Creation of CBRNE protection system for large area shopping malls

WARNING BOOK

FOR CBRNE THREATS IN SHOPPING MALLS

Co-funded by the Internal Security Fund
of the European Union
Grant Agreement No. 861643 - Mall-CBRN

mall-cbrn.uni.lodz.pl

Creation of CBRNE protection system for large area shopping malls

WARNING BOOK

FOR CBRNE THREATS IN SHOPPING MALLS

Co-funded by the Internal Security Fund
of the European Union
Grant Agreement No. 861643 - Mall-CBRN

mall-cbrn.uni.lodz.pl

Creation of CBRNE protection system for large area shopping malls

MALL-CBRN CONSORTIUM

University of Lodz, PL (coordinator)
www.uni.lodz.pl

Military Institute of Chemistry and Radiometry, PL
www.wichir.waw.pl

International Security and Emergency Management Institute, SK
www.isemi.sk

National Institute of Aerospace Technology, ES
www.inta.es

Hellenberg International, FI
www.hellenberg.org

ATRIUM Promenada, PL
www.warszawa.promenada.com/en

Military Institute of Hygiene and Epidemiology, PL
www.wihe.waw.pl

Co-funded by the Internal Security Fund
of the European Union
Grant Agreement No. 861643 - Mall-CBRN

mall-cbrn.uni.lodz.pl

Document description

WP number and title	WP3-Identification of most likely CBRNe scenarios
Lead Beneficiary/ Author(s)	ISEMI
Contributor(s)/ Author(s)	UNILODZ, INTA, ATRIUM PROMENADA, HELLENBERG INT, MIHE,
Document type	Report
Last Update	18/01/2023 V.1.0
Dissemination level	**Public**

Acknowledgement
This project is funded by the European Union's Internal Security Fund — Police
Grant Agreement No. 861643 — Mall-CBRN

Disclaimer
The content of this document represents the views of the author only and is his/her sole responsibility. The European Commission does not accept any responsibility for uses that may be made of the information it contains.

This work is licensed under the Creative Commons Attribution 4.0 International Licence. To view a copy of this license, visit creativecommons.org/licenses/by/4.0/ with relevant national copyright provisions to be applied accordingly.

NOTE: Third party images have been used in this work in accordance with applicable fair use provisions for educational and demonstration purposes only. Relevant copyright or other rights apply accordingly. References to third party products are not commercial endorsements.

The material for this publication was developed and reviewed by the Mall-CBRN consortium and Advisory Board

CONTENT:

1. GENERAL 9
1.1. OBJECT OF THE DOCUMENT 9
1.2. DESCRIPTION OF THE CONCERNED WORK PACKAGE 9
1.3. LIST OF ACRONYMS 10
2. WARNING BOOK METHODOLOGY PRESENTATION 11
2.1. CBRN MALL WARNING BOOK APPROACH 13
2.2. DEFINITION OF CBRN INCIDENT 15
2.3. CHEMICAL THREAT SCENARIO STRUCTURE 16
2.4. BIOLOGICAL THREAT SCENARIO STRUCTURE 28
2.5. RADIOLOGICAL THREAT SCENARIO'S STRUCTURE 32
2.6. SCENARIO PRIORITISATION STRATEGY WITHIN THE VULNERABILITY 37
ASSESSMENT 37
2.7. SCENARIO TEMPLATE 57
TABLES 60
FIGURES 60
SOURCES 61
ANNEXES 63
1.1 Chemical scenario - ESCALATOR 64
1.2 Chemical scenario - PARKING GARAGE UNDERGROUND 67
1.3 Chemical scenario – HVAC 70
1.4 Chemical scenario - FLOOR SCRUBBER MACHINE 73
1.5 Chemical scenario - HAND SANITISER 76
1.6 Chemical scenario - REFILED DISINFECTANT FOGGER SPRAY CAN 79
1.7 Chemical scenario - RELEASE OF THE TOXIC AGENT IN A MALL 82
1.8 Chemical scenario – PERFUMERY 85
1.9 Chemical scenario - GLITTER BOX 88
1.10 Radiological scenario - OUTLET STORE 91
1.11 Radiological scenario - DIRTY BOMB 94
1.12 Radiological scenario - COLOUR SMOKE 97

1.13 Radiological scenario - SHOPPING CART HANDLES 101

1.14 Radiological scenario - INDOOR PLAYGROUND..... 104

1.15 Biological scenario - FIRE SUPPRESSION SYSTEM..... 107

1.16 Biological scenario - RESTROOMS – CONTAMINATED TOILET PAPER..... 110

1.17 Biological scenario - AIR-VENTILATION SYSTEM..... 113

1.18 Biological scenario - CONTAMINATION OF MUSTARD/ MAYONNAISE/ KETCHUP IN A FOOD COURT WITH A BIOLOGICAL AGENT 116

1.19 Biological scenario – BALLOONS..... 119

1.20 Biological scenario - FLOWER HUMIDIFIER 122

1.21 Biological scenario - 5D – SPECIAL EFFECT CINEMA..... 125

INTRODUCTION

Chemical, biological and radiological threats are currently emerging. European society must take into consideration the associated risks. Potential targets that are vulnerable to be found in the epicentre of the attack include large gatherings of people, and places of continuous rotation of people. These two key features characterise the large shopping malls which are "perfect" soft target to perform attack on large number of people and to cause a panic in public spaces. The next huge threat is food terrorism. This kind of incident seems to be a very simple to execute and can cause a huge public panic. Current records related with ISIS organisation (the notice addressed to Islamic terrorists ISIS advice how use poisons to pinioning food in storage in Europe - classified report - EDOC#: 920826) indicate that this terrorist group encourages this type of action. Using dangerous agents in food and beverages as a way of carrying out terrorist attack is getting much more real than ever before. Therefore, this project addresses this threat in the areas of big shopping centres. For all of these reasons we decide create our project proposal which main objective is increasing safety of EU MS society using daily the services of large-area shopping malls. We want to create comprehensive program of prevention and response to CBRNe threats (CBRNe response system) and food defence programme in one of the most endangered public spaces area – the large area shopping malls. As the subject of the project is an innovative solution opening a new dimension of CBRN's internal security in the European Union at the level of large-area shopping centres we assume that this project will increase capacity of mitigation of CBRNe risks in the territory of the European Union and increase safety of European citizens. Additionally, the CBRN Mall project will generate a common European understanding about new type of soft targets potentially exposed on a CBRN incidents

CBRN Mall has two specific objectives with short term effects:

- Gaps analysis in security systems of shopping malls where our consortium experts together with associated advisory team members (composed of Police Officers from various EU MS) will check all procedures, equipment and knowledge of internal security services of selected shopping malls in the EU territory.
- Identification of most likely scenarios of terrorist acts with CBRN substances in the area of shopping malls where our consortium experts and internal security representatives as well as advisory team members will discuss and create a list of most possible threats and define the terms for best prevention measures.

There will be other specific objectives with long-term effects:

- Recommendation for response procedure to CBRNe terrorist act dedicated to shopping malls internal security services. This objective will include preparation of special materials with fundamental knowledge as well as procedures of recognition and response to CBRNe hazards. Additionally, thanks to our advisory board members we will prepare short guidelines dedicated to better communication and cooperation between shopping malls' internal security services and law enforcement services arriving at the action scene.
- Equipment recommendation for detection of CBRNe hazards, which will be specially adjusted to the level of knowledge and skills of internal security services as well as the matching specification of working places.

- Capacity building - series of CBRNe training dedicated to representatives of shopping malls who will get knowledge to implement developed CBRNe protection system in their own facilities. These training will be carried out by consortium CBRNe experts as well as the representative of law enforcement institutions which give completive preparation of trainees to performing their tasks. These trainings will be also offered after project implementation comes to the end and will be available for all EU MS stakeholders.

In line with consortium compliance, the classification of chemical hazard groups was made on the basis of REGULATION (EC) No 1272/2008. Classification, labelling and packaging of substances and mixtures are understandable and familiar to the incident and medical first responders. Such classification is also sufficient for risk analysis, prevention and preparedness planning in civilian institutions, performed by management and staff including security staff.

1. GENERAL

1.1. OBJECT OF THE DOCUMENT

This document is the DL 3.2 deliverable of the project: List of most-likely CBRNe Scenarios – Warning book.

#	WP	Title	Lead beneficiary	Type	Dissemination level
1.	WP3	3.2 Preparation of the most likely CBRNs scenarios list (warning book)	ISEMI	Electronic	"Unclassified" "EU Restricted"

1.2. DESCRIPTION OF THE CONCERNED WORK PACKAGE

There are a lot of different potential ways of use of CBRNe agents in a soft target of the type of shopping mall, taking in a large number of people. The objective of this WP is to create a list and examples of the most possible CBRNe threats which can appear in this type of public spaces.

The CBRNe act can be performed in two ways: (1) in the form of a hidden attack or (2) during a public terrorist operation (attack). We intend to focus on both types of potential threats and create a list of the most likely scenarios in shopping malls.

Additionally, in this WP the intention is to focus on the very urgent and dangerous possibility of dispersion of CBR agents by a home-made dispersion system.

WP3 is split into 3 activities:

- A.3.1. Expert meeting. This meeting is necessary to perform different consultations among the experts as well as brainstorm for sketching the potential ways of CBRNe attacks on the shopping malls. During this meeting team leader will be nominated who will coordinate the work and separate the tasks according to the specializations of individual experts. This meeting will be the main departure point and guideline for the next activity.
- A.3.2. Preparation of most likely CBRNe scenarios list (warning book). During this activity, all experts participating in the current WP will elaborate examples of potential scenarios which are in their opinion most dangerous and most likely to happen in the shopping malls.
- A.3.3. Preparation of examples of home-made CBR agent dispersion system. This activity is focused on a novel and very dangerous threat which are home-made dispersion systems. During the implementation of this activity, we will prepare an example of a homemade dispersion system which can be "potentially" used durian attacksack on crowded places.

1.3. LIST OF ACRONYMS

Acronym	Description
AT	Acutely toxic
C/B	Chemical and Biological
CBRNe	Chemical, Biological, Radiological, Nuclear, Explosive
CLP	Classification of labelling and packaging
CCTV	Closed-Circuit Television
CMG	Carcinogenic, mutagenic, germ-toxic
CORR ED	Corrosive – eye-damaging
EC	European Commission
EH	Environmental Hazard
EOD	Explosive Ordnance Disposal
EX	Explosive
FL	Flammable
GUP	Compressed gas vessel
IEDs	Improvised explosive devices
IPE	Individual protective equipment
IN	Incapacitating agents
OX	Oxidizer
PO	Substances having a pungent odour
RAD	Radiological (risk)
RCA	Riot control agent
RDD	Radiological Dispersion Devise
RED	Radiological Exposure Devise
SEN	Sensitizing
SM	Shopping mall
STOT SE	Selective target organ toxic single exposure
STOT RE	Selective target organ toxic repeated exposure
TIM	Toxic Industrial Material
UAV	Unmanned Aerial Vehicles
UGV	Unmanned Ground Vehicles
WP	Work-Package

2. WARNING BOOK METHODOLOGY PRESENTATION

The scenarios developed in the framework of the Mall-CBRN project represent a set of complete and realistic situations and events involving CBR agents to which the first and second responders may be confronted in shopping malls. The main objective of the Warning book is to provide the support to Shopping Mall Management Level and Law Enforcement Agencies in recognition of the potential CBRN threat present in Shopping Malls and to reinforce awareness, prevention and preparedness for any CBRN attack.

Note: Unclassified version of the Warning book doesn't contain details that should be classified, however the sensitivity of provided information doesn't allow to disseminate of this deliverable to a wide public. Therefore, the list of scenarios doesn't represent the full picture of modus operandi, relevant CBR agents with specific characteristics and their quantity and the whole consequences description. It covers the basic description of potential modus operandi, group of agents and warning signs to be detected visually, through the ICT tools or specific detection devices.

Scenario development is generally a methodology for predicting future events. As part of the prevention of potential CBRNe terrorist threats, there are various methods of compiling them. It depends on the terrorist goals, intentions and expected output. The Scenarios can be qualitative or quantitative, simple, general or complex and detailed, exploratory or anticipatory. When developing scenarios, it is necessary to use the methodology of gradual systematic steps.

As Hildering (1) points out in relation to the development of health impact scenarios, it is important in particular to:

1. select and create a topic framework;
2. identify driving forces and their effects on public health using a conceptual model;
3. choose spatial and time scale (i.e. place and time horizon),
4. define the logic of the scenario (i.e. the arrangement of the driving forces given by the spatial and temporal scale, e.g. by formulating a one-axis or multi-axis spectrum),
5. determine the type of scenario (qualitative or quantitative or their combinations, recast or forecast)
6. select tools, such as computer simulation models.

Authors of FEWS NET (2) further state, the compilation of the most probable scenarios in the field of food security is based on the convergence of evidence. The FEWS NET methodology cannot be fully applied to the conditions of CBRNe terrorism, but we can adapt some of the eight defined steps to our needs.

One of the main challenges of terrorist risk assessment is to estimate the likelihood of terrorist attacks. There are valid theories that a terrorist attack is not an accidental event, but a deliberate action based on the assessment of the perpetrators of the act and it is related to their abilities and the vulnerability of the target. If we intend to link probability to a terrorist attack, emphasis must be placed on human and behavioural factors.

This is mainly related to the intentions and goals of terrorists, their preferences, the system of values and the decision-making mechanism. As Reznikov, Makhutov and Akhmetkhanov (3) point out, this makes it possible to assess the probability of different attack scenarios. Their probability is therefore a function of the successful implementation of the scenario and their preferences in relation to the expected consequences.

Reznikov, Makhutov and Akhmetkhanov offer an interesting model of terrorist scenarios.

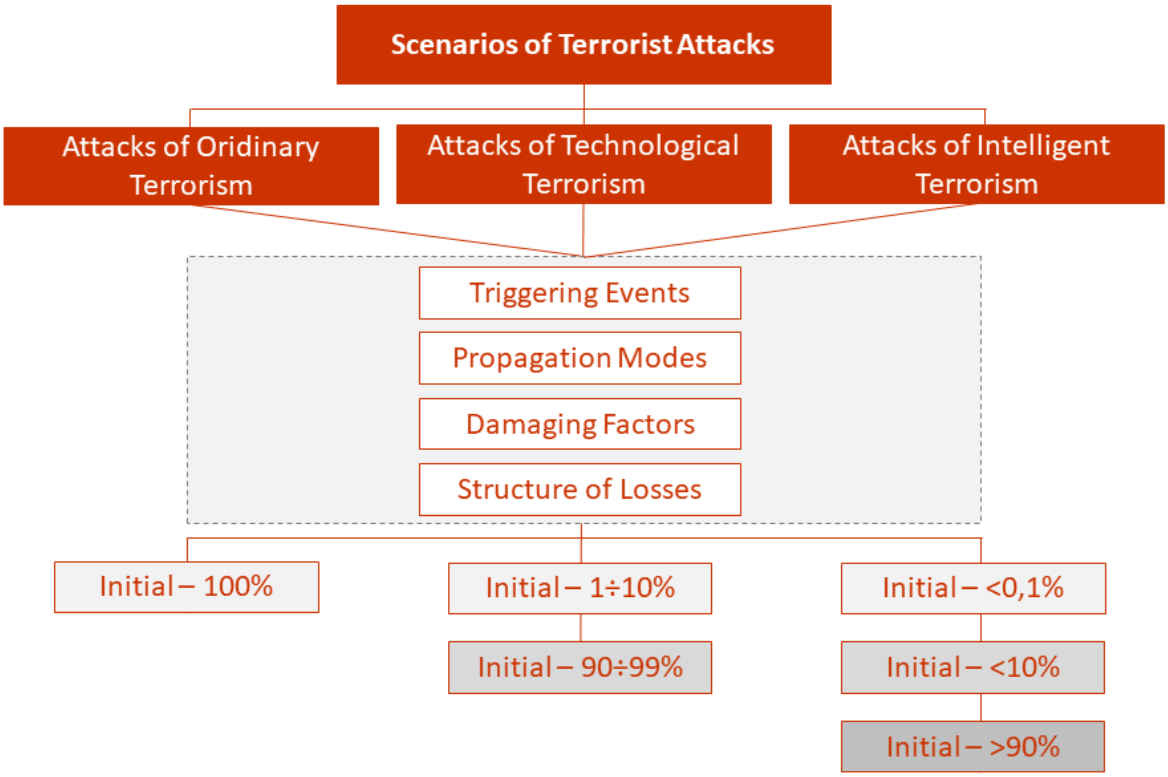


Figure 1: **Terrorist scenarios structure.**

When considering potential terrorist scenarios, we need to consider several factors. These include the dynamism of the processes, the ability and knowledge of terrorists to choose the scenario, the complexity of the threats over time and their association with the vulnerability of the target and, ultimately, a high degree of uncertainty.

In this context, Reznikov, Makhutov and Akhmetkhanov discuss the high level of dynamism of terrorist scenarios compared to scenarios of natural disasters and unintentional incidents. The dynamism of processes is mainly related to developments in the field of new technologies. Terrorists know how to react and adapt their actions to established barriers to successfully avoid them.

The choice of scenarios by terrorists (location, time, type of attack and type of means) is related to their political or religious objectives and is closely linked to the parameters of the target's vulnerability as well as the calculated consequences. Terrorists must therefore have the ability

to analyse the vulnerability matrix and the structure of losses with maximum impact in the form of the destruction of society in CBRNe attacks.

A target vulnerability can be defined as a measure of the likelihood that an attack of a given type will be successful from the moment it is launched. According to Henry H. Willis, Andrew R. Morral, Terrence K. Kelly, Jamison Jo Medby (4), the greatest source of uncertainty comes from estimates of terrorist threats related to the goals, motives, and capabilities of terrorists. The sources of information we have about these factors, such as intelligence, historical analysis, and expert judgment, support only rough estimates of the likelihood of attacks on specific targets.

Consequently, we have to take into account secondary and cascading impacts. However, these are conditioned by uncertain factors. When defining scenarios, it is therefore appropriate to use the methodology of game theory and apply it to the deliberate actions of terrorists.

If we plan to develop scenarios, we cannot forget the complex nature of the terrorist threat. It is characterized by the presence of a terrorist organization in the region or their supporters. This is closely linked to the link between the terrorist threat and the vulnerability of the target and the expected extent of the consequences. It is therefore certain that if we succeed in reducing the vulnerability of the target, in our case Shopping Mall, the level of risk of the terrorist threat will naturally be reduced.

Understandably, we encounter a higher degree of uncertainty when modelling terrorist scenarios. This is mainly due to the connection of the threat with natural factors or circumstances of an artificial nature. It is also related to the complexity of evaluating the values and behaviour of terrorists as well as the human and technical resources at their disposal.

2.1. CBRN MALL WARNING BOOK APPROACH

The scenarios in our proposed Warning book will be based on a generated analysis of the vulnerability assessment of specific shopping malls, previous attacks or attempted attacks, as well as an analysis of trends in terrorism and new technologies. However, they will be drafted as generic with the possibility of application to any shopping mall. We therefore propose a qualitative scenario building process and not a quantitative one for the reasons mentioned above. The most important part of the scenarios will be a behavioural component describing various elements of suspicious behaviour related to the planned attack, alarming events and symptoms after the "open" and "hidden" attack and suspicious objects observed in Shopping Malls.

After consideration of several types of methodologies taking into account two target audiences, we will develop obviously two versions of documents dealing with unclassified and EU restricted data. Unclassified version will be available for the management of SM whilst restricted level documents will be intended for a benefit of DG Home EC and LEA.

The restricted document will comprise the scenarios methodology and scenarios with a particular data of hazardous agents to develop realistic scripting.

Warning Book (unclassified document) will not consist of the scenarios´ methodology, but scenarios description without exact agent's data, alarms triggers, etc. Unclassified document does not fully apply the detailed concept of consequences or likelihood in our methodology. This requires the provision of a large amount of sensitive and accurate data based a risk analysis for a specific location, building and time period.

The likelihood and health consequences of CBRNe attacks depend largely on several unknown factors. Some can be estimated and some not at all. Those that can be estimated due to vulnerability assessment and the potential selection of a specific CBRN agent can be combined into several matrices and detailed scenarios for a specific shopping mall in a specific timeframe. These are, in particular, the modus operandi of the perpetrators, the type of agent with the relevant characteristics and their quantity, the way of dissemination, the routes of entry into the human body, the duration of exposure and the timeline of infection / contamination. They also depend on external conditions such as weather, but also technological equipment such as type of ventilation and air condition in the shopping mall or active and passive barriers. Subsequently, it is necessary to implement a model calculation for each scenario.

However, as already written, above mentioned is not the purpose of the CBRN Mall Warning book. The likelihood and impact consequences will therefore only be described in a basic form without detailed quantification reflecting the restricted but not the confidential level of security.

Impact in our understanding represents the generic values of the loss of human life, direct physical injuries, indirect physical injuries through cross-contamination, psychological traumas suffered by survivors and immediate or subsequent economic losses (destruction of property and infrastructure, disturbed supply chains, increased security costs as the effect of quarantine).

Standard operating procedures in the Vulnerability assessment

Each shopping mall should provide its own vulnerability check in order to be able to subsequently identify gaps, develop scenarios and, thanks to them, quantify the likelihood of and impact consequences.

