HOTHREAT
CBRN

Guidelines for epidemiological enquiry for hotels

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Document introduction

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Project consortium

Research, expertise, technology providers

End-users

Law enforcement agencies

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Polaris Hospitality Enterprises	PL
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Safety Core	PL
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National Institute of Aerospace Technology	ES
Atiram Hotels	ES
The Center for Security Studies	EL
Hellenic Police	EL
Konngruent	RO
Sigoria Security Solutions	PL
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1. Introduction

Hotels, leisure, and conference facilities have historically been targets of terrorist attacks, and the threat level continues to rise. Due to its characteristics, this sector is vulnerable to attacks as during the last 25 years over 160 attacks were conducted[1]. Chemical, biological and radiological/nuclear (CBRN) threats are emerging risks that the European public must take into consideration. Notably, the use of those agents can be often combined with explosive devices, leading to CBRNe threats.

The HOTHREAT project aims to address the existing gap in the protection of hotels from CBRNe terrorist threats by bringing together a consortium composed of private and public entities, experts, end-users, security companies and law enforcement agencies (LEAs). Indeed, the Consortium is composed of 19 partners from 8 EU Member States.

The main objective of HOTHREAT is to increase the safety of EU Member States (MS) society from CBRNe threats by targeting hotels and conference centres. To do so, during the project cycle, comprehensive vulnerability and needs analysis will be conducted as well as best practices identification in order to elaborate tailor-made measures for CBRNe protection. The measures include recommendations for prevention, protection and response procedures. Moreover, CBRNe measures include recommendations for the adoption of protective equipment, multi-service communication models, programmes for VIP visits, cleaning services, food defence, epidemiology inquiries and CBRNe emergency application for mobile devices integrated with AR. Finally, training sessions will be delivered for hotel employees through a series of piloting and large-scale exercises to ensure the adoption of high-quality and well-addressed measures.

Specifically, Work Package (WP) 3 is the core of the HOTHREAT project with the aim of creating a comprehensive system supporting hotel and conference centres against CBRNe threats. This system is composed of 5 guidelines addressing CBNRe threats:

- Recommendations for prevention, protection and response procedures to CBRNe terrorist acts
- Food protection guidelines
- Guidelines for epidemiological enquiry
- CBRNe VIP protection Programme
- Cleaning services recognition & reaction Programme

The document at hand represents a key project legacy thus contributing to the creation of a comprehensive system supporting hotels and conference centres against CBRNe by providing food protection guidelines.

[1] W. Michael Jr., S. Tibbles Hotels At Risk: The Legal Consequences Of Terrorist Attacks. https://vlex.com/vid/hotels-at-risk-the-650717569

2. Executive summary

The goal of this deliverable is to stablish an epidemiological enquiry that allows for the suspicion of a CBRN attack and how to act at the first moment an alert is suspected, in order to minimise the possible effects.

Methodology

Information on possible CBRN agents, and the symptoms they cause, was collected using official lists such as CDC (for biological and nuclear agents), Organisation for the Prohibition of Chemical Weapons (OPCW) (for chemical agents), NATO (nuclear agents).

Once all this information was compiled, common points were found to draw up a table with all the symptoms, the onset time and number of affected people, and a "how to act" protocol in case of a possible CBRN alert. In addition, it was incorporated procedures stablished in the previous *Internal Security Fund Police* projects (ISFP) from the European Commission: BULLSEYE, MALL-CBRN and SAFE STADIUM. These procedures are 5 S ("sights, signs, symptoms, smell and sounds"), 4C" (confirm, clear, communicate and control), "HOT" (hidden, obviously suspicious and typical) for identification of the incident, and "Remove Remove Remove", for an early reaction. These procedures were taken into account to stablish a protocol on how to respond to a possible CBRN alert.

Results and Conclusions

Based on all the previous gathered information above, the following items were elaborated:

- ✓ **an epidemiological enquiry:** in order to recognise a possible CBRN event, we have elaborated a table with symptoms, onset times and number of affected people (*Checklist of Symptoms*, table 11), and a table to locate the affected people and possible sources of the CBRN threat (*Stranger things happened?,* table 12), both tables to be filled in by the responsible hotel and conference centre personnel.
- ✓ **a *Four-steps protocol* for evaluation of a possible CBRN threat and "how to act " (called *SINS* protocol):** this four-step protocol include the two previous tables.
  First step: (S) Symptoms that raise suspicion of a CBRN attack (use *Checklist of Symptoms*, table 11)
  Second step: (I) Isolation of both people involved and suspected sources (use Stranger things happened?, table 12),
  Third step: (N) Notification to health and security/police authorities
  Forth step: (S) *Site clean-up* of all suspected affected rooms
- ✓ **a *Decision Tree* for facilitating the implementation of a *SINS* protocol for the evaluation of a possible threat and *How to Act* :** this *Decision Tree* make

easier the responsible hotel and conference centre personnel to use SINS protocol.

<u>Recommendations</u>

This *SINS* protocol and its decision tree, are very useful in hotel, conference centres and indoor places, to be used by the responsible hotel and conference centre personnel.

<u>Impact and Relevance</u>

All the proposed items (SINS protocol and its decision tree) provide hotels and conference centres with a tool for the first detection and reaction to a possible CBRN alert.

3. Epidemiology

3.1. Definition of Epidemiology

The word epidemiology has its etymological origin in the Greek ‘epi’, a prefix meaning 'about'; ‘demo’, meaning 'people' and ‘logos’ meaning 'study, reasoning or treatise'. Epidemiology therefore studies diseases that affect people. Thus, Epidemiology is the science that studies the phenomenon of the spread of diseases that affect societies in an expansive manner within a time cycle. As described by Dembek et al. (2007), Basic epidemiology is necessary to manage all aspects of the outbreak: recognising an outbreak, tracing and limiting the spread of the disease, identifying populations at risk, establishing preventive measures and providing treatment or prophylaxis after exposure.

Specifically, epidemiology investigates the distribution of health problems among the population, the factors that can trigger and participate in their spread. Throughout history, epidemics have been a major cause of mortality.

Hence, it is an investigation whose main purpose or function is the control of diseases, especially contagious diseases because of their rapidity, which threaten to decimate the population, which is why infectious diseases are of particular importance in epidemiology.

3.2. Key points of Epidemiology

3.2.1. Epidemiological Triangle

Determining whether an outbreak occurs depends, therefore, on the disease, the at-risk population, the location, and the time of year. For an outbreak to occur, three points of the classic epidemiological triangle must be present: **agent**, **host** and **environment**. Disruption of any of these three points can limit or interfere with the outbreak (Dembek *et al.,* 2007).

The determinant of an infectious disease is an epidemiological triad, formed by the combination of the biological agent (the pathogen), the host and the environmental factor. In this sense, the outcome of exposure to a biological agent depends on the one hand, on the dynamic relationship between the infectivity, pathogenicity and virulence determinants of the agent and the intrinsic determinants of host susceptibility to infection and disease, and, on the other hand, on environmental factors, both physical and social behavioural, such as extrinsic determinants of host vulnerability to exposure (Van Seventer and Hochberg, 2017). Moreover, it is very important to consider the existence or not of a reservoir, and, in case it exists, what type of reservoir it is (animal, vegetable, soil, water…), the frequency of contact with it, the existence of more than one reservoir.

3.2.2. Key Points in an Epidemiological Study

The list below, presents several aspects that should be examined during the study or risk assessment of a potential epidemic outbreak, in order to plan effective mitigation and response actions.

- Identification of foci of infection: helps to locate possible points of origin of diseases.
- Description of disease evolution: analyses how diseases develop and spread (routes of entry and transmission).
- Identification of risk factors: searches for elements that increase the likelihood of disease.
- Prediction of the spread of disease: assesses how diseases will spread in the future. The value of R_0 is an epidemiological index that represents the average number of people to whom an infected person can transmit a disease in a susceptible population. A value of R_0 greater than 1 indicates that, on average, each infected person will transmit the disease to more than one person, resulting in sustained disease spread in the population. Conversely, if R_0 is less than 1, the disease will eventually decrease and become extinct in the population.
- Designing intervention and prevention programmes: contribute to the development of strategies to curb the impact of diseases.
- Outcome evaluation: analyses the effectiveness of implemented measures.

4. The most dangerous and common agents and threats

4.1. Biological agent

According to the European Directive 2000/54/EC of the European Parliament and of the Council of 18 September 2000, "biological agent" is defined as any biological substance that may cause infection, allergy, toxicity, or any other harmful effect on human health. This includes a variety of biological entities such as bacteria, viruses, fungi, parasites, as well as cells and tissue cultures of human origin. Additionally, this definition also covers toxins produced by microorganisms, plants, animals, or biological processes, which can cause harm to human health if inhaled, ingested, absorbed through the skin, or come into contact with the eyes. Broadly, biological agents encompass bacteria, viruses, prions, parasites, fungi as well as toxins.

4.2. Modes and Routes of Transmission

TRANSMISSION

In accordance with Commission implementing decision (EU) 2018/945 of 22 June 2018, on the communicable diseases and related special health issues to be covered by epidemiological surveillance as well as relevant case definitions, the transmission may occur by one or more of the following routes:

- **Airborne**: by projection of aerosol from an infected person onto the mucous membranes while coughing, spitting, singing or talking, or when microbial aerosols dispersed into the atmosphere are inhaled by others;
- **Contact:** direct contact with an infected person (faecal-oral, respiratory droplets, skin or sexual exposure) or animal (for example, biting, touching) or indirect contact to infected materials or objects (infected fomites, body fluids, blood);
- **Vertical:** from mother to child, often in utero, or as a result of the incidental exchange of body fluids usually during the perinatal period;
- **Vector transmission:** transmission by infected mosquitoes, ticks, mites, flies and other insects which transmit disease to humans through their bites;
- **Foodborne and/or waterborne:** consumption of potentially contaminated food or drinking water.

