may include appearance of small blisters or bumps itching, swelling, and skin sore with a black center. The treatment includes antibiotics and antitoxins.

Nuclear/Radiological hazard is difficult to detect, due to complexity of radiation. In an explosion, the fact that radioactive material was involved may or may not be obvious, depending upon the nature of the explosive device used. Countering radiation hazard might succeed if the intervention personnel have the adequate sensors and knowledge to use them.

Conventional Explosives are considered the most facile vectors to build improvised weapons which could generate explosive or incendiary effects, or to be used as primary means to spread CBRN agents. Explosives are most dangerous as their components are commonly available on market, and the manufacturing technology is easy to be accessed.

Combined Hazards = CBRNE agents and substances might be combined to get more complex and difficult to detect and to combat hazards. Effects of combined WMD could be stronger and could last for longer time than in case of component effects. Combined hazards such as mixed bio contamination or explosion mixed with bio agents' contamination could endanger efficiency of intervention, and expose the emergency personnel to additional and hard to detect dangers.

Attack on buildings need to be seriously considered after 9/11 2001. Although infrastructure protection is more focused on security, decision makers have to consider plans and way of actions in case a building is collapsed due to a terrorist attack.

Infections through contact with sharp objects and the potential contamination of open wounds. Although not directly provoked by terrorist hazards, such injuries and effects as transmission of human immunodeficiency virus (HIV) and hepatitis could take place during an intervention. Therefore, it is important to establish safety practices to prevent and control the exposure to blood and body fluids.

3.4.3 Security of emergency personnel to terrorist or assimilated terrorist threats

This section will focus on the security actions which decision makers need to prepare and apply to ensure first responders a safe intervention at the site of disaster. Evaluation of situation, planning and engaging actions in support of S&R personnel are permanent activities developed by decision makers, who need to adapt to concrete situation in what regards threats, capabilities and timing of response.

3.4.3.1 *Collecting information before S&R personnel intervention*

Information regarding potential hazards to be met by S&R personnel is crucial for the decision makers. Collecting reliable information about hazards in proximity of collapsed structures could be a real challenge, because of the wide range of possible hazards to be monitored, difficulty of coordination between responsible organizations and lack of technical means to survey and track hazards (see Figure 3-3).

Information about valid S&R personnel is another important set needed for decisions, including their specializations, their involvement and number, their technical means and skills.

A real challenge regarding personnel is related to the efficient management of their number, as it is very possible to over crowd the site and generate operational conflicts if the workforce is not properly used.

Figure 3-3: CBRN Pictures

Health state of S&R personnel is critically important, all injuries, exposures to CBRN need to be known, to ensure the security measures and diminish risks of S&R personnel. Areas where such dangers exist have to be secured and the intervention persons need to be properly equipped.

3.4.3.2 *Situational analysis and decision making*

Although information gathering is an important step, it is only the initial one. Managers face in short time due to emergency feature of disaster, a lot of uncertainties and challenges before deciding the best way to proceed for the first responders. The major analysis they have to do is related to magnitude and type of hazards, risk management, safety options for the S&R personnel and planning further requirements.

Hazard estimation is problematic due to scale it might happen, the large number of organizations which act at the site and their different ways of assessing hazard, the need of a collective decision of responsible actors (see Figure 3-4).

Figure 3-4: Firefighter light

Risk management is problematic as the scale of disaster and number of victims is large. When the destruction and victims are significant, managers have to decide on protecting lives of FR or accept a high level of risk. This issue is even more complicate when several organizations with different procedures and understandings are acting together.

Deciding on the safety and security of S&R personnel is one of the main attributes of managers, they need to choose the safety means and equipment and must have a clear picture and perspective on

resources which are necessary and possibly available to ensure to the S&R personnel as the operations develop in time and space.

Next step is implementing management decisions into practice, which supposes to apply procedures, standards and policies. However, understanding the situation as it evolves in time and space, managers' expertise and their power to enforce such rules are the same important. Ability and will of managers from different organizations to cooperate and have convergent actions are determining criteria for a successful safety and security management.

Managers need to prepare and apply measures to respond and treat the emergency personnel health problems and medical needs, but most of all, to foresee measures to prevent medical problems, such for example decontamination, short intervention time or involving workforce only in known procedures.

The influx of personnel and equipment to the scene need to be known and is one of managers activity which requires optimization, especially when people are volunteering in large number or responders from several organizations are supposed to intervene. These issues could generate safety and security problems which are amplified when scene of intervention is large and when communication means with the incoming work force are missing.

3.4.3.3 *Safety and security implementation*

Gathering knowledge on situation and preparing for an implementation scenario are of paramount importance, however safety and security successful implementation management depends on how the participating entities to a disaster scene are acting together and cooperating. In most cases there is a need for a coordinating body / committee which manages the overall situation, including safety and security. It is possible that in usual / standard events, emergency response organizations act alone and safety management complies with their internal procedures. However, in situations of large and complex hazards, safety and security needs to be

Figure 3-5: Fire Image

addressed from several perspectives in a multi domain and multi organizations approach.

Such considerations need to be addressed in advance and the seven Use Cases of present project and the S&R platform will definitely contribute to aggregating a more complete view on First Responders safety and security environment.

4 UC analysis in terms of risks for safety and security of first responders

In emergency management, one of the fundamental paradigms of search-and-rescue actions is that "the first responder must not be exposed to a significantly higher risk than the victim".

An example of this, from an extremely rich case study in the field, is the road accident in the Gotthard tunnel (Switzerland), of October 24, 2001, which caused a major fire that, among other things, caused the death of about 20 people, including the collapse of parts of the tunnel ceiling.

First responders were no closer than 300 meters from the scene of the disaster, as their risk of losing their lives was 100%, and the chance of survival of those caught in the wave of fire was zero.

It is already common knowledge that risk analysis is the fundamental tool for generating actions to prevent and limit their effects, in a multitude of areas, of which we mention only: protection of critical infrastructure, technological processes, public order and the fight against corruption.

In emergency management, risk analysis is the basis for risk coverage and protection plans.

This fact allows the permanent updating of these plans, depending on the changes that occur in the evolution of environmental conditions, natural or industrial hazards or other socio-economic conditions.

Protecting the safety, security and health of first responders in the event of a natural or   man-made disaster is essential to having a healthy and efficient workforce, capable of providing the affected community with optimal protection and effective feasibility of essential public services that have been affected[5].

Reason for managing the risks that may affect first responders (correct use of equipment and technologies, real-time information on the situation on the ground, avoiding "false" alarms, maintaining physical and mental health, avoiding conflict situations in the area of intervention, etc.) , is an important topic of the S&R project, given that the previous approaches of this topic were relatively small, compared to the importance of the topic, or only analyzed fragmentary aspects of the problem.

This chapter will address the issue of the importance of using the risk matrix for the implementation of safety and security measures of the first responder, with reference to the most significant aspects of this activity within the UC of the S&R project.

4.1 Risk Identification - risk matrix regarding safety and security of first responder

The analytical tool commonly used for risk assessment and estimation is the Risk Matrix[6](also known as "Probability and Impact Matrix").

The risk matrix is a graphical tool used to visualize and classify the risks already identified, the source of the risks or the risk treatments according to the probability and impact of each risk easily and quickly.

In practice, the risk matrix defines the different levels of risk as the product of the categories of probability of injury and the categories of severity of injury[7].

Thus, the risk matrix classifies and prioritizes the danger of adverse events according to the level of risk, in order to facilitate the management to decide whether certain risks can be admitted or not[8].

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[5] Responder Safety and Health | ASPR TRACIE (hhs.gov)
[6] https://www.dreamstime.com/risk-assessment-values-determined-multiplying-scores-probability-severity-together-higher-greater-overall-image18616176
[7] Risk Management - Risk assessment techniques, Dansk Standart DS/EN ISO 31010, 2010
[8] Recommendation on the use and design of risk matrices', Nijs Jan Duijm, Safety Science 76, p.21-31, DTU, 2015

According to ISO 31000[9], the definition of risk is presented as a combination of two basic criteria:

1. Consequences or severity of the impact of an adverse event caused by the risk
2. The probability or probability that this event will occur

In turn, the level of risk or the value of the risk is defined as the multiplication of these two criteria "Risk Level = Probability x Consequence (Impact)"[10]

The combination of these parameters created a risk matrix like a two-dimensional grid, with consequences / impact on one axis (usually the X axis) and probability or probability on the other (Y axis).

The process of making and optimizing the risk matrix is usually determined by five (5) steps[11].

In step 1, a list of risks is drawn up and the probability of each risk is estimated and assigned a rating (see Table 4-1).

Table 4-1: Example of probability criteria

FREQUENCY		
Verbal	Numeric	Description
'"Highly unlikely"'	1	Unlikely risks, which have a rare level occurrence such as less than 10%.
'"Unlikely"'	2	Seldom risk contains low probability of occurrence however cannot yet excluded entirely.
'"Possible"'	3	Hazard, which have occasional (50/50) likelihood of occurrence harm
'"Likely"'	4	Risks that lies among 60-80% chances of occurrence can be grouped as likely.
'"Very likely"'	5	A definite hazard that has highest frequency (generally more than 80 %) of reveal during certain project stages.

In step 2, the severity of the impact of an adverse event caused by the risk is identified and assessed (see Table 4-2)[12].

Table 4-2: Example of consequences criteria

SEVERITY		
Verbal	Numeric	Description
'"No impact"'	1	Limited hazard that will cause a near insignificant amount of harm to the overall progress of the project.
'"Minor impact"'	2	A minor hazard which lead to less significant extent of harm which in its turn not cause of a difference to the overall progress of the project are classified as minor risk.
'"Medium impact"'	3	Moderate hazard which do not imply a huge harm, though yet a considerable harm portrayed as medium.
'"Major impact"'	4	Critical risks with significantly large impact that may lead to a huge amount of loss or harm identified as major.
'"Extensive impact "'	5	The most adverse hazard that lead to a catastrophic consequences such as high amount of lives losses or harm that totally destroyed a project (for example tsunami) is outlined as extensive impact.

In step 3, the list of risks, probabilities and impact of risk actions on the Risk Matrix are explored and mapped (see Table 4-3).

Table 4-3: Risk Matrix with assigned risks

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[9] Risk Management – Principles and Guidelines] Dansk Standart DS/EN ISO 31000, 2009
[10] Recommendation on the use and design of risk matrices', Nijs Jan Duijm, Safety Science 76, p.21-31, DTU, 2015
[11] Risk Impact/Probability Chart - Learning to Prioritize Risks", https://www.mindtools.com/pages/article/newPPM_78.htm
[12] A Critical Tool for Assessing Project Risk, http://www.brighthubpm.com/risk-management/88566-tool-for-assessing-project-risk/#imgn_0

		Consequences Categories				
		C1 ""No impact""	C2 ""Minor impact""	C3 ""Medium impact""	C4 ""Major impact""	C5 ""Extensive impact""
Probability categories	P5 ""Very likely""	5	10	15 Brochure not ready in time for business launch	20 Website not ready in time for business launch	25
	P4 ""Likely""	4	8	12	16	20
	P3 ""Possible""	3	6 Group cannot agree on items to be sold	9 Initial stock not ready	12	15
	P2 ""Unlikely""	2	4	6	8	10 Banking facilities not ready
	P1 ""Highly unlikely""	1	2	3	4	5 Loss of one of group members

In step 4, prioritize each risk based on the value of the calculation by highlighting them with colors, for example:

    - red (extreme risk level, immediate action is needed and all available resources will be used as a matter of priority)

    - yellow (moderate level of risk, acted upon by specific standard procedures, with the involvement of workplace management)

    - green (very low level of risk, conducting actions through normal, routine procedures)

For a more accurate understanding of the methodology set out above, we will present, in a concise manner, the risk analysis on how to achieve the risk metrics at an electricity and heat generation unit in the Romanian capital, Bucharest.

A team of experts in the analyzed technology and specialist officers from the Bucharest Inspectorate for Emergency Situations carried out a qualitative measurement of the consequences of production accidents, placing them in five levels of severity, which have the following significance:

1. Insignificant
- For people (population): insignificant injuries
- Emissions: no emissions
- Ecosystems: Some minor adverse effects on a few species or parts of the ecosystem, short-term and reversible
- Socio-political: Insignificant social effects without concern

2. Minor
- For people (population): first aid is needed
- Emissions: emissions within the target are retained immediately
- Ecosystems: insignificant, rapid and reversible damage to a few species or parts of the ecosystem, animals forced to leave their usual habitat, plants are unable to grow according to all natural rules, air quality creates local discomfort, water pollution exceeds the limit for a short time
- Socio-political: Social effects with little cause for concern for the community

3. Moderate
- For people (population): medical treatments are needed
- Economic: reduction of production capacity

- Emissions: emissions within the objective retained with external aid
- Ecosystems: temporary and reversible damage, damage to habitats and migration of animal populations, plants unable to survive, air quality affected by compounds with a potential long-term health risk, possible damage to aquatic life, limited soil contamination and which may be remedy quickly
- Socio-political: Social effects with moderate concerns for the community

4. Major

- For people (population): special injuries
- Economic: interruption of production activity
- Emissions: off-site emissions without harmful effect
- Ecosystems: death of animals, widespread damage, damage to local species and destruction of extensive habitats, air quality requires "safe haven" or the decision to evacuate, soil remediation is possible only through long-term programs
- Socio-political: Social effects with serious concerns for the community

5. Catastrophic

- For people (population): death;
- Economic: stopping the production activity;
- Emissions: off-site toxic emissions with harmful effects;
- Ecosystems: the death of large numbers of animals, the destruction of flora species, air quality requires evacuation, permanent contamination of large areas of soil;
- Socio-political: Social effects of great concern.