Therefore, we propose following standard operating procedures:

1. Vulnerability check of the shopping mall

- preparation of the survey/questionnaire for the managers, security services and third parties (categories: personnel knowledge, training, etc.; external parts; internal parts; etc. as in the annex from WP2),
- implementation of the survey via interviews and through personal visit of each Shopping mall premises according to established categories in the survey.

2. Generate gaps from the survey results in several individual categories. Categories may vary depending of the state of art of each shopping mall. Identified gaps will serve for the establishment of categories for the calculation of the likelihood and impact and prioritisation of scenarios.

3. Development of scenarios using the proposed scenario list and identified gaps. Each shopping mall can adapt the scenarios or develop similar scenarios.

4. Attribution of values for calculation of the likelihood and impact consequences according the scenario prioritisation instructions.

5. Calculation of the resulting likelihood and impact tables (see the whole procedure in the part 2.6 Scenario prioritisation strategy within the vulnerability assessment).

6. Final list of prioritisation of scenarios based on which the respective preventive measures have to be drafted.

2.2. DEFINITION OF CBRN INCIDENT

An event in which chemical, biological, radiological or nuclear (CBRN) agents are intentionally or unintentionally released, or in which weapons that are specifically designed to inflict harm through the release of CBRN agents are used, has the potential for affecting the lives, health and well-being of a large number of people, directly from exposure to the released agent and/or indirectly after the release and dispersal of the agent, such as through cross-contamination is called CBRN incident (Gregor Malich, 2015).

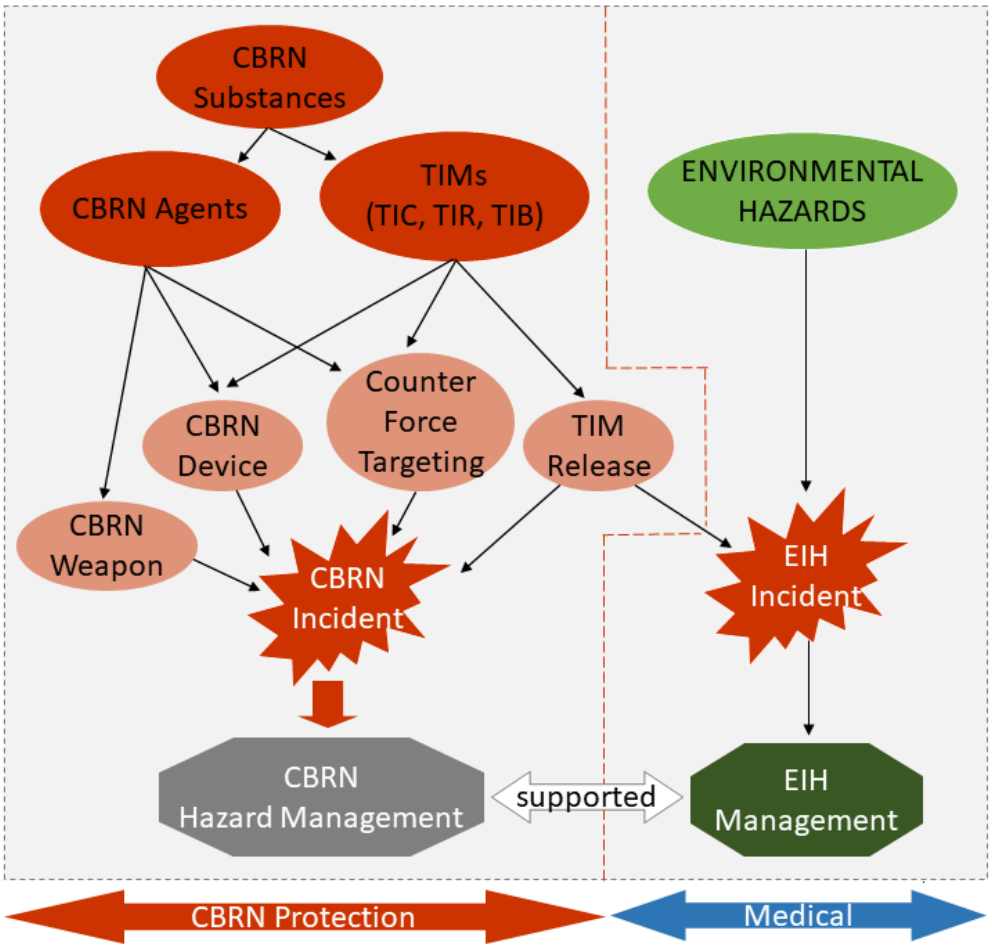


Figure 2: **CBRN Incidents and EIH Incidents.**

Environmental hazards (EH) pose environmental or occupational health concerns similar to those considered under CBRN hazard protection. Although EH may present a danger to life or health, their management need not be emphasised in this document any further. A naturally occurring incident, such as fumes from a volcanic eruption, smoke from forest fires, exposure to pathogenic micro-organisms or low-level radiation from naturally occurring materials is not considered a CBRN incident. Figure 3 (6) represents the common interrelation between CBRN incidents and environmental industrial hazards incidents and the responsibilities of management incident handling.

Generic scenarios will be developed in three main categories according to threats of particular substances (chemical, biological and radiological). Explosives will be affiliated with some of the scenarios.

Subsequently, they will be sorted into clusters according to the type of agents.

2.3. CHEMICAL THREAT SCENARIO STRUCTURE

(note: Cytotoxic proteins as part of chemical agents will be an integral part of biological threats)

Introduction

To communicate chemical hazard within the CBRN universe of discourser (community), some adjustments deem needed. The system of classification and hazard communication that is currently applied in the CBRN community is based on old chemical warfare agent (CWA) classification. That classification was developed mainly for battlefield planning purposes and was based on a limited number of agents having properties tailored for the battlefield. In view of the destruction of old chemical weapons and the presence of large number of hazardous chemicals on the market, the focus on sparse and not-so-easy manufacture of substances limiting the threat to CWA is far from sufficient. A goal of prevention and response to CBRN threats used against civilian populations and spaces requires information that is more in line with hazard classification used in economy and response actions.

A palette of possible substances to be used against civilians and in particular in congested or enclosed spaces is much larger. E.g. out of 18000 chemical substances registered under REACH (7) Regulation and thus more or less available on the EU market, about 1000 are classified as acutely toxic in category 1 (deadly).

Assessment of the current situation

The currently used classification of chemical CBRN agents has been derived from the traditional classification of chemical warfare agents, expanded by two generic categories: riot control agents and toxic industrial chemicals. Such classification is internally inconsistent, as it:

- in the case of Nerve, Blister, Choking and Blood agents, it partially refers to toxicological effects
- in the case of an incapacitating agent, it refers a to generalized description of the action on the human organism

- in the case of riot control agents (RCA), it refers to the purpose of use
- in the case of toxic industrial chemicals (TIC), it refers to the conjunction of one (out of several) of the hazardous properties: toxicity and placement of a substance in the economy, represented by the term "industrial chemical". Moreover, there is no uniform understanding of TIC category. It seems that nowadays it means every toxic chemical present on the market. If the old Paracelsus theorem[1] is applied to that practice, it means almost all chemicals are included as everything depends on the dose. To recall history, TIC was once defined as a limited group of chemicals, selected on a risk basis, taking toxicity and volume of production into consideration. A major, leading to miscalculation, deficiency of that approach was ignoring, as a risk factor, any characteristics of substance's supply chain.

Classification proposal

Classification made on the basis of CLP Regulation (9) is understandable and familiar to the incident and medical first responders.

It is also sufficient for risk analysis, prevention and preparedness planning in the civilian institutions, performed by management and staff including security staff. For this purpose, CLP provides quick communication and information deriving methodology.

Should the detailed analysis of particular hazard be required, e.g. if there is a need for specific scenario development and analysis, the specific data pertaining to CWA may be obtained from CWA databases or, in case of hazardous chemicals, retrieved from European Chemicals Agency (ECHA) portal (10).

Threat of malevolent or terrorist acts require new approach in communicating hazard, including properties. Hazard information/communication should be recognized by internationally developed and accepted classification system.

The easiest way would be to base CBRN hazard communication on one of the existing systems, in practice either on CLP or ADR (11). The problem with direct application of any of the two regulations is their dedication to specific regulatory function different from the requirements of CBRN security. As a result, a large amount of information noise would be obtained when describing CBRN hazards with CLP or ADR systematics. The way to bypass the problem is to select CBRN relevant properties and simplify the general system accordingly.

A proposal of those properties is presented in the Table 1. It is made on the assumption that a widespread panic is the required effect.

Based on that principle the following observations are taken into account:

- Visibility of impact is paramount,
- Number (of casualties) outweighs severity,
- Speed of symptoms development outweighs severity.

[1] All things are poison, and nothing is without poison; but the dose makes it clear that a thing is not a poison (8).

Table 1: **CBRN relevant properties.**

1	Acute toxicity
2	Energy in a form of heat created in a mass reaction of materials having flammable properties, or locally, by materials with pyrophoric or self-reacting properties causing burns or carbonisation of tissue
3	Energy in a form of work created in a mass reaction of materials having explosive, peroxides or self-reacting properties causing fragmentation of tissue and matter
4	Oxidative properties leading to damage of tissue – skin, eyes, respiratory tract causing chemical burns or carbonisation of tissue
5	Corrosive properties leading to damage of tissue – skin, eyes, respiratory tract causing chemical burns
6	Sensitising properties leading to hyperactive response of respiratory tract such as asthma or erythema/ allergic response of skin
7	Olfactory sensation (pungent odour) leading to psychosomatic and psychological effects followed by panic

Table 2: **Forms of materials.**

1	Solid in a form of aerosol
2	Liquid in a form of aerosol
3	Vapour (a product of evaporation in-situ)
4	Gas

For the purpose of CBRN threat two of CLP components should be taken into consideration:

- Communication of type of hazard, for general risk assessment, prevention and preparedness,
- Specification of the intensity of hazard, useful for the purpose of risk assessment.

Each substance/mixture can be assigned symbolic labels and statements. Labels take form of hazard pictograms, presented in the Table 3.

Table 3: **Descriptions of pictograms.**

GHS 01		Exploding bomb	Explosive
GHS 02		Flame over a surface	Flammable

GHS 03		Flame over a circle	Oxidizing
GHS 04		Gas cylinder	Compressed gases
GHS 05		Droplets corroding skin or surface	Corrosive
GHS06		Skull and bones	Toxic
GHS 07		Exclamation mark	Various health hazard of lower intensity
GHS 08		Bursting internal organ	CMG and sensitizing

CBRN most relevant hazard statements selected on the basis of noxious action listed in the Table 1, are presented in a Table 4.

Table 4: **Description of CBRN threat relevant hazard statement.**

H310	Fatal if in contact with skin
H330 or H331	Fatal if inhaled
H314	Causes severe skin burns and eye damage
H318	Causes serious eye damage
H319	Causes serious eye irritation
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled

Proposal of chemical hazard classification relevant to scenarios structure

Proposal of combination: Combining such diverse, partially inconsistent systems pose a particular challenge. We propose organising that classification based on Classification Labelling and Packaging system enforced by a Regulation 1262/2008 (CLP). Using that extensive classification developed for communication in the supply chain we propose dividing properties into groups consistent as to type of action and characteristics suitable for CBRN incidents.

For CBRN purpose chemical hazards are divided in a general classis identical to the class groups defined by CLP Regulation:

A. Health hazards
B. Physical hazards

Further division to clusters is made on the basis of symptoms and action on organism or matter.

A. Health hazards

Health chemical hazards are divided into four main groups, each of them based on the following health hazard classes specified in CLP:

I. TOXIC

Toxic substances are chemicals that will cause harm to human health when they enter the body through inhalation, skin absorption or ingestion. Some toxic substances can be found in everyday products like household cleaning chemicals, prescription drugs, alcohol, pesticides and cosmetics.
Some toxic substances such as organic solvents and organic pesticides can be absorbed through your skin and enter your bloodstream. Ingestion is the least common form of exposure and it mostly occurs when people eat, drink or smoke after handling toxic substances. Inhalation is the most common form of exposure which occurs when you come into contact with airborne toxic substances.

For the purpose of more specific classification, we decided to subdivide the toxic substances group into:

- I.I CLP class 3.1 - Acute toxicity
- I.II CLP class 3.8 - Specific Target Organ Toxicity single exposure (STOT)
- I.III Chemical Warfare Agent CWA

(CWA are added to this group for the purpose of maintaining consistency with so far used classification described later on)

II. CORROSIVE

Corrosive substances are destructive materials that pose great risks to people, property and the environment. It is presumed that solid or liquid corrosive substance will cause destruction of body tissue at the site of the contact within a specific period of time.

Corrosive substances (and mixtures) may also be acutely toxic after inhalation to a varying degree and by different modes of action.

Naturally, the more acidic or more alkaline a substance is, the more effective it will be as a corrosive substance.

For the purpose of more specific classification, we decided to subdivide the toxic substances group into:

- CLP class 3.2 - skin corrosion
- CLP class 3.3 - eye damage

III. OXIDISING

Oxidizing substances are characterised by the fact that, in contact with other materials, they are able to cause or contribute to the combustion of those materials.

Although widely known as oxidising materials, their hazard and behaviour might be better understood by considering them to be fire enhancing substances or mixtures:

- CLP class 2.4 - oxidizing gases
- CLP class 2.13 - oxidizing liquids
- CLP class 2.14 - oxidizing solids

Substances in this cluster cause chemical burns.

IV. SENSITISATION CLP class 3,4

Sensitisers are substances which can cause sensitisation in the lungs (respiratory sensitisers) and/or skin (skin sensitisers) after exposure to them. Once sensitised, individuals can have severe reactions to further exposure, even in small amounts. In the most extreme cases, individuals may develop asthma and/or dermatitis respectively.

B. Physical hazards

Physical hazards are divided into three main groups, each based on the following physical hazard classes specified in CLP Regulation.

V. FLAMMABLE

Flammable substances are substances that will ignite and continue to burn when they are brought into contact with an ignition source. Flammable substances can exist in a solid, liquid or gaseous state. Most flammable liquids are volatile, and they give off vapours that mix with air to form a flammable mixture that will ignite in the presence of an ignition source.

Substances in this hazard group produce danger of fire and cause heat burns.

To this hazard group belong:

- CLP Class Flammable materials: 2.2 - gas, 2.3 - aerosol, 2.6 - liquid, 2.7 - solid
- CLP Class 2.9 Pyrophoric, liquids, 2.1 Pyrophoric solids substances
- CLP Class 2.11 Self-heating substances

VI. EXPLOSIVE

An explosive substance is a solid or liquid substance (or mixture of substances) which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings.

To the group belong:

- CLP class 2.1 - Explosives all divisions
- CLP class 2.15 - Organic peroxides
- CLP 2.8 class - Self-reacting substances

VII. GASES UNDER PRESSURE

We may define gases under pressure as gases which are contained in a container at a pressure of 200 kPa or more, or which are liquefied or liquefied and refrigerated. This includes compressed gases, liquefied gases, dissolved gases, and refrigerated liquefied gases. They are defined as CLP class 2.5.

Simplifications and limitations

Selective target organ toxicity, repeated exposure (STOT-2), carcinoma, germ and mutagenicity are considered irrelevant to CBRN threat as it induces effects after prolonged time only thus doesn't satisfy most important terror functions. Asphyxiation is considered as irrelevant to CBRN hazard as it is hardly conceivable how it could be exploited. Corrosive to metals property is omitted as it is hardly conceivable how this property could be exploited.

Relation between current and proposed system

In order to preserve linkage between battlefield related classification and modern classification, particular CBRN classes are assigned to the classes derived from CLP. Graphical presentation is presented on a Figure 3.

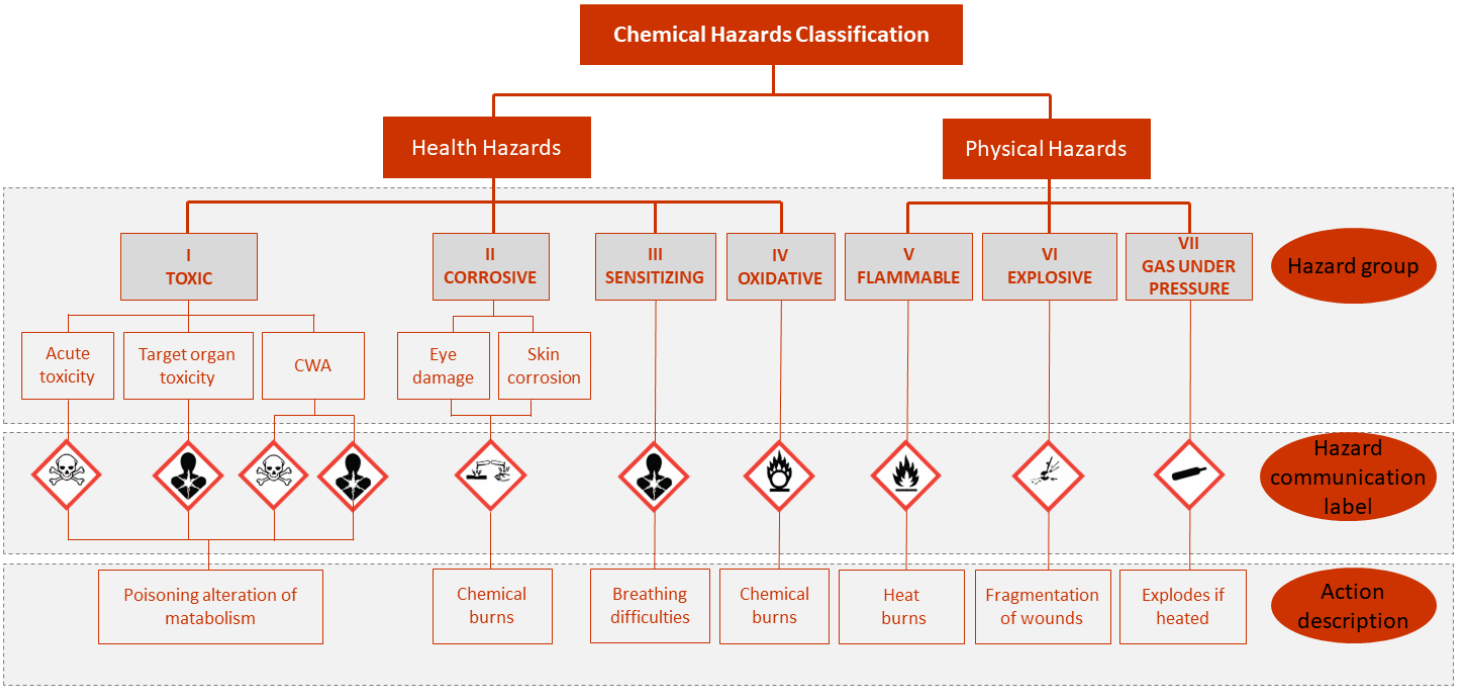


Figure 3: **Description of the proposed CBRN oriented chemical hazard classification system for chemical scenarios structure.**

Explanation of the proposed classification

Belonging to a particular hazard class means that substance is harmful in the concentrations specified in CLP regulation. Toxicity data are specified in the table 3.1.1 (Toxicity estimates) and 3.1.2 (conversion) of the CLP Regulation, Skin corrosion in a table 3.2.1, Eye damage Table 3.3.1, Sensitisation 3.4.2, Target organ Table 3.8.2.

For the particular scenarios toxicity or harmfulness data from CWA databases may be used for describing impact.

Chemical warfare agents

The chemical weapon is defined by the chemical weapon convention as a toxic chemical used to cause intentional death or harm through its toxic properties. Munitions, devices and other equipment specifically designed to weaponize toxic chemicals also fall under the definition of chemical weapons (Organisation for the Prohibition of Chemical Weapons, 2014).

One of the classifications of the chemical warfare agents divides the agents into five categories: blister agents, nerve agents, asphyxiants, choking agents and incapacitating/behaviour altering agents.

1. Blister Agents

Blister agent or vesicants are a group of chemicals that cause severe blistering when they come in contact with skin. Blister agents are a chemical agent that injures the eyes, lungs, and burns or blisters the skin. (6) These may also have systemic effects if absorbed. These agents

are not very lethal as far as causing death is concerned but can incapacitate the enemy and overload the already burdened health care services during war time. These include sulfur mustard, nitrogen mustard and lewisite.

2. Nerve agents

Nerve agents (NAs) are the most toxic agents (12). Nerve agents are organophosphorus compounds which affect the transmission of nerve impulses by inhibition of the enzyme acetylcholinesterase. These organophosphorus cholinesterase inhibitors have been used in the treatment of human diseases, the control of insect pests, as chemical warfare agents and weapons of terrorism. Commonly known as nerve agents, these are the deadliest of chemical warfare agents (S. Chauhan, 2008). These are categorized as G series agents: GB (Sarin), GD (Soman), GA (Tabun), GF and V Series agents: VE, VG, VM and VX.

3. Asphyxiants - Blood agents

Asphyxiants are substances that cause tissue hypoxia. Chemical asphyxiants like cyanides interfere with oxygen transport at cellular level causing tissue hypoxia, anaerobic metabolism and lactic acidosis. The important chemical asphyxiants used as CWA's include cyanogen chloride (CK), hydrogen cyanide (HCN), arsine (SA).

4. Lung Damaging Agents – choking agents

Lung damaging agents attack the breathing passages and in extreme cases membranes swell, lungs become filled with liquid, and death results from lack of oxygen; thus, these agents "choke" an unprotected person (Hoenig, 2007). This category include chlorine, chloropicrin (PS), phosgene (CG) and diphosgenenitrogen oxides.