ROUTES OF ENTRY IN THE HUMAN BODY

Based on the US Centres for Disease Control and Prevention (CDC) classification, the routes of entry for infectious agents into the human body can be categorised into several main routes:

- Cutaneous route and associated mucous membranes
- Digestive mucosal route
- Eye and Conjunctival route
- Urogenital route
- Respiratory route
- Parenteral route

4.2.1. Sorting Human-Pathogenic Biological Agents

The Article number 2 of the Directive 2000/54/EC of the European Parliament and of the Council of 18 September 2000, classifies biological agents into four risk groups, according to their different infection risk index:

1) **Group 1** biological agent: biological agent unlikely to cause disease in humans.

2) **Group 2** biological agent: a pathogenic agent that is likely to cause disease in humans and is likely to present a hazard to people exposed to it; it is unlikely to spread to the general public. An effective prophylaxis or treatment is generally available.

3) **Group 3** biological agent: a pathogenic agent which is likely to cause serious disease in man and is a serious danger to people exposed to it; there is a risk of it spreading in the community. An effective prophylaxis or treatment is generally available.

4) **Group 4** biological agent: a pathogenic agent which is likely to cause serious disease in humans and poses a serious hazard to people exposed to; there is a high probability that it will spread within the community. There is generally no effective prophylaxis or treatment available.

4.2.2. Natural or Unnatural Biological Agent Exposure?

4.2.2.1 Indicators of a Biological Attack

Unlike an attack with a chemical, whose effects are evident immediately upon release of the agent, in the case of a biological agent there is a time lag between exposure to the agent and the development of symptoms (except for toxins produced by organisms such as ricin from plants, botulinum toxin from bacteria, T2 from fungi, which effects can be produced within minutes), which is different depending on the incubation times inherent in the pathogen. The success of the response to a biological attack will therefore depend directly on both whether and when the event is recognized. Because the earlier it is recognized, the lesser the health consequences. It is very important that health professionals are familiar with biological warfare events and maintain a healthy 'index of suspicion' to recognize an event early enough to significantly alter the outcome (Dembek *et al.,* 2007).

When medical professionals identify a new case, the first suspected cause is unlikely to be a biological warfare event, especially if the disease presents common symptoms like other typical illnesses such as influenza.

There are several considerations which could indicate an intentional event:

Unusual Number of Cases: the sudden appearance of many cases of an unusual or rare disease can be cause for concern. The key is to compare the observed incidence with expected rates and historical trends. The coefficient of dispersion (COD), explained below, gives a rough idea of this information.

Unusual Geographic Pattern: the presence of cases in unexpected geographic areas or rapid spread of disease to multiple locations could be suspicious. The COD, gives a rough idea of this information.

Cases with Inconsistent or Unusual Symptoms: the presence of unusual or severe symptoms that do not correspond to typical disease characteristics may be a red flag.

Anomalous Temporal Patterns: the identification of unusual temporal patterns, such as a sudden increase in cases over a short period, could indicate a deliberate cause.

Links to Specific or Local Events: if cases are linked to specific events (e.g., mass gatherings) or particular locations, it could suggest a common source.

Presence of Multiple Pathogens this could be indicative of an intentional release, especially if the combination of pathogens is unusual or unprecedented. This situation could point towards a deliberate attempt to create a more complex and challenging public health scenario.

As mentioned above, the **coefficient of dispersion (COD)** of a disease is a measure that indicates the variability or dispersion of the disease in a population. The COD is mathematically defined as:

$$COD = \frac{\sigma^2}{\mu}$$

σ^2: is the observed variance of the spatial distribution of the disease and μ: is the mean of the spatial distribution of the disease.

A value of COD equal to 1 indicates a random spatial distribution of disease. Values greater than 1 indicate a larger than expected spread, suggesting an aggregation or clustering of cases. Even though the coefficient of dispersion cannot confirm whether a biological accident is intentional or unintentional, it can provide clues to assist in the investigation. If a disease outbreak shows a dispersion pattern that is higher than expected, this could indicate possible intentional manipulation, suggesting that the disease has spread in an unnatural way, such as through the deliberate release of a pathogen in a specific area.

In the BULLSEYE MALL-CBRN and SAFE STADIUM projects the established number of cases related to a suspicious CBRN event was **three or more (1-2-3+ procedure for recognition of the incident)**, in persons who are been in the hotel or Conference Centre, in the same period of time and showing non-common symptoms.

4.2.2.2 Biological agent classification as possible biowarfare agent

In order to consider a biological agent as a biological threat, it must be characterised by **low visibility**, **high potency** and **relative ease of delivery** and **dissemination**. Moreover, it must also be easily obtained, cultured or reproduced, and be relatively stable in the environment (Keraney and Pettit, 2015).

In accordance with the CDC, the potential Bioterrorism Agents are provided, categorised by their risk of propagation and severity of symptoms.

Category A: includes high-priority agents, it means, organisms that can be easily disseminated, result in high mortality, and have the potential to cause significant public panic.

Category B: includes agents related to food and water safety threats, are moderately easy to disseminate, and cause significant morbidity (even though their mortality rates are lower).

Category C: includes emerging pathogens; they can adapt in the future to take full advantage of their pathogenicity, availability and lethality.

The following tables (tables 1 to 5, shown below), have been prepared showing these biological agents, categorised as presented above, with all their epidemiological and other relevant characteristics.

Table 1 List of Category A biological agents for the CDC.

Aetiological agent	Disease	Symptoms	Route of entry	Transmission	Risk Group	Incubation time	Decontamination
Bacillus anthracis	Cutaneous anthrax	Depressed black eschar with surrounding oedema or a pauper or vesicle lesion, swelling of nearby lymph nodes. As the infection progresses, general symptoms such as fever, fatigue and malaise may appear	Skin	Contact to infected materials	3	1-7 days	Containment of the affected area. Decontamination carried out with Personal protective equipment (PPE): protective suits, respiratory masks, gloves and eye protection. **Surface decontamination** <u>Physical decontamination</u>: hoovers equipped with high-efficiency (HEPA) filters, can be used to remove visible spores. Absorbent material in case of spills. <u>Chemical decontamination</u> Sodium Hypochlorite (Bleach): 5-6% (v/v) sodium hypochlorite or a solution of 1 part bleach to 9 parts water (1:10 dilution), resulting in a final concentration of about 0.5% sodium hypochlorite. Hydrogen Peroxide (Hydrogen Peroxide):
	Gastrointestinal anthrax	Fever or feverishness, nausea, vomiting, fever and abdominal discomfort. There may be abdominal swelling and bloody diarrhoea.	Digestive	Food-borne water-borne	3	1-7 days	
	Inhalational anthrax	Symptoms like flu (fever, chills, headache and cough). Acute respiratory distress.	Respiratory	Airborne	3	7-30 days	
	Meningeal/ Meningoencephalitic anthrax	Fever, headache, neck stiffness, photophobia, nausea and vomiting. Confusion and altered mental status. Seizures. Neurological deficit (in speaking, weakness and paralysis).	Skin Digestive Respiratory (Caffes *et al., 2022)*	Contact to infected objects. Food-borne. Water-borne. Airborne.	3	Few hours – 21 days	

Aetiological agent	Disease	Symptoms	Route of entry	Transmission	Risk Group	Incubation time	Decontamination
							Hydrogen peroxide is 3 to 10% Allow the disinfectant to remain on the surface for at least 10 minutes before wiping it off. **Air decontamination:** Ventilation of the area Use HEPA filtration or ultraviolet germicidal irradiation (UVGI) systems. At finish, the area should be monitored again. All materials used during decontamination, including personal protective equipment, must be disposed of safely.
Clostridium botulinum (spores producers of botulinum toxin in anaerobiosis)	Wound-borne Botulism	Bilateral cranial nerve impairment (for example, diplopia, blurred vision, dysphagia, bulbar weakness); — Peripheral symmetric paralysis.	Skin (wound)	Contact to infected materials	2	10 days	Containment of the affected area. Decontamination carried out with Personal protective equipment (PPE): protective suits, respiratory

Aetiological agent	Disease	Symptoms	Route of entry	Transmission	Risk Group	Incubation time	Decontamination
Botulinum toxin from *Clostridium Botulinum* produced in anaerobiosis	Food-borne botulism	Gastrointestinal symptoms: Nausea and vomiting. Abdominal discomfort and diarrhoea. Neuromuscular symptoms: Generalised muscle weakness, which may progress to paralysis. Double or blurred vision. Difficulty speaking, chewing and swallowing. Facial paralysis, which may affect the ability to express facial emotions. Difficulty breathing, which is a serious and potentially life-threatening symptom. Breathing problems: Muscle paralysis can affect the respiratory muscles, leading to difficulty breathing and, in severe cases, respiratory failure.	Digestive	Food borne	2	6-36 hours	masks, gloves, gowns and eye protection. **Surface decontamination** Physical decontamination: cleaning, scrubbing, scraping or vacuuming with hoovers equipped with high-efficiency (HEPA) filters. Absorbent material in case of spills. Chemical decontamination: Chlorine-based disinfectants Sodium Hypochlorite (Bleach) (1:10 dilution). Peroxygen compounds: Hydrogen peroxide (6-10%) or peracetic acid solutions (5 to 15% (v/v)). Allow the disinfectant to remain on the surface for at least 10 minutes before wiping it off.
Clostridium botulinum (spores producers of botulinum toxin in	Infant botulism	Constipation; Lethargy; Difficulty in sucking or feeding; ptosis; dysphagia; General muscle weakness.	Digestive	Food borne	2	14-28 days	

Aetiological agent	Disease	Symptoms	Route of entry	Transmission	Risk Group	Incubation time	Decontamination
anaerobiosis)							At finish, the area should be monitored again. All materials used during decontamination, including personal protective equipment, must be disposed of safely.
Yersinia pestis	Plague	**Bubonic plague:** painful swollen lymph nodes or 'buboes **Pneumonic plague:** The most virulent form of plague. Coughing, fever, headache, weakness, rapidly developing pneumonia. It may result in respiratory failure and shock.	Respiratory Parenteral (flea bite)	Airborne. Direct contact with an infected person (respiratory droplet, infected tissues. Vector transmission: fleas	3	1-7 days	Containment of the affected area. Decontamination carried out with Personal protective equipment (PPE): protective suits, respiratory masks, gloves, gowns and eye protection. **Surface decontamination:** Physical decontamination: cleaning, scrubbing, scraping. Absorbent material in case of spills. Chemical decontamination: Chlorine-based disinfectants such as
Variola virus	Smallpox (variola major)	High fever, fatigue, and head and body aches. A characteristic rash follows, starting with small, red spots that develop into raised bumps and then into fluid-filled blisters. These blisters eventually form scabs, which fall off after a few weeks, leaving scars.	Respiratory	Direct contact with an infected person by respiratory droplets, touching the skin lesions of an infected person. Indirect contact to infected obj.	4	7-17 days	