The measurement of the probability of occurrence of technological accidents, based on the existing database at the moment, is also performed by framing in five levels, which have the following meaning:

1. **Rare (unlikely) (may occur only in exceptional circumstances)** - Occurrence frequency less than 10^{-12}
2. **Unlikely (may happen rarely)** - Occurrence frequency between 10^{-8} and 10^{-12}
3. **Possible (may happen sometime)** - Occurrence frequency between 10^{-6} and 10^{-8}
4. **Probably (can happen in many situations)** - Occurrence frequency between 10^{-4} and 10^{-6}
5. **Almost certainly** - (happens in most situations) - Frequency of occurrence over 10^{-4}

For a more suggestive presentation of the conclusions resulting from the analysis of accidental risks specific to the activity within the electricity and heat generation unit, only the beginning and end of the table for quantifying the probability and impact of each risk are presented below (see Table 4-4).

Table 4-4: Table for quantifying the probability and impact of each risk

Criterion number	Danger	Probability	Severity (Impact)	Risk
a. Fuel oil management				
1	*Fire at the fuel oil unloading ramp*	2	3	6
2	*Fire at fuel oil tanks*	2	4	8
3	*Fire at pump stations*	3	2	6
4	*Accidental pollution at the unloading ramp*	3	2	6
5	*Accidental pollution of tanks*	1	3	3
6	*Accidental pollution at pump stations*	3	1	3
b. Energy group				

1	Fire at energy boilers	3	2	6
2	Fire at the transformers related to the generator set	2	3	6
3	Fire in bridges, streams and cable ducts related to the energy group	2	2	4
4	Fire at the oil tanks in the turbine room	1	2	2
5	Hydrogen explosion at turbogenerators	2	3	6
6	Accidental oil pollution in the boiler room	2	1	2
	c. CAF hot water boilers			
1	Boiler fire	2	2	4
2	Accidental pollution with fuel oil	2	1	2

...

	m. High possible accidents			
1	Power outage	1	2	2
2	Fires at other targets on the site	2	3	6
3	Accidents at work	3	2	6

The risk matrix specific to an electricity and heat generation unit can be seen in Table 4-5.

Table 4-5 The risk matrix of an electricity and heat generation unit

				Result				
				Insignificant	Minor	Moderate	Big	catastrophe
				1	2	3	4	5
Probability	Unlikely	$<10^{-12}$	1	1	2	3	4	5
	Little bit Unlikely	10^{-8} la 10^{-12}	2	2	4	6	8	10
	Possible	10^{-6} la 10^{-8}	3	3	6	9	12	15
	Probable	10^{-4} la 10^{-6}	4	4	8	12	16	20
	Almost sure	$>10^{-4}$	5	5	10	15	20	25

Finally, the manager of the electricity and heat generation unit and the emergency committee may, depending on the level of risk (see Table 4-6), take measures to prevent or limit the destructive effects of technological accidents.

Table 4-6: Measures specific to each level of risk

In any field of human activity, the creation of a healthy and safe working environment is an important legal responsibility, leading, if we consider only the industrial environment, to a better efficiency of the activity of any worker (in first responder emergencies).

It should be noted that it is considered a widely accepted paradigm that the inability to eliminate a risk automatically leads to the implementation of processes to minimize it, leading to the situation where if the risk of death or serious injury to workers is very high carrying out that activity.

The general format of the risk matrix for workers is shown in Table 4-7[13].

Table 4-7: The general format of the risk matrix for workers

Risk levels	Definition	Actions to be taken
1 – 4	*Very low risk*	Conducting actions through routine, routine procedures
5 – 9	*Low risk*	
10 – 14	*Moderate risk*	It acts through specific standard procedures, with the involvement of workplace management
15 – 19	*High risk*	Prompt actions, taken as soon as the normal management system allows, with the involvement of top management
20 – 25	*Extreme risk*	As it is an emergency, immediate action is needed and all available resources will be used as a matter of priority

An example of the usefulness and necessity of using the risk matrix in another field (within the

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[13] https://www.sitesafe.org.nz/globalassets/guides-and-resources/practical-safety-advice/risk-assessment-matrix.jpg

example of the university environment) can be seen in Figure 4-1 (in this case, the people at risk refer to the university staff, including students)[14].

In the field of emergency management, risk analysis is the basic analytical tool used for the preparation, operationalization and updating of Risk analysis and coverage plan for local communities, state institutions and economic agents at local, regional and national level. Such a methodology, which includes all stages of risk analysis for emergencies (especially on the impact on human losses, critical infrastructure, financial losses and population morale), for a community can be found at https://greenhealthcare.ca /wp-content/uploads/2016/10/HIRA-2014-08-20.pdf.

Table 4-8: Risk matrix specific to a university environment

Consequence					
Likelihood		Insignificant	Minor	Moderate	Major	Severe
	Almost certain	Medium	High	High	Extreme	Extreme
	Likely	Medium	Medium	High	Extreme	Extreme
	Possible	Low	Medium	Medium	High	Extreme
	Unlikely	Low	Low	Medium	High	High
	Rare	Low	Low	Low	Medium	High

Likelihood	Consequence
Almost certain – will occur in most circumstances when the activity is undertaken (greater than 90% chance of occurring)	Insignificant –First aid treatment, minor injury, no time off work
Likely - will probably occur in most circumstances when the activity is undertaken (51 to 90% chance of occurring)	Minor – Single occurrence of medical treatment, minor injury, no time off work
Possible – might occur when the activity is undertaken (21 to 50% chance of occurring)	Moderate – Multiple medical treatments, non-permanent injury, less than 10 days off work
Unlikely – could happen at some time when the activity is undertaken (1 to 20% chance of occurring)	Major – Extensive injuries requiring medical treatment (e.g. surgery), serious or permanent injury/illness, greater than 10 days off work
Rare – may happen only in exceptional circumstances when the activity is undertaken (less than 1% chance of occurring)	Severe – Severe injury/illness requiring life support, actual or potential fatality, greater than 250 days off work

Risk Rating Priority for Action			
	Risk acceptance guide	Action	Recommended action time frame
Extreme	Not acceptable	Cease or isolate source of risk	Immediate
		Implement further risk controls	Up to 1 month
		Monitor, review and document controls	Ongoing
High	Generally (in most circumstances) not acceptable	Implement risk controls if reasonably practicable	1 to 3 months
		Monitor, review and document controls	Ongoing
Medium	Generally (in most circumstances) acceptable	Implement risk controls if reasonably practicable	3 to 6 months
		Monitor, review and document controls	Ongoing
Low	Acceptable	Monitor and review	Ongoing

The fundamental purpose of this type of plan is to ensure the knowledge by all the factors involved in the management of emergency situations of the tasks and attributions incumbent on them before, during and after the occurrence of an emergency situation, to create a unitary and coherent framework of action to prevent and manage emergency risks and to ensure an optimal response in the event of an emergency, appropriate to each type of risk identified.

In this direction of action, IT tools have been developed to create risk matrices specific to an area affected by disasters[15].

In the literature, the most addressed issue, which is part of ensuring the safety and security of the first responder, is related to ensuring the psychological protection of the first responder[16][17].

These papers place great emphasis on debriefing for first responders against the mental and physical effects that a high level of cumulative stress can bring.

In this context, an overview of the issue of ensuring the safety and security of the first responder defines a necessary and mandatory.

Achieving a risk matrix that meets the above requirement would be an important step for the optimal use of the limited resources (human, material, financial, etc.) available to a community affected by

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[14] http://safety.unimelb.edu.au/__data/assets/pdf_file/0007/1716712/health-and-safety-risk-assessment-methodology.pdf

[15] Strategic Toolkit for Assessing Risks A comprehensive toolkit for all-hazards health emergency risk assessment ISBN 978-92-4-003608-6 (electronic version) ISBN 978-92-4-003609-3 (print version) © World Health Organization 2021

[16] https://www.blueline.ca/eighty-five-per-cent-of-first-responders-face-mental-health-challenge-university-of-phoenix-5298/

[17] Preventing and Managing Stress – Tips for Disaster Responders, Publication ID SMA14-4873, Publication Date September 2014

natural disasters or human action.

Taking into account the scenarios of the seven (7) UCs of the S&R project and taking into account the answers given in the UC leaders' questionnaires (see Annex II) on the security and safety risks of first responders, the general list of risks related to ensuring the safety and security of the first responders the answer, according to end users, is this:

-   lack or inadequate training for the first responder to specific hazards at the local level to test agreed roles, responsibilities, capabilities and protocols

-   lack of specialized instrumentations, available at all times, easily accessible, that meet stringent requirements in terms of detection accuracy and quick localization of victims

-   wrong choice or misuse of personal protective equipment (PPE) by the first responder (e.g., respirators, suits, gloves, footwear, face and eye protection)

-   lack of information on the evolution of the operational situation in the intervention area

-   receiving false, incomplete or outdated information about the evolution of the operational situation in the intervention area

-   lack of information about the evolution of the physical and mental state of the first responder during the intervention in the affected area

-   lack of first responder security measures (public order) in the intervention area

- failure to comply with health protection, vaccination and first responder testing measures in the event of an epidemic or pandemic affecting the area of intervention (in the case of field exercises within the UCs of the R&D project, COVIT-19 pandemic affecting European countries).

Regarding the calculation of the probability of triggering the events listed above and the impact of their occurrence for the calculation of each risk and the preparation of the risk matrix, this operation is specific to each UC scenario (see D8.2 -D8.8 of the S&R project) and falls under the responsibility of each leader who plans, organizes and conducts the exercise in the field.

4.2 Scenario description from safety and security first responder perspective

An exercise is a controlled, objective-driven activity used for testing, practicing or evaluating processes or capabilities[18].

In the S&R project, the purpose of the seven (7) pilot UCs scenarios is to test the equipment and technologies developed in the project and validate the S&R governance model by transforming the requirements gathered from the first responders to functional requirements for the implementation of the S&R platform.

In this process, an important role is played by the management of the risks related to each exercise in the field in all its phases: planning, organization, execution and final evaluation.

From the risks identified in each case study, the risks to ensuring the safety and security of the first responder play a key role in solving the purpose stated above.

In fact, in any planning of an exercise in the field, one of the functions that the planning team must perform refers to "safety and security" for the first respondent, but not only to them.

Depending on the complexity of the field exercise, there is a need for a team dedicated exclusively to ensuring safety and security during the field exercise, not just during the planning stage[19].

As a result, a risk management plan (see D8.1 pg. 38-39) must be developed during the planning phase based on a risk register specific to each use case of the S&R project.

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[18] See D8.1 S&R Pilot guidelines and User's Handbook, v1.0, p.12
[19] See D8.1 S&R Pilot guidelines and User's Handbook, v1.0, p.35

In order to ensure the implementation of risk protection measures (including those on the safety and security of the first responder or ensuring site security[20]), a safety and security officer becomes mandatory during the exercise in the backyard[21].

One of its main tasks is to conduct at least a "safety briefing" before starting the exercise in the field[22] and" hot debriefing" after the end of the field exercise (see D 8.1).

As the scenarios of some UCs foresee the onset of disasters that are found in several of them, we consider grouping them by disaster category is more useful, when considering the need for standardized online training, for the training of all staff involved in an exercise in the field from the perspective of ensuring the safety and security of first responders.

In the opinion of end users, a grouping by UC-specific disaster categories within the S&R project for training is as follows:

- Rescue of victims imprisoned under rubble and vehicles as a result of earthquakes or of a road accident (UC-1, UC-2 UC-3 UC-5)
- Relevant issues in CBRN risks (UC-6)
- Forest fire with expansion in the urban area (UC-4)
- Chemical accident at a factory (UC-7)
- Introduction to Emergency Management (UC-1 to UC-7)

A first step forward in achieving the above goal is the first responder safety and security questionnaires for each UC (see Annex II).

An example of this is the provision of standardized training on the use of CBRN means in terrorist actions for first responders and the planning team of S&R Use Case 6: Resilience Support for Critical Infrastructures through Standardized Training on CBRN (Romania).