5. Incapacitating/behaviour altering agents.

An incapacitant is a chemical agent, which produces a temporary disabling condition which can be either physical or mental, that persists for hours to days after exposure to the agent has occurred (unlike that produced by riot control agents). These included lysergic acid diethylamide (LSD-25), ketamine, fentanyl, carfentanil and several glycolate anticholinergics. The only agent classified as chemical warfare agent is 3-quinuclidinyl benzilate, an anticholinergic compound (S. Chauhan, 2008).

Table 5: **Chemical scenario's structure.**

Group of chemical hazards	Subgroup of chemical hazard	Way of dissemination and scenario type/label	The most probable Chemical Agents used in CBRN-E crime
1.Toxic (toxic industrial chemicals, war agents)	1.1 Acute toxicity	a. liquid spill over surface or items b. gas/vapor/aerosol spread in the air c. liquid spill over people d. food/water contamination	• Organophosphate pesticides: Chlormephos, Chlorthiophos, Cyanophos, Demeton, Chlordane, etc. • Carbamate pesticides: Aldicarb, Oxamyl, Thiofanox • Other pesticides: Fenamiphos, Mevinphos, Azinphos methyl, Difenacoum, Fluoroacetamide, Sodium fluoroacetate, Strychnine • Substances used in professional or customer products e.g.: potassium cyanide 1,2,3,7,8, Pentachlorodibenzo-p-dioxin • Substances used in industrial processes: Phosgene, Hydrogen cyanide, Cyanogen chloride, Arsenic acid, Acrylonitrile, 1,1,3, Trichloroacetone, Acryolyl chloride, Glutaral - Hexamethylene diisocyanate, Methyl isocyanate, Nitrous oxide, Boron trichloride, Dichlorosilane, Chlorine dioxide, Phosphine, Osmium tetroxide – trioxide, Hydrogen sulphide, Arsenic (III) oxide • Side products of industrial processes, combustion etc.: Tetrachlorodibenzo dioxin (TCDD), Dimethyl mercury
	1.2 Prolonged effect and Target organ toxicity	a. liquid spill over surface or items b. gas/vapor/aerosol spread in the air c. liquid spill over people d. food/water contamination	• Acrylonitrile • Arsine • Benzene • Carbon disulphide • Arsenic acid • Chlorpyrifos • Carbon tetrachloride • Nitrobenzene • Bromelain – juice • TCDD • Methyl mercury • Chlordane
	1.3 CWA (Nerve, Blister, Choking - pulmonary agents, Blood agents) poisoning, alteration of metabolism	a. liquid spill over surface or items b. gas/vapor/aerosol spread in the air c. liquid spill over people d. food/water contamination	• Sarin-(GB) • Soman-(GD) • Tabun-(GA) • VX, Cyclosarin-(GF) • Hydrogen cyanide-(AC) • Phosgene-(CG) • Diphosgene-(DP) • 2,2'-Dichlorodiethylsulphide (Sulphur mustard, mustard gas, blister agent-HD) • Nitrogen mustard - HN-1,2,3 • Sesquimustard • Phenyldichloroarsine (PD)

			• Methyldichloroarsine (MD) • Phosgene oxime (CX) • Lewisite (blister agent) • Novichok – A agent • Arsine • Cyanogen chloride (CK) • Potassium cyanide (KCN) • Sodium cyanide (NaCN) • Quinuclidinyl benzilate (BZ)
2. Corrosive	2.1 Eye damage	a. gas/vapor/aerosol spread in the air	• Acryolyl chloride • Acrylonitrile • Aluminium chloride • Aluminium phosphide • Arsine • Bromelain, juice • Chlorine dioxide • Dichlorosilane • Cellulase • Glutaral • Hexamethylene diisocyanate • Maleic anhydride • Methyl isocyanate • Succinic anhydride • Aniline • Benzenyl chloride • Hydrogen sulphide (irritant) • Acids • Alkali, alkali aqueous solutions • TCDD • Riot control agents CA, CR
	2.2. Skin Corrosion	a. liquid spill over surface or items b. aerosol spread in the air	• Acids (e.g. Sulphuric acid) • Acryolyl chloride • Boron trichloride • 2-phenylethylisocyanate • Bromelain, juice • Dichlorosilane • Hydrogen sulphide, (irritant) • Succinic anhydride • Alkali, alkali aqueous solutions
	2.3 Objects and goods corrosion	a. liquid spill over surface or items b. aerosol spread in the air	• Acids • Glutaral
3. Sensitizing – respiratory (breathing difficulties, allergy) or skin (allergy)		a. liquid spill over surface or items b. gas/vapor/aerosol spread in the air	• 1,5-naphthylene diisocyanate • 2-phenylethylisocyanate • Acrylonitrile • Bromelain, juice • Cellulase • Ficin • Glutaral • Hexamethylene diisocyanate • Maleic anhydride • Methyl isocyanate • Osmium tetroxide • Succinic anhydride

		• Chlorine • Ammonia • Nitric acid • Phosphine • Red phosporus • White phosporus • Perflurorisobutylene (PFIB) • Titanium tetrachloride • Zinc oxide • Riot control agents: Chlorobenzylidenemalonitrile (CS), Dibenz (b,f) (1,4) oxazepine (CR), Chloroacetophenone (CA), Chloropicrin (PS), Lysergide • some solvents
4. Incapacitating (vomiting agents)	a. liquid spill over surface or items b. gas/vapor/aerosol spread in the air c. liquid spill over people	• Adamsite (DM) • Diphenylchloroarsine (DA) • Diphenylcyanoarsine (DC)
5. Oxidative (chemical burns)	a. liquid spill over surface or items b. gas/vapor/aerosol spread in the air c. liquid spill over people	• Chlorine • Chlorine dioxide • Magnesium perchlorate - saturated aqueous solution • Perchloric acid • Ammonium perchlorate • Bromine • Chromic acid • Dibenzoyl peroxide • Hydrogen peroxide • Nitrous oxide • Sodium perchlorate • Oxidizing acids eg.: Nitric acid Sulphuric acid, 80% Acetic acid, Acetic anhydride • Sodium hypochlorite
6. Flammable (heat burns)	a. liquid spill over surface or items causing the risk of fire after ignition b. gas/vapor/aerosol spread in the air causing the risk of fire after ignition	• Acrylonitrile • Ammonia • Arsine • Petrol • Ethanol • Hydrogen Sulphide • Methylated spirit • paint thinners • Kerosene • Acetone • Diesel • Phosphine
7. Water reacting (emitting flammable products)	a. contact of liquid or solids with water	• Aluminium phosphide • Dichlorosilane
8. Water reacting (emitting toxic products)	a. contact of liquid or solids with water	• Aluminium arsenide • Aluminium chloride • Aluminium phosphide • DA, DC

9. Explosive (fragmentation wounds)	a. explosion of chemicals after ignition	• TNT • TATP • Pentrite • Aziroazide azide
10. Gas under pressure (explodes when heated)	a. explosion of chemicals after ignition	• Ammonia anhydr. • Arsine • Boron trichloride • Chlorine • Chlorine dioxide • Dichlorosilane • Phosgene • Propane • Nitrous oxide • Carbon dioxide • Phosphine • Sulphur dioxide
11. Psychotomimetic agents (induce a psychosis, often including hallucinations and delusions)	a. liquid spill over surface or items causing the risk of fire after ignition b. gas/vapor/aerosol spread in the air causing the risk of fire after ignition	• Lysergic acid diethylamide (LSD) • BZ (CWA) • other benzilic acid esters • Agent 15 • Cannabinoids • Fentanil • Phenothiazines (several)
12. Pharmaceutical (illicit and commercial drugs at supra-therapeutic or toxic doses)	a. solid particles/dust spread in the air	• Pancuronium • Carfentanil
13. Property and security threatening substances		• Graphite (electro-chemical reaction) However, it may contain trace amounts of silica causing health hazard

2.4. BIOLOGICAL THREAT SCENARIO STRUCTURE

We have selected five following biological hazard groups:

1. Toxins

Toxins are chemical compounds of natural origin produced by a plant, animal, or microbe, which can cause significant diseases at significant levels required for lethality, and are therefore harmful substances to be used to spread the terror among people (6).

Toxins which might be misused for bioterrorism include Ricin, Abrin, Botulinum, *Clostridium perfrigens epsilson* toxin, Conotoxins, Shigatoxins, Saxitoxins, Tetrodotoxins, Mycotoxins, and Ticotine.

2. Bacteria

Bacteria agents can cause disease in humans invading the tissues, or by producing toxins. Unless they have been genetically altered for antibiotic resistance, antibiotics can control bacterial agents (6).:

- Rickettsia are organisms which belong to bacteria but with some viral properties. Rickettsia agents are normally sensitive to antibiotics.
- Chlamydia is obligatory intracellular parasites incapable of generating their own energy source. Like bacteria, they are responsive to broad spectrum antibiotics. Like viruses, they require living cells for multiplication.

The most relevant bacteria used for bioterrorism could be *Bacillus anthracis* – Anthrax, *Brucella* genus bacteria – Brucellosis, toxigenic bacterium *Vibrio cholerae* – Cholera, *Yersinia Pestis* – Plague, bacterium *Francisella tularensis* – Tularemia, *Salmonella typhi* – Typhoid Fever, bacterium *Listeria monocytogenes* – Listeriosis, *Rickettsia prowazekii* – Typhus.

3. Viruses

Viruses are pathogenic agents, lack a system for their own metabolism and depend on host cells (6). Viruses are parasites that cause disease by damaging host cells. The host cells can be from humans, animals, plants or bacteria. Viruses are not sensitive to antibiotics, but may be treated by antiviral compounds. Tick-borne virus (Nairovirus) causing Crimean-Congo Haemorrhagic fever, Dengue virus causing Dengue Fever, Cuevavirus, Marburgvirus, and Ebolavirus causing Ebola, RVF virus (RVFV) causing Rift Valley Fever, Yellow Fever virus causing Yellow Fever, Apodemus agrarius virus causing Korean Haemorrhagic Fever etc. are representatives of viruses which are to be concerned for bio scenarios development.

4. Parasites

Parasites are organisms that live on or in a host organism and get their food from or at the expense of its host. There are three main classes of parasites that can cause disease in humans: protozoa, helminths, and ectoparasites.

5. Fungi

Fungi originate fungal illnesses which are common in the environment. Most fungi are not considered to be dangerous, but some types can be harmful to health. Mild fungal skin diseases can look like a rash and are very customary. Pulmonary fungal diseases are often similar to other illnesses such as the flu or tuberculosis. Some fungal diseases like fungal meningitis and bloodstream infections are less common than skin and lung infections but can be deadly.

Fungi can cause many different types of illnesses, including:

- allergies asthma or
- rashes or infections on the skin and nails
- lung infections (pneumonia), with symptoms similar to the flu or tuberculosis
- bloodstream infections
- meningitis

Table 6: **Biological threat scenario structure.**

Group of biological hazards	Way of dissemination and scenario type/label	The most probable Biological Agents used in CBRN-E crime
1. Toxins (bacterial, plant, mycotoxins, animal)	a. powder or liquid food or contaminated water b. vapor/aerosol spread inti the air c. powder apply or liquid spill over surface or items	• Ricin • Abrin • Aconitine • Clostridium botulinum neurotoxin • Clostridium perfrigens epsilson toxin • Conotoxins • Shigatoxins • Saxitoxins • Tetrodotoxins • Aflatoxin • Ochratoxin A • T2 toxin • Staphylococcal enterotoxin B (SEB) • Epsilon toxin of Clostridium perfringens • Food poisoning toxins: e.g. Salmonella species, Escherichia coli O157:H7, Shigella • Convallatoxin
2. Viruses	a. droplets/ aerosol - release into the air b. person to person c. vectors d. food and water	• Tick-borne virus (Nairovirus) causing Crimean-Congo Haemorrhagic fever (CCHFV) and Tick-borne encephalitis virus (TBEV) • Zoonotic flu viruses like H1N1 or H5N1 etc. • Dengue virus causing Dengue Fever • Cuevavirus, Marburgvirus, and Ebolavirus causing Ebola • RVF virus (RVFV) causing Rift Valley Fever • Yellow Fever virus causing Yellow Fever • Haemorrhagic Fever viruses with Renal Syndrome including: Hanta virus, Apodemus agrarius virus causing Korean Haemorrhagic Fever • Pathogenic hantaviruses e.g.: Hantaan HNTV, Seoul SEOV, Sin Nombre SNV, Andes ANDV, Dobrave-Belgrad DOBV • Monkey pox virus causing monkeypox • HIV/HCV viruses • Noroviruses • Vaccinia (orthropoxvirus) • Coronaviruses – SARS, MERS • Arenaviruses (Lassa, Machupo) • Mushroom virus X • Venezuelan equine encephalomyelitis virus causing Venezuelan equine encephalomyelitis • Rift Valley fever virus causing FVF
3. Bacteria	a. droplets/ aerosol - release into the air b. person to person c. vectors food and water	• “Super bugs” – multidrug resistance pathogens • Bacillus anthracis – Anthrax • Bacillus cereus biowar anthracis • Brucella genus bacteria – Brucellosis • Toxigenic bacterium Vibrio cholerae – Cholera • Yersinia Pestis – Plague • Bacterium Francisella tularensis – Tularemia • Salmonella typhi – Typhoid Fever

		• Bacterium Listeria monocytogenes – Listeriosis • Rickettsia prowazekii – Typhus • STEC (Bacterium) Shiga toxigenic Escherichia coli – gastrointestinal illnesses, haemorrhagic colitis (HC) and haemolytic uremic syndrome (HUS) • Legionella – (bacterium Legionella pneumophila) – legionellosis • Burkholderia mallei – Glanders • Burkholderia pseudomallei – Melioidosis • Chlamydia psittaci – Psittacosis • Q fever – Coxiella burnetiid • Rickettsia prowazekii – Typhus fever • Coxiella burnetii – Q fever
4. Parasites	a. vectors b. food and water	• Entamoeba histolytica • Toxoplasma gondii • Giardia lamblia (giardiasis) • Tapeworm • River blindness • Filariasis • African trypanosomiasis (sleeping sickness) • Plasmodium parasite – Malaria
5. Fungi	c. vectors d. food and water	• Candida albicans – Bloodstream infections • Fungus – Meningitis
6. Animal diseases	a. particles release into the air b. food and water	• African horse sickness • African swine fever • Akabane Avian influenza (highly pathogenic) • Bluetongue (exotic) • Brucellosis of cattle (Brucella abortus) • Bovine spongiform encephalopathy • Brucellosis of sheep (Brucella melitensis) • Camel pox • Brucellosis of swine (Brucella suis) • Classical swine fever • Contagious caprine pleuropneumonia • Contagious bovine pleuropneumonia • Foot-and-mouth disease (FMD) • Goat pox • Heartwater (Cowdria ruminantium) • Japanese encephalitis • Lumpy skin disease • Malignant catarrhal fever • Menangle virus • Newcastle disease (exotic) • Peste des petits ruminants • Rinderpest • Sheep pox • Swine vesicular disease • Vesicular stomatitis
7. Plant pathogens and diseases	a. particles release into the air	• Phytophthora ramorum • Phytophthora kernoviae • Liberobacter africanus, L. asiaticus / Citrus greening caused • Peronosclerospora philippinensis / Philippine downy mildew (of corn)

		• Ralstonia solanacearum, race 3, biovar 2/ Bacterial wilt, brown rot (of potato) • Sclerophthora rayssiae var. Zeae / Brown stripe downy mildew (of corn) • Synchytrium endobioticum / Potato wart or potato canker • Xanthomonas oryzae pv. Oryzicola / Bacterial leaf streak (of rice) • Xylella fastidiosa / Citrus variegated chlorosis

2.5. RADIOLOGICAL THREAT SCENARIO'S STRUCTURE

We have selected three following hazard groups:

1. Alpha radiation sources

Alpha particles are composite particles consisting of two protons and two neutrons tightly bound together (15). They are emitted from the nucleus of some radionuclides during a form of radioactive decay, known as alpha-decay. An alpha-particle is identical to the nucleus of an ordinary (atomic mass four) helium atom i.e. a doubly ionised helium atom.

Alpha radiation has a very limited range in air (centimetres), and is not able to penetrate paper, clothing or intact skin. Alpha radiation-emitting material constitutes no hazard while outside the body. However, in sufficient quantity alpha source can deliver large radiation doses to individual organs and may become a serious health hazard if ingested or inhaled.

There are many alpha emitters that can be occurred naturally in the environment. For example, alpha particles are given off by radionuclides such as uranium-238, radium-226, and other members of the naturally occurring uranium, thorium and actinium decay series which are present in varying amounts in nearly all rocks, soils, and water.

Artificially produced sources of alpha particles include the radioisotopes of elements such as plutonium, americium, curium and californium. These are generally produced in a nuclear reactor through the absorption of neutrons by various uranium radioisotopes.

Alpha particles have low penetrating power but this still provides a range of useful applications:

- Americium-241 is commonly used in smoke detectors and in ionising smoke detectors. Smoke that enters the detector reduces the number of alpha particles that are detected and triggers the alarm
- Alpha source Polonium-210 is used typically in static eliminators to remove static charges from equipment
- Radioisotope Plutonium-238 provides Alpha particle decay which is used thermoelectric generators (space probes) in order to generate heat which is converted to electricity
- some alpha emitters are being investigated for their potential use in unsealed source radiotherapy to treat cancer.

2. Beta radiation sources

Beta particles (β) are high energy, high speed electrons (β^-) or positrons (β^+) that are ejected from the nucleus by some radionuclides during a form of radioactive decay called beta-decay. Beta-decay normally occurs in nuclei that have too many neutrons to achieve stability (15).

Beta radiation has meters range in air and can be stopped by relatively thin layers of most solid materials. However, high-energy beta can penetrate clothing, causing beta burns. Beta radiation-emitting material in case of sufficient quantity can represent a hazard if inhaled or ingested and may result in high skin doses from external exposures that can manifest into beta burns. Most beta-emitters emit both beta radiation and gamma radiation.

Significant number of beta emitters occur naturally in the radioisotopes found in the natural radioactive decay chains of uranium, thorium and actinium. Examples include lead-210, bismuth-214 and thallium-206.

Beta emitters are also commonly found in the radioactive products of nuclear fission. Examples include strontium-90, caesium-137 and tritium.

The medium penetrating power of beta particles provides a range of useful applications which include:

- thickness detectors for the quality control of thin materials i.e. paper
- treatment of eye and bone cancers, strontium-90 or strontium-89 are commonly used
- Tritium is used in some phosphorescent lighting typically for emergency lighting as it requires no power
- Fluorine-18 is commonly used as a tracer for positron emission tomography.

3. Gama radiation sources

A gamma ray is a packet of electromagnetic energy (photon) emitted by the nucleus of some radionuclides following radioactive decay. Gamma photons are the most energetic photons in the electromagnetic spectrum (15).

Gamma radiation is penetrating (similar to X-rays) but can be absorbed and diminished in intensity by dense materials (shielding). Gamma radiation emitting material is able to deliver radiation doses to the “whole body” while remaining outside the body. External exposure from a sufficient quantity of radiation, and likewise from internal exposure from inhalation or ingestion, can increase short and long-term health risks. Due to its penetrating power, gamma radiation has a long range and is easy to detect.

Gamma radiation is released from many of the radioisotopes found in the natural radiation decay series of uranium, thorium and actinium as well as being emitted by the naturally occurring radioisotopes Potassium-40 and Carbon-14. These are found in all rocks and soil and even in our food and water.

Artificial sources of gamma radiation are commonly produced in fission in nuclear reactors, high energy physics experiments, nuclear explosions and accidents.

Gamma emitting radionuclides are the most widely used radiation sources. The penetrating power of gamma rays has many applications. However, while gamma rays penetrate many materials, this does not make them radioactive. Cobalt-60, Caesium-137, Technetium-99m, Iridium-192 and Americium-241 are considered as the most useful radionuclides in medicine and industry.

Uses of cobalt-60

- sterilisation of medical equipment in hospitals
- pasteurisation via irradiation of certain foodstuffs
- levelling or thickness gauges (i.e. food packaging, steel mills)
- industrial radiography.

Uses of caesium-137

- measurement and control of the liquid flow in industrial processes
- investigation of subterranean layers (i.e. oil, coal, gas and other mineralisation)
- measurement of soil moisture-density at construction sites
- levelling gauges for packaging of food, drugs and other products.

Uses of technetium-99m

- Tc-99m is the most widely used radioactive isotope for medical diagnostic studies
- different chemical forms are used for brain, bone, liver, spleen and kidney imaging. It is also used for blood flow studies.

Uses of Iridium 192

- medicine as brachytherapy to treat tumour by selectively delivering a cytotoxic dose of radiation to the tumour site
- industrial gauges which inspect welding seams.

Uses of americium-241

- smoke detectors for households
- fluid levelling and density gauges
- thickness gauges for thin materials (i.e. paper, foil, glass)
- aircraft fuel gauges
- when mixed with beryllium, americium-241 produces a ^{241}AmBe neutron source with uses in well logging, neutron radiography and tomography.