Aetiological agent	Disease	Symptoms	Route of entry	Transmission	Risk Group	Incubation time	Decontamination
				ts.			sodium Hypochlorite (Bleach) (1:10 dilution). Quaternary ammonium compounds (Quats): 0,5 to 1 %. Peroxygen compounds: Hydrogen peroxide (6-10%) or peracetic acid solutions (5 to 15%). Allow the disinfectant to remain on the surface for at least 10 minutes before wiping it off. **Air decontamination:** Ventilation of the area. Use HEPA filtration or ultraviolet germicidal irradiation (UVGI) systems. At finish, the area should be monitored again. All materials used during decontamination, including personal protective equipment, must be
Francisella tularensis (subsp. Tularensis)	Tularaemia	Primary local ulcerative lesion, regional lymphadenopathies, deep systemic symptoms, and sometimes atypical pneumonia.	Digestive Parenteral Respiratory	Food-borne. Water-borne. Vector transmission (ticks, fleas, horse-flies). Airborne. Contact with fomites.			
Virus causing haemorrhagic fevers Flavivirus Filovirus **Orden Buyanvirales:** Arenavirus	<u>Viral haemorrhagic fevers:</u> Alkhurma hemorrhagic fever (AHF). Kyasanur forest disease (KFD). Omsk haemorrhagic fever (OHF). Severe Dengue Yellow fever. Ébola disease Marburg virus	High fever. General feeling of tiredness and weakness. Severe muscle and joint pain. Severe headaches. Irritation and pain in the throat. Nausea and vomiting. Abdominal pain. Diarrhoea. <u>Bleeding, or haemorrhaging:</u> Cutaneous haemorrhages (bleeding under the skin). Nosebleeds and gingival bleeding. Blood in stool and urine. Internal bleeding.	Parenteral Mucosal Skin (wound)	Initial vector transmission Spread with direct contact with an infected person (body fluids).	3 / 4 Most VHFs have no known cure or vaccine .	4-21 days	

Aetiological agent	Disease	Symptoms	Route of entry	Transmission	Risk Group	Incubation time	Decontamination
	disease						disposed of safely.
Hantavirus	Chapare haemorrhagic fever (CHHF). Lassa fever. Lujo haemorrhagic fever (LUHF).						
Nairovirus	Hantavirus pulmonary syndrome (HPS). Haemorrhagic fever with renal syndrome (HFRS).						
Phenuivirus	Crimea-Congo haemorrhagic fever (CCHF).						
	Rift Valley fever (RVF).						

Table 2 List of Category B biological agents for the CDC.

Aetiological agent	Disease	Symptoms	Route of entry	Transmission	Risk Group	Incubation time	Decontamination
Brucella sp.	Brucellosis	Fever and at least one of: Sweating, Chills, Arthralgia, Weakness, Depression, Headache, Anorexia.	Digestive Skin (wound) Respiratory	Food-borne (raw or unpasteurised dairy products). Airborne. Contact with infected animals.	3	14-28 days	Containment of the affected area. Decontamination carried out with Personal protective equipment (PPE): protective suits, respiratory masks (N95 or powered air-purifying respirators), gloves, gowns and eye protection. **Surface decontamination:** <u>Physical decontamination:</u> Adsorbent material in case of spills. Cleaning, scrubbing, scraping. <u>Chemical decontamination:</u> Chlorine-based disinfectants such as sodium Hypochlorite (Bleach) (1:10 dilution).
Chlamydia psittaci	psittacosis	Fever and chills, headache, muscle aches, dry cough, nausea or vomiting, diarrhoea and, less commonly, a rash.	Respiratory	Airborne. Direct contact with infected animal.	3 / 2	5-14 days	
Coxiella burnetti	Q fever	Fever. Chills or sweats. Fatigue (tiredness). Headache. Muscle aches. Nausea, vomiting, or diarrhoea. Chest pain. Stomach pain. Weight loss. Non-productive cough. People who develop	Respiratory Digestive	Airborne. Direct contact with infected animals (touching, being licked). Indirect contact with material of infected animals: birth products, urine, faeces,	3	14-21 days	

Aetiological agent	Disease	Symptoms	Route of entry	Transmission	Risk Group	Incubation time	Decontamination
		severe disease may experience infection of the lungs (pneumonia) or liver (hepatitis).		milk. Food-borne.			Quaternary ammonium compounds (Quats): 0.5 to 1 %. Phenolic disinfectants: 0,5 to 5 %. Allow the disinfectant to remain on the surface for at least 10 minutes before wiping it off. **Air decontamination:** Ventilation of the area. Use HEPA filtration or ultraviolet germicidal irradiation (UVGI) systems. At finish, the area should be monitored again. All materials used during decontamination, including personal protective equipment, must be disposed of safely.
Tick-borne encephalitis virus (belong to Flaviviridae family).	Tick-borne viral encephalitis.	Fatigue, headache and general malaise, usually combined with fever of ≥38 °C. Second phase of the disease characterised by fever frequently exceeding 40 °C and signs of central nervous system involvement, such as meningitis (e.g., fever, headache, and a stiff neck), encephalitis (e.g., drowsiness, confusion, and sensory disturbances), myelitis or radiculitis. It may result in paralysis, permanent sequelae or death.	Parenteral	Vector transmission (tick bite).	3	2-28 days	
Venezuelan equine encephalitis virus (genus Alphavirus).	Viral encephalitis such as Venezuelan equine	Flu-like illness. And neurological symptoms in more	Parenteral. Respiratory Direct	Vector transmission. Airborne. Direct contact	3	2-10 days	

Aetiological agent	Disease	Symptoms	Route of entry	Transmission	Risk Group	Incubation time	Decontamination
	encephalitis (VEE)	severe cases: Headache. Dizziness Seizures. Photophobia. Confusion. Coma.	contact with contamina-ted fluids.	person to person (through open wounds or body fluids).			
Burkholderia pseudomallei	Melioidosis	High and persistent fever. General malaise. Headache. Muscle/ joint pain Chest pain. Cough. Difficulty breathing. Skin ulcers. Internal abscesses. In severe cases: septicaemia.	Skin (wound). Digestive. Respiratory. Parenteral.	Soil borne. Waterborne. Airborne. Foodborne. Direct contact person to person (through open wounds or body fluids).	3	1-21 days	
Burkholderia mallei	Glanders	High fever. Mucopurulent Nasal discharge. Cough. Respiratory distress. Nasal and mouth sores. Abscesses in various organs.	Skin (wound) and mucosa.	Direct contact of infected animal/person (body fluids). Foodborne. Waterborne	3	1-14 days	

Aetiological agent	Disease	Symptoms	Route of entry	Transmission	Risk Group	Incubation time	Decontamination
		Weight loss. Weakness.					
Rickettsia prowazekii	Typhus fever	Fever. Headache. Muscle and joint pains. Rash. Weakness. Fatigue. Chills. Cough. In severe cases: delirium/ confusion. Pneumonia. Myocarditis. Even death.	Skin (wound) Respiratory	Direct contact with infected person (unfrequently) Vector borne transmission (mainly lice).	2	7-14 days	
Epsilon toxin of *Clostridium perfringens*	Epsilon toxin poisoning	Gastrointestinal Symptoms: Abdominal pain. Diarrhoea. Nausea and vomiting. Neurological Symptoms (in severe cases): Convulsions. Ataxia (loss of coordination). Paralysis. Respiratory Symptoms	Mainly Digestive (Less common respiratory or cutaneous).	Food-borne	2	6-24 hours	

Aetiological agent	Disease	Symptoms	Route of entry	Transmission	Risk Group	Incubation time	Decontamination
		(in severe cases): Difficulty breathing. Respiratory failure. Other General Symptoms: Fever. Headache. Weakness.					
Ricin toxin from *Ricinus communis* (from castor beans)	Ricin poisoning	Ingestion poisoning: Abdominal pain. Diarrhoea. Nausea and vomiting. Severe dehydration. Inhalation poisoning: Cough. Difficulty breathing. Fever Respiratory distress. Chest tightness. Injection poisoning: Localised pain and swelling at the injection site. Systemic symptoms similar to those seen with ingestion or	Digestive Respiratory Parenteral	Food-borne Airborne Injection	2	1-24 hours	

Aetiological agent	Disease	Symptoms	Route of entry	Transmission	Risk Group	Incubation time	Decontamination
		inhalation General Symptoms: Fever. Headache. Weakness. Sweating.					
Staphylococcal enterotoxin B (SEB)	*Streptoccus aureus* toxin poisoning	Food poisoning: Abdominal pain. Diarrhoea. Nausea. Vomiting. Inhalation poisoning: Cough. Difficulty breathing. Nasal congestion. Throat irritation. **Toxic shock syndrome** (severe systemic inflammatory that can produce hypotension, multiorgan failure and shock).	Digestive Respiratory	Foodborne Airborne	2	1-6 hours	

Table 3 List of food safety threats within category B biological agents for the CDC.

