Hospitals Safe from Disasters

Guide for the evaluation of small and medium-sized health facilities

Pan American Health Organization
Regional Office of the World Health Organization

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Hospital Safety Index

GUIDELINES FOR THE EVALUATION OF SMALL AND MEDIUM-SIZED HEALTH FACILITIES

Emergency Preparedness and Disaster Relief Coordination

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Preface

The impact of torrential rain, earthquakes, hurricanes, landslides, and other hazards reveals the complexity of natural hazard vulnerability in Latin American and Caribbean countries. Many of the effects of natural hazards are seen in severe damage to health infrastructure. When facilities that are built to provide health services are damaged or are unable to function, the ill and injured have no place to go for assistance. This has an enormous impact on populations that depend on these services on a regular basis.

Given this reality, the countries of the Americas agreed to adopt "Hospitals Safe from Disasters" as a national policy for risk reduction,[1] in order to ensure that all new hospitals are built with a level of safety that will ensure that they will continue to function during, and immediately after, severe natural-hazard events. This initiative also calls for the use of risk mitigation measures to retrofit existing health facilities, particularly those providing primary health care.

A "safe hospital" can be defined as a health care facility whose services remain accessible and function at maximum capacity and in the same infrastructure, during and immediately following the impact of a major event. This implies structural stability, ongoing availability of basic services, and organization within the health facility.

The Pan American Health Organization, with the support of a group of experts from different countries, developed the Hospital Safety Index,[2] a tool for making a quick and reliable assessment of health facilities. It provides a snapshot of the safety level of a hospital, which is an essential facility for a community, and as such must continue to function following an adverse event.

Because facilities that belong to a health network have different functions, levels of safety to be achieved can be addressed differently and progressively. This manual complements the Hospital Safety Index and aims to improve the safety and response capacity of smaller facilities in adverse events.

In this guide, smaller facilities are defined as those of low complexity, which along with the major hospitals, make up the health networks. Among them are primary hospitals, which

1. The resolution "Safe Hospitals: A Regional Initiative on Disaster-Resilient Health Facilities" (Resolution CD45.R8) was adopted by the Directing Council of the Pan American Health Organization in 2004 (available from: www.paho.org/english/gov/cd/CD45.r8-e.pdf).
2. See Pan American Health Organization, Hospital Safety Index--Guide for Evaluators, Washington, D.C.: PAHO; 2008. http://www.paho.org/english/dd/ped/SafeHosEvaluatorGuideEng.pdf.

provide certain basic specialties (obstetrics and gynecology, pediatrics, internal medicine, and general surgery), hospitals with less than 20 beds or without inpatient services, health centers, polyclinics, clinics, etc.

It is important to understand that in a disaster situation, health networks are activated to care for those affected. In this context, health facilities, large and small, are key to an effective response.

In most countries of Latin America and the Caribbean the condition of health infrastructure is precarious, particularly in less complex facilities. This can be attributed to a variety of reasons, including:

- Some facilities have outlived their usefulness but cannot be replaced and must continue functioning to meet the needs of the population.
- Others were not designed to provide this service, which has led to improvising in some facilities.
- In many cases, these facilities are located in vulnerable areas with poor soil quality, accessibility issues, or are exposed to hazards in the area.
- In other cases, the original design has been altered, thus affecting structural stability.
- Many have grown as the demand has increased, without taking account of structural integrity, architectural features, or basic services required.
- The budgets allocated to preventative maintenance are minimal and corrective actions are almost impossible to implement, thus accelerating the deterioration of these buildings.
- Often the quality of work falls below the normal standards due to budget cuts. This results in recruiting non-specialized and unskilled labor, use of inferior materials, minimal supervision, etc.