Table 7: **Radiological threat scenario's structure.**

Group of radiological hazards		Way of dissemination and scenario type/label	The most probable radiological Agents relevant to scenarios development
1. Alfa	a.	b. powder applied or liquid spill over surface c. RDD - vapor/aerosol spread into air d. powder or liquid food or water contamination e. RDD combined with explosives - dirty bomb	• Americium (Am-241); in addition to alpha this radionuclide emits also some lower energy gammas • Plutonium (Pu-238); alphas are accompanied by a very low energy of gammas • Plutonium (Pu-239); the primary fissile isotope used for the production of nuclear weapons • Polonium (Po-210); emits practically only alpha emitter • Radium (Ra-226); in addition, alpha emits also gammas • Radon (Rn-222); gas emitting only alphas • Uranium (U-235); in addition to alpha this radionuclide emits also some lower energy gammas
2. Beta / Gamma	a.	b. powder applied or liquid spill over surface c. RDD - vapor/aerosol spread into air d. powder or liquid food or water contamination e. RDD (I. explosives - dirty bomb) and (II. Dispersion without explosives) f. RED – Radiological exposure device causing irradiation (hidden sealed source: partially or fully unshielded radioactive material)	• Cobalt (Co-60); beta-gamma emitter, used mainly as a gamma source with very penetrating radiation • Cesium (Cs-137); beta – gamma emitter, used mainly as a gamma source • Iodine (I-125); low energy beta and gamma emitter • Iodine (I-131); high energy beta and gamma emitter • Iridium (Ir-192); emits penetrating gammas • Iron (Fe-55); emits low energy photons and betas • Phosporus (P-32); beta particles able to penetrate 0.8 cm into tissue

			• Selenium (Se-75); emits penetrating gammas • Strontium (Sr-89, Sr-90); main radiation emitted – high energy beta • Strontium (Sr-90); high energy beta emitter • Technetium (Tc-99m) – emits penetrating gamma photons • Tritium or hydrogen-3 (symbol T or 3H) – emits a low-energy beta particle • Ytrium (Y-90); it is a pure beta emitter
3. Neutrons-associated with nuclear fission material (see below) and neutron produced by (alpha, n), (gamma, n)	a.	b. powder applied or liquid spill over surface c. RDD - vapor/aerosol spread into air d. powder or liquid food or water contamination e. RDD combined with explosives - dirty bomb	• Californium (Cf-252); it is used exclusively as a neutron source • AmBe; neutron source, mixture of Am-241 and Be • PuBe; neutron source, mixture of Pu-239 and Be

2.6. SCENARIO PRIORITISATION STRATEGY WITHIN THE VULNERABILITY ASSESSMENT

Scenarios can be prioritised based on generated likelihood and impact, as suggested in the table below. The order/prioritisation of the highest likelihood of successful completion of an attack with highest level of impact will be made at the end of all scenario's development after likelihood and impact assessment.

Example of scenarios we propose for Warning book

Table 8: **Prioritization based on likelihood and impact.**

Scenario	Summary	Category	Type of agent	Means of dispersion	Type of exposure	Specific target	Type of atta	Space	Likelihood	Impact	Risk
1	Lone wolf terrorist radicalised on-line and inspired by ISIS propaganda initiate the explosion of bottle filled with chemicals. After explosion the chemical mixture produce one of Sensitizing chemical which is spread into the air	Chemical	Sensitizing	smal IED to spread chemical	Cutaneous/inhalation	Shopping mall visitors actually present in the toilet and toillet coridors	Overt	Confined	Almost certain	Low	High
3	A group of terrorists conducts an attack with a nerve agent filled hand grenade in a shopping mall restaurant	Chemical	CWA-Nerve	Explosives (hand grenades)	Cutaneous/inhalation	Shopping mall restaurant guests	Overt	Confined	Rare	Critical	High
5	A network of international terrorists conducts an attack on shopping mall visitors - drivers getting in or getting out of cars at the parking by spraying blister agent with dron	Chemical	CWA-Blister	Aerosol device (drone)	Cutaneous/inhalation	Shopping mall parking guests	Overt with a short delay	Open	Rare	Very High	High
23	Local terrorist cell conduct rapidally planned attack with Bio- Toxin. They spray it to salad bar in one of self-service restaurant in shopping mall (Ordinary way in SM (pretending being a shopping mall visitor – restaurant guest) carrying hand bag with homemade spray device masked as balsamic or oil olive spray)	Biological	Toxin	Home made aerosol device	Ingestion	Salad bar consumers	Covert with some hours of symptoms appearance and probably some days to identify the origin of sickness	Confined	Moderate	High	Very High
25	Spreading of agent via the air-conditioning system of a public building by a technician affiliated to a terrorist group.	Biological	Bacteria	Air condition system	Inhalation	Whole shopping mall	Covert with some days of incubation	Confined	Moderate	Medium	High
45	Lone wolf contaminates several clothes (inner side) by alfa radioactive small particles in several shops within shopping mall (in trying cabines)	Radiological	Alfa radioactive source	Home made powder dispenser	Inhalation, Ingestion (when touching nose, mouth after contamination)	Clothes shops customers	Covert with some hours/days of symptoms identification as internal irradiation	Confined	Moderate	Medium	High

It is important to remember the previous discussion of likelihood. As in the Warning book we do not provide the specific scenarios, it is impossible to use any existing prediction methodology. The likelihood of scenarios will be very narrow and linked only to vulnerability, the way of getting in the shopping mall and potential way of dispersion of the agent based on restricted document version.

Definition of prioritisation aspects:

A/ LIKELIHOOD

Likelihood is defined based on DHS Risk Lexicon (16) as an estimate of the potential of an incident or event's occurrence. As stated in the above-mentioned lexicon, qualitative and semi-quantitative risk assessments can use qualitative probability estimates. We can express them either numerically (assigning a scale of values to certain analytical categories) or verbally (almost certain, likely, moderate, unlikely and rare values).

Quantitative evaluations use mathematically derived values based on several variables to express the probability.

The probability of a successful attack is usually assessed on the basis of two related variables. The first is the probability that an attack will occur (a threat expressed mathematically) and the

probability that an attack will be successfully completed if it starts (mathematical representation of a vulnerability). The lexicon also specifies probability, which is a specific type of likelihood. This must be clearly defined by strict mathematical operations.

In defining likelihood within our Warning book, we also relied on the conclusions of further research. Beitel, Gertman and Plum (17) discuss the fact that terrorist threat assessment experts should not assume that all types of infrastructure are equally at risk. Terrorist groups see the attack as an investment based on long-term goals. Beitel, Gertman and Plum talk about estimating the likelihood of terrorist success scenario based on terrorist skills, easy execution of an attack and previous attacks. Scenarios for some target objects will be represented by different values of success. This is because terrorists are increasing investment to increase the likelihood of success. In this approach, linear values between 0% and 100% are applied.

Fechner's law (18) deals with the specific logarithm relationship of three variables. For all measures for which natural values are in the range of many orders of magnitude, the base 10 logarithm is used. The values are adjusted to fair value before the subsequent mathematical operation.

In our case the likelihood can be defined only as the likelihood of the attack success, once it starts to be implemented by terrorist. Taking into consideration specific target group (shopping malls) and unclassified approach, our scenario development has to be based on vulnerability check of different systems, rules, structures, infrastructures and constructions of assessed shopping malls (vulnerability check on selected shopping malls will be used to set-up the basic assessment categories that can be employed in general scenarios) and the way of dispersion or use of the CBRN agents including the way of penetration to a shopping mall. However, we have to pay the attention on specific categories that cannot be generalised. Therefore, we have decided to use qualitative and semi-mathematic approach (basic mathematic operation of assigned vulnerabilities values) in assessing the likelihood of the attack success.

Table 9: **CBRN MALL Methodology Definitions.**

Scenario Likelihood level (SLI)	The value represents the likelihood of a successful completion of the attack
Calculated Likelihood average (CLa)	The value represents the risk level of the probability of a successful completion of the attack for specific vulnerability category
Vulnerability due Risk values (VRv)	They represent specific value of a risk detected during the vulnerability assessment in each counter-measure sub-category
Vulnerability Categories (Vc)	They represent groups of deliberate planned activities related to the preparation and execution of a terrorist attack and/or general conditions supporting the attack. We consider four types of those activities or prerequisites: 1. Way of the access to Shopping mall 2. Way of spreading a CBRN agent 3. The difficulty of bringing the CBRN agent into the place of attack 4. General conditions for spreading the specific physical form of the agent
Counter-measures sub-categories (CMSc)	Counter-measures subcategories describe the different types of barriers to successful attack. They respond directly to defined categories. Counter-measures categories have to be divided into HUMAN (shopping mall staff competencies, knowledge, skills, etc.), TECHNICAL (IT system, CCTV,

	equipment, etc.), ORGANISATIONAL (CT plans, established procedures, rules, etc.) and INFRASTRUCTURAL (construction, fire system, water supply, etc.).
Priority attributes (Pa)-weighing factors	Additionally, we have to add the so-called preferential value. In some categories preferential value is not applicable. It has to be attributed individually. They represent the order preference for each counter-measures sub-category in terms of significance for countering any threats. The individual subcategories may or may not be interconnected. If they are, the priority should be given to the category that is most important to prevent the attack.

Calculated likelihood average

Calculated likelihood average (CLa) will be enumerated as the sum of vulnerability risk values (VRv) generated from gaps in counter-measures and barriers per vulnerability category individually mathematically adjusted by priority attributes (Pa) divided by the number of counter-measure sub-categories (CMSc).	
Equation	CLa = SUM (VRvx1…xn * Pa1…Paxn)/CMSc

Priority attributes

Priority attributes are represented by specific values as below. After careful assessment it is possible to set two or three first level, etc. of priorities with the same level of values depending on the scope and strength of counter-measure sub-category. It is also possible to mix the priorities attributes (e.g: Two similar priority levels for 2 sub-categories or three similar priorities for three sub-categories, or combination of two similar levels for two subcategories and two other similar levels for two remaining cub-categories, etc.).	
Attributes values	Priority N. 1 (Pa1 = 1,0) Priority N. 2 (Pa2 = 0,75) Priority N. 3 (Pa3 = 0,5) Priority N. 4 (Pa4 = 0,25) (eventually)

Rules in attributing scores

It is important to highlight following aspects when attributing score to each sub-category: 1. Use factual assessment - no personal interpretation 2. Specify gaps and explain in details (shortcomings and strengthen) 3. First comments, then score 4. Use attributes to classify shortcomings (e.g., minor, moderate or significant, weak or very weak, very minor, medium level, not fully developed, etc.) 5. Use attributes to classify strengthens (e.g., very high, high, accurate, strong, etc.) 6. Double check factual statements 7. Score all sub-categories in consistency with comments in Gap specification	
Scoring system	The vulnerability risk value is scored from 0 to 10, where 0 is the lowest risk and 10 is the highest. Therefore, the low risk is situated between 0 and 2, the medium risk between 2,01 and 4, high risk between 4,01 and 6, very high 6,01 and 8, critical 8,01 and 10. Scoring is allowed between 0 and 2 points with 0,5 steps. **Finally, Calculated Likelihood average, and Scenario Likelihood results are situated in the range as follow:**
	Rare level = 0,01 – 2
	Unlikely level = 2,01 – 4
	Moderate level = 4,01 - 6
	Likely = 6,01 - 8
	Almost certain = 8,01 - 10

Since it is possible to assume different Vulnerability values for categories in individual shopping malls based on vulnerability assessment, we will use at least two scenarios per sub-cluster in the Warning book with the same way of spreading the CBRN agent (E.g.: air-condition) but with different details of the modus operandi depending on security measures. Appropriate likelihood level values will be attributed to those scenarios.

Example - Biological scenario

25	Spreading of agent via the air-conditioning system of a public building by a technician affiliated to a terrorist group.	Biological	Bacteria	Air condition system	Inhalation	Whole shopping mall	Covert with some days of incubation	Confined	Moderate	Medium	High

Vulnerability category selected for specific scenario (the way of distribution of CBRN agent via air-conditions) (Note: the vulnerability risk value is assigned from 0 to 10, where 0 is the lowest risk and 10 is the most critical. Additionally, we have to add the so-called preferential value. In some categories preferential value is not applicable. It has to be attributed individually. In our example, the preferential value will apply to sub-category 1 as this is the main access to maintenance room and when the risk value is 1, other sub-categories are not so relevant.

Vulnerability category I

Vulnerability Category (Vc) / **Way of access to Shopping Mall**	Counter-measures Sub-category 1 (CMSc)	Counter-measures Sub-category 2 (CMSc)	Counter-measures Sub-category 3 (CMSc)	
Ordinary way in SM (pretending being a shopping mall visitor – restaurant guest)	Trained staff working as private security agent to detect suspect behavior when entering into shopping mall (direct visual monitoring and personal security check of people entering with bag packs).	Trained staff working as private security agent to detect suspect behavior when entering into shopping mall (CCTV monitoring of all shopping mall entrances).	CCTV coverage of all entrances into shopping mall to monitor suspect behavior.	
Priority attribute (Pa)	2	2	1	Average (without Pa calculation)
Assigned vulnerability risk value based on vulnerability check (gaps in counter-measures) – (**VRv**)	1	1	5	2,3

Specification of the gaps	Security staff is well trained in personal security check and suspect behaviour. Security check is well performed at each shopping mall entrance.	Security staff in charge of CCTV monitoring is well trained in suspect behaviour detection. CCTV monitoring by relevant staff is performed 24/7.	Two access in SM are not covered by CCTV. It is a medium shortcoming.	**CLa**
CLa Lump Sum	0.75	0.75	5	2.16

Vulnerability category II

Vulnerability Category (Vc) / **Bringing the weaponised CBRN agent into the place of attack**	Counter-measures Sub-category 1 (CMSc)	Counter-measures Sub-category 2 (CMSc)	Counter-measures Sub-category 3 (CMSc)	
Pretending being a shopping mall visitor – restaurant guest carrying bag pack with small bottler containing weaponised agent	Trained staff working as private security agent to detect suspect behavior when walking in shopping mall towards target place.	Trained staff working as private security agent to detect suspect behavior when walking in shopping mall towards target place (CCTV monitoring).	CCTV monitoring of the chain of corridors to Aircon maintenance room.	
Priority attribute (Pa)	2	2	1	Average (without Pa calculation)
Assigned vulnerability risk value based on vulnerability check (gaps in counter-measures) – (**VRv**)	1	1	4,5	2,16
Specification of the gaps	Security staff is well trained in personal security check and suspect behaviour.	Security staff in charge of CCTV monitoring is well trained in suspect behaviour detection. CCTV monitoring by relevant staff is performed 24/7.	Impossibility to shut down CCTV manually without being detected. Well protected corridors by CCTV. Possibility to shut down CCTV by hacking the IT system due the medium level of IT security system.	**CLa**

CLa Lump Sum	0,75	0,75	4,5	2

Vulnerability category III

Vulnerability Category (Vc) / Way of agent spreading	Counter-measures Sub-category 1 (CMSc)	Counter-measures Sub-category 2 (CMSc)	Counter-measures Sub-category 3 (CMSc)	
Spreading the agent via air condition / ventilation	Air-Con maintenance room access barriers.	CCTV monitoring of the chain of entrances and corridors to Aircon maintenance room.	Technical arrangements for opening the service wicket door to the air conditioning or ventilation (section after filter chamber).	
Priority attribute (Pa)	1	2	3	Average (without Pa calculation)
Assigned vulnerability risk value based on vulnerability check (gaps in counter-measures) – (**VRv**)	3	5	9	5,6
Specification of the gaps	Triple security door locking, pin code to open the door, no windows, no other entrance! Very high level or protection. (Impossible to access without force bridging or insider having full access rights). The force bridging by explosive would become a triggering alarm, therefore not realistic. The insider threat risk management is not yet fully developed.	Impossibility to shut down CCTV manually without being detected. Well protected corridors by CCTV. Possibility to shut down CCTV by hacking the IT system due the medium level of IT security system.	Easy to open with any screwdriver. Very week protection level. Any alarm protection against unauthorised opening of the wicket door.	**CLa**
CLa Lump Sum	3	3,75	4,5	3,75

Vulnerability category IV

Vulnerability Category (Vc) / Shopping mall conditions for spreading of selected type of agent	Counter-measures Sub-category 1 (CMSc)	Counter-measures Sub-category 2 (CMSc)	Counter-measures Sub-category 3 (CMSc)	
	Air-condition system	**Inside temperature**	**Humidity**	
Priority attribute (Pa)	2	1	1	Average (without Pa calculation)
Assigned vulnerability risk value based on vulnerability check (gaps in counter-measures) – (**VRv**)	3	7	4,5	4,8
Specification of the gaps	Shopping mall air-con system is divided into several sections with separate air distribution to different parts of building, which represent the lower risk than one section air-condition system.	Shopping mall temperature of 20 °C is favourable to spread bio agent.	Shopping mall humidity at the level of 50% (depending on the season) is favourable to spread bio agent at intermediate level.	**CLa**
CLa Lump Sum	2,25	7	4,5	4,58

Scenario likelihood level

Finally, Scenario likelihood level (SLL) will be calculated as the lump sum of Calculated likelihood Average (CLa) of vulnerability categories (Vc) divided by the number of vulnerability categories (CnCla). Relevant qualitative value will be attributed to likelihood as a result of simple mathematic operation.	
Equation	SLL = CLaVc/CnCla

Resulting Likelihood table

Scenario Likelihood Level (SLL)	Rare	Unlikely	Moderate	Likely	Almost certain	Scenario LL
Vulnerability category I.: Way of the access to Shopping mall		2,16				
Vulnerability category II.: Bringing the weaponised CBRN agent into the place of attack	2					
Vulnerability category III.: Way of agent spreading		3,75				
Vulnerability category IV.: Shopping mall conditions for spreading of selected type of agent			4,58			
All categories average						3,12

B. Impact

We assume, that the terrorist group or lone wolf were capable to procure and weaponised a CBRN agent. We also assume the minimum quantity of CBRN agent for intended spreading was used and the attack has been successfully performed. This way, we can derive a certain level of generic impact However, this approach is not fully accurate due the fact, that we produce generic scenarios. Impact or consequences level is usually provided for specific scenarios with precise algorithm based on quantity of CBRN agent and its characteristics, source of origin, weaponization, way of entrance into the body, specific weather conditions, etc. (Note: without details in unclassified document, it is not possible to provide a full impact calculation).

Therefore, in this Warning book, we cannot quantify potential loss of human life, direct physical injuries, indirect physical injuries through cross contamination, psychological traumas suffered by survivors and immediate economic losses (destruction of property and infrastructure, disturbed supply chains and increased security costs). We decided to describe the impact severity as extreme, very large, large, significant and moderate to low level based on

assessment of the hazard level of each CBRB agent category, generic quantity of CBRN, combination with explosives and attack prerequisites (attack range, directly affected location size, generic number of present visitors in shopping mall).

Impact severity of CBRN substances

In order to help the management of SM with the assessment of CBRNe risk, the estimated recognition of severity impact of CBR substances on population and infrastructure of SM was developed. Based on relevant substances characteristics a particular group of CBR substances has been positioned into the matrix consisting of three columns (Health effects, Psychological effects and Effects on infrastructure) and five or three lines describing linguistic or numeric impact severity.

Impact severity of chemical substances

Reflecting chemical hazard classification for scenarios structure in Table 9 the proposed impact severity of chemical substances to SM is outlined below.

IMPACT		**Health effects**	**Psychological effects**	**Effects on infrastructure** **a) Destruction** **b) Contamination**
Linguistic description	**Numeric value**			
Critical	**5**	**CWA Nerve,** **CWA Lung damaging**	**RCA, IN** **PO** **CWA Nerve**[2]	**EX** (in case of deflagration) (a) **GUP** (in case of explosion) (a)
Very high	**4**	**CWA Blood,** **AT** (if H330,H331 classes)	**CWA Blood** **CORR ED** (H318, H319) **CORR SC,** **SEN** – respiratory H334 **CWA Blister**[3]	**FL** (in case of fire) (a)
High	**3**	**CORR ED**, **STOT SE** Cat. 1, **AT** H332	**CWA Lung damaging** **AT dermal (**H310, H311) **OX** **AT (**H300, H301)	Any persistent **CWA: Nerve, Blister Choking** Any persistent **AT, STOT-SE, STOT RE, CMG, IN**
Medium	**2**	**CORR SC**, Other **STOT SE** categories, **STOT-RE**, **CMG**, **SEN**,	Other **CORR** (skin burns H314	any other persistent hazardous[4,5]

[2] On condition that the dose is between LD_{10} and LD_{50} above that, there is a disaster, not a psychological effect
[3] On condition blister effect is instant
[4] Regardless of hazard nobody can be admitted in before full decontamination and destruction of contaminant id completed
[5] Effect depends on persistency and difficulty to decon, not on toxicity

		CWA Blister, OX, AT H310-312 (dermal exposure)		
Low	**1**	Incapacitating, Riot[6]	**AT** H332,H312, H302 **CORR** (skin irritant H315) **SEN** – (skin irritant H317) STOT RE2 CMG (produce long term psychological effects only)	Non –persistent hazardous including **IN, RCA, CWA BLOOD**

Impact severity of biological substances

A creation of Impact severity of biological substances formed these considerations: Toxins kill instantly, viruses and bacteria cause diseases, but viruses are more difficult to cure Viruses spread through vectors and are hard to fight.

Toxins kill fast but does not spread (the initial psychological effect can be large). Bacteria spread but usually there is a cure Biological vectors make viruses and bacteria hard to fight. Their incapacitating effect can have negative impact on infrastructure. Toxins kill, but do not spread and degrade.

