CHEMICAL, BIOLOGICAL, RADIOLOGICAL AND NUCLEAR HAZARDS

Please note that the foundation messages are included in the previous section: ***Key messages for all-hazards household and family disaster planning****. Separate messages are also available for other specific hazards.*

Chemical, biological, radiological and/or nuclear (CBRN) emergencies are accidents or deliberate acts involving CBRN hazards. The umbrella term CBRN is commonly used because there are distinct similarities between these hazards, making some of the emergency preparedness and response measures common or very similar for all of them.

Nuclear and radiological hazards are linked to ionizing radiation from radioactive sources – the ability of atoms to release ionizing radiation, which in sufficiently high doses is hazardous to humans and animals and has also an impact on the environment. Nuclear emergencies involve or emerge from nuclear chain reactions. Such chain reactions take place for instance in nuclear power plants and research reactors. Radiological emergencies can involve all other situations involving radioactive sources, for example, those used in radiological devices for medical, industrial or research applications.

Chemical emergencies can occur in a number of different situations where hazardous chemicals are released into the surroundings. Chemical agents are all chemical elements and compounds in a natural or processed state and their by-products. Exposure by inhalation, ingestion or to the skin may result in illness or injury to human health depending on the chemical substance, the amount of the dose and the duration of exposure. The standard terminology refers to industrial chemicals that are hazardous as toxic industrial chemicals (TICs); CBRN agents for deliberate release can be either TICS or chemical warfare agents (CWAs).

Biological agents include bacteria, viruses, fungi and parasites or parts thereof or products they generate. Exposure in sufficient quantities and over a given duration may result in illness or injury to human health, and this can happen through natural exposure or release (intentional or unintentional) of microorganisms from, for example, a research facility. As the key messages for CBRN emergencies focus on general characteristics common for these kinds of emergencies, more specific key messages related to biological hazards are elaborated under Major epidemic and pandemics diseases.

It is useful to note that the term CBRN emergencies is usually linked to the security related context. CBRN emergencies often fall under technological emergencies. In addition to encompassing CBRN events, this term includes other emergencies stemming from technological and industrial activities, such as dam ruptures, transport accidents and factory explosions, to name a few..

Assess and plan

Key messages	Context-specific details
Know the CBRN risks where you live, work and your children study and play	• Seek information about the location of sites where hazardous and toxic substances are stored or used and of nuclear facilities in your area. Be aware that research centres can also house CBRN agents. • Familiarize yourself with information given by the authorities, companies and facilities on what is considered safe distance to the facilities under regular circumstances. • Advocate with authorities and facilities to make information about hazardous material and the relevant safety measures for the public available to the population. • Be aware that safe zones change depending on kind of hazardous material and the degree of severity of the accident. Seek information about safe zones in advance.
Familiarize yourself with existing warning systems and preparedness plans in your area	• Depending on the event and on the product involved, you may need to stay at home, under confinement (refer to *shelter-in-place* under *Prepare to respond: develop skills and store provisions* of this section), or go to a safe zone. Get this information from authorities responsible for preparedness plans in your area. • Learn the public warning channels, for example, sirens, media and text messages among others in your community in case of a CBRN emergency. • Be aware of local and regional contingency plans for CBRN emergencies. This may be a part of general contingency plans and possible countermeasures that can be put in place by the authorities. • Know if and where there are shelters in your community that can protect you from different types of contamination. Depending on the distance to CBRN facilities, these shelters may require special air filters and special locations.

Mitigate risks: physical or environmental

Key messages	Context-specific details
Know the symbols that CBRN agents should be marked with	• Make sure the entire family is aware of the symbols for the different CBRN hazards so that they understand that they should not attempt to touch any object or enter any facility carrying these symbols. • Keep household chemicals out of reach for children. • The most widely used symbol for radiological, biological and chemical hazards are:  • Be aware that different countries may use additional symbols.
Consider CBRN risks and multi-hazard effects when determining your living location	• Think about potential risk zones and proximity to industrial facilities with possible CBRN hazards when you move to a new place. • Consider the proximity to safe shelter or review the possibility of sheltering in the house in case of a CBRN emergency.
Familiarize yourself with potential evacuation routes	• Following guidance from the authorities. Relocations or evacuations may be necessary in certain situations. Familiarize yourself with potential routes and evacuation zones that are foreseen in the emergency plans. Consider that mass evacuations can cause considerable traffic disruptions or evacuation routes might be damaged due to a multi-hazard disaster like an earthquake or landslide. • Consider the preparation of a family *go-bag* (refer to *Key messages for all-hazards household and family disaster prevention* for further information).