All of these factors contribute to increase the vulnerability of a facility's structural, non-structural, and/or functional elements, which, if threatened by natural hazards can interrupt the provision of services. Many past disasters have confirmed this. Lessons learned indicate that most of the health infrastructure losses were due to location in vulnerable areas, inadequate design, substandard construction, or lack of facility maintenance.[3]

Ensuring that health care facilities are safe during emergencies is a collective responsibility and involves the active participation of local authorities, other related sectors and institutions, and the general community. Health personnel have a key role in this endeavor: their

3. Pan American Health Organization, *Guidelines for vulnerability reduction in the design of new health facilities*, Washington DC: PAHO/WHO and the World Bank, 2004.

work can contribute to increasing or decreasing the risks in their workplace.
It is well-known that the first response to a disaster occurs with locally available resources. Facilities, therefore, must be prepared to provide services without interruption following an adverse event.

This guide outlines the risks that most often occur in health facilities of medium and low complexity, and is designed to build the capacity of these facilities so that they can continue to provide services after an adverse event occurs. It provides information on identifying key areas of vulnerability in the structural, nonstructural, and certain functional aspects of a building in order to guide interventions that may be necessary to increase a facility's safety from natural and other hazards. It has been prepared taking into account the realities of Latin America and the Caribbean, and we encourage users to adapt the contents that best apply to their country's situation.

To use this tool, the practices detailed in the introduction should be followed. This includes the formation of evaluation teams, among other actions.

The information in this manual will help health authorities to develop an intervention strategy and to prioritize actions according to their importance and the time and resources available. The process takes into account the importance of directing resources gradually to solve the problems already mentioned and to carry out activities in the short-term. Rather than a large budget, the process requires resourcefulness and the will to carry out the activities.

This guide is organized in four chapters:

- Chapter 1: Issues related to geographical location. It provides for rapid identification of the hazards posed by the site and terrain of a facility
- Chapter 2: Structural aspects. It describes aspects of diagnosing the safety of the facility in terms of the type of structure, materials, and its history of exposure to natural or other hazards. It is important to note that structural components require specialized intervention, so the chapter describes warning signs that demand more detailed study according to the type of building structure.
- Chapter 3: Nonstructural aspects. It facilitates assessment of the safety of nonstructural elements of the health facility, including lifelines, equipment, architectural elements, access routes, and the facility's internal and external circulation.
- Chapter 4: Functional aspects. This chapter discusses evaluation of the level of institutional organization, the implementation of plans and preparedness programs to respond to adverse situations, the availability of resources, and the level of staff training.

The following annexes are included:

Annex A: General information about the health facility.

Annex B. An evaluation form, or checklist. This checklist summarizes information used in this manual that will be applied to the facility.

Annex C. An intervention plan for increasing the facility's safety level. A matrix summarizes results from the evaluation and helps in planning how to introduce solutions.

Finally, it is important to emphasize that this tool does not attempt to solve all issues that would increase the vulnerability of a health facility. It prioritizes those items that could prevent a health facility from functioning as well as elements that should be addressed immediately. Likewise, results of this process should not be considered a definitive statement about whether a facility can continue to function after an adverse event. For that, in depth vulnerability studies will have to be carried out.

Introduction: Overview of the evaluation process

This tool is designed to facilitate the assessment of the safety in small and medium-size health facilities impacted by natural and other hazards and to guide authorities in identifying priority areas that should be acted on to reduce vulnerability.

The application and use of the checklists included in the Annexes should encourage health personnel to see the facility as their own work space, where they must continually work to improve conditions for their own safety and that of their patients.

The following provides an overview of the evaluation process:

Type of facilities to assess

This manual address small and medium-size health facilities, such as: primary hospitals (which provide basic specialties—obstetrics, pediatrics, internal medicine and general surgery); those with less than 20 beds or without inpatient services; health centers; polyclinics; clinics; etc. The process explained in this manual should be distinguished from that outlined in the Hospital Safety Index, which is designed for the evaluation of larger, more complex hospitals.

The evaluation team

An evaluation team must be formed to use this tool. Members should have received prior training and have detailed knowledge of technical issues and other hospital safety aspects mentioned in the Hospital Safety Index. The team must also be available to visit different local facilities.