Aetiological agent	Disease	Symptoms	Route of entry	Transmission	Risk Group	Incubation time	Decontamination
Salmonella bongori, Salmonella enterica	Salmonella enteritis	Diarrhoea, fever and abdominal cramps	Digestive	Food-borne Direct contact with an infected person (faecal-oral).	2	8 hours – 3 days	Safely Water and food Handling according to National Guides to Good Hygiene Practice for Food and Feed, from European Commission. Containment of the affected area. Decontamination carried out with Personal protective equipment (PPE): protective suits, respiratory masks (N95 or powered air-purifying respirators), gloves, gowns and eye protection. **Surface decontamination:** <u>Physical decontamination:</u> cleaning, scrubbing, scraping. <u>Chemical decontamination:</u>
Escherichia coli (STEC/VTEC)	Shiga toxin/verocytotoxin-producing E. coli infection (STEC/VTEC), including Haemolytic-uraemic syndrome (HUS)	Range from the asymptomatic to the life-threatening haemolytic-uremic syndrome: small blood vessels become damaged and inflamed, which cause clots to form in blood vessels throughout the body. This produces diarrhoea, often bloody. Abdominal pain, cramps or swelling in the stomach area. Fever. Vomiting.	Digestive	Water-borne Food-borne Direct contact with infected person and animal (faecal-oral).	3	3-8 days	

Shigella dysenteriae. *Shigella flexneri*. *Shigella boydii*. *Shigella sonnei.*	Shigellosis	Diarrhoea. Abdominal pain. Fever. Tenesmus. Nausea and vomiting.	Digestive	Water-borne Food-borne Direct contact with infected person and animal (faecal-oral).	2/3	1-7 days	Chlorine-based disinfectants such as Sodium Hypochlorite (Bleach) (1:10 dilution). Quaternary ammonium compounds (Quats): 0,5 to 1 % (v/v). Phenolic disinfectants: 0,5 to 5 % (v/v). Contaminated food and water should be disposed of by first disinfecting it. At finish, the area should be monitored again. All materials used during decontamination, including personal protective equipment, must be disposed of safely.
Salmonella typhi and *Salmonella paratyphi,* respectively.	Typhoid and paratyphoid fevers	High fever, malaise, cough, rash and enlarged spleen develops. Diarrhoea may be present at some stage. When *Salmonella typhi* is the cause, intestinal perforation and haemorrhage may occur. *Salmonella typhi* blood stream infection can also cause infection in all organs.	Digestive	Water-borne. Food-borne. Direct contact with infected person and animal (faecal-oral).	2/3	7-14 days	

Table 4 List of water safety threats within category B biological agents for the CDC.

Aetiological agent	Disease	Symptoms	Route of entry	Transmission	Risk Group	Incubation time	Decontamination
Vibrio cholerae	Cholera	Diarrhoea, vomiting.	Digestive	Food-borne (faecal contamination)	2	Cholera	**Water decontamination:** Filtration (filter < 0,45 µm). Boiling. Chlorination. UV treatment Ozonation. **Hand hygiene,** (washing hands with soap and water). **Surface disinfection**: Bleach: 1/10 dilution. Iodine. Ozone. QUATS. Hydrogen peroxide.

Table 5 List of Category C biological agents for the CDC.

Aetiological agent	Disease	Symptoms	Route of entry	Transmission	Risk Group	Incubation time	Decontamination
Nipah virus	Encephalitis by Nipah	Severe headache. Muscle aches. Dizziness. Confusion. Drowsiness. Altered mental status. Neck stiffness. Signs of neurological dysfunction. In severe cases: death.	Skin (wound) Mucosa	Direct contact with infected animal/person (body fluids).	4	4-14 days	Containment of the affected area. Decontamination carried out with Personal protective equipment (PPE): protective suits, respiratory masks (N95 or powered air-purifying respirators), gloves, gowns and eye protection. **Surface decontamination:** Physical decontamination: In case of spills, use absorbent material to soak. Chemical decontamination: Allow the disinfectant to remain on the surface for at least 10 minutes before wiping it off. Chlorine-based disinfectants such as sodium Hypochlorite (5.25-6% (v/v)) (Bleach) (1:10 dilution).
Hantavirus	Hantavirus cardiopulmonary syndrome (HPS).	High fever. Muscle aches. Headache. Chills. Dry cough. Shortness of breath. Nausea and vomiting. Fatigue. Dizziness.	Skin (wound) Mucosa.	Direct contact with infected animal/person (body fluids).	2	7-25 days	

	Haemorrhagic fever with renal syndrome (HFRS)	In severe cases, respiratory failure and shock may occur. Fever. Headache. Abdominal pain. Muscle aches. Nausea and vomiting. Blurred vision. Kidney failure. Bleeding.					Ethanol / Isopropanol: both 70 % (v/v). Quaternary ammonium compounds (Quats): 0,5 to 1 % (v/v). Peroxygen compounds: Hydrogen peroxide: 3 % (v/v). Peracetic acid.5-15%(v/v) **Air decontamination:** Ventilation of the area Use HEPA filtration or ultraviolet germicidal irradiation (UVGI) systems. At finish, the area should be monitored again. All materials used during decontamination, including personal protective equipment, must be disposed of safely

4.3. Chemical threats

4.3.1. Chemical threats by OPCW

The Organisation for the Prohibition of Chemical Weapons (OPCW) has elaborated a list of the chemical agent with a potential use as chemical weapon (1997). The updated list of chemicals came in force on 7th June of 2020. Based on this list, we have prepared the next table (table 6), which shows the chemical agents with their epidemiological and relevant characteristics.

Table 6 List of chemical threats by OPCW.

Type of agent	Compounds	Symptoms	Route of entry	Time of onset symptoms	Decontamination	How to act before going to the hospital
Pneumotoxic or suffocating	**Chlorine.** **Phosgene.** **Chloropicrin.**	Dose-dependent. At low doses: irritation of eyes, nose, throat (tearing, coughing, sore and scratchy throat). Dizziness, fatigue and headache can occur. At higher doses: Injury to the respiratory tract; Reactive Airway Disturbances Syndrome (RADS) (a type of asthma).	Mainly respiratory. Sometimes: digestive and cutaneous too.	Minutes to hours.	DS2[2] solution or water with alkaline (caustic soda, etc.).	Administration of sodium bicarbonate aerosols has been shown to be useful in preventing lung damage. Skin and eyes should be flushed with running water for 15-20 minutes.

[2] Decontamination Solution 2 - a military-grade disinfectant used for chemical and biological decontamination purpose

		Pulmonary oedema. Death can occur in severe cases. If ingested: nausea, vomiting, colic and diarrhoea. If skin contact: skin lesions or blisters; frostbite (chlorine).				
	Sulphur mustard or mustard gas. **Nitrogen mustard.** **Lewisite.**	Skin burns: skin erythema, blisters. Destroy internal tissues and, even liver or systemic toxicity. **Vapour:** On eyes: irritation, tearing, light sensitivity, swelling of the eyelids, eye pain, sometimes blindness. On lungs: breathing difficulties, pulmonary oedema **Ingestion:** nasal irritation, scratchy throat, laryngitis and choking sensation. Vomiting.	Mainly Cutaneous. Contact of liquid or vapour with any exposed tissue (eyes, skin or lungs). Sometimes: respiratory, digestive.	Minutes (Lewisite) to hours (mustards).	Bleach solution, DS2 solution or neutral adsorbent powders (fuller's earth, diatomaceous earth, etc.).	Treatment with Dimercaprol is the standard treatment for arsenic poisoning as it acts as a chelator and is available as intramuscular injections, ointments and eye drops. The analogues DMSA and DMPS are less toxic and can be administered orally or intravenously.

Nerve agents	**Organophosphorus classified as** **Nerve agents G-series (Tabun, Sarin, Soman).** **V-series (VX,VXR)** **and A-Series (Novichocks)** **.**	Blocking the action of acetylcholinesterase, increasing the acetylcholine concentration and intensification of neurotransmission in the neuromuscular junctions causing involuntary muscle contraction. This leads to respiratory arrest, cardiac arrest and ultimately death.	Mainly cutaneous and eye contact. Digestive (by food and water contaminated).	Seconds to minutes (G series). Minutes to hours (V-series).	Rapid and thorough washing of the skin with soap and water. This washing should last between 5 and 10 minutes. In addition, hypochlorite and large quantities of water or commercial kits such as M258A1 or M291are often used for Tabun decontamination. M258A1, it is older and, consists of, only, wipes impregnated with phosphoric acid and phenol or sodium hydroxide (a strong base) and ethanol, M291, however, consists of wipes with neutralize and absorbent chemical agents, as M258A1, but, also, contains activated charcoal, clays and other absorbent.	Atropine and Pralidoxime Chloride, which displaces the action of the nerve gas, are used. In severe cases, Diazepam (anticonvulsant), ventilation and airway aspiration.

Blood agents	**Hydrogen cyanide** **Cyanogen Chloride**	At low doses: Weakness, headache, confusion, nausea, vomiting and jaw stiffness. Higher doses: Irregular and painful breathing, insensitivity, cardiac and/or respiratory arrest, seizure, coma and, in severe cases, death.	Mainly respiratory and cutaneous. In addition, digestive route by contaminated food and water.	Seconds to minutes (hydrogen cyanide). Minutes to hours (cyanogen chloride).	Decontamination of clothing or equipment is not necessary due to their high volatility.	Immediate administration of 100% oxygen and administration of antidotes that dissociate cyanide ion from cytochrome oxidase such as cyanide kit.
Incapacitating agents	**Tear gas 2-chlororaceto phenone (CN)** **Tear gas 2-chlorobenzal malononitrile (CS)**	Temporary mental or physical incapacity. The first symptoms: redness, burning eyes, lacrimation, rhinorrhoea, salivation, blepharospasm, conjunctival injection, followed by the appearance of erythema, sneezing	Mainly respiratory, cutaneous and eye contact.	Seconds to minutes.	Using a caustic soda solution. Eyes and face should be washed immediately with plenty of water. Most soaps contain oily substances and should not be used to wash the area as this substance traps the agent in the skin and	The eye should be washed with a weak solution of boric acid. Skin should be washed with warm water for 15 minutes. CS dissolves rapidly in a sodium metabisulphite

		and coughing. Sometimes, nausea and vomiting. At high concentrations, reactive airway dysfunction syndrome (RADS) may occur.			may cause a rash or severe burn. Decontamination is achieved by using an alkaline solution. A 5% (w/v) solution of water and sodium bisulphite is normally used for this purpose.	solution and such solutions can be used to remove solid particles of the irritant. In skin contaminated with CN, with a sodium carbonate solution can be used. Saline or weak boric acid solutions can relieve eye symptoms and soothing lotions such as calamine can be used on injured skin.