IMPACT		**Health effects**	**Psychological effects**	**Effects on infrastructure**
Linguistic description	**Numeric value**			
Critical	**5**	Toxins	Viruses	Viruses
Very high	**4**	Viruses	Toxins	Bacteria
High	**3**	Bacteria	Bacteria	Fungi
Medium	**2**	Fungi	Fungi	Toxins
Low	**1**	Parasites	Parasites	Parasites

Impact severity of radiological substances

High energy gamma can have immediate severe impact. Alpha are dangerous over longer period of time (internal contamination). Psychological effect is related to measurable

[6] Depending on difference between IC and LC

radioactivity and does not matter on type of radiation. Usually, alpha sources have long half-lives. High energy gammas and betas have short half-lives.

IMPACT		Health effects	Psychological effects	Effects on infrastructure
Linguistic description	Numeric value			
Critical	**5**	Alpha, Beta, Gamma (high energy)	Gama (long T1/2)	Alpha
Very high	**4**	Alpha, Beta, Gamma (high energy)	Gama (long T1/2)	Alpha
High	**3**	Alpha, Beta	Alpha, Beta	Gamma (long T1/2)
Medium	**2**	Alpha, Beta	Beta	Beta
Low	**1**	Alpha, Beta	Beta	Beta

CBRN MALL Methodology Definitions

Scenario Impact level (SIl)	The value represents the generic impact (health, psychological, infrastructure, economic losses, etc.) to shopping mall and potentially the surrounding area/town.
Calculated Impact average (CIa)	The value represents the generic attack´s impact level for specific impact category.
Impact values (Iv)	They represent specific attributed value of an impact in each sub-category after impact assessment.
Impact Categories (Ic)	They represent groups of impact characteristics. We consider three following types: 1. Type of CBRN agent 2. CBRN agent quantity and combination with explosives 3. Attack prerequisites
Impact sub-categories (ISc)	Subcategories describe specific types of impact characteristics. They respond directly to defined categories.
Priority attributes (Pa)	Additionally, we have to add the so-called preferential value. In some categories preferential value is not applicable. It has to be attributed individually. They represent the order preference for each sub-category in terms of significance in connection to an attack and impact.

Calculated Impact average

Calculated impact average (Cia) will be enumerated as the sum of impact values (Iv) generated from Impact sub-category values (IScV) in each Impact category individually mathematically adjusted by priority attributes (Pa) divided by the number of Impact sub-categories (IScN).	
Equation	Cia = SUM (Ivx1…xn * Pa1…Paxn)/IScN

Priority attributes

Priority attributes are represented by specific values as below. After careful assessment it is possible to set two or three first level, etc. of priorities with the same level of values depending on the scope and strength of each sub-category. It is also possible to mix the priorities attributes (e.g: Two similar priority levels for 2 sub-categories or three similar priorities for three sub-categories, or combination of two similar levels for two subcategories and two other similar levels for two remaining cub-categories, etc.).	
Attributes values	Priority N. 1 (Pa1 = 1,0) Priority N. 2 (Pa2 = 0,75) Priority N. 3 (Pa3 = 0,5) Priority N.4 (Pa4 = 0,25) (eventually)

Rules in attributing scores

It is important to highlight following aspects when attributing score to each sub-category:

1. Use factual assessment - no personal interpretation within those categories where verbal assessment is expected
2. Specify arguments and explain in details (overt attack effects…)
3. First comments, then score
4. Use attributes to classify respective values (e.g., minor, moderate or significant, very minor, medium level, not fully developed, high, medium, etc.)
5. Double check factual statements
6. Score all sub-categories in consistency with defined rules

Scoring system

The impact value is scored in following way for each sub-category:

I. Impact category

1.1 Hazard classification – health impact (Toxicity, virulence, immediate health effects, delayed health effects, …). It is not easy to make the exact order of the hazard per category as some agent in one category can have more health effect comparing to another agent from another category. In Radiological category other aspects play the role when assessing the health impact (source energy and time of exposure and distance from a radioactive source).

However, we have tried to established this general order of the hazard to facilitate the impact assessment based on specific characteristic of selected most hazardous agents within each category.

CHEMICAL

1.1.1 CWA Nerve, Choking	**5**
1.1.2 CWA Blood, AT (if H330, H331 classes)	**4**
1.1.3 CORR ED, STOT SE Cat. 1, **AT** H332	**3**
1.1.4 **CORR SC**, Other **STOT SE** categories, **STOT-RE**, **CMG**, **SEN**, **CWA Blister** **OX**, **AT** H310-312 (dermal exposure)	**2**
1.1.5 Incapacitating, RIOT	**1**

BIO

1.1.1 Viruses	**5**
1.1.2 Toxins	**4**
1.1.3 Bacteria	**3**
1.1.4 Fungi	**2**
1.1.5 Parasites	**1**

Radio

1.1.1 Gamma (level of energy and way of exposure in scenario)	**4-5**
1.1.2 Beta (level of energy and way of exposure)	**1-5**
1.1.3 Alpha (way of exposure)	**1-5**

Note: In radiological scenarios, Alpha sources classification can range from 1 to 5. The health effect from exposure to alpha particles depends greatly on how a person is exposed. The exposure to the outside of the body is not a major concern. However, inside contamination can be very harmful. If alpha-emitters are inhaled, swallowed, or get into the body through a cut, the alpha particles can damage sensitive living tissue.

1.2 Psychological impact - (Immediate effects of some Chemical agents (or TICs) can cause panic (Choking, RIOT). Delayed effects of Blister agents delay the panic and thus the psychological effects are dampened. However, it is very difficult to accurately categorize them – for example, exposure of the skin to mustard droplets is painless. Exposure to Lewisite causes severe pain immediately). Categorisation may be adapted to specific scenarios. Wide range panic ca be caused in covert biological or radiological (exposure to contamination or irradiation) scenario when a terrorist group make an official statement some days after attack.

1.2.1 RCA, IN, PO, CWA Nerve	**5**
1.2.2 CWA Blood, CORR ED (H318, H319), **CORR SC,SEN –** respiratory H334,**CWA Blister**	**4**
1.2.3 CWA Choking, AT dermal, (H310, H311)**OX, AT (**H300, H301)	**3**
1.2.4 Other **CORR** (skin burns H314	**2**
1.2.5 AT H332,H312, H302 **CORR** (skin irritant H315) **SEN** – (skin irritant H317) STOT RE2 CMG (produce long term psychological effects only)	**1**

BIO

1.2.1 Viruses	**5**
1.2.2 Toxins	**4**
1.2.3 Bacteria	**3**
1.2.4 Fungi	**2**
1.2.5 Parasites	**1**

Radio

1.2.1 Gamma	**4-5**
1.2.2 Beta	**1-3**
1.2.3 Alpha	**3**

1.3 Impact on infrastructure and economy – (Stability and persistency of the agent can have impact on infrastructure (decontamination, decommissioning, damage, delayed health effects…)

1.3.1 EX (in case of deflagration) **GUP** (in case of explosion)	**5**
1.3.2 FL	**4**
1.3.3 Any persistent **CWA: Nerve, Blister Choking** Any persistent **AT, STOT-SE, STOT RE, CMG, IN**	**3**
1.3.4 Any other persistent hazardous	**2**
1.3.5 Non –persistent hazardous including **IN, RCA, CWA BLOOD**	**1**

BIO

1.3.1 Viruses	**5**
1.3.2 Toxins	**4**
1.3.3 Bacteria	**3**
1.3.4 Fungi	**2**
1.3.5 Parasites	**1**

Radio

1.3.1 Gamma	**3**
1.3.2 Beta	**1-2**
1.3.3 Alpha	**4-5**

When attributing values to some specific agents' categories (mainly biological) under infrastructure impact, the priority level could be lower than other agents' categories due the nature of impact.

The Impact value is scored from 1 to 5, where 1 is moderate to low impact, 2 is significant impact, 3 is large impact, 4 is very large impact and 5 is representing extreme impact.

II. Impact category

3.1 Quantity of CBRN agent - (Small, Medium, Big amount in terms of possibility and capabilities to bring this amount of weaponised agent into the shopping mall).

2.1.1 Very big amount	7
2.1.2 Big amount	6
2.1.3 Large medium amount	5
2.1.4 Medium amount	4
2.1.5 Small medium amount	3
2.1.6 Small amount	2
2.1.7 Very small amount	1

The Impact value is scored from 1 to 7, where 1 is the lowest value and 7 is the highest. The moderate to low impact is considered when the score 1 is attributed. The significant impact is considered when the score is between 2 and 3. The large impact is represented by score 4, very large impact by 5 and finally score 7 represents critical impact.

2.2 Use of explosives in combination with CBRN agent - (In some scenarios explosives will be used, therefore the effect/impact could be assessed differently like in scenarios where explosives are not used. It can have more significant or less significant impact depending on scenario. Using explosives will be assessed as higher impact to infrastructure and direct immediate injuries to present persons additionally to CBRN agent (depending on the reason why explosives were used: as the initiation of the agent spreading or as destructive device used independently of CBRN agent spreading.)

The Impact value is scored from 1 to 7, where 1 is the lowest value and 7 is the highest. The moderate to low impact is considered when the score 1 is attributed. The significant impact is considered when the score is between 2 and 3. The large impact is represented by score 4, very large impact by 5 and 6, and finally score 7 represents critical impact.

III. Impact Category

3.1 Attack range type – (Depending on the definition in scenario – the assessment of the overt/covert/combined attack´s impact including the range of spread of specific category of CBRN agent have to be done separately in the scale ranging from 1 to 7 (affecting people and infrastructure). All characteristics of overt/covert/combined attack have to be taken into account – e.g. expected time of incubation of bio agent in covert scenario, existing possibilities to rapidly identify symptoms of certain CBRN agent, spreading agent – cross-contaminating people in shopping mall and outside, etc.).

Devastating/Widely Epidemic (out of shopping mall – town, city)	7
Significant (affecting the whole shopping mall and partially the surrounded places/buildings/people)	6
Considerable (affecting the major part of the shopping mall)	5
Important (affecting half of shopping mall at least)	4
Medium range (affecting some important shopping mall parts)	3
Partial (affecting some shopping mall parts)	2
Minor (affecting negligible shopping mall part)	1

The Impact value is scored from 1 to 7, where 1 is the lowest value and 7 is the highest. The moderate to low impact is considered when the score 1 is attributed. The significant impact is considered when the score is between 2 and 3. The large impact is represented by score 4, very large impact by 5 and 6, and finally score 7 represents critical impact.

3.2 Directly impacted location size – (Depending on the definition in scenario – the place when the CBRN agent will be spread or used without taking into account the further spread of agent or effects of the attack: e.g. toilet, central hall, the whole shopping mall area, one clothes shop, one restaurant, restaurant court, etc.)

Very big (whole shopping mall)	**7**
Big size	**6**
Bigger Medium size	**5**
Medium size	**4**
Small Medium size	**3**
Small (toiler, newspaper stand)	**2**
Very small (cleaner room)	**1**

The score is attributed based on defined size of shopping mall premises/type of location. The highest score is attributed to biggest premises in terms of size and the lowest score to a small place (cleaner room, etc.). The Impact value is scored from 1 to 7, where 1 is the lowest value and 7 is the highest. The moderate to low impact is considered when the score 1 is attributed. The significant impact is considered when the score is between 2 and 3. The large impact is represented by score 4, very large impact by 5 and 6, and finally score 7 represents critical impact.

3.3 Number of visitors in shopping mall (rush hours) - (Small, Medium, Big amount in terms of possibility and capabilities to bring this amount of weaponised agent into the shopping mall).

2.1.1 Very big number/rush hours	**7**
2.1.2 Big number	**6**
2.1.3 Large medium number	**5**
2.1.4 Medium	**4**
2.1.5 Small medium number	**3**
2.1.6 Small number	**2**
2.1.7 Very few visitors/night hours	**1**

The Impact value is scored from 1 to 7, where 1 is the lowest value and 7 is the highest. The moderate to low impact is considered when the score 1 is attributed. The significant impact is considered when the score is between 2 and 3. The large impact is represented by score 4, very large impact by 5 and 6, and finally score 7 represents critical impact.

Finally, Calculated Impact average and Scenario Impact results are situated in the range as follow:

Critical level	**6,01-7**
Very high level	**4,01-6**
High level	**3,01-4**
Medium level	**1,01-3**
Low level	**0,01-1**

Impact category I

Impact Category (Ic) / Type of Biological agent	Impact sub-category	Impact sub-category	Impact sub-category	
Bacteria	Hazard classification (health impact)	Psychological effects	Infrastructure and economy - losses/damage/ decommissioning	
Priority attribute (Pa)	1	1	3	Average (without Pa calculation)
Assigned impact value based on (Iv)	4	4	4	4
Specification of Impact value (sIv)	**Hazard category**	**Hazard category**	**Less priority**	**CIa**
CIa Lump Sum	4	4	2	**3,33**

Impact category II

Impact Category (Ic) / Bio agent quantity and combination with explosives	Impact sub-category	Impact sub-category	
Quantity/Explosives	Quantity	~~Using explosives~~	
Priority attribute (Pa)	1	2	Average (without Pa calculation)
Assigned impact value based on (Iv)	2	~~0~~	2
Specification of Impact value (sIv)	Scenario has foreseen the small amount of Bio toxin in powder form.	~~xxx~~	**CIa**
CIa Lump Sum	2	0	**2**

Impact category III

Impact Category (Ic) / Attack prerequisites	Impact sub-category	Impact sub-category	Impact sub-category	
Range / directly impacted location / Affected number of people	Attack range type	Directly Impacted location size	Visitor´s number	
Priority attribute (Pa)	1	2	1	Average (without Pa calculation)
Assigned impact value based on (Iv)	5	5	3	4,3
Specification of Impact value (sIv)	xxxxxx	xxxxx	xxxx	**CIa**
CIa Lump Sum	5	3,75	3	**3,92**

Scenario impact level

Finally, Scenario Impact level (SIL) will be calculated as the lump sum of Calculated Impact Average (Cia) of Impact categories (Ic) divided by the number of Impact categories (CnCia). Relevant qualitative value will be attributed to likelihood as a result of simple mathematic operation.	
Equation	SIL = CIaIc/CnCia

Table 10: **Resulting Impact table**

Scenario Impact Level (SIL)	Low	Medium	High	Very high	Critical	Scenario LL
Impact category I.: **Type of biological agent**			**3,33**			
Impact category II.: **Bio agent quantity and combination with explosives**		**2**				
Impact category III.: **Attack prerequisites**			**3,92**			
All categories average						**3,08**

C/ Risk

Risk evaluation of scenario in our warning book is made by estimation of both the likelihood of attack success and resulting impact of particular scenario.

The gradation adopted for the risk estimation is deduced from the classifications of likelihood and impact. The likelihood level of attack success is being a non-dimensional magnitude. Though risk takes the same units as the impact that it may produce.

By combining (multiplying) the value All Categories Average (ACA) of Scenario Likelihood Level (SLL) and the value of ACA of Scenario Impact Level, the risk is estimated.

Risk = ACA (SLL) x ACA (SIL)

Mathematical model delineating limits of risk adopts the example outlined in risk limits estimation of WP2, Weaknesses assessing methodology. Finally, calculated risk of scenarios is situated in the range as follows:

Critical	40,01-70
Very high	20,01-40
High	8,01-20
Medium	2,01-8
Low	0,01-2

Table 11: **Risk Estimation table**

		Scenario Impact Level				
Scenario Likelihood level	Values	**Low**	**Medium**	**High**	**Very high**	**Critical**
		0,01-1	1,01-3	3,01-4	4,01-6	6,01-7
Almost certain	8,01 - 10	≥10	≥30	≥40	≥60	≥70
Likely	6,01 - 8	≥8	≥24	≥32	≥48	≥56
Moderate	4,01 - 6	≥6	≥18	≥24	≥36	≥42
Unlikely	2,01 – 4	≥4	≥12	≥16	≥24	≥28
Rare	0,01 – 2	≥2	≥6	≥8	≥12	≥14

For the explanatory reasons to track the ultimate risk estimate result of reference biological scenario we will use the risk estimation formula and emplacement in Scenario risk estimation table:

Risk = ACA (SLL) x ACA (SIL)

Risk = 3,12 x 3,08

Risk = **9,6**

		Scenario Impact Level				
Scenario Likelyhood level	Values	Low	Medium	High	Very high	Critical
		0,01-1	1,01-3	3,01-4	4,01-6	6,01-7
Almost certain	8,01 - 10					
Likely	6,01 - 8					
Moderate	4,01 - 6					
Unlikely	2,01 – 4		**9,6**			
Rare	0,01 – 2					

Bearing in mind a risk mitigation of potential scenario, we proposed to add line „Recommended Security Measures" into structured scenario template. Those recommended security measures are to be filled by originator of scenario and create profound floor for WP4 elaborating on recommendation for prevention and response procedure to CBRNe terrostist acts.

Scenario's methodology application

The European Commission has published a very important manual for assessing terrorist threats (19). This guide, together with the experience of ISEMI and partners from the previous experience in development of terrorist scenarios, has become a pillar in the compilation of scenarios in this Warning book.

We therefore suggest the following procedures for compiling scenarios:

1. Create a Methodology
2. Organize a meeting to discuss and approve the methodology
3. Perform the vulnerability check of selected shopping malls
4. Create a list of scenarios based on the methodology and vulnerability check taking into account previous terrorist attacks or plots
5. Organize a meeting to discuss and approve the list
6. Prepare individual scenarios
7. Organize a meeting to discuss and approve scenarios

2.7. SCENARIO TEMPLATE

(NOTE: The Cause, threat compounds, their properties and specific quantity, detailed location description (weather, population at risk, time, etc.), description of CBRN agent procurement and weaponization, dispersion device production, possible consequence will not be provided because this document is not classified and is not intended to specific place – shopping mall). They have not been integrated into the table below.)

BIOLOGICAL SCENARIO	
Scenario Number **Title**	
Summary	

LIKELIHOOD	
CBRN agent	
Agent group	Virus, Toxin, Bacteria, Parasites, Fungi (Chem: Nerve, Blood, Choking, Blister, TICs, Psychotomimetic, Riot control), (Rad: Alpha, Beta, Gamma/Neutron)
Agent	Only restricted version
Physical state	Vapour, Gas, Liquid, Solid, Granular material, Suspension, Mixture, Spores, etc.
Quantity	(Big, medium, small amount)
Ease to procure or develop	Very easy, Easy, Medium level, medium difficult, difficult, very difficult (Only restricted)
Modus operandi and technical features	
Description of each step	- the way of planning the attack (only one step of planning: while being inside the shopping mall prior to the attack and/or checking the open sources information about the shopping mall infrastructure (IT security of shopping malls), etc.) - (Note: steps of agent procurement and weaponization including the dispersion tool development will not be provided as this document is not classified) - the way of intrusion inside the shopping mall (cover or uncover, insider, by force or without force and the way of bringing the weaponised agent and dispersion tool (if relevant) into the shopping mall: - the way of initiating the attack
Way of dispersion /entrance to the body	
Release mechanism	Only generic description
Dispersion device	Type
Other supporting equipment	
Overt/Covert/Combined attack	
Terrorist capacities	
Needed resources	
Pre-Incident indicators/Warning signs	

Visual observation of the threat (in person or via CCTV)	Description of direct observation of suspect behaviour or suspect items before the event occur (planning or initiation phase)
Potential announcement before the attack	Yes, No (Intel agencies, Media declaration by terrorist group, etc.)
On-going attack signs/Post attack signs	
Detection of the event	Human detection (smell, fume, symptoms: nausea of visitors, …) after attack or ongoing attack
Technical detection of the event	Sensors, CBR detectors at the place
Alert	What causes the alert to be raised? How is the alert raised, and what is reported to the first responders, authorities or site personnel?
Recommended Security measures	Physical security measures, detection equipment, procedures,
Impact	
Affected groups (health)	Injuries, death (generic number of people – high, medium, small number)
First responders	
Health care services	
Command and control centre	
Site/building/infrastructure	Description of the place (category/size of the place)
Environment	
References/Literature:	
1	
2	

Tables

Table 1: **CBRN relevant properties.** 18
Table 2: **Forms of materials.** 18
Table 3: **Descriptions of pictograms.** 18
Table 4: **Description of CBRN threat relevant hazard statement.** 19
Table 5: **Chemical scenario's structure.** 25
Table 6: **Biological threat scenario structure.** 30
Table 7: **Radiological threat scenario's structure.** 35
Table 8: **Prioritization based on likelihood and impact.** 37
Table 9: **CBRN MALL Methodology Definitions.** 38
Table 10: **Resulting Impact table** 55
Table 11: **Risk Estimation table** 56

Figures

Figure 1: **Terrorist scenarios structure.** 12
Figure 2: **CBRN Incidents and EIH Incidents.** 15
Figure 3: **Description of the proposed CBRN oriented chemical hazard classification system for chemical scenarios structure.** 23

Sources

1 - HBM Hilderink, Scenario development methodology: Henk Hilderink, European Journal of Public Health, Volume 23, Issue suppl_1, October 2013, ckt126.030, https://doi.org/10.1093/eurpub/ckt126.030

2 - FEWS NET. 2018. Scenario Development for Food Security Early Warning. Washington, DC: FEWS NET.