This choice was based on the need for a specialization course on CBRN weapons in case of use in terrorist acts (due to the complexity of the topic, especially in terms of ensuring the safety and security of first responders, a CBRN introductory course was not enough).

Achieving significant resilience to terrorist attacks using CBRN means is one of the EU's strongest directions for action[23][24].

In the above-mentioned documents, it is considered that chemical attacks are becoming increasingly easier to carry out because the knowledge barrier is low and equipment and materials are readily accessible.

In the same time, biological threats remain a continuing threat with evidence that terrorist groups are experimenting with such weapons.

Similar, the use of radiological weapons is considered to be a lower threat in terms of probability of use and severity of consequences.

For example, in 2014, the European Commission noted that 150 cases of trafficking of radiological and nuclear materials are reported annually to the Incident and Trafficking database of the International Atomic Energy Agency (IAEA).

Nuclear weapons comprise explosives and the means for their delivery. Use of such weapons by a rogue state or terrorist group would result in devastating consequences through the powerful blast and exposure to thermal radiation with far-reaching effects into the future through the presence of residual radiation.

The biggest threat from a nuclear incident is more like to come from a major accident or a cyber-attack on a nuclear facility.

Regardless of organizational setup, each nation has, for example, some kind of decontamination

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[20] See D8.1 S&R Pilot guidelines and User's Handbook, v1.0, p.54
[21] See D8.1 S&R Pilot guidelines and User's Handbook, v1.0, p.47
[22] See D8.1 S&R Pilot guidelines and User's Handbook, v1.0, p.51
[23] Policy Department for Citizens 'Rights and Constitutional Affairs, Directorate General for Internal Policies of the Union - Member States 'Preparedness for CBRN Threats (see http://www.europarl.europa.eu/supporting-analyses)
[24] Policy Department for Citizens 'Rights and Constitutional Affairs, Directorate General for Internal Policies of the Union – UE Civil Protection Responding to CBRN Incidents and Attacks (see http://www.europarl.europa.eu/supporting-analyses)

capability, procedures for mass-casualty management, communication protocols, et cetera.

Focusing on improving capabilities and structuring the functions themselves is therefore a fruitful way of reducing fragmentation and improving the resilience against CBRN incidents both, at national and at EU level.

Efficient and standardized planning involving well-defined, standardized practices together with a well-rehearsed preparedness in all stages of emergency response will lead to better use of available resources.

The above analyses did not address the role of added value to resilience which I can offer the preparation of first responders through standardized training courses online.

The terminology used during the course is that contained in the CBRN Glossary designed by the EUROPEAN COMMISSION DIRECTORATE-GENERAL HOME AFFAIRS, Directorate A: Internal security, Unit A.1: Crisis management – Terrorism[25].

The methods of presenting the topic of the online course follow, depending on the type of course (with or without a trainer), the principles of the model for Information Society Pedagogy[26], as follows:

- Working in teams
- Supporting each other
- Integrating theory and practice
- Integration between subjects
- Teams of teachers

The course takes place in the e-Learning system (MOODLE platform), because it offers a series of advantages, among which we mention:

- There is no time spent commuting to class
- There are no travel costs
- Your learning options are not constrained by your geographic location
- There are often more student-to-student interactions
- There can be more focused on the learner and less on the instructor
- Instruction can be more customized and flexible
- It can take lower costs for both learning providers and organizations that need training
- It can take fewer costs for students than traditional programs
- There are side benefits of learning new technologies and technical skills

Until now, there is no e-Learning standard acceptable to everyone, but ADL (Advanced Distributed Learning) has the standard, called SCORM (Sharable Content Object Reference Model), which could be acceptable to "considerably many" people. ADL considers the following as the requirements of e-Learning standards: Accessibility, Interoperability, Durability, Reusability, Adaptability and Affordability[27].

During the course, special attention was paid to learning the procedures that ensure the safety and security of the first responder in case of intervention to limit the effects of a terrorist attack with CBRN means.

In Annex IV, the format of such a standardized online course is presented, both in the version of using a trainer (s) - **Section A** - and in the version without using a trainer (text only) - **Section B** (using the format in Annex III)-.

This course is a development within UC6 within the S&R project.

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[25] HOME-CBRN-AG@ec.europa.eu

[26] J. Voogt, Consequences of ICT for aims, contents, processes, and environments of learning. In J. van den Akker, W. Kuiper & U. Hameyer (Eds.), Curriculum landscapes and trends. Kluwer Academic Publishers, Dordrecht 2003, p. 222.

[27] http://adlnet.gov/adl-research/performance-tracking-analysis/experience-api/

5 Risk mitigations regarding safety and security for first responders by online platform training

In the S&R project, special attention is paid to the risks and threats related to the security and safety of first responders, both in terms of the need to properly assess these types of risks and the use of key safety protocols for the optimal use of personal protective equipment (PPE), including the training of intervention and management staff through refresher and refresher courses.

As part of the measures to reduce the risks to the safety and security of the first responder, one of the most effective methods is to take online courses, using an e-learning platform, which will provide a better understanding of the issues under discussion, including by updating the theoretical knowledge and practical skills of students (first responders or managers responsible for risk management in emergencies).

This creates, in the opinion of end users, the premises for achieving a safe working environment in the intervention area, regardless of the level of action of the participants in the intervention (first responder, counsellor - officer - safety and security, coordinator of the intervention).

Moreover, in the deliverables of the S&R project, relating to testing and evaluating the equipment and technologies related (results of evaluation of previous exercises, operational observations and / or lessons learned, new practices. Legislative or regulatory requirements) the need staff training courses, including the safety and security of the first responder, among other staff requirements is also specified.[28]

In the next two subchapters, the training framework, the way of organizing online training courses and the choice of training materials will be addressed.

5.1 Defining the training framework for first responder regarding safety and security – the e-learning platform

In the literature on ensuring the safety and security of first responders in emergency situations, the following statements is considered a fact:" Protecting the First Responders in these instances becomes critical as time-sensitive decisions must be made with limited information.

These situations are fraught with potholes for the safety professionals working to protect the responders. A balance must be achieved between the responders' health and safety and the immediate need for action to protect the community.

For example, predicting only the worst-case scenario may needlessly keep responders from doing their job expeditiously, or, conversely, not taking any precautions may place them in harm's way".[29]

The detailing of the specific phases of these two processes (safety and security) has attracted the attention of many specialists in the field.[30]

To address the aforementioned, a Learning Management System (LMS) (e-platform) was developed in MOODLE environment (https://hit-projects.gr/SnR_elearning/ in the context of the present task.

Figure 5-1 provides a view of the home page of the e-learning platform environment.

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[28] See D8.1" S&R Pilot guidelines and User's Handbook", v1.00, p.14 and p.19
[29] https://www.cteh.com/blog-detail/safety-considerations-for-the-first-responder
[30] https://hpsdma.nic.in/WriteReadData/LINKS/First%20Responders%20Module%20fb405a5a-8f4a-4b60-a27e-8859c4ae7604.pdf
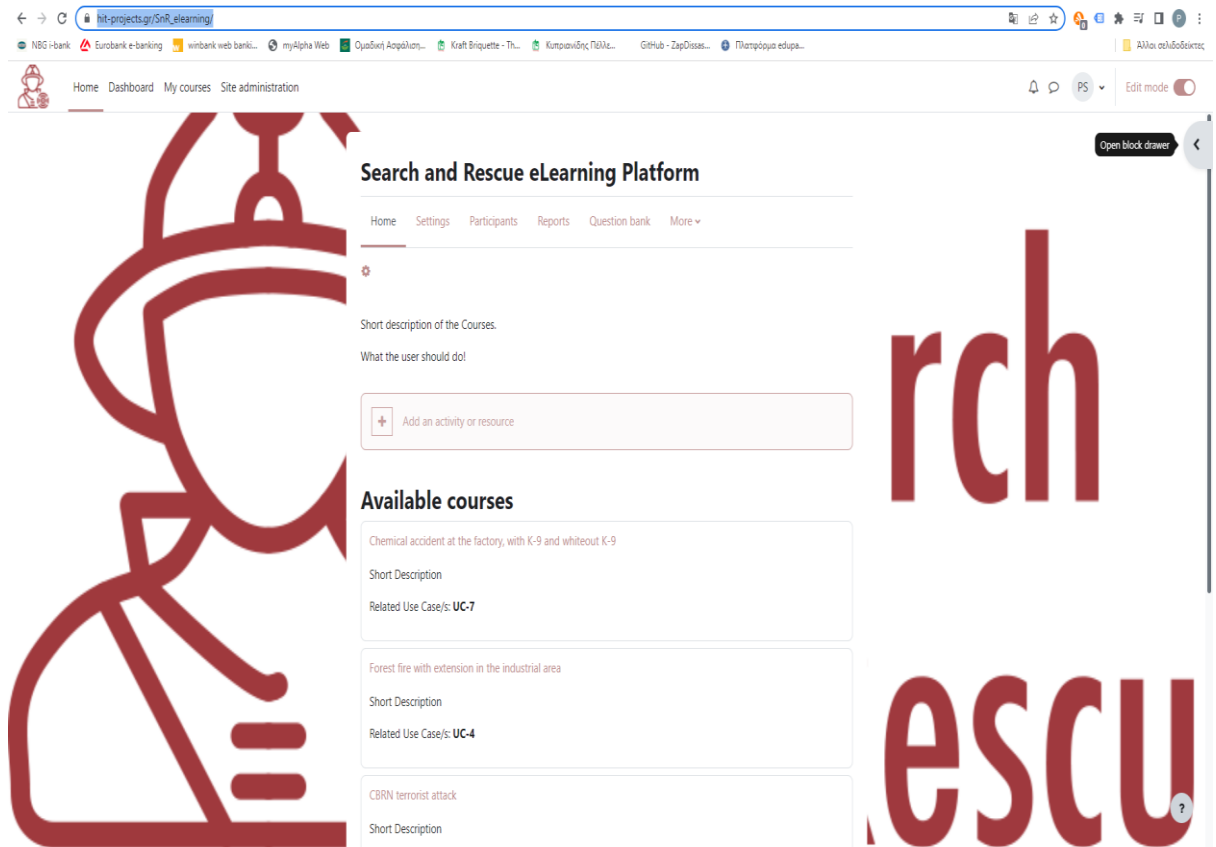
Figure 5-1: Main page of the e-Learning Platform

The aim of the e-learning platform is to provide training material and courses related to the UCs performed during the project. The structure that was followed for the e-learning Platform consists of a strategic level for each course / thematic developed text only version (in this context, in order to clearly define the "operational" and "strategic" level and to avoid confusion, a course at operational level is also presented in Annex V of D2.4).

In addition, short manuals for selected technologies, in particular those in advanced TRLs are provided in a separate section of the eLearning -platform. An online User Manual for the use of the platform has also been uploaded https://hit-projects.gr/SnR_elearning/course/view.php?id=6) and also.

The e-learning platform covers the major thematics (corresponding to those mentioned on page 80) that, as aforementioned, will be operationalized in the UCs.

The training material (e-content) has been developed by partners that act as first responders and have extensive expertise in the relevant thematic (i.e., PROECO, PUI, ESDP, HRT and EPAYPS). The platform is available in: https://hit-projects.gr/SnR_elearning/].

In the rest of the document, we avoid reproducing the material that has been uploaded in the platform which can be easily accessed through the provided link.

However, we wish to note that videos taken from the UC operationalization for learning /demonstration purposes and/or additional manuals for selected equipment after these are finalized may be added once available during the course of the project or even after the project has ended.

Figure 5-2 shows the conceptual structure of the e-learning platform.
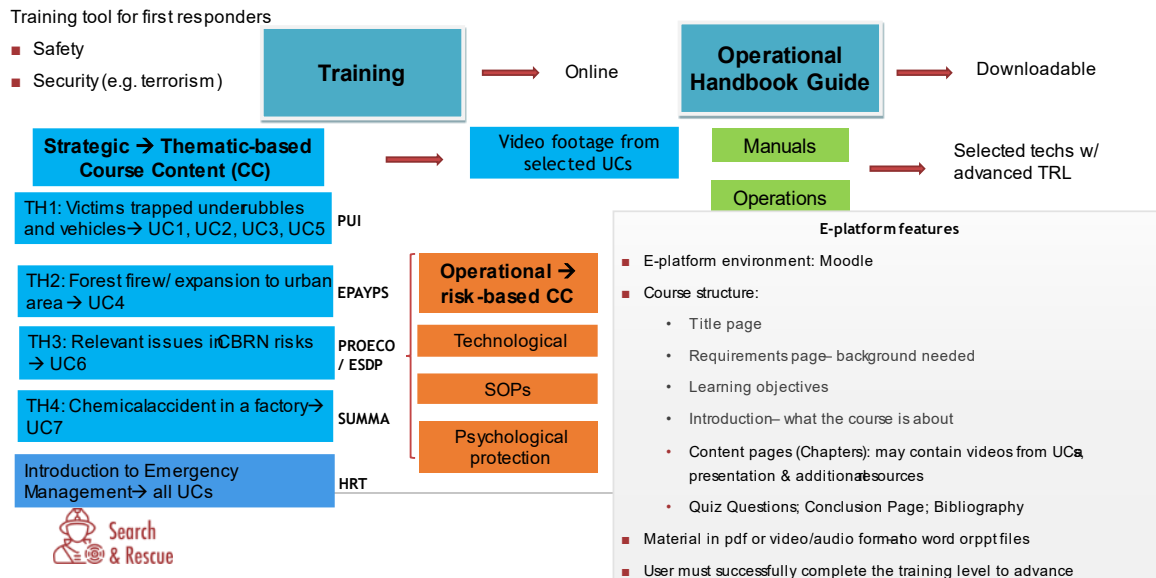
Figure 5-2: The conceptual structure of the e-learning platform

Next, some details pertaining to the developed courses are provided.