4.4. Disruptive and incapacitating drugs as a possible chemical threat

"Drug" refers to any substance that alters the biological functioning of the body, whether for medicinal, recreational, or other purposes. Some drugs can be used as weapons because of their altering and incapacitating effects. See table 7.

Table 7 Disruptive and incapacitating drugs as a possible chemical threat.

Type of agent	Compounds	Symptoms	Route of entry	Time of onset symptoms
Nervous system stimulants drugs (overdose)	**Amphetamine** **Cocaine and derives**	**Physical:** Increased heart rate (tachycardia), elevated blood pressure (hypertension), hyperactivity, dilated pupils, dry mouth, sweating and tremors. Similar to drunkenness. **Psychological:** Euphoria, increased focus, alertness, confidence, agitation, restlessness. High doses: anxiety, paranoia, or hallucinations**.**	**Oral (only amphetamine):** (tablets, capsules) **Intravenous (IV** **Inhalation and Smoking** **Insufflation (snorting)**	**Oral:** 30-60 minutes **Snorting:** 3-5 minutes **IV** **injection:** Immediate (seconds to a few minutes) **Inhalation:** Almost immediate (1-2 minutes
Psychedelic or disruptive substances	**Hallucinogens**: LSD, mescaline... **Psilocybin** (Magic Mushrooms)	**Physical:** Dilated pupils, increased heart rate, elevated blood pressure, nausea, tremors, sweating. In severe cases: respiratory	**Oral:** Pills, tablets, or ingestion of substances like mushrooms or LSD on blotter paper. **Inhalation/Smoking:**	**Oral**:20-90 minutes (e.g., LSD, psilocybin, MDMA, PCP). **Inhalation/Smoking**:

Type of agent	Compounds	Symptoms	Route of entry	Time of onset symptoms
	Cannabinoids: hashish, marijuana... **Ecstasy (MDMA)** **Phencyclidine (PCP)** **Ketamine** **N,N-Dimethyltryptamine (DMT)**	distress, seizures, body temperature changes, dehydration, heart issues, inability to move, unconsciousness **Cognitive:** Euphoria, heightened emotional openness, paranoia, delusions, anxiety, spiritual experiences, confusion, and impaired memory. **Sensory:** Hallucinations (visual/auditory), altered perception of time and space, synaesthesia, visual distortions, and dissociation	Often used for substances like DMT, PCP, or ketamine (powder or vaporized). **Intravenous (IV):** Direct injection into the bloodstream (e.g., ketamine, DMT, PCP). **Insufflation (Snorting):** Powder form, typically for substances like MDMA, ketamine, PCP.	Immediate to 5 minutes (e.g., DMT, PCP, ketamine). **IV Injection:** Immediate to 5 minutes (e.g., ketamine, DMT). **Snorting (Insufflation):** 3-15 minutes (e.g., PCP, MDMA, ketamine**)**
Incapaciting drugs	**Scopolamine** ("burundanga) **Date Rape Drugs** -Rohypnol (Flunitrazepam): Known as a "roofie" - Gamma-	**Memory Loss (Amnesia):** Disorientation and Confusion **Impaired Motor Function:** Drowsiness/Sedation: Lack of Control Over Actions: **Scopolamine are used specially in terms of**	**Ingestion (Oral):** secretly added to drinks and food is the most common method of administration **Inhalation:** Burundanga can be inhaled, for example, through powder or vapor (in rare cases, date rape drugs could also be administered via this route).	**10-30** minutes after exposure

Type of agent	Compounds	Symptoms	Route of entry	Time of onset symptoms
	Hydroxybutyrate (GHB) - Ketamine	**inducing compliance and amnesia without unconsciousness, while date rape drugs are more likely to cause sedation and incapacitation leading to sexual assault**	**Injection or Intravenous (IV):** Some date rape drugs, like **Ketamine** or **GHB**, can be injected or taken intravenously, though this is less common in non-medical settings. **Topical (Skin contact):** Burundanga can be absorbed through the skin in some cases, unlike most date rape drugs.	

4.5. Toxic Industrial Chemicals (TICs) as a possible chemical threat

Toxic Industrial Chemicals (TICs) are chemicals that are produced, stored, transported, and used in industrial processes but can be harmful or lethal if released accidentally or used deliberately. TICs are used in agriculture, mining, pharmaceutical and manufacturing, and pose severe health risks due to their toxic nature. They can be hazardous if not handled properly, and also pose a risk of being used as chemical weapons by terrorists or in warfare). See table 8.

Table 8 More common Toxic Industrial Chemicals (TICs).

Type of agent	Status and appearance of the agent	Symptoms	Route of entry	Time of onset symptoms
Ammonia (NH_3)	Colourless gas at room temperature with a pungent odour, but can be liquefied under pressure. Colourless gas. Highly soluble in water, forming ammonium hydroxide.	**Respiratory:** Irritation of the mucous membranes, coughing, wheezing, and difficulty breathing. **Dermal:** Skin irritation, burns. **Ocular:** Eye irritation, burns, potential damage to corneal tissue. **Ingestion:** Can cause severe gastrointestinal distress.	**Inhalation:** Most common route. **Dermal Contact** **Ingestion**	Immediately after exposure
Chlorine (Cl_2)	Gas Yellow-green gas with a strong, bleach-like odour at room	**Respiratory:** Severe irritation of the respiratory tract, coughing, choking,	**Inhalation:** Most dangerous route, causing immediate respiratory	Immediate to Minutes

Type of agent	Status and appearance of the agent	Symptoms	Route of entry	Time of onset symptoms
	temperature, with a strong, bleach-like odour. Solubility: Moderately soluble in water, forming hydrochloric acid and hypochlorous acid.	difficulty breathing, pulmonary oedema. **Dermal:** Skin irritation, burns. **Ocular:** Eye irritation, redness, and potential damage to the cornea**.**	symptoms. **Dermal Contact:** Can cause burns and irritation. **Ingestion:** Less common, can cause severe gastrointestinal issues	
Phosgene ($COCl_2$)	Colourless gas with a musty or mouldy odour, at room temperature. Poorly soluble in water	**Respiratory:** coughing, difficulty breathing, chest tightness, and pulmonary oedema. Systematic effect. Can be fatal if exposure is high. **Dermal:** Minimal direct effect	**Inhalation:** Primary route	Several hours after exposure
Hydrogen Cyanide (HCN)	Colourless gas, with a faint, bitter almond odour, at room temperature. Soluble in water, forming hydrocyanic acid.	**Respiratory:** headache, dizziness, confusion, respiratory distress, and possibly death due to asphyxiation. **Neurological:** seizures or unconsciousness.	**Inhalation:** most common and dangerous route. **Dermal Contact:** minimal effects. **Ingestion:** highly toxic if	Immediate to minutes

Type of agent	Status and appearance of the agent	Symptoms	Route of entry	Time of onset symptoms
		Cardiovascular: Can cause cardiovascular collapse and death	ingested.	

4.6. Nuclear and radiological threats

The next table (Table 9) has been elaborated to show how nuclear and radiological threats can be acted and how to react as possible.

Table 9 Nuclear and radiological threats.

Agent	Type	Symptoms	Transmission/ Route of entry	Incubation time	Decontamination
Nuclear	Nuclear explosion or power plant accident: heat and pressure waves	Trauma, burns, temporary or permanent blindness.	External physical impact.	Immediately.	**Soap and water** (mainly for skin decontamination)
	Emission of ionizing radiation.	More or less severe symptoms depending on the radiation absorbed (see radiological section).	Irradiation; internal or external contamination	Immediately	**Detergent solutions: include chelating agents** that bind to radioactive contaminants and make them more soluble in water (for solid surfaces).
	Dispersion of radioactive material (accidental or intentional, e.g., dirty bomb) **= radiological agent (see below).**	**= radiological agent (see below).**	**= radiological agent (see below).**	**= radiological agent (see below).**	
Radiological	Industrial toxic materials of nuclear and radiological origin.	<u>Prodromal phase</u> (depending on the absorbed dose): vomiting, nausea and general malaise. <u>At the cellular level</u>: Somatic effects (in somatic cells:	Irradiation; internal or external contamination. Direct contact with affected person (by	Hours: ataxia and convulsions. Few days: diarrhoea and lack of	**Acids and bases**: may be used to dissolve or neutralise radioactive materials adhering

Agent	Type	Symptoms	Transmission/ Route of entry	Incubation time	Decontamination
		Deterministic effects are short-term and predictable: umbral doses, high doses, total or partial involvement of organism, **“acute radiation syndrome: SAR”**); Stochastic/probabilistic effects: are long-term (several years), no umbral doses, low dose, cancer. **SAR**: a single high dose rate exposure; 3 possible syndromes according to dose, in increasing order: i) hematopoietic: infections, anaemia and haemorrhage; onset: 10 days-6 or 8 weeks; ii) gastrointestinal: severe combined involvement of bone marrow and gastrointestinal tract; diarrhoea and lack of nutrient absorption; very severe prognosis; clinical manifestation appears earlier than hematopoietic syndrome; onset: a few days-1 week; iii) neurovascular: ataxia and convulsions; steadily	touching and/or airborne radioactive particles).	nutrient absorption. 10 days-8 weeks: infections, anaemia and haemorrhage .	to surfaces. **Absorbent solutions**: Some substances, such as certain types of clays or resins, can absorb radioactive particles from contaminated surfaces. **Physical methods**: such as mechanical abrasion, ultraviolet light irradiation or steam (in addition to chemicals).

Agent	Type	Symptoms	Transmission/ Route of entry	Incubation time	Decontamination
		deteriorating consciousness with subsequent coma and death; onset: several hours-1 to 3 days; 100 % mortality. **Hereditary effects (in reproductive cells**; stochastic/probabilistic effects). **Effects on the embryo of a foetus** (depending on the gestational age): miscarriages, mental retardation and development of cancer or leukaemia up to 15 years of age.			

4.7. Other threats

Other found threats are shown in the following tables (table 10).