Understand the nature and effects of CBRN hazards	• You may be able to see, smell or touch certain CBRN hazards, others can only be detected using special equipment. • Depending on the CBRN agent, exposure can take place through contact with skin, inhalation or ingestion. For radiological emergencies, irradiation can also happen if you are standing close to a radioactive source. • Depending on the source, the way in which exposure occurs and the degree of contamination, the impact on the body can range from minor to serious health effects or even to be lethal.
Understand where CBRN hazards can be found and how they can spread	• In addition to being stored or used in various facilities, CBRN agents are sometimes transported, and an emergency can therefore occur on road, rail or at sea. • Warning signs for the transport of hazardous goods include:  • There are different ways in which CBRN agents can spread. In emergencies these most commonly spread through air as light particles, aerosols, vapour or in liquid form like some of the chemical substances. Some CBRN agents can also be spread through touch or contact with body fluids. In larger emergencies, the area affected can be wider and even have cross border implications.
Nuclear and radiological emergencies	
Make sure you know were to get and have access to potassium iodide (KI) pills	• There is a range of protective actions authorities can and will consider to put in place to reduce and/or limit the impact on public health from nuclear and radiological emergencies. These can range from *shelter-in-place*, evacuation, relocation, and restrictions on foodstuff to intake of stable iodine. • Distribution channels of KI tablets can vary from country to country. If taken before being exposed to radiation, KI pills can help to protect against damage on the thyroid gland. • **Note:** KI is not a radiation antidote and is only effective against radioactive iodine that affects thyroid glands and can cause thyroid cancer. • Ensure you know where to get KI pills in case of emergency and who should take these and the required dosage. *This should only be administered when authorities instruct to do so, as there can be adverse effects if taken these without reason.* • KI pills should be taken before exposure to radioactive iodine to protect the thyroid gland from uptake of radioactive iodine. Children, pregnant and lactating women are most vulnerable to radioactive iodine exposure.

Chemical emergencies	
Leave household chemicals out of sight and reach of children and pets	• To prevent chemical accidents from taking place in your home, it is important that hazardous chemicals are out of sight and reach from children and pets. This is particularly relevant in the case of detergents and cleaning agents, as well as paint.
Make sure household chemicals are kept in original packaging and properly marked	• To prevent mishaps with household chemicals, everyone in the house must be able to see what these are and be able to read the instructions for use and potential warnings on the package. Chemicals should not be transferred to containers previously used for drinks or food to prevent its consumption by mistake.
Do not mix chemicals	• Some chemicals like chlorine can produce hazardous gases if mixed. Refrain from experimenting with this.
Always have easy access to important phone numbers	• Many countries have a special emergency number you can call in the case of poisoning or mishandling hazardous chemicals and materials. Memorize the number, store it on your mobile phone and/or display it in a visible place in your home together with other emergency numbers.
Ensure proper ventilation	• Ensure you open your windows every day: air pollution is higher indoors than outside. Ensure good ventilation through window opening if you are undertaking renovation work in your home or getting new furniture.