The terminology used during the courses is:

- Online training course: "Safety and security first responder – operational level"[31][32][33]
- Online training course: "Safety and security first responder" – strategic level"[34]

The methods for presenting the topic of the on-line course respect the principles of the model for Information Society Pedagogy[35], as follows:

- Working in teams
- Supporting each other
- Integrating theory and practice
- Integration between subjects
- Teams of teachers
- Supporting each other
- Integrating theory and practice

The courses take place in the e-Learning system (MOODLE e-platform), because it offers a series of advantages, among which we mention (the choice of these advantages depends on the type of online course, i.e., with or without a trainer):

- There is no time spent commuting to class
- There are no travel costs
- Your learning options are not constrained by your geographic location
- There are often more student-to-student interactions

[31] The Union Civil Protection Mechanism Training Program, Print ISBN 978-92-79-57737-6 doi:10.2795/017285 KR-01-16-332-EN-C, Web ISBN 978-92-79-57736-9 doi:10.2795/776763 KR-01-16-332-EN-N

[32] INSARAG_Guidelines_V2_Chapeau__Manual_A_-_Capacity_Building1.pdf

[33] https://www.cteh.com/blog-detail/safety-considerations-for-the-first-responder

[34] ISO 45001, First edition 2018-03-12, Occupational health and safety management systems Requirements with guidance for use

[35] J. Voogt, Consequences of ICT for aims, contents, processes, and environments of learning. In J. van den Akker, W. Kuiper & U. Hameyer (Eds.), Curriculum landscapes and trends. Kluwer Academic Publishers, Dordrecht 2003, p. 222.

- There can be more focused on the learner and less on the instructor
- Instruction can be more customized and flexible
- It can take lower costs for both learning providers and organizations that need training
- It can take fewer costs for students than traditional programs
- There are side benefits of learning new technologies and technical skills

Until now, there is no e-Learning standard acceptable to everyone, but ADL (Advanced Distributed Learning) has the standard, called SCORM (Sharable Content Object Reference Model), which could be acceptable to "considerably many" people. ADL considers the following as the requirements of e-Learning standards: Accessibility, Interoperability, Durability, Reusability, Adaptability and Affordability[36].

5.2 Training material development and organizing online platform training courses for first responders

5.2.1 Online platform training course: "Safety and security first responder – operational level"

The course is addressed to students who have completed the first responder security and safety course at tactic level and want to complete their portfolio of skills to hold, at a minimum, the position of head of search-rescue team or officer in charge of intervention operations in the training centre. operational command.
Students are given the skills to use the safety and security procedures on the first responder during the deployment in the intervention area, to develop and implement security plans for the intervention teams deployed in the field, to analyze and evaluate the local environments. safety and security, to develop mission risk assessments and to adapt standardized first responder safety and security procedures to changes in the environment in which they operate.
The training material shall be organized to cover operational level (advanced training course).
The format of this type of course, with the contribution of a trainer (s), can be found in Annex V, **section A**.
The format of this type of computer-based course (text only) is set out in Annex V, **section B** (using the format in Annex III, text only).

5.2.2 Online platform training course: "Safety and security first responder" – strategic level"

Any organization operating in the field of emergency management (state, private, voluntary, etc.) is responsible for the health, safety and security of workers (including first responders) and others who may be affected by its activities. This responsibility includes promoting and protecting their physical and of mental health.
The implementation and optimal functioning of a management system that ensures the security and safety of the first responder depends, in order to achieve the desired results, on a number of key factors, which may include:

    a) top management leadership, commitment, responsibilities and accountability
    b) b) top management developing, leading and promoting a culture in the organization that supports the intended outcomes of the security and safety-first responder management system
    c) communication

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[36] http://adlnet.gov/adl-research/performance-tracking-analysis/experience-api/

d) consultation and participation of workers, and, where they exist, workers' representatives

e) allocation of the necessary resources to maintain it

f) security and safety-first responder policies, which are compatible with the overall strategic objectives and direction of the organization

g) effective process(es) for identifying hazards, controlling OH&S risks and taking advantage of security and safety-first responder opportunities

h) continual performance evaluation and monitoring of the security and safety-first responder management system to improve   security and safety-first responder performance

The level of detail, the complexity, the extent of documented information and the resources needed to ensure the success of an organization's security and safety-first responder management system will depend on a number of factors, such as:

- the organization's context [e.g., number of workers, size, geography culture legal requirements and other requirements)

- the scope of the organization's security and safety-first responder management system

- the nature of the organization's activities and the related security and safety-first responder risks

The core objective of the course is to enhance participants' competences in terms of security and safety-first responder management at strategic levels.

The course is addressed to students who have completed the first responder security and safety course at operational level and want to complete their portfolio of skills to hold, at a minimum, the position in top management of any organization operating in the field of emergency management (state, private, voluntary, etc.).

Students are given the skills to use the safety and security procedures on the first responder during the deployment in the intervention area, to develop and implement security plans for the intervention teams deployed in the field, to analyze and evaluate the local environments. safety and security, to develop mission risk assessments and to adapt standardized first responder safety and security procedures to changes in the environment in which they operate.

The training material shall be organized to cover strategic level (advanced training course).

The format of this type of course, with the contribution of a trainer (s), can be found in Annex VI, **section A**.

The format of this type of computer-based course (text only) is set out in Annex VI, **section B** (using the in Annex III).

6 Conclusions and final proposals

Addressing the safety and security issues of the first response in the field of emergency and crisis management is a major issue addressed in theoretical and practical research specific to emergencies. In the S&R project, special attention was paid to this aspect, both by performing theoretical and practical research, the results of which have been presented within D2.4.

One of the key aspects in achieving the above-mentioned goal is the use of risk analysis to define the risk matrix, adapted to the specific scenario of each of the 7 (seven) UCs of the project, as a basis for drawing up the Risk Register of each field exercise, according to the requirements stipulated in D8.1 pg. 38-39.

In the opinion of end-users, by correlating the theoretical aspects with the practical characteristics of search-rescue actions, it can be concluded that ensuring safety and security for first responders should be a constant concern throughout each field exercise, at all stages of its development. As such, the risk management plan (see requirements of D8.1), specific to each UC within the S&R project should account for this.

In order to ensure a correlation, harmonization and optimization of ensuring the safety and security of first responders both from strategic and operational perspectives, in the deliverable D2.4, a series of courses have been proposed on this subject, mainly at strategic level [which contain also operational elements]. To provide an example of a clear distinction and avoid confusion between the strategic and operational level, the thematic that relates to CBRN terrorist attack (UC6) has been analyzed separately at both levels. In addition, with regard to the operational level, the identification of risks to be taken into account in the Use Case Risk Management Plans by each Use Case Leader has been performed for each Use Case as per Annex II.

These courses are organized in the form of e-learning training, with the help of a MOODLE platform, dedicated especially to this purpose (for text only courses).

In the view of end-users, such training may result in safeguarding and better management, including savings, of the limited resources usually available in the field in case of search and rescue operations, while also exchanging experience between representatives of various search and rescue EU organizations working in the field.

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Annex II: Safety and Security First Responder Questionnaire from UC leaders

Use Case 1: Victims trapped under rubble (Italy)

End-user organization: CNR

Contact Name	**Fabio Cibella**
Company Name	**Consiglio Nazionale delle Ricerche**
Company Address	**Piazzale Aldo Moro,7 - 00185, Roma, Italia**

COMPANY OPERATIONS	Yes	No
Do you have a health and safety policy?	X	
Do you have a health and safety manual and procedures?	X	
Is there an appointed person within your organisation responsible for health and safety matters?	X	
THEORETICAL QUESTIONS		
What are the dangers of my job?		
Risk of collapses of building, fall on the rubbles, injured with the tools, cold and hot weather		
Are there any other hazards (noise, radiation, chemicals) that I should know about?		
Noise, gas, chemical, electricity, radiation		
Will I be trained in emergency procedures (fire, chemical spill)? When?		
As firefighters the training is permanent about this topic, training every day, week and month		
Where are fire extinguishers, first aid kits, and other emergency equipment located?		
They are located on the work site and in the BoO (Base of Operation) in the area called "La Souterraine", where the pilot will take place		
What do I do if I get hurt? Who is the first aid person?		
There is a medical team on the work site with equipment, one medical post on the Base of Operation, and hospital		
What are my health and safety responsibilities?		

COVID protocol before the deployment, health parameters during the deployment and during the turn-over of the USAR teams, first-aid and medical assistance on the rubbles for the rescuers; during the operation a security officer in on the site		
Who do I ask if I have a health and safety question?		
the medical team leader and the security officer; all the medical team members have a white helmet, and the security officer has a special yellow jacket "Security officer"		
SECURITY & SAFETY LEGISLATION		
Do you carry out risk assessments?	X	
Do you have a formal accident and near miss reporting and investigation procedure?	X	
Do you operate a maintenance and inspection system for work equipment?	X	
Are you aware of the current health and safety legislation which governs your activities?	X	
Do you have procedures for reporting and investigating accidents, dangerous occurrences, and diseases?	X	
Do all personnel have access to written SOPs that document safety procedures?	X	
Do all personnel know how and when to report accidents, incidents, or near misses in operation site?	X	
Was a safety self-inspection performed and documented within the last 12 months?	X	
Are assessments of hazards conducted and documented for new work and chemical usage?	X	
Are additional hazard warning signs (laser, magnetic fields, high voltage, etc.) posted?	X	
Has the inventory been reviewed and updated within the last year?	X	
Personal Protective Equipment		
Has a PPE hazard assessment been completed for all activities?	X	
Have all personnel completed PPE Training?	X	
If cartridge respirators are being used, have personnel been fit tested?	X	
Is the required personal protective equipment worn?	X	
Is personal protective equipment readily available for all personnel?	X	
Is all personal protective equipment free from damage and deterioration?	X	
Are all employees using respiratory protection properly trained and authorized?	X	

Is self-contained breathing equipment properly maintained/ inspected?	X	
Are supplies of minimum PPE required for routine work available to all members?	X	
SECURITY		
Are all doors unlocked/openable from the inside during working hours?	X	
Are all escape routes clearly marked with exit signs incorporating the 'running man' symbol and directional arrows?	X	
Are all escape routes unobstructed both inside and out?	X	
Are emergency eyewashes provided in the required chemical areas?	X	
Are all exit doors able to be opened from the inside without special knowledge/keys?	X	
Have personnel been trained in the use of personal protective equipment?	X	
Are all employees trained in hazardous substances safety?	X	
Have personnel working in high noise areas been trained in hearing conservation?	X	
Have employees who use respirators been trained, fit tested, and received the required health monitoring examination?	X	
Are employees who use self-contained breathing apparatus properly trained and authorized?	X	

(PROECO contribution)

Use Case 2: Plane crash, mountain rescue, non-urban (Greece)

End-user organization: HRT

Contact Name	**Lorenzo Nerantzis, Dimitris Iliadis**
Company Name	**Hellenic Rescue Team**
Company Address	**13 Kifisias str. 54248, Thessaloniki, Greece**

COMPANY OPERATIONS	**Yes**	**No**
Do you have a health and safety policy?	X	
Do you have a health and safety manual and procedures?	X	
Is there an appointed person within your organisation responsible for health and safety matters?		x
THEORETICAL QUESTIONS		
What are the dangers of my job?		
	N/A	
Are there any other hazards (noise, radiation, chemicals) that I should know about?		