3 - Dmitry O. Reznikov, Nikolay A. Makhutov, Rasim S. Akhmetkhanov, Analysis of Terrorist Attack Scenarios and Measures for Countering Terrorist Threats, DOI 10.5772/intechopen.75099, Dimensions IDpub.1107721823, September 2018

4 - Henry H. Willis, Andrew R. Morral, Terrence K. Kelly, Jamison Jo Medby, Estimating Terrorism Risk, RAND, ISBN 0-8330-3834-6 (pbk. : alk. paper), 2005

5 - NATO Standard AJP-3.8 Allied Joint Doctrine for Comprehensive Chemical, Biological, Radiological and Nuclear Defence Edition B version 1 1 Oct 2018 recorded in STANAG 2451

6 - NATO Standard ATP-3.8.1 Volume CBRN Defence on operations, January 2010, recorded in STANAG 2521

7 - REGULATION (EC) No 1907/2006 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC

8 – https://en.wikiquote.org/wiki/Paracelsus,access 2.02.2021

9 – REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006

10 - https://echa.europa.eu/information-on-chemicals

11 - Accord relatif au transport international des marchandises dangereuses par route https://unece.org/transportdangerous-goods/adr-2021-files.

12 - SEMI, SCK-CEEN, RIVM, CIVIPOL, ENCO, Gap analysis on detection of CBRN threats and organization of cross-border exercise - Brief on CBRN Terrorist threats scenarios – DG HOME (unclassified part of document), 2018 and other internet sources: https://www.health.ny.gov/environmental/emergency/chemical_terrorism/nerve_agents_general.htm and https://chemm.nlm.nih.gov/na_prehospital_mmg.htm

13 - https://www.emedicinehealth.com/chemical_warfare/article_em.htm#nerve_agents_as chemical weapons

14 - Centres for disease control and Prevention
https://emergency.cdc.gov/agent/riotcontrol/factsheet.asp

15 - Australian radiation Protection and Nuclear Safety agency
https://www.arpansa.gov.au/understanding-radiation/what-is-radiation/ionising-radiation/gamma-radiation

16 - Risk Steering Committee, DHS RISK LEXICON, U.S. DEPARTMENT OF HOMELAND SECURITY, 2008 https://www.dhs.gov/xlibrary/assets/dhs_risk_lexicon.pdf

17 - G. A. Beitel, D. I. Gertman & M. M., Balanced scorecard method for predicting the probability of a terrorist attack, Plum Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho, USA, Wit press, 2004, ISBN 1-85312-736-1

18 - Fechner, G.T. (1861/1966). Elements of Psychophysics (Translated by H.E. Adler), Holt, Rinehart, and Winston, New York.

19 - European Commission, DG HOME, Terrorism Risk Assessment of Public Spaces for Practitioners, April 2020,
https://ec.europa.eu/newsroom/pps/itemdetail.cfm?item_id=674909&utm_source=pps_newsroom&utm_medium=Website&utm_campaign=pps&utm_content=Terrorism%20Risk%20Assessment%20of%20Public%20Spaces%20for%20Practitioners&lang=en

Annexes

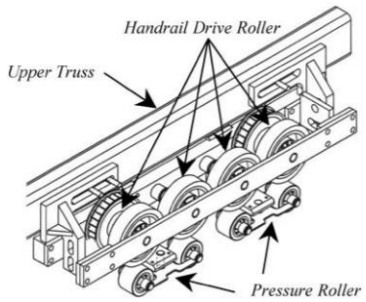
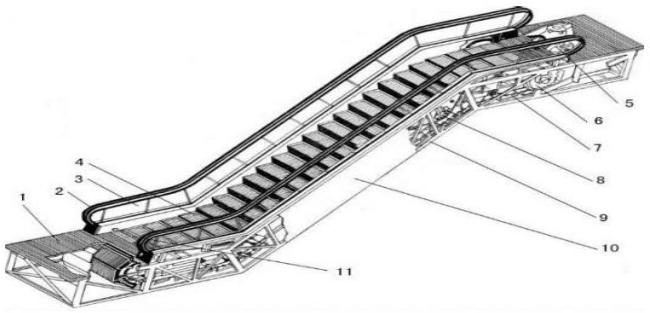
Annex I

In Annex I are proposed the classified technical details of the scenarios that cannot be disclosed to a general public, as explained for each scenario where applicable. Available on demand.

Annex II

The unclassified version of scenarios containing limited information to be disclosed to a general public.

1.1 Chemical scenario - ESCALATOR

CHEMICAL SCENARIO	
 *Figure 2.* Handrail drive system.	
Scenario Number	**1**
Title	**ESCALATOR**
Summary	Contaminated moving hand rail of the shopping mall escalator with toxic chemical poisonous upon contact.
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description of each step	The "group" establishes a company for escalators and lift maintenance. Under a fake annual maintenance schedule, (or created escalator failure) they start fixing the escalator. They instal containers with odourless contact poison under the escalator in such a way, that the handrail drive roller is dipped in an agent and it continuously spreads the poison over the handrail.
Way of dispersion/entrance to the body	Contact
Overt/Covert/Combined attack	Covert. Perpetrators discased as maintenance company employees.
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	Suspicious maintenance on escalators.
Potential announcement before the attack	No
On-going attack signs/Post attack signs	

Detection of the event	The event will be detected after a few days when there will be too many patients in local hospitals with similar symptoms and it triggers the official investigation.
Smell	The agent can have an aromatic, mercaptan-like or skunk-like odour
Technical detection of the event	CWAs and TIC detectors are available for HAZMAT teams. Not likely available for Mall staff.
Alert	People using the escalator see that the handrail is wet but the small sign informs them that it is a disinfection solution. Because it has no odour, they pay no attention.
	Some of the Mall staff Employees can find the sign next to the escalator saying that the liquid on a handrail is from disinfection which is odd and not according to the Mall's SOPs.
Recommended Security measures	Overwatch about every maintenance
Impact	
Affected groups (health)	After a period of time, visitors of the mall will start to experience mild poisoning symptoms - impaired, blurry vision, runny nose, excess saliva, headache, nausea, muscle weakness, agitation etc. Following the mild poisoning, more severe symptoms will follow - very narrowed pupils, dizziness, disorientation, coughing and wheezing, sneezing, difficulty breathing, tremors, fatigue, severe vomiting and diarrhoea, involuntary urination and defecation.
First responders	After the Mall is identified as a source of the contamination it is closed and evacuated. HAZMAT teams search for the contamination for days until they detect the presence of the poisonous agent on door handles, railings and finally under the escalator. The decontamination of the Mall takes weeks until it is cleared for the public.
Health care services	The local hospitals treat poisoned people in various stages of poisoning. More people have symptoms caused by panic after the attack is medialized. Several poisoned persons die.
Command and control centre	C2 centre organizes the HAZMAT response together with CBRN Forensic investigation before the evidence is destroyed by decontamination. All the visitors must be tracked down and screened for contamination.

Site/building/infrastructure	The mall is closed for weeks. Hundreds of apartments are checked for contamination. Public transport must be decontaminated.
Environment	The contamination spread outside the Mall is caused by the visitors but the concentration is reduced. Even being a persistent agent, it eventually degrades.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**	**1,88**					
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**		**3**				
Vulnerability category III.: **Way of agent spreading**		**3,75**				
Vulnerability category IV.: Shopping mall conditions for spreading of selected type of agent			**4,88**			
All categories average						**3,38**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of chemical agent**			**3,83**			
Impact category II.: **Chemical agent quantity and combination with explosives**			**4,0**			
Impact category III.: **Attack prerequisites**			**3,1**			
All categories average						**3,64**

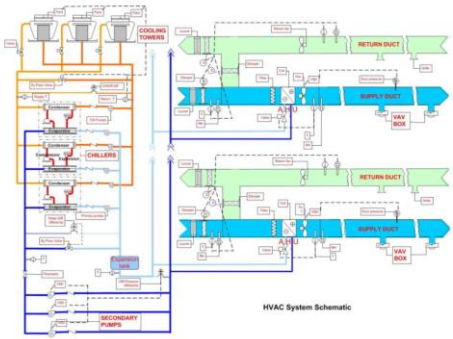
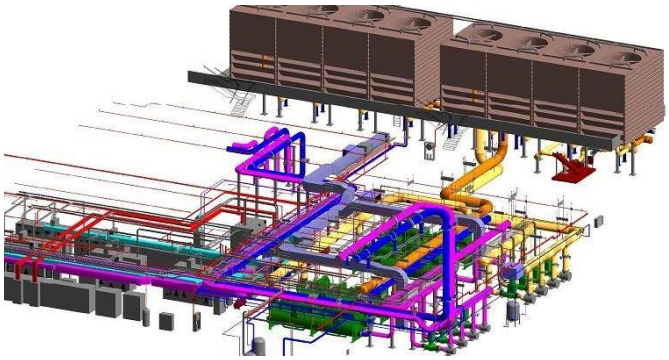
1.2 Chemical scenario - PARKING GARAGE UNDERGROUND

CHEMICAL SCENARIO	
Scenario Number	**2**
Title	**Parking Garage Underground.**
Summary	Van with pressurised gas cylinders containing toxic gas.
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description of each step	The "group" purchases/prepares the toxic gas and empty industrial pressure cylinders used by welders. On a "D" day they park the van in the underground parking garage near the entrance to the mall. They break the glass sliding door leading to the mall. Using a remote controller, they release the content in a few minutes into the mall.
Way of dispersion/entrance to the body	Inhalation
Overt/Covert/Combined attack	The whole preparation for the attack is covert. The attack is triggered remotely.
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	Van close to the mall entrance. Suspicious accident with sliding glass doors.
Potential announcement before the attack	No.
On-going attack signs/Post attack signs	
Detection of the event	After a short period of time, first persons will start to experience poisoning symptoms. Those closer to the

	entrance to the underground garage will get poisoned first. The gas will not trigger the CO and NOx detectors placed in underground garages.
Technical detection of the event	Only the CCTV cameras
Alert	People hear strange noises like escaping gas
Smell	The agent has a strong irritant odour
Recommended Security measures	Remote detectors inside the mall.
Impact	
Affected groups (health)	Depends on the type of gas. Inhalation of toxic gases can result in immediate death from asphyxia or cause mild to severe respiratory distress from acute upper airway inflammation, delayed pulmonary oedema, respiratory muscle dysfunction, or a combination of illnesses.
First responders	The first response on a scene focuses on panic control, evacuation, detection of the gas, and identification of the source. Once the gas cylinders are empty, the toxic gas is dispersed and finally ventilated by Firefighters.
Health care services	The first medical personnel on-site gets intoxicated. Only after the threat is recognized, the medical teams in PPE enter the Mall and start treating the victims.
Command and control centre	C2 centre focuses on crowd control, and identification of threats – perpetrators inside the mall, in a parking lot. Detection of the agent and identification of the source. The direction of the evacuation away from the source of the gas.
Site/building/infrastructure	Once the toxic gas is ventilated, the HAZMAT teams detect no residual toxic gasses or contamination. The Mall is cleared but closed due to the investigation.
Environment	There is no impact on the environment as the toxic gas is quickly dispersed into the atmosphere.
References/Literature	

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**		**2,16**				
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**	**2**					
Vulnerability category III.: **Way of agent spreading**		**3,75**				
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**			**4,58**			
All categories average						**3,12**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of chemical agent**		**2,83**				
Impact category II.: **Chemical agent quantity and combination with explosives**			**4,0**			
Impact category III.: **Attack prerequisites**			**3,1**			
All categories average						**3,31**

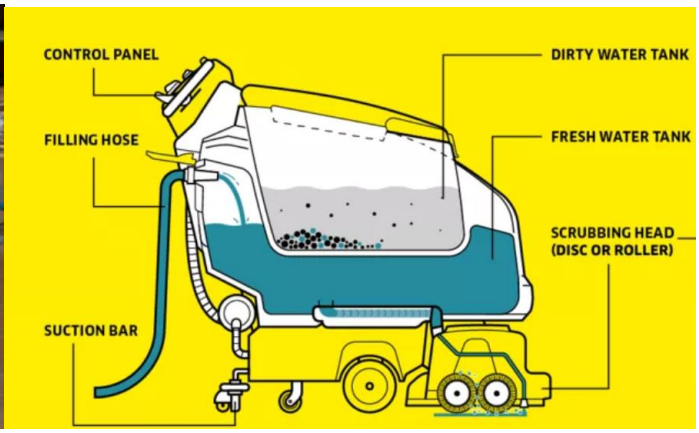
1.3 Chemical scenario – HVAC

CHEMICAL SCENARIO	
 	
Scenario Number	**3**
Title	**HVAC.**
Summary	Pressurized gas cylinders containing toxic gas attached to a ventilation system
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description of each step	The "group" purchases/prepares the toxic gas and empty industrial pressure cylinders used by welders and/or cylinders used to store refrigerant-type gas. They establish a company for maintaining the HVACs. They fake the HVAC failure and maintenance. They enter the mal discased as HVAC maintenance company employees. They set up the cylinders attached to the air inlets and hide them in an HVAC system. On a "D" day they remotely release the toxic gas.
Way of dispersion/entrance to the body	Inhalation
Overt/Covert/Combined attack	The whole preparation for the attack is covert. The attack is triggered remotely.
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	Suspicious HVAC maintenance.
Potential announcement before the attack	No

On-going attack signs/Post attack signs	
Detection of the event	After a short period of time, first persons will start to experience poisoning symptoms. Those closer to the sources will get poisoned first.
Technical detection of the event	CCTV cameras
Alert - smell	The agent has a strong irritant odour
Recommended Security measures	Remote detectors inside the mall.
Impact	
Affected groups (health)	Depends on the type of gas. Inhalation of toxic gases can result in immediate death from asphyxia or cause mild to severe respiratory distress from acute upper airway inflammation, delayed pulmonary oedema, respiratory muscle dysfunction, or a combination of illnesses.
First responders	The first response on a scene will focus on panic control, evacuation, detection of the gas, and identification of the source. Once the gas cylinders are empty, the toxic gas is dispersed and finally ventilated by Firefighters.
Health care services	The first medical personnel on-site gets intoxicated. Only after the threat is recognized, the medical teams in IPE enter the Mall and start treating the victims.
Command and control centre	Crowd control, identification of threat – perpetrators inside the mall. Detection of the agent and identification of the source. Shut off the HVAC system. The direction of the evacuation away from the source of the gas.
Site/building/infrastructure	Once the toxic gas is ventilated, the HAZMAT teams detect no residual toxic gasses or contamination. The Mall is cleared but closed due to the investigation.
Environment	There is no impact on the environment as the toxic gas is quickly dispersed into the atmosphere.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**	**1,88**					
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**		**3**				
Vulnerability category III.: **Way of agent spreading**		**3,41**				
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**			**4,63**			
All categories average						**3,23**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of chemical agent**		**2,5**				
Impact category II.: **Chemical agent quantity and combination with explosives**				**5**		
Impact category III.: **Attack prerequisites**				**4,83**		
All categories average						**4,11**

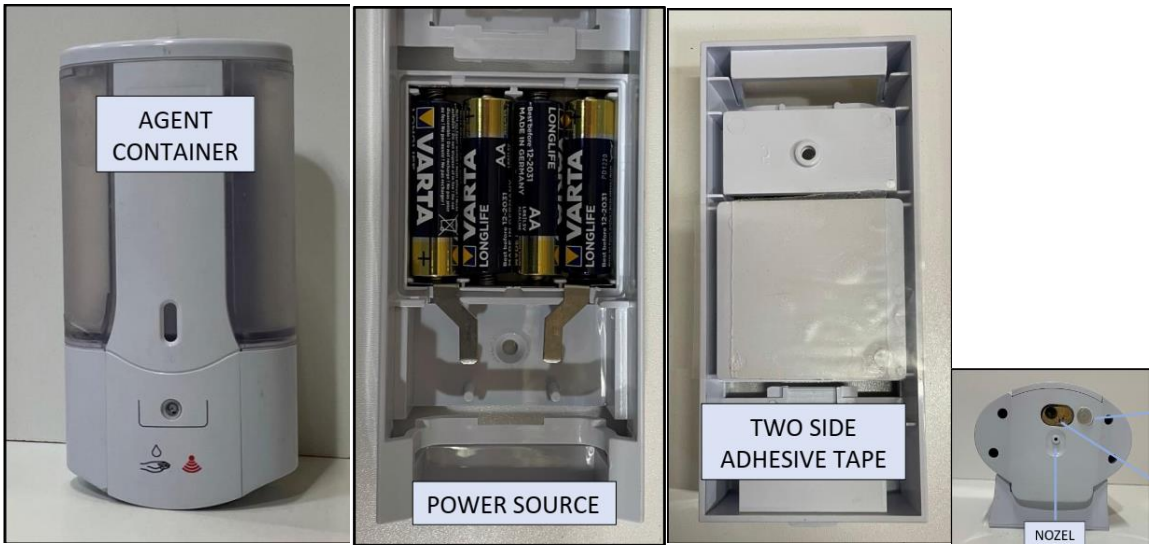
1.4 Chemical scenario - FLOOR SCRUBBER MACHINE

CHEMICAL SCENARIO	
	
Scenario Number	**4**
Title	**Floor scrubber machine.**
Summary	Toxic agent released spread over the floor in a thin layer using a floor scrubber machine.
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description of each step	The “group” infiltrates the mall cleaning staff. On a “D” day they deliver “new” floor scrubbing machines with fake ordering/delivering forms. The floor scrubbing machines are modified to spray the agent on the floor but not to whip it. The water tank contains the toxic agent.
Way of dispersion/entrance to the body	Inhalation
Overt/Covert/Combined attack	Combined
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	Suspicious member of the cleaning staff (wearing a respirator, driving too fast on/with a scrubber machine)
Potential announcement before the attack	No
Smell	Sweet, fruity odour.

On-going attack signs/Post attack signs	
Detection of the event	Visitors experiencing poisoning symptoms.
Technical detection of the event	Remote detectors designed for CWA detection (if available).
Alert	Visitors experiencing poisoning symptoms.
Recommended Security measures	None
Impact	
Affected groups (health)	After a short period of time, persons start to experience mild poisoning symptoms - impaired, blurry vision, runny nose, excess saliva, headache, nausea, muscle weakness, agitation etc. Following the mild poisoning, more severe symptoms will follow - very narrowed pupils, dizziness, disorientation, coughing and wheezing, sneezing, difficulty breathing, tremors, fatigue, severe vomiting and diarrhoea, involuntary urination and defecation. After a while, panic starts.
First responders	Initially, first responders do not recognise the ongoing attack. First teams get poisoned and contaminated as they try to help victims. Only after the number of victims grows, do they call specialised teams. Later dispatched HAZMAT teams to detect the contamination as it evaporated into the air. The Mall is evacuated and closed. The decontamination of the Mall takes weeks until it is cleared for the public.
Health care services	The local hospitals treat poisoned people in various stages of poisoning. More people have symptoms caused by panic. Several poisoned persons die.
Command and control centre	C2 centre organizes the HAZMAT response together with CBRN Forensic investigation before the evidence is destroyed by decontamination. All the visitors must be tracked down and screened for contamination.
Site/building/infrastructure	The mall is closed for weeks. Hundreds of apartments are checked for contamination. Public transport must be decontaminated.
Environment	The contamination spread outside the Mall is caused by the visitors but the concentration is reduced. Even being a persistent agent, it eventually degrades.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: Way of the access to shopping mall		**2,16**				
Vulnerability category II.: Bringing the weaponised CBRN agent into the place of attack	**2**					
Vulnerability category III.: Way of agent spreading		**3,75**				
Vulnerability category IV.: Shopping mall conditions for spreading of selected type of agent			**5,58**			
All categories average						**2,333**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: Type of chemical agent			**3,83**			
Impact category II.: Chemical agent quantity and combination with explosives		**3**				
Impact category III.: Attack prerequisites			**3,9**			
All categories average						**3,58**

1.5 Chemical scenario - HAND SANITISER

CHEMICAL SCENARIO	
	
Scenario Number	**5**
Title	**Hand sanitiser.**
Summary	Disinfectant in hand sanitiser replaced with toxic agent mixed with perfume and glycerine.
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description of each step	The "group" infiltrates the mall cleaning personnel. They replace the automatic hand sanitiser dispenser with the modified one containing toxic agents, perfume and glycerine in every public restroom.
Way of dispersion/entrance to the body	Contact
Overt/Covert/Combined attack	Covert
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	Suspicious behaviour of the staff (replacing the dispensers).
Potential announcement before the attack	No

On-going attack signs/Post attack signs	
Detection of the event	After a short period of time, first persons will start to experience mild poisoning symptoms - impaired, blurry vision, runny nose, excess saliva, headache, nausea, muscle weakness, agitation etc.
Technical detection of the event	None
Smell	Even the agents can have an odour, the perfume covers it.
Alert	Panic after experiencing symptoms
Recommended Security measures	None
Impact	
Affected groups (health)	Most injuries are caused by panic. In a later stage of poisoning some of the exposed persons experience excessive body secretions, including sweat, saliva, mucus, and tears, irregular heartbeat, collapse and respiratory depression or arrest.
First responders	Initially, first responders do not recognize the ongoing attack. Only after the number of victims grows, they call specialized teams. It takes the HAZMAT teams a long time to finally detect the contamination.
Health care services	The local hospitals treat poisoned people in various stages of poisoning. More people have symptoms caused by panic. Several poisoned persons die.
Command and control centre	C2 centre organizes the HAZMAT response together with CBRN Forensic investigation before the evidence is destroyed by decontamination. All the visitors must be tracked down and screened for contamination.
Site/building/infrastructure	The mall is closed for weeks and
Environment	The contamination spread outside the Mall is caused by the visitors but the concentration is reduced. Even being a persistent agent, it eventually degrades.
References/Literature	