The team should be multidisciplinary (including at least one engineer or architect, a physician or nurse, maintenance staff, and an administrator) and preferably represent different institutions such as health ministries, universities, civil protection, etc.

The team size will depend on the complexity of the facility. It is recommended that there be a maximum of six people, who will tour the facility accompanied by the administrator and/or maintenance manager.

Process for conducting the evaluation

The first step in the process is to contact the facility's management and to share with them issues related to the concept of hospital safety, the actual assessment of the facility, and the methodology that will be used.

Once a date has been set for conducting the assessment, the team should request the facility to make the following documents available:

- Detailed plans of the building;
- The disaster plan, if one exists;
- Documentation on the membership of the disaster committee;
- The facility's maintenance plans.

On the day of the assessment the team should hold an introductory meeting with the facility's administrators and disaster committee. At this meeting the evaluation form or checklist should be introduced. Following this, the team will take a complete tour of the facility and make a photographic and written record of any findings.

Preparing the evaluation report

After the evaluation, the entire team must meet to process the data, compare observations, propose a plan of action, and draft the final report.

The evaluation report should include:

- General background information about the facility;
- Evaluation results for components (divided into structural, nonstructural, and functional elements), with a general description of the findings;
- General information sheet (Form 1, see Annex 1);
- Evaluation form (Form 2, see Annex 2);
- Intervention plan (Form 3, see Annex 3);
- Photographs.

The intervention plan

An intervention strategy is developed in conjunction with the authorities and with the information gathered from the evaluation. This strategy should prioritize actions according to their importance, time, and available resources. A matrix for the intervention plan is provided (see Form 3 in Annex 3).

To complete this matrix, the evaluation team should provide specific interventions for each of the elements evaluated (structural, nonstructural, and functional). The form listing the specified actions should be submitted to the authorities of the facility so that they can assign priorities.

The goal of this process is to help to direct resources to solving the problems that have been identified, and to carry out the interventions in the short, medium, and long term.

Aspects of the geographic location of the health facility

1

The effects of different hazards on health infrastructure have shown the vulnerability of hospitals, health centers, and health posts throughout the region. Studies have shown that many of the losses are due to the location of these facilities in hazard-prone areas.

In fact, it is not uncommon to see health facilities that are covered by water or mud, that have lost their roofs in the hurricane season, been destroyed by a landslide, have major cracks in the walls, show evidence of settlement, etc. This occurs because at the time of planning, designing, and constructing a building, aspects of the site and the soils were not taken into account, factors that have a major impact on the safety of a health facility.

Generally, communities do not have micro-zone studies, hazard maps, or land-use plans that establish criteria for the location of buildings. The land obtained for the construction of a health facility might not be the safest. The building might be constructed on a backfilled area, located on a slope or near river banks, be on a geologic fault, or be in a site that would leave it cut off from transport routes. A site evaluation and vulnerability study must be undertaken and consulted before locating and constructing new facilities.

An analysis of geographic factors can help estimate the hazards to which a facility is exposed, taking into account prior emergencies and severe natural-hazard events that have occurred in the area, as well as the topography and type of soils where the facility is located. As outlined in the Hospital Safety Index,[4] these factors can be divided into two groups: hazards, topography and geotechnical properties of soil, taking into account both natural hazards and those caused by human activity.

To this end, it is essential to review maps that specify hazards present in the area[5] and access different sources of information to understand prior adverse events. If hazard or risk maps do not exist, local entities should be consulted, such as civil defense and emergency commissions, as well as the local population.

4. Pan American Health Organization, *Hospital Safety Index: Guide for Evaluators of Safe Hospitals*, Washington D.C.: PAHO/WHO, 2008. Available at: http://www.paho.org/english/dd/ped/SafeHosEvaluatorGuideEng.pdf.
5. A helpful source if risk maps are not available for the area is Pan American Health Organization, *Guía para la elaboración de mapas de riesgo comunitarios*,Quito: PAHO/WHO, 2006.