No		
Will I be trained in emergency procedures (fire, chemical spill)? When?		
According to the training program of each department		
Where are fire extinguishers, first aid kits, and other emergency equipment located?		
In different areas in the offices, vehicles, boats. Signs shows the exact location		
What do I do if I get hurt? Who is the first aid person?		
Immediately 1) call head of the department if in training, 2) call on-scene coordinator and head of operations in SAR missions		
What are my health and safety responsibilities?		
To maintain my health and safety first and then of my colleagues		
Who do I ask if I have a health and safety question?		
The Head of each Department and/or Head of Operations if needed		
SECURITY & SAFETY LEGISLATION		
Do you carry out risk assessments?		x
Do you have a formal accident and near miss reporting and investigation procedure?	x	
Do you operate a maintenance and inspection system for work equipment?	x	
Are you aware of the current health and safety legislation which governs your activities?	x	
Do you have procedures for reporting and investigating accidents, dangerous occurrences, and diseases?		X
Do all personnel have access to written SOPs that document safety procedures?	X	
Do all personnel know how and when to report accidents, incidents, or near misses in operation site?	X	
Was a safety self-inspection performed and documented within the last 12 months?	X	
Are assessments of hazards conducted and documented for new work and chemical usage?		X
Are additional hazard warning signs (laser, magnetic fields, high voltage, etc.) posted?		X
Has the inventory been reviewed and updated within the last year?	x	
Personal Protective Equipment		

Has a PPE hazard assessment been completed for all activities?	X	
Have all personnel completed PPE Training?	X	
If cartridge respirators are being used, have personnel been fit tested?	X	
Is the required personal protective equipment worn?		X
Is personal protective equipment readily available for all personnel?	x	
Is all personal protective equipment free from damage and deterioration?	X	
Are all employees using respiratory protection properly trained and authorized?	X	
Is self-contained breathing equipment properly maintained/ inspected?	X	
Are supplies of minimum PPE required for routine work available to all members?	x	
SECURITY		
Are all doors unlocked/openable from the inside during working hours?	X	
Are all escape routes clearly marked with exit signs incorporating the 'running man' symbol and directional arrows?	x	
Are all escape routes unobstructed both inside and out?	x	
Are emergency eyewashes provided in the required chemical areas?	N/A	
Are all exit doors able to be opened from the inside without special knowledge/keys?	X	
Have personnel been trained in the use of personal protective equipment?	x	
Are all employees trained in hazardous substances safety?		X
Have personnel working in high noise areas been trained in hearing conservation?	x	
Have employees who use respirators been trained, fit tested, and received the required health monitoring examination?		x
Are employees who use self-contained breathing apparatus properly trained and authorized?	N/A	

Use Case 3: Earthquake / heavy storms between Vienna Rail Station & Kufstein railway station heavy damages in the rail station (Cross-border pilot, Austria-Germany)

End-user organization: JOAFG & JUH

Contact Name	**Georg Aumayr, Sabrina Scheuer, Pia Ferner**
Company Name	**Johanniter Österreich Ausbildung und Forschung**
Company Address	**Josef-Bradzdovics-Straße 5, 1210 Wien, Austria**

COMPANY OPERATIONS	Yes	No
Do you have a health and safety policy?	x	
Do you have a health and safety manual and procedures?	x	
Is there an appointed person within your organisation responsible for health and safety matters?	x	
THEORETICAL QUESTIONS		
What are the dangers of my job?		
becoming sick or injured, being harassed/attacked by patients, traffic incidents, possible intoxication (gas leak etc.), psychological effects		
Are there any other hazards (noise, radiation, chemicals) that I should know about?		
infection (EMS), road traffic, risk of injury on disaster sites: injury in action; chemical hazards (to a lesser degree), contamination, terrorist attacks,		
Will I be trained in emergency procedures (fire, chemical spill)? When?		
simulation exercises (on mass casualty incidents, fire drill), at least one per year		
Where are fire extinguishers, first aid kits, and other emergency equipment located?		
in ambulance cars and all buildings		
What do I do if I get hurt? Who is the first aid person?		
organization is an emergency medical service provider, responsible person(s) depending on number of employees with first aid training		
What are my health and safety responsibilities?		
provide first aid whenever needed as far as my skills allow it, call for additional help if needed, alert in case of identified threat (potential for accident), don't come to work in case of feeling sick, wear protective equipment (when applicable); covid related measures: wearing mask, sanitizing/washing hands regularly, keeping distance		
Who do I ask if I have a health and safety question?		
security officer ("Sicherheitsvertrauensperson") in organization, Company doctor		
SECURITY & SAFETY LEGISLATION		
Do you carry out risk assessments?	x	
Do you have a formal accident and near miss reporting and investigation procedure?	x	
Do you operate a maintenance and inspection system for work equipment?	x	

Are you aware of the current health and safety legislation which governs your activities?	x	
Do you have procedures for reporting and investigating accidents, dangerous occurrences, and diseases?	x	
Do all personnel have access to written SOPs that document safety procedures?		x
Do all personnel know how and when to report accidents, incidents, or near misses in operation site?	x	
Was a safety self-inspection performed and documented within the last 12 months?		x
Are assessments of hazards conducted and documented for new work and chemical usage?		x
Are additional hazard warning signs (laser, magnetic fields, high voltage, etc.) posted?		x
Has the inventory been reviewed and updated within the last year?	x	
Personal Protective Equipment		
Has a PPE hazard assessment been completed for all activities?	x	
Have all personnel completed PPE Training?	x	
If cartridge respirators are being used, have personnel been fit tested?	N/A	
Is the required personal protective equipment worn?	x	
Is personal protective equipment readily available for all personnel?	x	
Is all personal protective equipment free from damage and deterioration?	x	
Are all employees using respiratory protection properly trained and authorized?	x	
Is self-contained breathing equipment properly maintained/ inspected?	N/A	
Are supplies of minimum PPE required for routine work available to all members?	x	
SECURITY		
Are all doors unlocked/openable from the inside during working hours?	x	
Are all escape routes clearly marked with exit signs incorporating the 'running man' symbol and directional arrows?	x	
Are all escape routes unobstructed both inside and out?	x	
Are emergency eyewashes provided in the required chemical areas?	N/A	
Are all exit doors able to be opened from the inside without special knowledge/keys?		x
Have personnel been trained in the use of personal protective equipment?	x	
Are all employees trained in hazardous substances safety?		x
Have personnel working in high noise areas been trained in hearing conservation?	x	

Have employees who use respirators been trained, fit tested, and received the required health monitoring examination?	N/A	
Are employees who use self-contained breathing apparatus properly trained and authorized?	N/A	

Use Case 4: Forest fire expanded and threat to industrial zone (Attica Region, Greece)

End-user organization: EPAYPS

Contact Name	Anastasios Kanavos/ Michail Chalaris
Company Name	EPAYPS
Company Address	Peiraios 31, Athina N. Attikis 10553, Greece

COMPANY OPERATIONS	Yes	No
Do you have a health and safety policy?	X	
Do you have a health and safety manual and procedures?	X	
Is there an appointed person within your organisation responsible for health and safety matters?	x	
THEORETICAL QUESTIONS		
What are the dangers of my job?		
exposure to high temperature and smoke - gas hazard - injured by tools-building collapse-debris		
Are there any other hazards (noise, radiation, chemicals) that I should know about?		
radiation - chemical - gas - electricity		
Will I be trained in emergency procedures (fire, chemical spill)? When?		
There is a monthly programme for everyday training in the organization		
Where are fire extinguishers, first aid kits, and other emergency equipment located?		
there will be located on the worksite during the pilot		
What do I do if I get hurt? Who is the first aid person?		
A team will be responsible for any incident that will happen to the field of operations. Furthermore, there is a hospital in Korinthos for any more health care		
What are my health and safety responsibilities?		

All the COVID restrictions will be established. Health and safety regulations will be applied to all of the participants on the field, under the supervision of an assigned person		
Who do I ask if I have a health and safety question?		
the head of the responsible team, which will have a yellow jacket with an appropriate sign		
SECURITY & SAFETY LEGISLATION		
Do you carry out risk assessments?	X	
Do you have a formal accident and near miss reporting and investigation procedure?	X	
Do you operate a maintenance and inspection system for work equipment?	X	
Are you aware of the current health and safety legislation which governs your activities?	X	
Do you have procedures for reporting and investigating accidents, dangerous occurrences, and diseases?	X	
Do all personnel have access to written SOPs that document safety procedures?	X	
Do all personnel know how and when to report accidents, incidents, or near misses in operation site?	X	
Was a safety self-inspection performed and documented within the last 12 months?	X	
Are assessments of hazards conducted and documented for new work and chemical usage?	X	
Are additional hazard warning signs (laser, magnetic fields, high voltage, etc.) posted?		X
Has the inventory been reviewed and updated within the last year?	X	
Personal Protective Equipment		
Has a PPE hazard assessment been completed for all activities?	X	
Have all personnel completed PPE Training?	X	
If cartridge respirators are being used, have personnel been fit tested?	X	
Is the required personal protective equipment worn?	X	
Is personal protective equipment readily available for all personnel?	X	
Is all personal protective equipment free from damage and deterioration?	X	
Are all employees using respiratory protection properly trained and authorized?	X	
Is self-contained breathing equipment properly maintained/ inspected?	X	

Are supplies of minimum PPE required for routine work available to all members?	X	
SECURITY		
Are all doors unlocked/openable from the inside during working hours?	X	
Are all escape routes clearly marked with exit signs incorporating the 'running man' symbol and directional arrows?	X	
Are all escape routes unobstructed both inside and out?	X	
Are emergency eyewashes provided in the required chemical areas?	X	
Are all exit doors able to be opened from the inside without special knowledge/keys?	X	
Have personnel been trained in the use of personal protective equipment?	X	
Are all employees trained in hazardous substances safety?	X	
Have personnel working in high noise areas been trained in hearing conservation?		X
Have employees who use respirators been trained, fit tested, and received the required health monitoring examination?	X	
Are employees who use self-contained breathing apparatus properly trained and authorized?	X	

Use Case 5: Victims trapped under rubbles (France)

End-user organization: PUI FRANCE

Contact Name	**Iliana Korma / Philippe Besson**
Company Name	**Pompiers de l'Urgence Internationale (PUI France)**
Company Address	**1, Avenue Abattoir, 87000 Limoges, France**

COMPANY OPERATIONS	Yes	No
Do you have a health and safety policy?	X	
Do you have a health and safety manual and procedures?	X	
Is there an appointed person within your organisation responsible for health and safety matters?	X	
THEORETICAL QUESTIONS		
What are the dangers of my job?		
Risk of collapses of building, fall on the rubbles, injured with the tools, cold and hot weather,		
Are there any other hazards (noise, radiation, chemicals) that I should know about?		

Noise, gas, chemical, electricity, radiation,		
Will I be trained in emergency procedures (fire, chemical spill)? When?		
As firefighters the training is permanent about this topic, training every day, week and month		
Where are fire extinguishers, first aid kits, and other emergency equipment located?		
They are located on the work site and in the BoO (Base of Operation) in the area called "La Souterraine", where the pilot will take place.		
What do I do if I get hurt? Who is the first aid person?		
There is a medical team on the work site with equipment, one medical post on the Base of Operation, and hospital in La Souterrain.		
What are my health and safety responsibilities?		
COVID protocol before the deployment, health parameters during the deployment and during the turn-over of the USAR teams, first-aid and medical assistance on the rubbles for the rescuers; during the operation a security officer in on the site		
Who do I ask if I have a health and safety question?		
the medical team leader and the security officer; all the medical team members have a white helmet, and the security officer has a special yellow jacket "Security officer"		
SECURITY & SAFETY LEGISLATION		
Do you carry out risk assessments?	X	
Do you have a formal accident and near miss reporting and investigation procedure?	X	
Do you operate a maintenance and inspection system for work equipment?	X	
Are you aware of the current health and safety legislation which governs your activities?	X	
Do you have procedures for reporting and investigating accidents, dangerous occurrences, and diseases?	X	
Do all personnel have access to written SOPs that document safety procedures?	X	
Do all personnel know how and when to report accidents, incidents, or near misses in operation site?	X	
Was a safety self-inspection performed and documented within the last 12 months?	X	
Are assessments of hazards conducted and documented for new work and chemical usage?	X	

Are additional hazard warning signs (laser, magnetic fields, high voltage, etc.) posted?	X	
Has the inventory been reviewed and updated within the last year?	X	
Personal Protective Equipment		
Has a PPE hazard assessment been completed for all activities?	X	
Have all personnel completed PPE Training?	X	
If cartridge respirators are being used, have personnel been fit tested?	X	
Is the required personal protective equipment worn?	X	
Is personal protective equipment readily available for all personnel?	X	
Is all personal protective equipment free from damage and deterioration?	X	
Are all employees using respiratory protection properly trained and authorized?	X	
Is self-contained breathing equipment properly maintained/ inspected?	X	
Are supplies of minimum PPE required for routine work available to all members?	X	
SECURITY		
Are all doors unlocked/openable from the inside during working hours?	X	
Are all escape routes clearly marked with exit signs incorporating the 'running man' symbol and directional arrows?	X	
Are all escape routes unobstructed both inside and out?	X	
Are emergency eyewashes provided in the required chemical areas?	X	
Are all exit doors able to be opened from the inside without special knowledge/keys?	X	
Have personnel been trained in the use of personal protective equipment?	X	
Are all employees trained in hazardous substances safety?	X	
Have personnel working in high noise areas been trained in hearing conservation?	X	
Have employees who use respirators been trained, fit tested, and received the required health monitoring examination?	X	
Are employees who use self-contained breathing apparatus properly trained and authorized?	X	