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**		**2,16**				
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**	**2**					
Vulnerability category III.: **Way of agent spreading**		**3,1**				
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**			**4,38**			
All categories average						**2,91**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of chemical agent**			**3,66**			
Impact category II.: **Chemical agent quantity and combination with explosives**		**2**				
Impact category III.: **Attack prerequisites**		**1,75**				
All categories average						**2,47**

1.6 Chemical scenario - REFILED DISINFECTANT FOGGER SPRAY CAN

CHEMICAL SCENARIO	
Scenario Number	**6**
Title	**Refiled disinfectant fogger spray can.**
Summary	Toxic agent released using refilled disinfectant fogger spray cans.
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description of each step	The “group” refills modified fogger spray cans with a toxic agent and pressurizes them. On D-day, they disguise themselves as young political activists known from local news. They enter the Mall and start throwing the cans all around while depressing the release valve.
Way of dispersion/entrance to the body	Inhalation
Overt/Covert/Combined attack	Overt
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	Perpetrators wearing respirators running through the mall and throwing away cans.
Potential announcement before the attack	No
On-going attack signs/Post attack signs	

Detection of the event	Perpetrators wearing respirators running through the mall and throwing away cans.
Visual observation	Cans releasing fog
Smell	The releasing agent has a faint fruity odour or smell after rotting fruit
Technical detection of the event	CCTVs and security personnel notice radicals
Alert	Flying perpetrators panic after experiencing symptoms
Recommended Security measures	Physical security measures, intercepting the perpetrators by the security personnel.
Impact	
Affected groups (health)	Immediately first persons will start to experience mild poisoning symptoms - impaired, blurry vision, runny nose, excess saliva, headache, nausea, muscle weakness, agitation etc.
First responders	Specialised HAZMAT teams are dispatched, and they detect the contamination almost immediately as it is evaporated into the air.
Health care services	The event is immediately recognized as an attack. First responders wear proper PPE. The local hospitals treat poisoned people in various stages of poisoning. More people have symptoms caused by panic. Several poisoned persons die.
Command and control centre	C2 centre organizes the HAZMAT response together with CBRN Forensic investigation before the evidence is destroyed by decontamination. All the visitors must be tracked down and screened for contamination.
Site/building/infrastructure	The mall is closed for weeks. Hundreds of apartments are checked for contamination. Public transport must be decontaminated.
Environment	The contamination spread outside the Mall is caused by the visitors carrying it outside on their clothes and shoes, but the concentration is reduced. Even being a persistent agent, it eventually degrades.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**		**2,16**				
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**	**2**					
Vulnerability category III.: **Way of agent spreading**		**3,1**				
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**		**3,63**				
All categories average						**2,72**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of chemical agent**			**3,66**			
Impact category II.: **Chemical agent quantity and combination with explosives**			**4,0**			
Impact category III.: **Attack prerequisites**		**2,1**				
All categories average						**3,25**

1.7 Chemical scenario - RELEASE OF THE TOXIC AGENT IN A MALL

CHEMICAL SCENARIO	
Scenario Number	**7**
Title	**Release of the toxic agent in a mall**
Summary	Perpetrators intend to use toxic gas released simultaneously from several dispersion devices hidden in a backpack.
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description of each step	The group modifies common bags-backpacks and hides in them dispersion devices used in gardening. The device is equipped with a timer. They prepare a liquid agent with a very low boiling point. Once released from the containers it evaporates quickly, immediately poisoning people around.
Way of dispersion/entrance to the body	Inhalation
Overt/Covert/Combined attack	Combined
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	Suspicious backpacks on CCTV. Suspicious persons with backpacks.
Potential announcement before the attack	No
On-going attack signs/Post attack signs	

Detection of the event	Releasing gas from backpacks
Detection of the event	Persons experiencing symptoms
Technical detection of the event	The agent can be detected using HAZMAT detectors
Smell	Almonds
Alert	The attack happens without panic or other triggers.
Recommended Security measures	None
Impact	
Affected groups (health)	Poisoned persons experience symptoms such as headache, dizziness, fast heart rate, shortness of breath, and vomiting. This phase may then be followed by seizures, slow heart rate, low blood pressure, loss of consciousness, and cardiac arrest. After a few minutes, the gas is dispersed in a volume of air and no longer presents an immediate danger.
First responders	The attack is immediately recognized and the first responders are contacted. The first responders evacuate the mall and provide first aid to the victims. The agent is quickly recognized and detected.
Health care services	Paramedics are advised to use PPE.
Command and control centre	Once the attack is recognized, the C2 centre starts to track down the perpetrators. Others malls and supermarkets are closed as the public panic spreads.
Site/building/infrastructure	The mall is closed and the investigation begins. The agent is ventilated and after several days the mall is cleared for the public.
Environment	None

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL

Vulnerability category I.: Way of the access to shopping mall		**2,16**				
Vulnerability category II.: Bringing the weaponised CBRN agent into the place of attack	**2**					
Vulnerability category III.: Way of agent spreading		**3,1**				
Vulnerability category IV.: Shopping mall conditions for spreading of selected type of agent		**3,63**				
All categories average						**2,72**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: Type of chemical agent			**3,66**			
Impact category II.: Chemical agent quantity and combination with explosives		**2**				
Impact category III.: Attack prerequisites		**1,75**				
All categories average						**2,47**

1.8 Chemical scenario – PERFUMERY

CHEMICAL SCENARIO	
Scenario Number	**8**
Title	**Perfumery**
Summary	Perfume testers filled with a toxic chemical agent in perfumery
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description of each step	The group synthesises the agent from purchased and stolen chemicals in a homemade laboratory. After a detailed reconnaissance of the perfumery, they purchase selected perfumes and replace the content of the perfume sprayers (atomizers) with a toxic agent. They replace the perfume testers in the perfume shop.
Way of dispersion/entrance to the body	Contact
Overt/Covert/Combined attack	Covert. Perpetrators secretly replace the perfume testers
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	A possible shoplifter spotted on CCTV (when replacing the perfume testers)
Potential announcement before the attack	No
On-going attack signs/Post attack signs	
Detection of the event	Likely no.

	The event will be detected after a long period of time when the first fatalities occur and officials start to investigate the occurrence of similar cases.
Technical detection of the event	Not available in the unclassified version.
Alert	None
Smell	Faint odour.
Recommended Security measures	CCTV cameras to prevent shoplifting.
Impact	
Affected groups (health)	After a period of time, visitors of the mall start to experience symptoms of mercury poisoning – sore gums, tingling in fingers, lips and tongue, clumsiness and weakness, slurred speech and metallic taste. Several people seek medical assistance and thus mercury poisoning is discovered
First responders	After the Mall is identified as a source of the contamination, it is closed and evacuated. HAZMAT teams search for contamination in a perfumery. All the testers and perfumes are analysed. The rest of the mall is searched with no results. The mall is closed for weeks.
Health care services	The local hospitals treat poisoned people in various stages of poisoning. More people have symptoms caused by panic after the attack is medialised. Several poisoned persons die.
Command and control centre	C2 centre organises the HAZMAT response together with CBRN Forensic investigation. All the visitors must be tracked down and screened for contamination.
Site/building/infrastructure	The mall is closed for weeks. The public transport system is checked for mercury contamination. The homes of the victims are checked as well, but the concentrations of detected mercury are mostly below safety limits.
Environment	The contamination spread outside the Mall is caused by the visitors, but the concentration is insignificant. The concentrations of detected mercury are mostly below safety limits.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**	**1,75**					
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**		**3**				
Vulnerability category III.: **Way of agent spreading**	**1**					
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**	**1**					
All categories average						**1,7**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of chemical agent**		**1,7**				
Impact category II.: **Chemical agent quantity and combination with explosives**		**2**				
Impact category III.: **Attack prerequisites**		**2,3**				
All categories average						**2**

1.9 Chemical scenario - GLITTER BOX

CHEMICAL SCENARIO	
Scenario Number	**9**
Title	**Glitter box**
Summary	Mail package contains “Glitter bomb” with incapacitating chemical
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description of each step	The group synthesises the agent from purchased and stolen chemicals in a homemade laboratory. They also build a package bomb and insert the agent inside. The chemical is tightly packed, so the package has no odour. They send the package via commercial delivery to the Shopping Mall operation centre.
Way of dispersion/entrance to the body	Aerosol
Overt/Covert/Combined attack	Covert. Perpetrators incapacitate the operation centre staff.
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	Pungent odour.

Potential announcement before the attack	No
On-going attack signs/Post attack signs	
Detection of the event	Likely no.
Technical detection of the event	Sensory detection (Smell).
Alert	Possibly if the package content is spilt inside the box, the pungent odour alerts the delivery boy.
Smell	Pungent odour
Recommended Security measures	Mail delivery policy
Impact	
Affected groups (health)	When receiving person opens the package, the content is rapidly released. Pungent odour incapacitates command centre staff immediately. People experience vomiting, nausea and unconsciousness. The odour is spread through the mall, evacuating the visitors and the surrounding area.
First responders	After the first responders are alerted, they arrive and evacuate the unconscious personnel and some of the visitors.
Health care services	The local hospitals treat poisoned people. There are no casualties.
Command and control centre	The C2 centre of the Mall is immediately incapacitated and off-line.
Environment	The contamination is spread to the surrounding area but with no damage. After a couple of days, it evaporated.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**	**1,1**					
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**	**1,1**					
Vulnerability category III.: **Way of agent spreading**		**3**				
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**			**3,2**			
All categories average						**2,1**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of chemical agent**		**2,8**				
Impact category II.: **Chemical agent quantity and combination with explosives**			**4,0**			
Impact category III.: **Attack prerequisites**				**4,2**		
All categories average						**3,7**

1.10 Radiological scenario - OUTLET STORE

RADIOLOGICAL SCENARIO	
Scenario Number	**1**
Title	**OUTLET STORE**
Summary	Strong sealed industrial sources hidden inside the clothes (pockets) to irradiate customers of the outlet store in a shopping mall.
LIKELIHOOD	Likely
CBRN agent	
Agent group	Sealed radioactive source
Modus operandi and technical features	
Description of each step	The group is asked to destroy the competition in the local shopping mall. The radical group decides to use radioactive source because this would give them a credit as it is not used so often. The group purchases two sealed industrial radioactive gamma sources on a black market. They place the sources inside the selected clothes. They purchase something and leave.
Way of dispersion/entrance to the body	Irradiation
Overt/Covert/Combined attack	Combined
Pre-Incident indicators/Warning signs	

Visual observation of the threat (in person or via CCTV)	None
Potential announcement before the attack	After a few days, an anonymous caller announces the presence of the radioactive sources to mall officials.
On-going attack signs/Post attack signs	
Detection of the event	Announcement
Technical detection of the event	Possibly CCTV
Alert	Announcement
Recommended Security measures	Evacuation of the mall without causing panic.
Impact	
Affected groups (health)	The customers who are irradiated from standing around the items with hidden radioactive sources receive an effective dose of a few μSv while persons touching the items and putting the on will receive an effective dose of up to 0,4 Sv. Based on the low dose rate of the source, radiation injuries will probably not occur when people come in contact with radiation sources.
First responders	Once the attack is announced, the first responders conduct a search for the radioactive material once the attack is revealed and the mall is evacuated and secured. They experience no adverse health effects.
Health care services	After the announcement of the attack, panic starts to spread and the hospitals are overwhelmed.
Command and control centre	After the announcement of the attack, the mall is secured, evacuated and closed. The search for the sources takes time and because there is no evidence of how many sources there were initially, the information is shared among the public that some of the items purchased in the outlet stores could be dangerous. The panic starts and officials are overwhelmed.
Site/building/infrastructure	The mall is closed and thoroughly searches for radioactive sources. To clear the mall and confirm its safety, a detailed survey is needed. The mall is closed for several weeks

Environment	As the sources are sealed, no contamination is spread into the surrounding environment.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**		**2,16**				
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**	**1,83**					
Vulnerability category III.: **Way of agent spreading**	**1**					
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**	**1**					
All categories average						**1,45**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of chemical agent**			**3,16**			
Impact category II.: **Chemical agent quantity and combination with explosives**	**1**					
Impact category III.: **Attack prerequisites**	**2**					
All categories average						**2,05**

1.11 Radiological scenario - DIRTY BOMB

RADIOLOGICAL SCENARIO	
Scenario Number	**2**
Title	**Dirty bomb.**
Summary	Liquid radioactive source dispersed by the dirty bomb hidden in a modified suitcase.
CBRN agent	
Agent group	Radioactive source
Modus operandi and technical features	
Description of each step	Group purchases sealed radioactive sources in small amounts. They disassemble the sources as much as it is possible with consideration for safety and dissolve them in a strong acid. They prepare the liquid explosive, fill the canisters with the liquid explosives and finally add dissolved radioactive sources. On a D-day, the perpetrator carries the suitcase inside the mall where he activates it and then he leaves.
Way of dispersion/entrance to the body	Contact
Overt/Covert/Combined attack	Combined
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	The suspicious visitor of the mall with a suitcase

Potential announcement before the attack	None
On-going attack signs/Post attack signs	
Detection of the event	The explosion of the dirty bomb kills several persons and injures dozen.
	Activated fire suppression system
	Smoke and small fire (from destroyed electrical wires)
Technical detection of the event	None
Alert	The explosion
Recommended Security measures	None
Impact	
Affected groups (health)	Injured people are rescued by first responders and taken to hospitals. They are not aware of the radiation until the police unit detects the radioactivity at the explosion site. Once the information about the radiation leaks from the officials, panic starts.
First responders	First responders are not aware of radiation and get contaminated. They spread the contamination to their vehicles and eventually to the hospitals.
Health care services	After the panic starts the hospitals are overwhelmed by thousands of scared people complaining about having radiation symptoms.
Command and control centre	C2 centre organises the evacuation of the mall. After the initial evacuation of the mall and its decontamination, the large operation begins focused on reducing the contamination levels all around the city, on tracking down exposed people and on clearing the supermarkets and other food supply stores. It takes months to return to a normal state.
Site/building/infrastructure	The mall is closed for several weeks until the decontamination is completed and the mall is cleared for the public. The situation lasts weeks.
Environment	The residual contamination is spread by victims into their homes. The places with the highest activities are localized

	and decontaminated but many contaminated places remain due to the low-level gamma radiation.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**		**2,16**				
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**	**1,83**					
Vulnerability category III.: **Way of agent spreading**	**1**					
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**	**1**					
All categories average						**1,5**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of chemical agent**			**3,16**			
Impact category II.: **Chemical agent quantity and combination with explosives**	**1**		**3,5**			
Impact category III.: **Attack prerequisites**			**3,42**			
All categories average						**3,36**

1.12 Radiological scenario - COLOUR SMOKE

RADIOLOGICAL SCENARIO	
Scenario Number	**3**
Title	**Colour smoke.**
Summary	Homemade colour smokes mixed with the powdered radionuclide.
CBRN agent	
Agent group	Open radioactive source
Modus operandi and technical features	
Description of each step	The group purchase radioactive powdered radionuclides from the facility located in the separatists-controlled region in a nearby state. They prepare the smoke bomb following online instructions. On D-day, they disguise themselves as young political activists known from local news. They enter the Mall and place the cans in selected places (near benches, garbage bins, etc). The second group lights in the right moment fuse and escapes.
Way of dispersion/entrance to the body	Contact, Inhalation, Ingestion
Overt/Covert/Combined attack	Overt
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	Suspicious persons lighting canisters.
Potential announcement before the attack	No.

On-going attack signs/Post attack signs	
Detection of the event	The smoke bombs release coloured smoke which lasts less than one minute. After the bomb burns out, the coloured dust falls and covers the floor up to a 10-meter radius. The air smells of pyrotechnics. There is no indication of radioactivity. Because the visitors recognize the political activists they don't panic. Most of the visitors are recording the event on their smartphones, some even cheer the group. Few young people run through the coloured smoke for fun or to show support.
Technical detection of the event	Coloured smoke was detected on CCTVs.
Smell	Smell of pyrotechnics
Colour	Dust of different colour
Alert	Group of masked people shouting political slogans.
Recommended Security measures	None
Impact	
Affected groups (health)	The exposed people breathe in the radioactive dust, swallow it or get it into their eyes. It covers the surface of their bodies, their clothes, hair. The first symptoms start to show after a few hours. Some of the victims with more severe symptoms visit the hospitals. External and internal exposures of visitors to radioactive dust have resulted in a spectrum of adverse health effects that range from nausea to death. Some of the exposed individuals show signs of acute radiation syndrome, such as nausea, vomiting, and diarrhoea. A large number of individuals with acute radiation syndrome develop bone marrow failure and can die. Dermal injuries can be observed among the exposed individuals - ranging from radiation dermatitis to severe radiation injuries leading to an amputation. Ocular and reproductive effects are also reported. Some incidents of external exposure to radiation demonstrate that serious adverse effects may also be expected when individuals are exposed only externally to high levels of radiation. Nausea, weakness, headaches, and loss of appetite are the most reported symptoms among

	exposed visitors. Vomiting is reported by some of the patients.
First responders	First, the firefighters who arrive at a Mall first, check the burnt-out beverage cans for a potential fire hazard. They spray fire retardant over the cans. There is still no indication of the radiation hazard. After the police's arrival, the cans are collected as evidence by firefighters. As there is no major damage to the property, the case is closed. The mall cleaning crews are sent to wipe the floor and remove the coloured dust. The radioactive dust is being spread by visitors and first responders throughout the city.
Health care services	After several patients with similar symptoms end up in hospitals the officials are alarmed.
Command and control centre	C&CC is established to control the radioactivity a track down the visitors carrying the contamination. Specialized hazmat teams are dispatched to reconnaissance the city and search for radioactive contamination.
Site/building/infrastructure	The Mall is closed and the places with the highest radioactivity are marked and shielded to prevent the further spread of radioactive contamination. The elevated radiation levels are detected on every floor of the mall, inside the ventilation system, and in most of the stores. The contamination is also spread inside the public transportation, outside in the closest vicinity of the mall. The visitors carried the contamination to their homes all around the city. Their cars, homes, and clothes are contaminated.
Environment	As rains can dissolve the radioactive substance there is the risk of soil contamination. The runoff from the paved areas is carried through the sewer system to a water treatment plant. From there it is released to a nearby river.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**		**3**				
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**	**1,83**					
Vulnerability category III.: **Way of agent spreading**		**3**				
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**	**2**					
All categories average						**2,45**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of chemical agent**			**3,16**			
Impact category II.: **Chemical agent quantity and combination with explosives**		**3**				
Impact category III.: **Attack prerequisites**			**3,42**			
All categories average						**3,19**

1.13 Radiological scenario - SHOPPING CART HANDLES

RADIOLOGICAL SCENARIO	
Scenario Number	**4**
Title	**Shopping cart handles**
Summary	The handle of the shopping carts wiped/sprayed with the dissolved radioactive source
CBRN agent	
Agent group	Radioactive source
Modus operandi and technical features	
Description of each step	A lonely wolf decides to take revenge on the chain of food stores. He gains access to discarded smoke detectors. He learns how to extract the radioactive source and dissolve it in weak acid. He discase himself as a staff and starts to "disinfect" the handles of the shopping carts in a supermarket, located inside the shopping mall.
Way of dispersion/entrance to the body	Contact
Overt/Covert/Combined attack	Combined
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	None
Potential announcement before the attack	In order to create panic, he announces the attack using social media the next day.
On-going attack signs/Post attack signs	

Detection of the event	The attack is not detected until it is announced by perpetrator through the social media.
Technical detection of the event	None
Alert	None
Recommended Security measures	None
Impact	
Affected groups (health)	The customers of the supermarket use the shopping carts and get exposed to the radioactive substance when touching the contaminated handles. As their hands get contaminated, the concentration of the radionuclide decreases and eventually most of the contamination is wiped off by the victims.
First responders	After the evacuation of the supermarket, specialized HAZMAT teams search for contamination all around the shopping mall. Later all the supermarkets (not only the one chain of supermarkets) are checked for contamination and the HAZMAT teams are overwhelmed.
Health care services	After the panic starts the hospitals are overwhelmed by thousands of scared people complaining about having radiation symptoms.
Command and control centre	After the initial evacuation of the mall and its decontamination, the large operation begins focused on reducing the contamination levels all around the city, on tracking down exposed people and on clearing the supermarkets and other food supply stores. It takes months to return to a normal state.
Site/building/infrastructure	The mall is closed for several weeks until the decontamination is completed and the mall is cleared for the public. The whole supermarket chain is closed and inspected. The people do not trust officials and refuse to visit large food supply stores. The situation lasts weeks.
Environment	The residual contamination is spread by victims into their homes. The places with the highest activities are localized and decontaminated but many contaminated places remain due to the low-level gamma radiation.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**		**2,16**				
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**	**0,75**					
Vulnerability category III.: **Way of agent spreading**	**1**					
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**	**1**					
All categories average						**1,2**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of chemical agent**		**2,6**				
Impact category II.: **Chemical agent quantity and combination with explosives**	**1**					
Impact category III.: **Attack prerequisites**		**2,5**				
All categories average						**2,03**