Prepare to respond: develop skills and store provisions

Key messages	Context-specific details
Minimize time of potential exposure	• If you hear about an emergency with potential CBRN hazards in the area, make sure that you take shelter and/or leave the exposed area as soon as possible as per instructions given to you by the relevant authorities and/or first responders. • Always follow instructions from authorities and first responders.
Avoid areas exposed to CBRN hazards	• If you are outside of the exposed area, do not attempt to travel into the area to collect personal items, pick up your children from day care facilities and/or schools or search for family members. Rely on trained emergency staff for this. • This is especially relevant for your children: they are taken care of at school.
Share information	• If you hear about a CBRN emergency, make sure to share the information with your family, neighbours and others in close proximity without putting your safety at risk. If you are instructed not to use a telephone device, please follow the advice. Beside face-to-face contact use other communication channels like social media.
Ensure sufficient distance between you and the emergency site if instructed to do so	• Following notification from authorities it might be necessary for you and your family to relocate or to evacuate. Make sure that you move to a dedicated safe area, sufficiently far away from the emergency site. Distance and direction can depend on the hazardous material involved, the size of the emergency as well as wind and weather conditions. • Take important personal items with you, as it might not be possible to return for some time.

It may be safer to shelter-in- place than to evacuate immediately if you receive information that a CBRN emergency took place in your area	• If the authorities provide no reliable information, it may be difficult to know exactly how the contamination spreads at the onset of a CBRN accident. Therefore, it may be safer to stay at your location in order to shield yourself against exposure (unless the responsible authorities have already issued the notice and instructed to shelter at home). • Houses featuring normal, solid construction provide a high level of protection. • Close, lock and stay away from all windows, exterior doors and other openings in the house. If possible, seal cracks around doors and windows, ventilation shafts with duct or strong tape. • Turn off all fans, heating and air conditioning systems and close the fireplace damper. • Make sure the radio is working in the room where you take shelter and have sufficient extra batteries for it. Keep listening to the radio and/or watch the television and follow relevant social media until information is issued announcing that conditions are safe or you are directed to evacuate. • It is ideal to have a landline telephone in the room you select to take shelter in. Mobile networks may not work well due to heavy load or may be damaged. It is possible that the internet may be down as well. • Keep a hard copy of a list of emergency contact numbers. • Bring everything you need into the room (including packaged food, bottled water, first aid kit, pets) and seal the door with duct tape, heavy plastic sheeting, clothes or anything else you may have at hand. • When you receive notice from the authorities that the danger phase has passed, the building must be aired and cleaned thoroughly in order to get rid of any contamination that it may have been exposed to due to cracks or openings. • In a sealed room do not light fires or burn gas to cook or provide warmth – these will use up oxygen and will produce toxic carbon monoxide when oxygen levels are low.
Take shelter if you are outside or in a car when you hear that a CBRN hazard is spreading in the air near you	• Look for a safe location to take shelter. This should be the largest concrete building easily accessible to you, but any building is better than staying outside or in a car in an area that is potentially exposed for a longer period.

Learn how to decontaminate yourself	• If you fear that you may have been contaminated, it is essential that quick action be taken. To limit the effect of the contamination on the body and ensure you do not contaminate others, take a few essential steps. Before entering a building or taking shelter do the following:
	  ◦ If you are outside, cover your mouth and nose with a handkerchief, a piece of cloth or similar.
	  ◦ Remove clothing without touching the outside of the items, seal in plastic bags and put the bags as far away as possible.
	  ◦ Wash skin and hair thoroughly with soap and lukewarm water if possible, rinsing eyes and ears with bottled water and blow your nose. If you do not have access to water, scraping or wiping contamination off your skin with a clean cloth or wipe is the next best option. Extra care should be taken to clean the area around the mouth, nose, eyes and ears.
	  ◦ Maintain good hygiene practices after decontaminating.