Table 10 Other recently used threats.

Agent	Type	Symptoms	Transmission/ Route of entry	Incubation time
Microwave radiation (so called silent threats, because they cannot be perceived by the senses)	Radio frequencies: Infrasound emission from 0.1 Hz to 20 Hz, Ultrasound from 20 kHz to 300 kHz.	**Havana syndrome**: sensory phenomena (hearing of strange sounds and noises, pressure, warmth) and physical symptoms (sudden dizziness, nausea, headache, neck pain, neck pain), separately or jointly.	Auditory system	Immediately

5. Evaluation of a Possible Threat and How to Act: SINS protocol

The proposed protocol (called *SINS* protocol) consists of four steps:

First step: (**S**) **Symptoms** that raise suspicion of a CBRN attack

Second step: (**I**) **Isolation** of both people involved and suspected sources

Third step: (**N**) **Notification** to health and security/police authorities

Forth step: (**S**) ***Site clean-up*** of all suspected affected rooms

This procedure could be implemented in combination with the "4C" (confirm, clear, communicate and control), "HOT" (hidden, obviously suspicious and typical) for identification of the incident and "Remove Remove Remove" procedures described in the aforementioned MALL-CBRN project for acting in case of a CBRN incident (ISF-P projects).

This protocol will be used by the responsible hotel and conference centre personnel.

5.1. First Step: (S) SYMPTOMS that raise suspicion of a CBRN attack

In order to stablish if a CBRN attack could happen, we have elaborated a table to be used by hotels and/or conference centres. This table consist of a checklist of symptoms and number of people who show these symptoms (table 11), and it has been elaborated based on the previous tables (tables 1 to 10), so the objective of this table is to allow the hotel and/or conference centre to suspect of a potential CBRN attack, regardless the specific agent or nature of agent (biological, chemical, nuclear…), since symptoms are classified by action mechanisms. It allows to take into account a lot variety of CBRN agents.

Table 11 “Checklist of Symptoms” table: Proposed list of symptoms to recognise a possible CBRN incident.

Type of symptoms		**Is it a *Frequent symptom* in low-risk infectious diseases or in another unpleasant situations?**	**Presence or not of the symptom (YES /NOT)**	**Number of people showing these symptoms**	**Time of onset of symptoms after the stay in the hotel /conference centre**
DESCRIPTION		DESCRIPTION	TO FILL	TO FILL	TO FILL
General symptoms	Fever	Yes			
	Headache	Yes			
	Weakness / fatigue	Yes			
	Malaise	Yes			
	Body temperature changes	Yes			
Respiratory symptoms					
Symptoms like flu:	Fever	Yes			
	Chills	Yes			
	Headache/ muscles ache	Yes			
	Cough	Yes			
Other symptoms	Weakness / fatigue	Yes			
	Difficulty breathing	No			
	Asphyxiation / respiratory failure	No			
	Chest pain	No			
Digestive symptoms	Nausea	Yes			
	Vomiting	Yes			
	Diarrhoea	Yes			
	Bloody	No			

	diarrhoea				
	Stomach and Abdominal swelling/discomfort/cramps and/or pain	Yes			
Nervous symptoms	Double vision (diplopia)	No			
	Blurred vision	No			
	Swallowing difficulty (dysphagia)	No			
	Muscle paralysis	No			
	Facial paralysis	No			
	Sleepiness (lethargy)	Yes			
	Neck stiffness	No			
	Photophobia	No (except in patients with diagnosed migraine headaches or similar)			
	Dizziness	Yes			
	Confusion	No			
	Seizures	No			
	Neurological deficit (such as speaking, chewing and/or swallowing difficulty)	No			
	Coma	No			
	Hyperactivity / anxiety	Yes			
	Hallucinations / paranoia	No			

Cutaneous					
	Painful swollen lymph nodes or 'buboes'	No			
	Depressed black eschar with surrounding oedema	No			
	Regional lymphadenopathies	No			
	Rash / itching	Yes			
	Burns	No (unless the source of the burn is localisable)			
Haemorrhaging symptoms	Cutaneous haemorrhages (bleeding under the skin)	No			
	Nosebleeds and gingival bleeding.	No (except people prone to nasal epistaxis)			
	Blood in stool and urine	No			
Cardiovascular symptoms	Heart rate changes (specially tachycardia)	Yes			
	Blood pressure changes (specially hypertension)	Yes			
Acoustic symptoms	Havana syndrome	No			

5.2. Second Step: (I) ISOLATION of both people involved and suspected sources creasing the danger

The second part consists of determining if strange things happened who could help to determine the origin of that suspected CBRN attack in order to isolate it and avoid increasing the danger (second step). For this purpose, we have elaborated table 11 (called “Stranger things happened?” table).

In the aforementioned BULLSEYE[3], MALL-CBRN[4] and SAFE STADIUM[5] projects, signs, sights, smells, symptoms, sounds are taken into account as part of the 5S procedure for recognition of the incident …. In this document, we have elaborated a table (table 12) to be filled out by hotels and/or conference centres after the appearance of symptoms, including important elements for consideration and identification of a possible CBR attack, as well as its origin.

Table 12 “Stranger Things Happened?” table: Signs to identify a possible CBR attack incident (adapted from the 5S procedures: signs, symptoms, smells and sounds specified in the ISF-P projects mentioned above), and people and rooms to be considered in order to isolate the suspected threat.

	Yes or not	**If “yes”, explain it**
Did you have some drink/food?		
Did you see anything strange like drops, suspicious clouds, anything unusual?		
Did you smell a strange odour?		
Did you hear some strange noise?		
Indicate person in touch		
Specify the visited rooms within the hotel / conference centre		

[3] European Commission (ISFP-2017-AG-PROTECT) (Grant Agreement No 815220).
[4] European Commission (ISFP-2018-AG-CT-PROTECT) (Grant Agreement No 861643).
[5] European Commission (ISFP-2020-AG-PROTECT) (Grant Agreement No 101034226).

In order to avoid increasing the danger, first of all it is necessary to isolate the affected both people and rooms / and remove every presence of food and drink, not only to prevent but also to analyse them in order to search for the source of the threat. People in contact with the affected person must be checked and isolated too. It may be necessary to evacuate the affected area to protect the safety of other individuals. Objects to be removed, persons to be isolated or rooms to be decontaminated are established after filling in table 12.

Everybody in contact with the affected person must use appropriate personal protective equipment (PPE), such as face masks, gloves, and protective suits, to prevent exposure to hazardous agents. Used material must be removed safely.

5.3. Third Step: (N) NOTIFICATION to health and security/police authorities

This point should be carried out in accordance with the plan drawn up by the health authorities in each country, also to be compliant with respective national legislations which may differ from country to country. It should be an epidemiological communication network whose main objective is the detection, surveillance, and rapid response to outbreaks of communicable diseases and other public health emergencies.

In the event of a biological alert, an epidemiological plan led by the relevant authorities must be taken into account.

In most countries, there is a predesigned plan ready to be carried out. For example, in Spain, there is an epidemiological network from local to national level. At the local level, public health services, such as health departments, play a key role in the detection and notification of local outbreaks. Primary care physicians, local hospitals and other health care providers also contribute to the early detection of diseases. At the regional level, each autonomous community in Spain has its own public health structure in charge of epidemiological surveillance and outbreak management within its territory. These structures are interconnected with the Ministry of Health and Consumer Affairs and with the Centre for the Coordination of Alerts and Health Emergencies (CCAES) at the national level, which reports to the Ministry of Health, coordinates the response to health emergencies throughout Spain. It is responsible for coordinating the National Epidemiological Surveillance Network (RENAVE), responsible for the collection, analysis, and dissemination of epidemiological information at the national level.

Each European country may have their own epidemiologic plan but there are both coordination and collaboration between EU member countries and other regional organisations to address public health challenges at the European level. In the context of the European Union, the European Centre for Disease Prevention and Control

(ECDC) plays an important role in epidemiological surveillance and response to infectious diseases across Europe. The ECDC provides technical guidance, support and coordination for disease surveillance and outbreak management in EU member countries. In addition, the ECDC manages a database called 'The European Union Communicable Diseases Information System (TESSy)' for territory-wide epidemiological surveillance.

The European Union cooperates with international organisations such as the World Health Organisation (WHO) and the CDC on epidemiological issues. This cooperation includes the exchange of information, participation in training programmes and collaboration in responding to global public health outbreaks and emergencies.

5.4. Forth Step: (S) SITE CLEAN-UP of all suspected affected rooms

Important consideration beforehand: the responsibility for site clean-up usually falls to a venue owner or a venue operator (depending on agreement or national or local regulations). Governmental or local specialised emergency services (like Firefighters) typically conduct decontamination only if contamination generates hazard to general population otherwise the venue is closed and secured until proves of decontamination are delivered to relevant authorities.

Decontamination must be conducted only be professional services or specialized private companies unless the threat is minimal and typical cleaning or simple decontamination methods could be applied. However, it must be determined by those professional services. **The contaminated venue owner or operator must always rely on experts' advice as improper decontamination procedures could lead to health risk including death.**

Depending on the magnitude of the threat and local policies, government agencies, fire teams, military personnel or other specialised emergency response organisations may be involved.

However, although the decontamination procedure should be carried out by a specialised team, hotels are recommended to follow a disinfection routine, not only after a relevant attack and subsequent disinfection by specialised teams, but also as a cleaning routine after use of the hotel rooms and/or conference centres.