Use Case 6: Resilience Support for Critical Infrastructures through Standardized Training on CBRN (Romania)

End-user organization: PROECO-CBRNE

Contact Name	Nicolae Maruntelu

Company Name	PROECO
Company Address	Romania

COMPANY OPERATIONS	Yes	No
Do you have a health and safety policy?	X	
Do you have a health and safety manual and procedures?	X	
Is there an appointed person within your organisation responsible for health and safety matters?	X	
THEORETICAL QUESTIONS		
What are the dangers of my job?		
inhalation of dangerous substances, contamination of the equipment used by the first responder team		
Are there any other hazards (noise, radiation, chemicals) that I should know about?		
dangerous toxic substances		
Will I be trained in emergency procedures (fire, chemical spill)? When?		
yes, during 2021 we participated in a CBRN course at NBC school from Rieti		
Where are fire extinguishers, first aid kits, and other emergency equipment located?		
in a warehouse inside the airport		
What do I do if I get hurt? Who is the first aid person?		
A paramedics group will be involved in UC-6 for first aid		
What are my health and safety responsibilities?		
provide first aid whenever needed according to my skills , call for additional help , alert in case of identified threat (potential for accident), wear protective equipment (when applicable);		
Who do I ask if I have a health and safety question?		
The responsible person of safety and security and the leader of the medical team		
SECURITY & SAFETY LEGISLATION		
Do you carry out risk assessments?	x	

Do you have a formal accident and near miss reporting and investigation procedure?		X
Do you operate a maintenance and inspection system for work equipment?	x	
Are you aware of the current health and safety legislation which governs your activities?	x	
Do you have procedures for reporting and investigating accidents, dangerous occurrences, and diseases?	x	
Do all personnel have access to written SOPs that document safety procedures?	X	
Do all personnel know how and when to report accidents, incidents, or near misses in operation site?	X	
Was a safety self-inspection performed and documented within the last 12 months?	X	
Are assessments of hazards conducted and documented for new work and chemical usage?	x	
Are additional hazard warning signs (laser, magnetic fields, high voltage, etc.) posted?		X
Has the inventory been reviewed and updated within the last year?	x	
Personal Protective Equipment		
Has a PPE hazard assessment been completed for all activities?	X	
Have all personnel completed PPE Training?	X	
If cartridge respirators are being used, have personnel been fit tested?	X	
Is the required personal protective equipment worn?	x	
Is personal protective equipment readily available for all personnel?	x	
Is all personal protective equipment free from damage and deterioration?	X	
Are all employees using respiratory protection properly trained and authorized?	X	
Is self-contained breathing equipment properly maintained/ inspected?	X	
Are supplies of minimum PPE required for routine work available to all members?	x	
SECURITY		
Are all doors unlocked/openable from the inside during working hours?	x	
Are all escape routes clearly marked with exit signs incorporating the 'running man' symbol and directional arrows?	x	
Are all escape routes unobstructed both inside and out?	x	
Are emergency eyewashes provided in the required chemical areas?	X	
Are all exit doors able to be opened from the inside without special knowledge/keys?	X	

Have personnel been trained in the use of personal protective equipment?	x	
Are all employees trained in hazardous substances safety?	x	
Have personnel working in high noise areas been trained in hearing conservation?	x	
Have employees who use respirators been trained, fit tested, and received the required health monitoring examination?	X	
Are employees who use self-contained breathing apparatus properly trained and authorized?	X	

Use Case 7: Chemical substances spill (Spain)

End-user organization: SERMAS – ESDP

Contact Name	Marta Burgos González
Company Name	ESDP
Company Address	Madrid

COMPANY OPERATIONS	Yes	No
Do you have a health and safety policy?	X	
Do you have a health and safety manual and procedures?	X	
Is there an appointed person within your organisation responsible for health and safety matters?	X	
THEORETICAL QUESTIONS		
What are the dangers of my job?		
Risks derived from accidents during interventions, risks derived from substances that have been previously located. Risks of building collapse during the intervention. These risks are for dog handles and rescue dogs too.		
Are there any other hazards (noise, radiation, chemicals) that I should know about?		
Yes, there is. In changing and uncertain situations there is a risk of undetected chemicals or radiation that could affect both dog handles and rescue dogs		
Will I be trained in emergency procedures (fire, chemical spill)? When?		
	x	
Where are fire extinguishers, first aid kits, and other emergency equipment located?		
First responders know where the equipment is located. They are into the ESDP van. If we have to leave the van, this equipment will be in the worksite.		
What do I do if I get hurt? Who is the first aid person?		

The medical staff involved in the intervention is the first aid person. Protocols regarding how to manage this situation are part of INSARAG guidelines and know by the FRs.		
What are my health and safety responsibilities?		
Follow the protocols and guidelines. Be aware of the danger signals (acoustic signals collected in INSARAG guidelines), and take precautions taking into account the danger signals in the INSARAG.		
Who do I ask if I have a health and safety question?		
Health: Chief of medical operational intervention / Chief of operational intervention (Firefighters in our case)		
SECURITY & SAFETY LEGISLATION		
Do you carry out risk assessments?	X	
Do you have a formal accident and near miss reporting and investigation procedure?	x	
Do you operate a maintenance and inspection system for work equipment?	x	
Are you aware of the current health and safety legislation which governs your activities?	x	
Do you have procedures for reporting and investigating accidents, dangerous occurrences, and diseases?	x	
Do all personnel have access to written SOPs that document safety procedures?	X	
Do all personnel know how and when to report accidents, incidents, or near misses in operation site?	X	
Was a safety self-inspection performed and documented within the last 12 months?	X	
Are assessments of hazards conducted and documented for new work and chemical usage?	x	
Are additional hazard warning signs (laser, magnetic fields, high voltage, etc.) posted?	x	
Has the inventory been reviewed and updated within the last year?	x	
Personal Protective Equipment		
Has a PPE hazard assessment been completed for all activities?	X	
Have all personnel completed PPE Training?	X	
If cartridge respirators are being used, have personnel been fit tested?	X	
Is the required personal protective equipment worn?	x	
Is personal protective equipment readily available for all personne?	x	

Is all personal protective equipment free from damage and deterioration?	X	
Are all employees using respiratory protection properly trained and authorized?	X	
Is self-contained breathing equipment properly maintained/ inspected?	X	
Are supplies of minimum PPE required for routine work available to all members?	x	
SECURITY		
Are all doors unlocked/openable from the inside during working hours?	X	
Are all escape routes clearly marked with exit signs incorporating the 'running man' symbol and directional arrows?	x	
Are all escape routes unobstructed both inside and out?	x	
Are emergency eyewashes provided in the required chemical areas?	X	
Are all exit doors able to be opened from the inside without special knowledge/keys?	X	
Have personnel been trained in the use of personal protective equipment?	x	
Are all employees trained in hazardous substances safety?		X
Have personnel working in high noise areas been trained in hearing conservation?	x	
Have employees who use respirators been trained, fit tested, and received the required health monitoring examination?	X	
Are employees who use self-contained breathing apparatus properly trained and authorized?	X	

Contact Name	Horrillo Garcia, Cristina Lorena
Company Name	SUMMA 112
Company Address	Madrid

COMPANY OPERATIONS	Yes	No
Do you have a health and safety policy?	X	
Do you have a health and safety manual and procedures?	X	
Is there an appointed person within your organization responsible for health and safety matters?	X	
THEORETICAL QUESTIONS		
What are the dangers of my job?		

The exposure in the hot´s zone (physical, chemical and biological risks) and risks in the failure of communications in the interveners		
Are there any other hazards (noise, radiation, chemicals) that I should know about?		
Chemical: ammonia, smoke poisoning, noise associated with the explosion. at the physical level objects such as glass or materials thrown by the explosion		
Will I be trained in emergency procedures (fire, chemical spill)? When?		
yes, within the SUMMA112 mandatory training there are courses to deal with these particular multi-victim incidents.		
Where are fire extinguishers, first aid kits, and other emergency equipment located?		
the fire extinguishers and fire protection equipment are carried by firefighters. the first aid teams and material to attend to the victims are located in the advanced life supports (uvi movil, vir, alfa lima vehicle, and special vehicles) that are taken to the advanced medical post		
What do I do if I get hurt? Who is the first aid person?		
If i hurt myself, i will be taken out of the temperate zone and cared for by advanced life support		
What are my health and safety responsibilities?		
The first thing is to protect myself, and luegi to protect the victims		
Who do I ask if I have a health and safety question?		
At a general level to the department of occupational risks and quality of summa 112 and in the intervention to the head of guard, doctor / nurse		
SECURITY & SAFETY LEGISLATION		
Do you carry out risk assessments?	X	
Do you have a formal accident and near miss reporting and investigation procedure?		X
Do you operate a maintenance and inspection system for work equipment?		X
Are you aware of the current health and safety legislation which governs your activities?		X
Do you have procedures for reporting and investigating accidents, dangerous occurrences, and diseases?		X
Do all personnel have access to written SOPs that document safety procedures?	X	
Do all personnel know how and when to report accidents, incidents, or near misses in operation site?	X	

Was a safety self-inspection performed and documented within the last 12 months?	X	
Are assessments of hazards conducted and documented for new work and chemical usage?		X
Are additional hazard warning signs (laser, magnetic fields, high voltage, etc.) posted?		X
Has the inventory been reviewed and updated within the last year?		X
Personal Protective Equipment		
Has a PPE hazard assessment been completed for all activities?	X	
Have all personnel completed PPE Training?	X	
If cartridge respirators are being used, have personnel been fit tested?	X	
Is the required personal protective equipment worn?		X
Is personal protective equipment readily available for all personnel?		X
Is all personal protective equipment free from damage and deterioration?	X	
Are all employees using respiratory protection properly trained and authorized?	X	
Is self-contained breathing equipment properly maintained/ inspected?	X	
Are supplies of minimum PPE required for routine work available to all members?		X
SECURITY		
Are all doors unlocked/openable from the inside during working hours?	X	
Are all escape routes clearly marked with exit signs incorporating the 'running man' symbol and directional arrows?		X
Are all escape routes unobstructed both inside and out?		X
Are emergency eyewashes provided in the required chemical areas?	X	
Are all exit doors able to be opened from the inside without special knowledge/keys?	X	
Have personnel been trained in the use of personal protective equipment?		
Are all employees trained in hazardous substances safety?		X
Have personnel working in high noise areas been trained in hearing conservation?		X
Have employees who use respirators been trained, fit tested, and received the required health monitoring examination?	X	
Are employees who use self-contained breathing apparatus properly trained and authorized?	X	

Annex III: Content structure of courses in e-learning platform

An Example Course Structure

Title Page: This is the first page learners will see when they launch the course. Your title page should articulate the focus of the content. It should also drive anticipation and excitement about the upcoming learning journey.

Requirements Page: The next page should inform your learners about any requirements relating to your course. This is your opportunity to encourage learners to optimize their learning environment.

Learning Objectives Page: You should state the goal of your course upfront, so your learners understand where this course will take them. This provides useful context for your learners as they navigate through your content.

Introduction Page: You're now ready to launch into your content. You should start by introducing the topic with a broad overview. A good introduction identifies the topic, provides context and provokes interest.
You may use Grammarly guide "Here's How to Write an Introduction (with Examples and Tips)". (https://www.grammarly.com/blog/how-to-write-an-introduction/)

Content Pages: You will use these pages to communicate the ideas and concepts that will drive your audience towards your pre-set learning objective. Remember to offer a variety of multimedia assets to maintain your learners' interest.

Quiz Questions: Quizzes offer learners an opportunity to review what they've learned and ensure they understand the key concepts of your course. We recommend including 3-5 quiz questions at the back-end of your course.

Conclusion Page: You've made it! Your conclusion should briefly restate the main points of your course. We also recommend including a final thought that highlights the significance of what's been learned and a call to action that spurs your learners on!

Content Structure
You may use the guide "The DIY Guide to Converting Existing Content into an eLearning Course". (https://www.shiftelearning.com/blog/bid/346397/the-diy-guide-to-converting-existing-content-into-an-elearning-course)

Annex IV: Online training course: "Standardized training on CBRN Terrorism for first responders"

Section A

The format of this type of course, with the contribution of a trainer (s) is as follows:

1. Introduction

1.1 Purpose of the online course:

Understanding the context and procedural actions to be taken to assess the operational situation, plan the intervention and carry out the intervention in case of CBRN terrorist attacks. The course is in the advanced training course category.