A preliminary inspection of the area immediately surrounding the facility can provide a rapid assessment of the impact that hazards could cause. The team should identify the major and alternative access routes to the facility, and inspect the land around the facility to identify irregularities in the terrain, presence of nearby slopes, and proximity to bodies of water (sea, rivers, lakes, etc.) that can raise the water table, among other factors.

An analysis of hazards in the area surrounding the facility must be taken into account when determining factors affecting a facility's safety, considering the frequency, magnitude and intensity of destructive phenomena (hazards), topography and the geotechnical properties of soil. While geotechnical properties are not suited to measurement by the evaluation team, and these properties do not figure into the calculations of safety levels, it is important to consider the environment and context of the site of the facility.

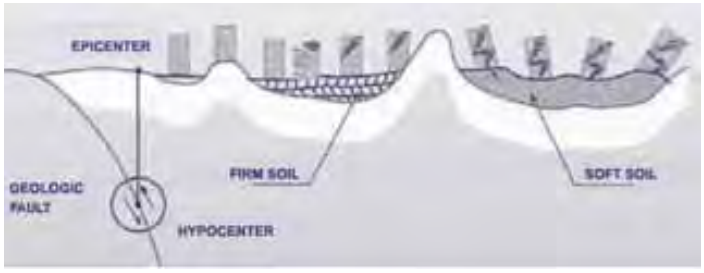
1.1 Hazards

This section analyzes different types of hazards[6] (geological, hydrometeorological, social, environmental health, chemical, and technological) related to the health facility's location. The hazard level which the facility may be subject to can be classified as high (high probability of a hazard or large-scale hazard), medium (high probability of a moderate hazard), or low (low probability of hazard or hazard of small magnitude).

A. What geological events can affect the health facility?

A.1 Earthquakes

Earthquakes occur when a sudden release of energy in the Earth's crust, caused primarily by the rupture of geologic faults, creates seismic waves that move through the earth's crust. They manifest themselves as sudden ground vibrations and shaking of great intensity.



The destructive capacity of an earthquake depends on a combination of factors: magnitude, distance from the hypocenter, soil characteristics (particularly its ability to amplify seismic waves), the strength of physical elements, and the level of preparedness of the population

According to the analysis of soil and geologic history of earthquakes in the area, identify the level of hazard to the facility.

6. For more information, see: Julio Kuroiwa, *Disaster reduction: living in harmony with nature*, Lima, Editorial NSG, 2004.

Effects on health services

Depending on the time the event takes place, the type of construction, and population density, an earthquake can cause:

- high number of deaths;
- mass casualties, whether serious injury or minor bruises;
- serious damage to health facilities, including damage to columns, beams, walls, ceilings, and floors; broken windows; blocked doorways; damage to equipment and furniture; ruined supplies; detached walls and light fixtures, etc.;
- blocked access routes and disruption of basic services (power, water, communications, etc.).

A.2 Volcanic Eruptions

The volcanic eruption is the output of molten rock (magma), gases, pyroclastic debris, and ash from inside the earth.

Identify the level of hazard to which the building is exposed based on the history of similar events, risk maps of the region, and the proximity and activity of volcanoes

The impact that results from an eruption depends on the size and nature of the eruption, the topography of the area, and the vulnerability of the community near the volcano (e.g., proximity of the population or lack of monitoring).

Effects on health services

The health effects associated with volcanic eruptions depend on the type of event. They can cause:

- increased mortality;
- possible increase in demand for health care, whether for serious injuries that require complex treatments (such as trauma and burns), respiratory and eye problems, and illness caused by drinking contaminated water;
- serious damage to health facilities, including collapsed roofs due to the weight of the ash; destruction of building if in the way of lava flows; water pollution; deterioration of equipment due to the presence of ash, among others;
- blocked access routes and disruption of basic services (power, water, communications, etc.).