1.14 Radiological scenario - INDOOR PLAYGROUND

RADIOLOGICAL SCENARIO	
Scenario Number	**5**
Title	**Indoor playground.**
Summary	Hidden source under indoor playground
CBRN agent	
Agent group	Sealed radioactive source
Modus operandi and technical features	
Description of each step	The lonely wolf – activist claiming that the mall was built on his property and that the developer robbed him, decides to force the mall to close. He purchases two sealed industrial radioactive gamma sources on a black market. On D-day, he pretends, that his child is playing on an indoor playground and places the sources using adhesive into the structure of the playground.
Way of dispersion/entrance to the body	Irradiation
Overt/Covert/Combined attack	Combined
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	The suspicious person around the playground (using tape and suspicious objects)
Potential announcement before the attack	Yes
On-going attack signs/Post attack signs	

Detection of the event	Once the incident is announced via media, the officials close the mall and evacuate the visitors. Specialized hazmat teams search for radioactive sources. They detect them and after confirmation that there is no explosive device present, they secure the two sources. Further search shows no radioactive contamination.
Technical detection of the event	CCTV.
Alert	None
Recommended Security measures	The radioactive gate detectors could possibly trigger an alarm.
Impact	
Affected groups (health)	Being exposed to a lot of radiation over a short period of time, such as during a radiation emergency, can cause skin burns. It may also lead to acute radiation syndrome (ARS, or "radiation sickness"). The symptoms of ARS include headache and diarrhoea. They usually start within hours. Those symptoms will go away and the person will seem healthy for a little while. But then they will get sick again. How soon they get sick again, which symptoms they have, and how sick they get depends on the amount of radiation they received. In some cases, ARS causes death in the following days or weeks.
First responders	Specialized hazmat teams locate and secure the sources. They confirm no residual radioactive contamination.
Health care services	Hospitals are overwhelmed by panicked parents with children those visiting the mall but also those, who visited other public playgrounds. People demand treatment for radiation sickness for their children, specialized tests, etc.
Command and control centre	C2 centre helps identify and track down victims.
Site/building/infrastructure	As no radioactive contamination has been present, there is no impact on infrastructure.
Environment	As no radioactive contamination has been present, there is no impact on the environment.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**		**2,16**				
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**	**1,83**					
Vulnerability category III.: **Way of agent spreading**	**1**					
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**	**1**					
All categories average						**1,5**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of chemical agent**			**3,16**			
Impact category II.: **Chemical agent quantity and combination with explosives**	**1**					
Impact category III.: **Attack prerequisites**	**2**					
All categories average						**2,05**

1.15 Biological scenario - FIRE SUPPRESSION SYSTEM

BIOLOGICAL SCENARIO	
Scenario Number	**1**
Title	**FIRE SUPPRESSION SYSTEM**
Summary	Biological agent released through a fire suppression system using ceiling-mounted water sprinklers.
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description	The group managed to produce a biological pathogen. They obtain the schematics of the Mall's fire extinguishing system and locate the water delivery system. On D-day, they trigger the fire suppression system.
Way of dispersion/entrance to the body	The pathogen is sprayed through fire suppression system sprinklers all over the people.
Overt/Covert/Combined attack	Covert attack
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	Suspicious activity around the fire suppression delivery system.
Potential announcement before the attack	No
Smell	The bouillon gets smelly after a while, but it is contained in a closed fire suppression system.
Colour	The bouillon is yellow but in a closed fire suppression system, it cannot be seen.

On-going attack signs/Post attack signs	
Detection of the event	The fire alarm was turned on, and sprinklers sprayed fire retardant.
Technical detection of the event	The hacked computer system triggered the fire alarm.
Smell	The water from the fire suppression system is smelly and slightly yellow. But the affected visitors pay no attention to it, as they try to get away.
Impact	
Affected groups (health)	The disease begins with sudden onset of symptoms after an incubation period of 1-6 days. Symptoms include high fever, chills, headache, and malaise, followed by cough (often with hemoptysis), progressing rapidly to dyspnea, stridor, cyanosis, and death. Gastrointestinal symptoms are often present. After a few days, victims start to seek medical care in local hospitals.
First responders	The firefighters respond to the fake fire alarm. By the time they arrive, the alarm is off, and the fire suppression system is depleted. They walk through contaminated water only in standard firefighters' PPE. They spread the contamination to their fire trucks and to the fire stations. After a few days, some of the responders experience symptoms of the disease.
Health care services	First aid – the responding ambulances suspect no biological threats and wear no special PPE. They treat minor injuries but they do not enter the mall as it is evacuated and no fire is detected.
Command and control centre	As the incident is without any sign that it could be an attack, the mall security and law enforcement suggest that the event was caused by hackers. Only closer inspection of the recent fire system routine maintenance reveals a possible terrorist attack. Later the growing number of victims in hospitals confirms the suspicion.
Site/building/ infrastructure	Once the official confirmation of the attack, the mall is evacuated and closed. The decontamination of the mall, public areas, apartments of the victims, and fire stations, takes weeks until it is cleared for the public. Meanwhile, the disease is spreading through the city. After the public announcement of the attack through social media, the

	panic starts and the hospitals are overwhelmed with people having similar symptoms.
Environment	The public areas, apartments of the victims, and fire stations are disinfected with strong disinfectants. No other impact on the environment.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**	**1,8**					
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**		**3**				
Vulnerability category III.: **Way of agent spreading**		**3,75**				
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**			**4,13**			
All categories average						**3,17**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of biological agent**		**2,5**				
Impact category II.: **Biological agent quantity and combination with explosives**				**6**		
Impact category III.: **Attack prerequisites**				**6,42**		
All categories average						**5**

1.16 Biological scenario - RESTROOMS – CONTAMINATED TOILET PAPER

BIOLOGICAL SCENARIO	
Scenario Number	**B2**
Title	**Restrooms – contaminated toilet paper.**
Summary	Contaminated toilet paper with the biological pathogen in public restrooms.
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description	The group recruited microbiologists with knowledge of how to cultivate all kinds of bacteria. They unroll toilet papers and spray those with an aerosol containing the pathogen. They carefully roll back the toilet paper and make it look new. With the help of the member of the group, who infiltrated the mall cleaning staff, they change the toilet paper in all public restrooms all over the mall.
Way of dispersion/entrance to the body	Contact. Use of contaminated toilet paper
Overt/Covert/Combined attack	Covert
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	There is no CCTV coverage on public toilets. Some visitors may complain that the toilet paper looks like-used.
Potential announcement before the attack	No.

Colour	The toilet paper looks as if it is wet and then dried off. Some of it looks dirty. Some of the visitors complain to the mall staff.
Smell	The visitors complain that the toilet paper smells bad.
On-going attack signs/Post attack signs	
Detection of the event	The attack goes undetected.
Post attack signs	An increased number of sick people with the same symptoms around the city leads to an investigation. The officials find out that the outbreak's source is the shopping mall.
Technical detection of the event	None
Alert	The growing number of sick people all around the city.
Impact	
Affected groups (health)	This bacterial infection can cause 2 serious conditions and both conditions affect the blood, kidneys and, in the most severe cases, the central nervous system. After an incubation period of 2-10 days, people infected with this pathogen can have experience symptoms:
First responders	None
Health care services	After the public announcement of the attack through social media, the panic starts and the hospitals are overwhelmed with people having similar symptoms.
Command and control centre	Later, when the attack is confirmed and announced by the perpetrators through social media, the mall is closed. As the command staff do not use the public toilets, they are unaffected.
Site/building/infrastructure	The decontamination of the mall takes weeks until it is cleared for the public.
Environment	None

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**		**2,16**				
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**	**2**					
Vulnerability category III.: **Way of agent spreading**	**1,75**					
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**			**4,4**			
All categories average						**2,57**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of biological agent**		**2,5**				
Impact category II.: **Biological agent quantity and combination with explosives**		**3**				
Impact category III.: **Attack prerequisites**		**2,42**				
All categories average						**2,64**

1.17 Biological scenario - AIR-VENTILATION SYSTEM

BIOLOGICAL SCENARIO	
Scenario Number	**3**
Title	**Air-ventilation system.**
Summary	Biological agent released through an Air-ventilation system in a form of powder.
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description	The group establishes an air condition – air ventilation system cleaning/maintenance company several months before the attack. While working inside commercial buildings they gain experience and the respect of the customers. They order the production of the purified agent from another country. On D-day, they smuggle the agent among the cleaning equipment into the mall during their routine cleaning or maintenance.
Way of dispersion/entrance to the body	Inhalation
Overt/Covert/Combined attack	Covert
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	White dust, mist in the air. The false maintenance crew leaving the mall in a hurry.
Potential announcement before the attack	Possible

Technical detection of the event	Sensors in the air ventilation system indicate missing filters.
On-going attack signs/Post attack signs	
Detection of the event	The event is covert. During the first stages, there is no evidence of the ongoing attack.
Technical detection of the event	None. Only special biological detectors could indicate the agent in the air
Alert	Some of the victims get a high dose of the agent and start showing symptoms (coughing, eye irritation, etc.). They can complain to the Mall staff.
Colour	White dust in the air, on a ground
Visual observation of the threat (in person or via CCTV)	The cleaning crew complains that at some places (near air ventilation) some strange dust accumulates.
Recommended Security measures	None
Impact	
Affected groups (health)	General: Acute onset of fever, chest tightness, cough, dyspnoea, nausea, and joint pain occur 4 to 8 hours after inhalation exposure. Pulmonary oedema can occur within 18-24 hours, followed by severe respiratory distress and death in 36-72 hours.
First responders	After the mall is closed and an attack is suspected, the first responders dispatch a specialized CBRN team. They confirm the presence of a biological agent
Health care services	After a while, the symptoms start to appear and the victims seek medical care in the hospital.
Command and control centre	The C2 centre staff is not affected. They close the mall as more and more visitors and staff members complained about the white powder. They call for first responders to describe the circumstances.
Site/building/infrastructure	The decontamination of the mall takes weeks until it is cleared for the public. After the public announcement of the attack through social media, the panic starts and the hospitals are overwhelmed with people having similar symptoms.

Environment	The public areas and apartments are decontaminated with strong disinfectants.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**	**1,88**					
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**		**3**				
Vulnerability category III.: **Way of agent spreading**		**3,75**				
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**		**3,75**				
All categories average						**3,1**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of biological agent**			**3,33**			
Impact category II.: **Biological agent quantity and combination with explosives**			**4,0**			
Impact category III.: **Attack prerequisites**				**4,75**		
All categories average						**4,02**

1.18 Biological scenario - CONTAMINATION OF MUSTARD/ MAYONNAISE/ KETCHUP IN A FOOD COURT WITH A BIOLOGICAL AGENT

BIOLOGICAL SCENARIO	
Scenario Number	**4**
Title	**Contamination of mustard/mayonnaise/ketchup in a food court with a biological agent**
Summary	Terrorists intend to use a biological agent to poison food in a food court
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description	The terrorists obtain a biological agent. Before the event, the terrorists identify and infiltrate the company supplying the food court. They contaminate different condiments and sauces (etc. mustard/mayonnaise/ketchup).
Way of dispersion/entrance to the body	Ingestion
Overt/Covert/Combined attack	Covert
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	Some of the mayonnaise looks spoiled
Smell	The agent has no smell

Taste	The agent has no taste
Potential announcement before the attack	No
On-going attack signs/Post attack signs	
Detection of the event	The growing number of patients with similar symptoms around the city.
Technical detection of the event	The agent can be detected only after laboratory analysis.
Alert	The attack happens without panic or other triggers.
Recommended Security measures	None
Impact	
Affected groups (health)	The infection is a common bacterial disease that affects the intestinal tract. Humans become infected most frequently through contaminated water or food. Typically, people with infections have no symptoms. Others develop diarrhea, fever and abdominal cramps within eight to 72 hours. Most healthy people recover within a few days without specific treatment.
First responders	The attack happens without panic or other triggers. Once the attack is recognised, the mall is closed and specialized HAZMAT teams start to assess the situation inside the mall.
Health care services	Hospitals start to treat patients with salmonellosis symptoms. As the number of patients grows, it triggers the alarm and the investigation begins. After a few days, the attack is medialized and panic starts. The hospitals are overwhelmed as infectious disease spreads throughout the city.
Command and control centre	Once the attack is recognised, the C2 centre starts to track down the visitors and coordinate the disinfection operations inside the mall and also in public spaces.
Site/building/infrastructure	The mall is closed and the investigation begins. Later the disinfection starts which lasts for several weeks. The mall is closed for weeks. The infectious disease starts to spread and the city is paralysed.

Environment	Strong disinfectants are used for the decontamination of public spaces, public transportation, apartments etc.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**	**0,75**					
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**		**4**				
Vulnerability category III.: **Way of agent spreading**		**3**				
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**		**3**				
All categories average						**2,67**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of biological agent**		**2,5**				
Impact category II.: **Biological agent quantity and combination with explosives**			**4,0**			
Impact category III.: **Attack prerequisites**			**3,75**			
All categories average						**3,42**

1.19 Biological scenario – BALLOONS

BIOLOGICAL SCENARIO	
Scenario Number	**5**
Title	**Balloons.**
Summary	Pathogen released from balloons punctured using BB gun/slingshot.
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description of each step	The group obtains samples of the pathogen through their contacts in different countries. The samples are probably from dead animals. They learn the technique to cultivate a bacterium. They buy party balloons of different colours and fill them with the spores of the pathogen. On D-day, they start shooting down the balloons with BB guns or slingshots and releasing the dust with spores.
Way of dispersion/entrance to the body	Inhalation
Overt/Covert/Combined attack	Combined
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	Suspicious persons with BB gun is spotted on CCTV cameras or by visitors of the Mall.
Smell, taste, color	The agent spores do not have a characteristic appearance, smell, or taste.

Potential announcement before the attack	No
On-going attack signs/Post attack signs	
Visual observation of the threat (in person or via CCTV)	Suspicious persons shooting down balloons are spotted on CCTV cameras or by visitors of the Mall.
Visual observation of the threat (in person or via CCTV)	Dust falling from balloons
Alert	Persons shooting down balloons.
Visual observation of the threat (in person or via CCTV)	Dust is gathered under the balloons. Visitors spread the dust around the mall. The cleaning staff is dispatched.
Recommended Security measures	Physical security measures, confrontation of the attackers with BB gun
Impact	
Affected groups (health)	After a few days first exposed persons will start to experience symptoms. Those can include headache, fever, malaise, chest pain, respiratory distress, fatigue, dyspnoea, myalgia, and skin lesions. As a complication meningitis can occur.
First responders	The attack happens without panic or other triggers. Once the attack is recognized, the mall is closed and specialized HAZMAT teams start to assess the situation inside the mall.
Health care services	Hospitals start to treat patients with salmonellosis symptoms. As the number of patients grows, it triggers the alarm and the investigation begins. After a few days, the attack is medialized and panic starts. The hospitals are overwhelmed as infectious disease spreads throughout the city.
Command and control centre	Once the attack is recognized, the C2 centre starts to track down the visitors and coordinate the disinfection operations inside the mall and also in public spaces.
Site/building/infrastructure	The mall is closed and the investigation begins. Later the disinfection starts which lasts for several weeks. The mall is closed for weeks.

	The infectious disease starts to spread and the city is paralyzed.
Environment	Strong disinfectants are used for the decontamination of public spaces, public transportation, apartments etc.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**	**1,88**					
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**		**3**				
Vulnerability category III.: **Way of agent spreading**					**9**	
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**			**4,13**			
All categories average						**4,5**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of biological agent**			**3**			
Impact category II.: **Biological agent quantity and combination with explosives**			**4**			
Impact category III.: **Attack prerequisites**			**4**			
All categories average						**3,67**

1.20 Biological scenario - FLOWER HUMIDIFIER

BIOLOGICAL SCENARIO	
Scenario Number	**6**
Title	**Flower Humidifier**
Summary	Pathogen released from the air humidifier in a flower shop
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description of each step	The group obtains samples of the pathogen through their contacts in different countries. The liquid containing the pathogen is filled into a humidifier, the same type as used in selected flower shops inside the shopping mall. The group infiltrates the flower supply company. On a D-day, during the standard flower delivery to the store, the employee-the group member switches the humidifier with the modified one.
Way of dispersion/entrance to the body	Inhalation
Overt/Covert/Combined attack	Covert
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	Suspicious behavior of the person in a store recorded on a CCTV
Potential announcement before the attack	None

Smell, taste, color	The agent has no smell, no taste and no colour
On-going attack signs/Post attack signs	
Detection of the event	The attack goes undetected. Only after the hospitals report an increasing number of similar cases the investigation begins.
Technical detection of the event	The agent can be detected only by laboratory analysis
Alert	None
Impact	
Affected groups (health)	The symptoms of the infection generally begin within two to 15 days of exposure to the agent. Initial signs and symptoms often include fever, sudden, severe headache, nausea and vomiting. Nasal congestion or discharge, changes in smell or taste As the disease worsens, signs and symptoms may also include: a stiff neck, sensitivity to light, confusion, loss of balance, sleepiness, seizures and hallucinations The disease can progress rapidly and typically leads to death within about five days of the start of symptoms.
First responders	The attack happens without panic or other triggers. Once the attack is recognized, the mall is closed and specialized HAZMAT teams start to assess the situation inside the mall.
Health care services	Hospitals start to treat patients with PAM symptoms. As the number of patients grows, it triggers the alarm and the investigation begins. After a few days, the attack is medialized and panic starts. The hospitals are overwhelmed with people having similar symptoms.
Command and control centre	Once the attack is recognized, the C2 centre starts to track down the visitors and coordinate the disinfection operations inside the mall and also in public spaces.
Site/building/infrastructure	The mall is closed and the investigation begins. Later the disinfection starts which lasts for several days. Once the disease is recognized as a non-infectious disease, the public is calmed down and the situation is under control.
Environment	Strong disinfectants are used for the decontamination of the flower store and selected areas inside the Mall.

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**	**1,5**					
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**	**1,5**					
Vulnerability category III.: **Way of agent spreading**		**4**				
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**			**4,38**			
All categories average						**2,85**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of biological agent**	**0,8**					
Impact category II.: **Biological agent quantity and combination with explosives**		**2**				
Impact category III.: **Attack prerequisites**	**0,9**					
All categories average						**1,23**

1.21 Biological scenario - 5D – SPECIAL EFFECT CINEMA

BIOLOGICAL SCENARIO	
Scenario Number	**B8**
Title	**5D – special effect cinema.**
Summary	The “rain system” in a 5D – cinema is filled with a biological agent.
CBRN agent	
Agent group	Not available in the unclassified version
Modus operandi and technical features	
Description	The group purchases large amounts of the agent in an oil form from different sources, and steals and purchases the necessary chemicals. Using the procedures published on the internet, and the darknet, the group extracts the toxin from the oil. On D-day, they enter the cinema and replace the water in an artificial rain system with contaminated water.
Way of dispersion/entrance to the body	Spray from the artificial rain system
Overt/Covert/Combined attack	Covert
Pre-Incident indicators/Warning signs	
Visual observation of the threat (in person or via CCTV)	CCTV inside the 5D cinema – it shows “a visitor” manipulating the 5D cinema system

Potential announcement before the attack	No.
On-going attack signs/Post attack signs	
Detection of the event	The cinema staff could alarm security if the behaviour of the group members is suspicious
Technical detection of the event	Only by specialised detection equipment
Taste	The agent can have a bitter taste
Alert	A growing number of sick people all around the city.
Recommended Security measures	Prevention of access to 5D cinema systems.
Impact	
Affected groups (health)	Poisoned visitors to the cinema develop poisoning symptoms within a few hours. The symptoms include difficulty breathing, fever, cough, nausea, and tightness in the chest. Heavy sweating may follow as well as fluid building up in the lungs (pulmonary oedema). Finally, low blood pressure and respiratory failure may occur, leading to death.
First responders	Once the attack is recognised, the first responders enter the place in a proper CBRN PPE.
Health care services	Once the number of victims increases, the hospitals alarm the officials, and the investigation begins, eventually leading to a shopping mall and the 5D cinema.
Command and control centre	Later, when the incident is investigated and the attack is confirmed, the Mall is closed and searched by specialized CBRN teams. The contamination is confirmed inside the 5D cinema
Site/building/infrastructure	The contamination is confirmed inside the 5D cinema and near the entrance. There are some minor spots of contamination across the Mall. The decontamination of the mall takes weeks until it is cleared for the public. Other malls in the country are closed and searched for potential hazard.
Environment	None

Scenario Likelihood Level (**SLL**)	**Rare**	**Unlikely**	**Moderate**	**Likely**	**Almost certain**	Scenario LL
Vulnerability category I.: **Way of the access to shopping mall**	**2**					
Vulnerability category II.: **Bringing the weaponised CBRN agent into the place of attack**		**4**				
Vulnerability category III.: **Way of agent spreading**					**9**	
Vulnerability category IV.: **Shopping mall conditions for spreading of selected type of agent**				**7**		
All categories average						**5,5**
Scenario Impact Level (**SIL**)	**Low**	**Medium**	**High**	**Very high**	**Critical**	Scenario LL
Impact category I.: **Type of biological agent**			**3,3**			
Impact category II.: **Biological agent quantity and combination with explosives**		**3**				
Impact category III.: **Attack prerequisites**		**2,4**				
All categories average						**2,9**