1.2 Learning Objectives:

- Training skills on assessing the operational situation through risk analysis
- Acquisition of knowledge on planning and conducting intervention in the event of terrorist attacks of the CBRN type
- Application of decontamination and first aid procedures specific to CBRN terrorist attacks

1.3 Target group:

The course will be organized for a maximum number of 18 people (5 days):
- 5 students from the private emergency service of Tuzla airport
- 5 students from the medical staff of the Central Military Hospital
- 6-8 students from the PROECO-CBRNE staff personal

Maximum 16 students per series.

1.4 Training Methods:

  a. Interactive presentation in groups and individually;
  b. Involving group work and study cases;
  c. Self-learning.

1.5 Timeline: The course takes place over 5 working days.

1.6 Training evaluation: the evaluation of the course is done through a test. Students who pass the test receive a diploma to complete the course which certifies the skills acquired.

2. Thematic contents of the course:

Module 1: Terrorist attack with toxic fighting substances
  Lesson 1.1: Operational specificities of terrorist attacks with toxic combat substances. Alarming, planning, execution of the intervention and ensuring the protection of the intervention personnel.
  Lesson 1.2: Particularities on decontamination and provision of emergency medical care in case of terrorist attack with toxic fighting substances. Safety and security first responder measures.
Module 2: Terrorist attack with biological agents
  Lesson 2.1: Operational specificities of terrorist attacks with biological agents. Epidemiological investigations, medical treatments, and prophylaxis of affected people. Ensuring the protection of intervention personnel.
  Lesson 2.2: Particularities regarding the initiation of disease prevention and measures for decontamination of the environment in case of terrorist attack with biological substances. Safety and security first responder measures.
Module 3: Terrorist attack on reactors or nuclear power plants.

Lesson 3.1: Operational specificities of terrorist attacks on reactors or nuclear power plants.
Lesson 3.2: Particularities on planning, intervention and limiting the effects of terrorist attacks on reactors or nuclear power plants. Safety and security first responder measures.
Module 4: Terrorist attack with radioactive substances
Lesson 4.1: Operational specificities of terrorist attacks with radioactive substances.
Lesson 4.2: Particularities regarding the assessment and decontamination of the affected persons, equipment and infrastructure. Safety and security first responder measures.

Thematic on-line planning course

The day on the platform	Time slot	Duration	Working format	Activity	Session content
Day 1	08.00-08.55	55	**Asynchronous**	**Self-learning**	**Course support study and administrative issues**
	09.00-10.30	90	**Synchronously**	**Interactive presentation**	Module 1- Lesson 1.1
	10.35-11.30	55	**Asynchronous**	Application 1	Case study 1
	11.40-12.10	90	**Synchronously**	**Interactive presentation**	Module 1- Lesson1.2
	15.00-16.30	90	**Asynchronous**	**Self-learning**	Module 2
Day 2	09.00-10.30	90	**Synchronously**	**Interactive presentation**	Module 2- Lesson 2.1
	10.35-11.30	55	**Asynchronous**	Application 2	Case study 2
	11.40-12.10	90	**Synchronously**	**Interactive presentation**	Module 2- Lesson 2.2
	15.00-16.30	90	**Asynchronous**	**Self-learning**	Module 3
Day 3	09.00-10.30	90	**Synchronously**	**Interactive presentation**	Module 3- Lesson 3.1
	10.35-11.30	55	**Asynchronous**	Application 3	Case study 3
	11.40-12.10	90	**Synchronously**	**Interactive presentation**	Module 3- Lesson 3.2
	15.00-16.30	90	**Asynchronous**	**Self-learning**	Module 4
Day 4	09.00-10.30	90	**Synchronously**	**Interactive presentation**	Module 4- Lesson 4.1
	10.35-11.30	55	**Asynchronous**	Application 4	Case study 4
	11.40-12.10	90	**Synchronously**	**Interactive presentation**	Module 4- Lesson 4.2
	15.00-16.30	90	**Asynchronous**	**Self-learning**	Consultations for the competency assessment test
Total		**1265** training hours			
Day 5	09.00 – 09.30	30	**Participants simultaneously**	**Ask for feedback**	
	09.40-10.40	60	**Participants simultaneously**	**Assessment test**	**Competency assessment**

3. Conclusions

Carrying out an online course on first responder training in the use of CBRN means in case of a terrorist attack is a necessity, because it covers a professional niche that has a special specific. The presence of a trainer / trainers is useful, first of all due to the transfer of practical experience that he / she provides to the students.

<u>Section B</u>

The Purpose of the online course (text only) is to understand the context and procedural actions to be taken to assess the operational situation, plan the intervention and carry out the intervention in case of CBRN terrorist attacks.
The training material shall be organized to cover operational level (advanced training course).

Using only the computer in the training process in this course provides a diverse database, up-to-date lessons and an unbiased assessment of the knowledge gained by the students.

1. Requirements relating to the course

Target group

The course is aimed primarily at people who have a CBRN introductory course, to specialize in ensuring the safety and protection of the population against terrorist attacks using CBRN means.

The course will be organized for a maximum number of 20 people (5 days).

The Training Methods are:

a.   Tests, case studies, etc.
b.   Self-learning.

Timeline of the course:

The course takes place over 5 days (4 days of training and 1 day of final evaluation)

The training online platform contains a database from which the student downloaded the content of lessons, case studies, etc. The download of the materials will be done at the rate of 1 module per day.

2. Learning Objectives

At the end of the course, students must practice and apply the following skills:
  - Training skills on assessing the operational situation through risk analysis
  - Acquisition of knowledge on planning and conducting intervention in the event of terrorist attacks of the CBRN type
  - Application of decontamination and first aid procedures specific to CBRN terrorist attacks

3. Introduction (why it is necessary and useful to participate in this course)

Achieving significant resilience to terrorist attacks using CBRN means is one of the EU's strongest directions for action.

In the above-mentioned documents, it is considered that chemical attacks are becoming increasingly easier to carry out because the knowledge barrier is low and equipment and materials are readily accessible.

In the same time, biological threats remain a continuing threat with evidence that terrorist groups are experimenting with such weapons.

Similar, the use of radiological weapons is considered to be a lower threat in terms of probability of use and severity of consequences.

For example, in 2014, the European Commission noted that 150 cases of trafficking of radiological and nuclear materials are reported annually to the Incident and Trafficking database of the International Atomic Energy Agency (IAEA).

Nuclear weapons comprise explosives and the means for their delivery. Use of such weapons by a rogue state or terrorist group would result in devastating consequences through the powerful blast and exposure to thermal radiation with far-reaching effects into the future through the presence of residual radiation.

The biggest threat from a nuclear incident is more like to come from a major accident or a cyber-attack on a nuclear facility.

Regardless of organizational setup, each nation has, for example, some kind of decontamination capability, procedures for mass-casualty management, communication protocols, et cetera.

Focusing on improving capabilities and structuring the functions themselves is therefore a fruitful way of reducing fragmentation and improving the resilience against CBRN incidents both, at national and at EU level.

Efficient and standardized planning involving well-defined, standardized practices together with a well-rehearsed preparedness in all stages of emergency response will lead to better use of available resources.

The above analyzes did not address the role of added value to resilience which I can offer the preparation of first responders through standardized training courses online.

In the following, we will present such a standardized online operational course that will ensure a minimum level of first responders' skills in any EU country. It should be noted that this type of course was designed to be conducted automatically, with the help of a computer, without the intervention of a trainer.

4. Thematic contents of the course:

Module 1: Terrorist attack with toxic fighting substances
    Lesson 1.1: Operational specificities of terrorist attacks with toxic combat substances. Alarming, planning, execution of the intervention and ensuring the protection of the intervention personnel.
    Lesson 1.2: Particularities on decontamination and provision of emergency medical care in case of terrorist attack with toxic fighting substances. Safety and security measures for first responder. Study case 1
Module 2: Terrorist attack with biological agents
    Lesson 2.1: Operational specificities of terrorist attacks with biological agents. Epidemiological investigations, medical treatments and prophylaxis of affected people. Ensuring the protection of intervention personnel.
    Lesson 2.2: Particularities regarding the initiation of disease prevention and measures for decontamination of the environment in case of terrorist attack with biological substances. Emergency medical measures. Safety and security measures for first responder. Study case 2
Module 3: Terrorist attack on reactors or nuclear power plants.
    Lesson 3.1: Operational specificities of terrorist attacks on reactors or nuclear power plants.
    Lesson 3.2: Particularities on planning, intervention and limiting the effects of terrorist attacks on reactors or nuclear power plants. Emergency medical measures. Safety and security measures for first responder. Study case 3
Module 4: Terrorist attack with radioactive substances
    Lesson 4.1: Operational specificities of terrorist attacks with radioactive substances.
    Lesson 4.2: Particularities regarding the assessment and decontamination of the affected persons, equipment and infrastructure. Safety and security measures for first responder. Emergency medical measures. Study case 4

5. Quiz Questions

After 4 days (all course materials have been downloaded), the student will be able to access the final evaluation questionnaire, with 18 questions (one question is scored with 0.5 and 1 point being awarded ex officio).

The computer will take the correct ones from the answer grid, calculating the final score obtained. The minimum score required to complete the course is 7.00.

6. Conclusion

This type of course is very useful when students cannot physically participate in the course (too long distances, high logistical costs, lack of specialized trainers in the field).

It addresses a topical issue, including the medium and long term, taking into account the dynamics of the terrorist phenomenon at regional and global level.

References

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- HOME-CBRN-AG@ec.europa.eu

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Annex V: Online training course format: "Safety and security first responder - operational level"

Section A

The format of this type of course, with the contribution of a trainer (s) is as follows:

1. Introduction

1.1 Learning Objectives:
- Training skills on assessing threats and risks to the safety and security of the first responder in emergency situations
- Training practical skills in the application and adaptation of standardized operational procedures for ensuring first responder safety and security in the intervention area
- Training in ensuring the psychological protection of the first responder in emergency situations

1.2 Target group

The course will be organized for a maximum number of 15 people per series (4 days):

1.3 Training Methods:
  a. Interactive presentation in groups and individually;
  b. Involving group work and study cases;
  c. Self-learning.

1.4 Timeline: The course takes place over 4 working days.
1.5 Training evaluation: the evaluation of the course is done through a test. Students who pass the test receive a diploma to complete the course which certifies the skills acquired.

2. Thematic contents of the course:

Module 1: Operational specificities of first responder safety and security in emergency situations
  Lesson 1.1: Safety and security in emergency situations at operational level - definitions, concepts and legislative aspects
  Lesson 1.2: Purpose, objectives and role of specific measures to ensure the safety and security of the first responder in emergency   situations
Module 2: Assessing the safety and security threats and risks of the first responder, specific to the area of intervention
  Lesson 2.1: Identify the threats and risks regarding the safety and security of the first responder, specific to the area of intervention at the operational level
  Lesson 2.2: Security and security threat and risk analysis for the first responder - at the operational level
Module 3: Methods for reducing the safety and security risks of the first responder in the area of intervention, at operational level
  Lesson 3.1: Practical application and adaptation of standardized operational procedures for ensuring first responder safety and security in the intervention area
  Lesson 3.2: Ensuring the psychological protection of the first responder in emergency situations

Thematic online planning course

The day on the platform	Time slot	Duration	Working format	Activity	Session content
Day 1	08.00-08.55	55	Asynchronous	Self-learning	Course support study and administrative issues

	09.00-10.30	90	Synchronously	Interactive presentation	Module 1- Lesson 1.1
	10.35-11.30	55	Asynchronous	Application 1	Case study 1
	11.40-12.10	90	Synchronously	Interactive presentation	Module 1- Lesson 1.2
	15.00-16.30	90	Asynchronous	Self-learning	Module 2
Day 2	09.00-10.30	90	Synchronously	Interactive presentation	Module 2- Lesson 2.1
	10.35-11.30	55	Asynchronous	Application 2	Case study 2
	11.40-12.10	90	Synchronously	Interactive presentation	Module 2- Lesson 2.2
	15.00-16.30	90	Asynchronous	Self-learning	Module 3
Day 3	09.00-10.30	90	Synchronously	Interactive presentation	Module 3- Lesson 3.1
	10.35-11.30	55	Asynchronous	Application 3	Case study 3
	11.40-12.10	90	Synchronously	Interactive presentation	Module 3- Lesson 3.2
	15.00-16.30	90	Asynchronous	Self-learning	Consultations for the competency assessment test
Total		**940** training hours			
Day 4	09.00 – 09.30	30	Participants simultaneously	Ask for feedback	
	09.40-10.40	60	Participants simultaneously	Assessment test	Competency assessment

3. Conclusions

Conducting an online training course for first responders in order to ensure their safety and security at the operational level is a necessity, as it covers a professional niche that has a special specific. The presence of a trainer / trainer is useful, first of all due to the transfer of practical experience that he / she offers to the students.