Make sure you have access to uncontaminated food and water	• Water sources can be contaminated during a CBRN emergency, and it is therefore important to refrain from drinking water from the tap or wells. Bottled water can be a safe alternative. • It may not be safe to consume fresh milk, fruit and vegetables, meat and other fresh foods during and after such an emergency. • Make sure that you have enough bottled water and packaged or canned foods stored for family members and pets for at least five days (the duration for which you may be sheltering). • Follow the advice of the public authorities in the aftermath of an emergency as to which foods are safe to consume and where to get safe food and drinking water.
Seek medical attention as soon as you can	• Seek medical attention if you think you have been contaminated with CBRN hazards, even if you do not initially show any symptoms.
Nuclear and radiological emergencies	
Listen to the instruction and guidance of the authorities regarding preventive and protective measures	• The instructions provided by the authorities are to be followed entirely and in a timely manner. If evacuation is ordered, the indicated evacuation routes and the time to commence and finalize the evacuation must be observed. • Take KI pills if instructed to do so by the authorities.
Pay attention to the weather conditions when considering whether to *shelter-in-place* or move	• The radioactivity on the ground may be several times higher after precipitation (rain or snow) from radioactive clouds than in regions where the clouds have passed without any rainfall. • An unfavourable wind direction from the site of the accident towards your location may transport radioactive particles and cause a radioactive pollution of the surfaces (soil, plants, tress, buildings, open water sources.). Almost no rise in activity can be expected if the wind blows in the direction from your location to the accident. • If instructed by the authorities to move from your location try to move upwind from the accident or emergency site.
Select a suitable room to shelter in within the building	• If the house features an underground cellar or an internal room without windows, this is the best place to stay. In taller buildings, opt for the middle floors if it is not possible to take shelter underground.
Understand the basics of decontamination	• Decontamination is the process of cleansing an object or substance to remove contaminants such as microorganisms or hazardous materials, including chemicals, radioactive substances and infectious diseases. • Decontamination can be a combination of processes, including cleaning, disinfection and sterilization. Changing clothes, washing with detergent and hot water can, in certain situations, be a satisfactory method of decontamination. Make sure that you dispose of clothes properly that you believe contain sources of contamination.

Learn how to recognize the symptoms of radiation sickness	• If a person has been exposed to a very high dose of radiation, he/she can develop acute radiation syndrome (ARS). Depending on the dose, ARS can manifest within hours or days. • Main symptoms of ARS include nausea, vomiting, diarrhoea, gastrointestinal pain, and flu-like sensation. If not treated immediately, ARS may be lethal. • In case of severe partial or localized exposure, a local radiation injury, i.e. radiation burn can occur. It may manifest as an insect bite and further evolve in a blister and a sever ulcer with necrosis unless treated in a specialized facility. • Seek medical attention if you recognize any of these symptoms.
Chemical emergencies	
Take care to avoid spillage and contamination	• When handling chemicals always wear gloves and other protective equipment as described in instructions on the packaging of the various chemicals. • Clean up any spillage right away and dispose it as described on the packaging. • Dispose of food and drink you suspect may have been in contact with chemicals. • If chemicals are burning or there are hazardous gases or vapour in the air, cover your mouth and nose and move away from the exposed area.
Call the emergency number for poisoning in a chemical emergency	• Always call the emergency number for the service that deals with cases of poisoning in your country if you suspect that you or anyone else in the vicinity has been contaminated due to exposure to dangerous chemicals. If there is no such specialized number, call the general emergency number. • If the contamination comes from household chemicals, keep any cans or containers with the information about the chemicals with you so you can describe it correctly to the emergency operator.
Take immediate action if chemicals come in contact with the eyes	• If a chemical comes in contact with the eyes, it is important to immediately flush the eyes with clear, lukewarm water for a minimum of 15 minutes. • Maintain this procedure even if the eye feels normal before 15 minutes have passed. • Seek medical help as soon as possible.
Pay attention to the weather conditions when considering whether to *shelter-in-place* or move	• If you are upwind from the spot of the accident you are likely to receive much less exposure to a chemical spread by wind than if you are in the direction that the wind is blowing. • Rain or snow will usually dilute the chemicals and hence decrease the intensity to the exposure.
Select a suitable room to shelter in within the building	• Some toxic gases are heavier than air and will therefore gather close to the ground or underground. • To be sure you avoid large concentrations of these following a major chemical emergency take shelter in a room above ground level. If the house features an internal room without windows, this is the best place to stay.
Learn how to recognize the symptoms of toxic poisoning	• Chemicals can affect the body in different ways depending on the type, and it is necessary to learn how to recognize the symptoms of toxic poisoning: breathing difficulties, irritation of eyes, throat and skin, changes in skin colour, headache or blurred vision, dizziness, lack of coordination, diarrhoea cramps or convulsions.