In the section 3.5.4 "Proposal for a general site clean-up protocol "**, the common points found from the disinfection protocols for each type of agent, are shown, with the aim to find the general disinfection protocol and site clean-up for all types of agents.**

5.4.1. Biological decontamination

Air decontamination

Firstly, adequate ventilation is critical to dilute and disperse chemical contaminants in the air. The use of High-Efficiency Particulate Air (HEPA) filtration is highly efficient to remove fungi, bacteria and viruses from air since HEPA filters are very effective at retaining particles of a wide range of sizes. Although the standard definition of a HEPA filter is that it can retain at least 99.97 % of particles of 0.3 micrometres in size or larger, it is important to note that HEPA filters can retain larger (until 10 µm) and smaller particles (100 – 10 nm). Air purification systems equipped with HEPA filters can help reduce the concentration of airborne biological contaminants in indoor environments. Therefore, there are several methods for air decontamination. In this sense, Ultraviolet Germicidal Irradiation (UVGI) systems use ultraviolet (UV) light to inactivate microorganisms by disrupting their DNA or RNA, preventing them from reproducing; they can be installed in air handling units to sterilise air. Air ionisers release charged particles into the air, which can attach to and neutralise airborne particles, including biological contaminants. Ozone generators produce ozone gas, which is introduced into the air to decontaminate indoor spaces. However, ozone can be harmful to human health at high concentrations and should be used with caution.

Chemical agents, such as hydrogen peroxide (H2O2) vapour or chlorine dioxide (ClO2) gas, can be used to disinfect the air by killing or inactivating airborne pathogens. These chemicals are typically introduced into the air as a vapour or gas and may require specialised equipment for safe and effective application.

Surface decontamination

Firstly, clean the contaminated surfaces with soap and water. You can also use UVGI systems or ozone generators for physical decontamination.

Secondly, a chemical decontamination must be carried out. In general, biological agents are destroyed with chlorine-based disinfectants such as sodium hypochlorite (bleach) (1:10 dilution), quaternary ammonium compounds (quats; 0.5 to 1 %), phenolic disinfectants (0.5 to 5 %), peroxygen compounds such as hydrogen peroxide (6-10 %) or peracetic acid solutions (5 to 15 %). Resistant structures as Spores, such as Bacillus anthracis spores, can be eliminated with formaldehyde (careful handling because of its toxicity; 10 to 37 %) and peracetic acid solutions (5 to 15 %). As indicated above, DS2 (Decontamination Solution 2) is a military-grade disinfectant used for chemical and biological decontamination purposes, as explained above, since there is hydrogen peroxide and sodium hypochlorite (bleach) in its composition.

Decontamination should be carried out with personal protective equipment (PPE): protective suits, respiratory masks (FFP3/FFP2/N95 or powered air-purifying respirators), gloves, gowns, and eye protection. Every used material, as absorbent material, must be safely removed.

5.4.2. Chemical decontamination

Air decontamination

Adequate ventilation is critical to dilute and disperse chemical contaminants in the air. In some cases, dilution, and dispersion of chemical pollutants in the air through ventilation and outdoor air circulation can help reduce pollutant concentrations to safe levels. Mechanical ventilation systems, such as fans or exhaust fans, can be used to increase airflow and remove contaminants from inside buildings. In addition, air purifiers equipped with specialised filters, such as activated carbon filters or HEPA filters, can help capture and remove chemical pollutants from the air. Although HEPA filters are not effective in retaining chemical gases or vapours due to their size, since chemical agents are released in the form of aerosol and dust, some chemical particles within these matrices may be of sufficient size to be retained by the HEPA filter. Thus, these filters can help to reduce chemical decontamination, although they are not sufficient for complete chemical decontamination. Filter with activated carbon is widely used for its ability to adsorb a wide range of chemicals.

Advanced oxidation is a process that uses strong oxidants, such as ozone, hydrogen peroxide or potassium permanganate, to break down chemical pollutants into less toxic compounds. This approach can be used to decontaminate air polluted by volatile organic compounds (VOCs) or other chemical pollutants.

Surface decontamination

Firstly, it is recommendable to carry out a physical decontamination which involves the mechanical removal of the chemical agents from the contaminated surface. This may include cleaning with soap and water, mechanical abrasion, scraping or removal of contaminated materials. Thermal decontamination may be useful for some chemical agents. It involves the use of steam, hot water, or heating the contaminated surface using equipment such as infrared lamps or radiant heat units. Ultraviolet (UV) irradiation can be used to decontaminate surfaces contaminated with certain chemical agents. Exposure to ultraviolet light can break down the chemical bonds of chemical agents and deactivate their toxicity. This method can be especially effective for decontaminating small areas and hard-to-reach surfaces.

Monitoring is very important after chemical decontamination by specialized CBRN units when a chemical incident has occurred.

For pneumotoxic / suffocating, vesicant, and neurotoxic agents, DS2 solution is indicated as a very effective decontamination solution.

DS2 (Decontamination Solution Number 2) is a military-grade disinfectant used for chemical and biological decontamination purposes. DS2 is primarily used by the military for decontaminating equipment, vehicles, and personnel exposed to chemical or biological warfare agents.

It's consisting of two parts:

For acid components, a mixture of isopropanol and hydrogen peroxide. This mixture helps to neutralise chemical warfare agents by breaking down their molecular structure. Therefore, hydrogen peroxide is used as a biological disinfectant too. Concentrations around 1 to 5 % are commonly used. Contact times of 10 minutes to 1 hour are common. Higher concentrations and longer time may be used for more stubborn contaminants or in situations where rapid decontamination is necessary.

Chlorine-based component: usually consists of sodium hypochlorite (bleach). Chlorine is an effective biological disinfectant. Concentrations around 1 to 5 % are commonly used. Contact times of 10 minutes to 1 hour are common. Higher concentrations and longer time may be used for more stubborn contaminants or in situations where rapid decontamination is necessary.

DS2 may have some limited efficacy against tear gases. A 5 % sodium bisulfite solution in water and, water with soap, or mild detergent solutions, may have some effectiveness in neutralising tear gases.

PPE and absorbent materials can be used to protect workers during this process and to prevent the dispersion of chemical agents

5.4.3. Radiological decontamination

Air decontamination

The most effective method for air decontamination is controlled ventilation combined with specialised filtration systems designed to remove radioactive particles from the air. This approach is based on dilution and extraction of contaminated air, as well as capture and retention of radioactive particles by suitable filters. Install specialised air filtration systems, such as HEPA filters, which can capture very small particles, including radioactive particles. Some radioactive particles may be similar in size to ordinary dust, while others may be considerably smaller. The smallest radiological particles can be in the order of fractions of a micron or even nanometres. Since these HEPA filters are highly effective in removing radioactive particles from the air and can help reduce the concentration of pollutants in the environment.

Continuous monitoring is very important in radiological decontamination. Therefore, implementing radiological surveillance networks to continuously monitor the concentration of radioactive material in the air is essential to guide decontamination actions.

Take measures to control the dispersal of radioactive material and prevent contamination of additional areas. This may include the use of physical barriers, such as tarpaulins or plastic sheeting, to limit the dispersal of radioactive material and to protect sensitive areas.

In situations of radiological contamination, it is important that people in the contaminated area use appropriate personal protective equipment, such as respiratory masks and protective suits, to minimise exposure to radiation and airborne contaminants.

Surface decontamination

Before beginning the decontamination process, it is important to assess the level and extent of radiological contamination on surfaces. This may involve the use of radiation measurement instruments to determine the amount of radiation present.

The first stage of decontamination involves the physical removal of the radioactive material from the contaminated surface. This can be done using tools such as wet rags, sponges, brushes or special hoovers designed for the removal of radioactive particles. After this, cleaning agents should be applied. These agents may include special chemical solutions, such as detergents or acidic or alkaline cleaning solutions, which help to dissolve and remove remaining radioactive particles. Contaminated surfaces should be thoroughly washed with water and detergent to remove any radioactive residues and any cleaning agents used. It is important to ensure that the resulting water and waste is handled safely and disposed of properly.

After completing the decontamination process, it is important to verify the effectiveness of the cleaning using radiation measurement instruments to ensure that radiological contamination has been removed to safe levels.

It is essential to protect oneself adequately. This may include the use of appropriate personal protective equipment (PPE), such as protective suits, gloves, goggles, and respiratory masks, to avoid direct exposure to radiation and contaminated materials. The 3 principles of reducing radiation exposure (time, distance, and shielding) should have been taken into account as well.

5.4.4. Proposal for a general site clean-up protocol

Once a CBRN threat is confirmed, decontamination procedure must be executed by specialised emergency response teams (first responders).

However, it is recommended that, after both an unconfirmed threat, and after routine use of the hotel rooms and conference centres, a protocol for cleaning the rooms and their surfaces should be followed.

As a result of all the above information, and after finding the common points, we propose a general *site clean-up* protocol to be carried out by the hotel and/or conference centre on a routine basis and in case of an unconfirmed threat where no decontamination protocol is executed by any emergency personnel (only for prevention purposes). This *site clean-up* protocol includes decontamination of air and surfaces.

Air decontamination

Firstly, adequate ventilation must be carried out.

Air purification systems equipped with HEPA filters in combination with activated carbon filters (both mainly for biological and chemical warning; for radiological decontamination, can help control it but are not fully effective).

Therefore, both to decontaminate and to minimise or even prevent the impact of an attack, it is advisable for the hotel or conference centre to have daily **cross ventilation and other forms of cross ventilation, using forced ventilation systems consisting of air purification systems, equipped with HEPA filters in combination, as far as possible, with activated carbon filters**. Good maintenance and replacement of filters will be needed.

Surface clean-up and decontamination

Firstly, physical decontamination must be carried out. Absorbent material (clays and absorbent pads) should be used in all the suspected affected surfaces. Washing the suspected surfaces with water and soap is effective mainly for both biological and chemical warning and can help control radiological warning.

Secondly, a chemical decontamination must be executed. The contaminated surface must be washed with chemical solutions too. DS2 is suitable for both chemical and biological warning in almost every case. However, it only can be used by specialized persons. Bleach dilution (1:10) is effective in a biological warning and in a lot of chemical warnings (but it is not effective in organic matter is present). In the case of radioactive particles, chelating agents or mild acids are effective. Oxidising agents, reducing agents or chemical neutralisers, are used in chemical warning, depending on the type of the specific chemical agent.

In short, it is consisted of: **using disposable adsorbent material soaked in 1:10 dilution of bleach (as DS2 is generally to be used by military or specialist personnel), followed after at least 10 minutes, by thorough washing with soap and water, and then drying with absorbent disposable material**.