Section B

The format of this type of course (text only), without the contribution of a trainer (s) is as follows:
The course is addressed to students who have completed the first responder security and safety course at tactic level and want to complete their portfolio of skills to hold, at a minimum, the position of head of search-rescue team or officer in charge of intervention operations in the training center. operational command.
Students are given the skills to use the safety and security procedures on the first responder during the deployment in the intervention area, to develop and implement security plans for the intervention teams deployed in the field, to analyze and evaluate the local environments. safety and security, to develop mission risk assessments and to adapt standardized first responder safety and security procedures to changes in the environment in which they operate.
The training material shall be organized to cover operational level (advanced training course).

1. Requirements relating to the course

Target group
The course is primarily aimed at people who have an introductory course on search-and-rescue actions and want to specialize in ensuring the safety and recurrence of the first responder.
The course will be organized for a maximum of 20 people (4 days).

The Training Methods are:

a. Tests, case studies, etc.
b. Self-learning.

Timeline of the course:
The course takes place over 4 days (3 days of training and 1 day of final evaluation)
The training online platform contains a database from which the student downloaded the content of lessons, case studies, etc. The download of the materials will be done at the rate of 1 module per day.

2. Learning Objectives

At the end of the course, students must practice and apply the following skills:
- Training skills on assessing threats and risks to the safety and security of the first responder in emergency situations
- Training practical skills in the application and adaptation of standardized operational procedures for ensuring first responder   safety and security in the intervention area
- Training in ensuring the psychological protection of the first responder in   emergency situations

3. Introduction (why it is necessary and useful to participate in this course)

In the literature on ensuring the safety and security of first responders in emergency situations, the following statements are considered as obvious truths:" Protecting the First Responders in these instances becomes critical as time-sensitive decisions must be made with limited information. These situations are fraught with potholes for the safety professionals working to protect the responders. A balance must be achieved between the responders' health and safety and the immediate need for action to protect the community. For example, predicting only the worst-case scenario may needlessly keep responders from doing their job expeditiously, or, conversely, not taking any precautions may place them in harm's way" (see https://www.cteh.com/blog-detail/safety-considerations-for-the-first-responder).   The detailing of the specific phases of these two processes has attracted the attention of many specialists in the field (https://hpsdma.nic.in/WriteReadData/LINKS/First%20Responders%20Module%20fb405a5a-8f4a-4b60-a27e-8859c4ae7604.pdf).
It should be noted that this type of course was designed to be conducted automatically, with the help of a computer, without the intervention of a trainer.

4. Thematic contents of the course:

Module 1: Operational specificities of first responder safety and security in emergency situations
Lesson 1.1: Safety and security in emergency situations at operational level - definitions, concepts and legislative aspects
Lesson 1.2: Purpose, objectives and role of specific measures to ensure the safety and security of the first responder in   emergency   situations. Study case 1
Module 2: Assessing the safety and security threats and risks of the first responder, specific to the area of intervention
Lesson 2.1: Identify the threats and risks regarding the safety and security of the first responder, specific to the area of   intervention at the operational level. Study case 2
Lesson 2.2: Security and security threat and risk analysis for the first responder - at the operational level
Module 3: Methods for reducing the safety and security risks of the first responder in the area of intervention, at operational level
Lesson 3.1: Practical application and adaptation of standardized operational procedures for ensuring first responder safety and security in the intervention area. Study case 3

Lesson 3.2: Ensuring the psychological protection of the first responder in emergency situations

5. Quiz Questions

After 3 days (all course materials have been downloaded), on the 4th day of the course, the student will be able to access the final evaluation questionnaire, with 18 questions (one question is scored with 0.5, 1 point being awarded ex officio).

The computer will take the correct ones from the answer grid, calculating the final score obtained. The minimum score required to complete the course is 7.00.

6. Conclusion

Ensuring an intervention (working) environment that optimally ensures the safety and security of the first responder is a necessary and mandatory condition, primarily due to the limited resources available for the training and use of rescuers.

Carrying out an automated online course on a platform is a mandatory step towards achieving the goal proposed above. Also, such a course allows the realization of first responder training courses dedicated to each type of disaster to improve its preparation.

References

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- http://adlnet.gov/adl-research/performance-tracking-analysis/experience-api/

Annex VI: Online training course format: "Safety and security first responder – strategic level"

Section A

The format of this type of course, with the contribution of a trainer (s) is as follows:

1. Introduction

1.1 Learning Objectives:

Students are given practical skills to:
- understanding the organization and its context
- understanding the needs and expectations of first responders and other interested parties
- assess of security and safety for first responder risks to the management system
- determining the scope and objectives of the security and safety management system
- establish, implement and maintain a security and safety for first responder policy
- the implementation of organizational roles, responsibilities and authorities
- planning action, control and eliminating hazards and reducing risks regarding the security and safety of first responder
- procurement proceeding
- monitoring, measurement, analysis and performance evaluation of security and safety of first responder management system

1.2 Target group

The course will be organized for a maximum number of 15 people per series (4 days):

1.3 Training Methods:

    d. Interactive presentation in groups and individually;
    e. Involving group work and study cases;
    f. Self-learning.

1.4 Timeline: The course takes place over 4 working days.

1.5 Training evaluation: the evaluation of the course is done through a test. Students who pass the test receive a diploma to complete the course which certifies the skills acquired.

2. Thematic contents of the course:

Module 1: Understand the organization and its context

Lesson 1.1: The needs and expectations of first responders and other interested parties

Lesson 1.2: Assess of security and safety for first responder risks to the management system

Module 2: The scope and objectives of the security and safety management system

Lesson 2.1: Establish, implement and maintain a security and safety for first responder policy

Lesson 2.2: The organizational roles, responsibilities and authorities

Module 3: planning action, control and eliminating hazards and reducing risks regarding the security and safety of first responder

Lesson 3.1: monitoring, measurement, analysis and performance evaluation of security and safety of first responder management system

Lesson 3.2: Procurement proceeding

Thematic online planning course

The day on the platform	Time slot	Dura tion	Working format	Activity	Session content
Day 1	08.00-08.55	55	Asynchronous	Self-learning	Course support study and administrative issues
	09.00-10.30	90	Synchronously	**Interactive presentation**	Module 1- Lesson 1.1
	10.35-11.30	55	Asynchronous	Application 1	Case study 1
	11.40-12.10	90	Synchronously	**Interactive presentation**	Module 1- Lesson 1.2
	15.00-16.30	90	Asynchronous	Self-learning	Module 2
Day 2	09.00-10.30	90	Synchronously	**Interactive presentation**	Module 2- Lesson 2.1
	10.35-11.30	55	Asynchronous	Application 2	Case study 2
	11.40-12.10	90	Synchronously	**Interactive presentation**	Module 2- Lesson 2.2
	15.00-16.30	90	Asynchronous	Self-learning	Module 3
Day 3	09.00-10.30	90	Synchronously	**Interactive presentation**	Module 3- Lesson 3.1
	10.35-11.30	55	Asynchronous	Application 3	Case study 3
	11.40-12.10	90	Synchronously	**Interactive presentation**	Module 3- Lesson 3.2
	15.00-16.30	90	Asynchronous	Self-learning	Consultations for the competency assessment test
Total		**940** training hours			
Day 4	09.00 – 09.30	30	Participants simultaneously	Ask for feedback	
	09.40-10.40	60	Participants simultaneously	Assessment test	Competency assessment

3. Conclusions

Conducting an online training course for first responders in order to ensure their safety and security at the strategic level is a necessity, as it covers a professional niche that has a special specific. The presence of a trainer / trainer is useful, first of all due to the transfer of practical experience that he / she offers to the students.

Section B

The format of this type of course (text only), without the contribution of a trainer (s) is as follows:

The course is addressed to students who have completed the first responder security and safety course at tactic level and want to complete their portfolio of skills to hold, at a minimum, the position of head of search-rescue team or officer in charge of intervention operations in the center command.

Students are given the skills to use the safety and security procedures on the first responder during the deployment in the intervention area, to develop and implement security plans for the intervention teams deployed in the field, to analyze and evaluate the local environments. safety and security, to develop mission risk assessments and to adapt standardized first responder safety and security procedures to changes in the environment in which they operate.

The training material shall be organized to cover operational level (advanced training course).

It should be noted that this type of course was designed to be conducted automatically, with the help of a computer, without the intervention of a trainer.

1. Requirements relating to the course

Target group
The course is addressed to people in the management subsystem of entities working in the field of emergency management, with a focus on search and rescue operations, who have completed the course at the operational level. The course will be organized for a maximum number of 20 people per series (3 days training and 1 day evaluation).

The Training Methods are:
   a.   Tests, case studies, etc.
   b.   Self-learning.

Timeline of the course:
The course takes place over 4 days (3 days of training and 1 day of final evaluation)
        The training online platform contains a database from which the student downloaded the content of lessons, case studies, etc. The download of the materials will be done at the rate of 1 module per day.

2. Learning Objectives

At the end of the course, students must practice and apply the following skills:
   -   understanding the organization and its context
   -   understanding the needs and expectations of first responders and other interested parties
   -   assess of security and safety for first responder risks to the management system
   -   determining the scope and objectives of the security and safety management system
   -   establish, implement and maintain a security and safety for first responder policy
   -   the implementation of organizational roles, responsibilities and authorities
     - planning action, control and eliminating hazards and reducing risks regarding the security
        and safety of first responder
   -   procurement proceeding
     - monitoring, measurement, analysis and performance evaluation of security and safety of
        first responder management system

3. Introduction (why it is necessary and useful to participate in this course)

        Any organization operating in the field of emergency management (state, private, voluntary, etc.) is responsible for the health, safety and security of workers (including first responders) and others who may be affected by its activities. This responsibility includes promoting and protecting their physical and of mental health.
        In the literature on ensuring the safety and security of first responders in emergency situations, the following statements are considered as obvious truths:" Protecting the First Responders in these instances becomes critical as time-sensitive decisions must be made with limited information. These situations are fraught with potholes for the safety professionals working to protect the responders. A balance must be achieved between the responders' health and safety and the immediate need for action to protect the community. For example, predicting only the worst-case scenario may needlessly keep responders from doing their job expeditiously, or, conversely, not taking any precautions may place them in harm's way".
        The implementation and optimal functioning of a management system that ensures the security and safety of the first responder depends, in order to achieve the desired results, on a number of key factors, which may include:
   a) top management leadership, commitment, responsibilities and accountability
      b) top management developing, leading and promoting a culture in the organization that
         supports the intended outcomes of   the security and safety-first responder management
         system

c) communication

d) consultation and participation of workers, and, where they exist, workers' representatives

e) allocation of the necessary resources to maintain it

f) security and safety-first responder policies, which are compatible with the overall strategic objectives and direction of the organization

g) effective process(es) for identifying hazards, controlling OH&S risks and taking advantage of security and safety-first   responder opportunities

h] continual performance evaluation and monitoring of the security and safety-first responder management system to improve   security and safety-first responder performance

The detailing of the specific phases of these two processes – security and safety - has attracted the attention of many specialists in the field.

The level of detail, the complexity, the extent of documented information and the resources needed to ensure the success of an organization's security and safety-first responder management system will depend on a number of factors, such as:

- the organization's context [e.g., number of workers, size, geography culture legal requirements and other requirements)

- the scope of the organization's security and safety-first responder management system

- the nature of the organization's activities and the related security and safety-first responder risks

It should be noted that this type of course was designed to be conducted automatically, with the help of a computer, without the intervention of a trainer.

4. Thematic contents of the course:

Module 1: Understand the organization and its context

Lesson 1.1: The needs and expectations of first responders and other interested parties

Lesson 1.2: Assess of security and safety for first responder risks to the management system. Study case 1

Module 2: The scope and objectives of the security and safety management system

Lesson 2.1: Establish, implement and maintain a security and safety for first responder policy. Study case 2

Lesson 2.2: The organizational roles, responsibilities and authorities

Module 3: planning action, control and eliminating hazards and reducing risks regarding the security and safety of first responder

Lesson 3.1: monitoring, measurement, analysis and performance evaluation of security and safety of first responder management system. Study case 3

Lesson 3.2: Procurement proceeding

5. Quiz Questions

After 3 days (all course materials have been downloaded), on the 4th day of the course, the student will be able to access the final evaluation questionnaire, with 18 questions (one question is scored with 0.5, 1 point being awarded ex officio).

The computer will take the correct ones from the answer grid, calculating the final score obtained. The minimum score required to complete the course is 7.00.

6. Conclusion

Carrying out an automated online course on a platform is a mandatory step towards achieving the goal proposed above. Such a course also allows for the preparation of training courses for the heads of emergency structures or the coordinators of intervention actions to improve their managerial training, especially regarding the organization, functioning and adaptation to change of civil emergency structures.

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