Site clean-up and decontamination must be carried out with PPE: protective suits, respiratory masks (FFP3/FFP2/N95 or powered air-purifying respirators), gloves, gowns and eye protection, and every used material, including absorbent material, must be properly removed.

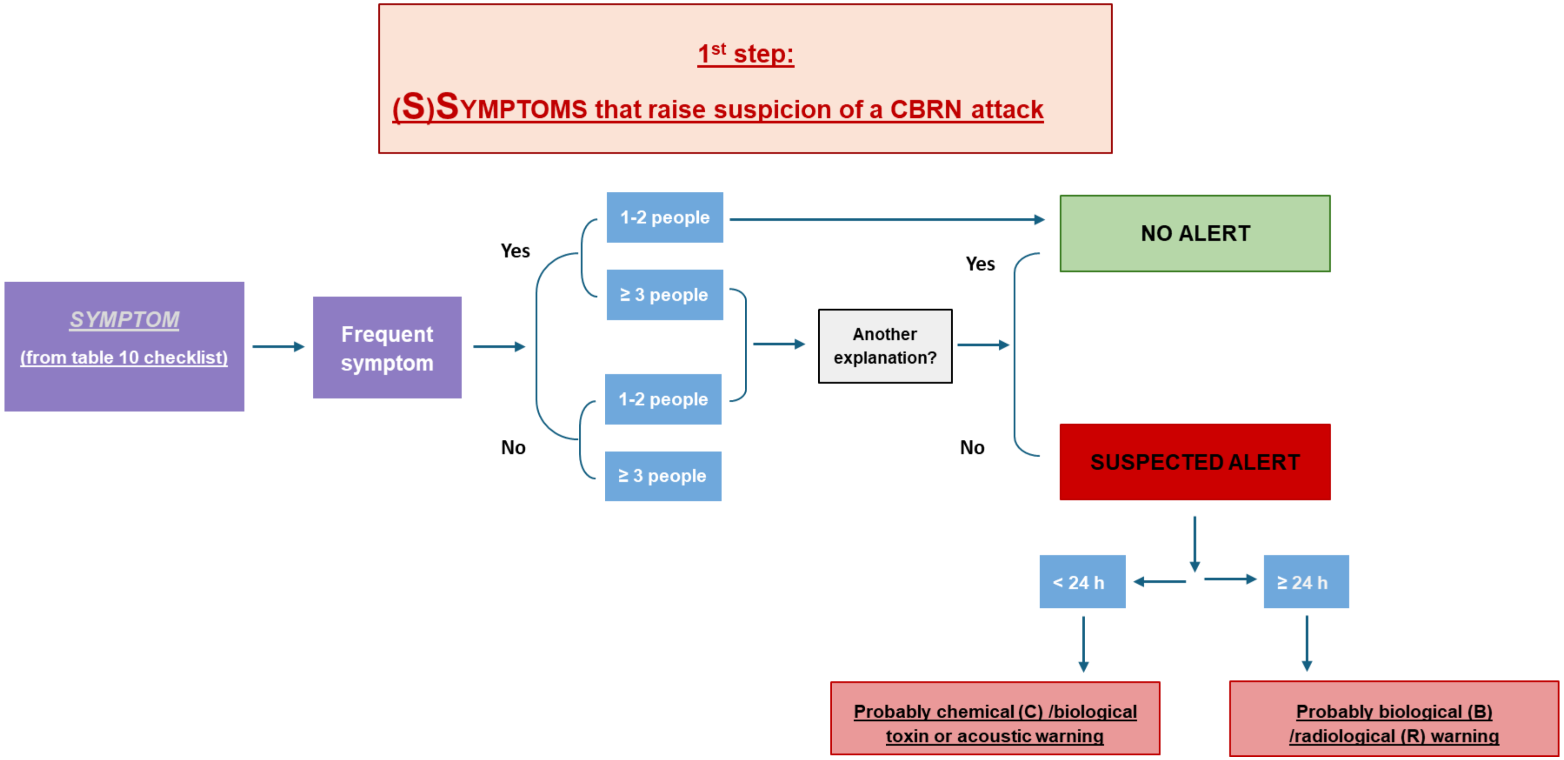
6. Decision Tree

Decision Tree of four-steps SINS protocol to CBRN threat detection

Based on the previous section, a decision tree (figure 1) of the proposed *SINS* four-step protocol (*SINS* protocol in section 3 above) is provided below, in order to facilitate the hotel and conference centres to use this *SINS* protocol in identifying a potential CBRN accident, and to decide how to act accordingly (figure).

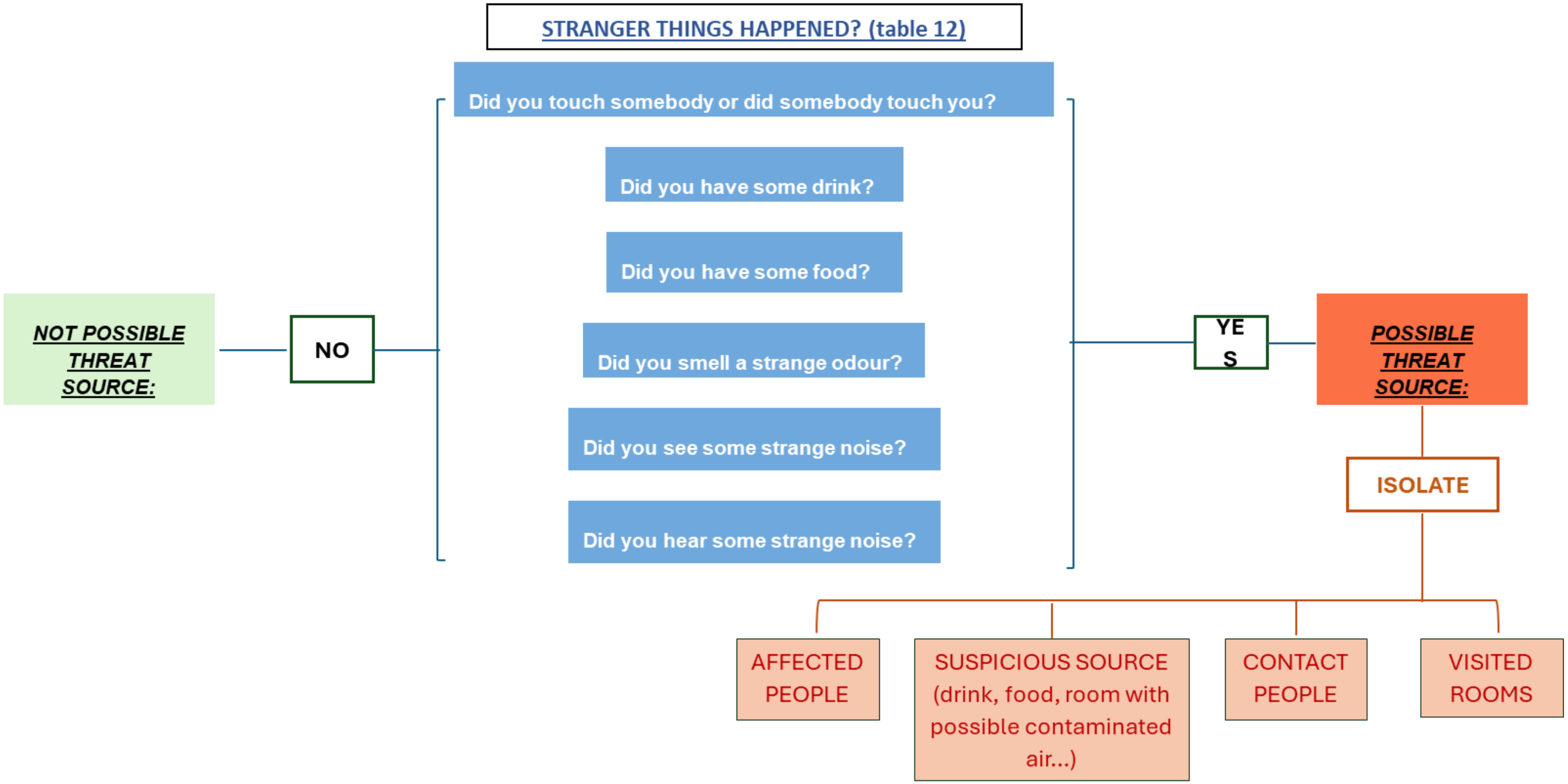
IMPORTANT NOTE**:** As indicated above, both the checklist and decision tree are only applicable to people showing symptoms during their stay in the hotel and / or in the conference centre.

Figure 1. Proposed decision tree of four steps *SINS* protocol for attack detection.



2nd step:

(I) ISOLATION of both people involved and suspected sources



3rd step:

(N)NOTIFICATION to health and security/police authorities

4th step:

(S)*SITE CLEAN UP* of all suspected affected rooms

UNCONFIRMED ALERT:

Site clean-up of every rooms suspected of being affected and routine general cleaning

CONFIRMED ALERT:

Decontamination by governmental or local specialised emergency services

AIR

- VENTILATION
- HEPA FILTERS IN COMBINATION WITH ACTIVATED CARBON FILTERS (B&C warning; can help control R warning but it is not fully effective)

SURFACES

- ABSORBENT MATERIAL
- WATER AND SOAP (B&C warning; can help control R warning)
- WASHING WITH CHEMICAL SOLUTIONS APPLIED > 10 MIN (DS2 bleach both B&C warning; bleach for B and a lot of C warning; chelating agents or mild acids for R; for C: oxidising agents, reducing agents or chemical neutralisers, depending on the type of C)

7. Conclusion

In summary, this deliverable allows the hotels and conference centres to stablish a simple protocol to suspect and early detect a possible CBRN event.

For this purpose, the following tools are provided:

1- An epidemiological enquiry based on the appeared symptoms, their onset-time and the number of affected people.

2- A *Four-step* protocol for evaluation of a possible CBRN threat and "how to act "(called *SINS* protocol), following a suspected alarm.

3- A *Decision Tree* for facilitating the implementation of the *SINS* protocol for the evaluation of a possible threat and *How to Act*. It will be very useful for the hotel and conference centres to decide whether there is a suspicion of CBRN event and how to act.

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