A.3 Landslides

Geological factors (such as seismic events), frequent and intense rains, topography, and human activities are factors that can result in unstable slopes that lead to landslides.

Landslides are the gradual or rapid downslope movement of surface matter (soil, rocks, and debris), due to gravity, changes in consistency of surface materials, and other factors that make a slope unstable.

To assess the level of hazard from landslides due to unstable soils, inspect the surroundings, review the history of similar events, and review the risk map.

Effects on health services

Depending on the magnitude of the event, landslides can have the following impacts on health services:

- increased mortality;
- increased demand for services because of severe injuries requiring complex treatment;
- severe but localized damage to health facilities: destabilized structure, deterioration of the foundation, destruction of parts of the building, massive volumes of mud or debris inside the building with damage to nonstructural elements, among others;
- disruption of access roads and the provision of basic services.

A.4 Tsunamis

The energy of a tsunami depends directly on the magnitude of the triggering event, the wave height and speed. The damage it causes depends on the topography of the area, including the configuration of the coastline or bays, and the degree of preparedness of the population.

Tsunamis are giant waves caused by undersea earthquakes, submarine landslides or volcanic eruptions on the ocean floor. They can travel thousands of miles, and cause widespread destruction along coastlines, bays, and harbors.

To identify the level of tsunami hazards, review hazard maps and gather information on similar events in the area.

Effects on health services

Depending on the time the event occurs, the type of buildings, and population density, a tsunami can cause:

- high mortality;
- mass casualties, whether serious injury or minor bruises;
- serious damage to health facilities, from total loss destruction to compromised stability because of deterioration of the foundations, flooding inside the building with damage to nonstructural elements, loss of supplies, etc.;
- disruption of access roads and the provision of basic services.

B. What weather-related phenomena can affect the health facility?

B.1 Hurricane

Hurricanes (or tropical cyclones) are violent storms that arise over the warm waters of tropical oceans around a low-pressure center. Winds blow counter-clockwise in the northern hemisphere, forming spiral rain bands, which bring intense rainfall.

Factors affecting the impact of hurricanes are wind speed, rainfall, and the vulnerability of communities.

Based on the wind map and the history of these events, check the level of hazard to the facility with regard to hurricanes.

Effects on health services

Hurricanes can have the following effects:

- Increased mortality;
- Increased demand for services for serious injury and trauma that require complex treatments;
- Serious damage to health facilities including: destruction of roofing, deterioration of the foundation of buildings, damage to exposed equipment, falling utility poles and lines, water damage inside building, loss of supplies, among others;
- Disruption of access roads and the provision of basic services.

B.2 Torrential rains

Intense rainstorms may be accompanied by thunder and lightning. Flat or basin-shaped areas, such as valleys or low areas, are rapidly flooded and the water may remain trapped. In mountainous or steeply sloped areas, high-volume flash floods and landslides may occur.

Review the history of prior events and available hazard maps to evaluate the exposure of the health facility to flooding due to intense rainfall.

The impact of torrential rains is directly dependent on soil type, topography, rainfall, and watershed characteristics.

Effects on health services

Flooding caused by intense rainfall can have the following effects:

- Increased mortality;
- Possible increase in number of persons with serious injuries and traumas requiring complex treatment;
- Severe but localized damage in health facilities, including: possible total destruction of the building if located on a slope; water damage to nonstructural elements; possible damage to foundations, among others;
- Disruption of access roads and the provision of basic services.

B.3 River flooding or storm surge

The encroachment of the ocean, rivers, or lakes on land is generally caused by heavy sea swells or river and lake flooding. Flooding is part of a normal pattern for rivers, and increased rainfall results in waters flooding land along the river channel.

To evaluate the facility's vulnerability to sea encroachment or river flooding, the history

The encroachment of the ocean or rivers has different effects relating primarily to the type of soils, topography of the area, and location of communities.

of similar events that did or did not cause flooding in the area surrounding the facility should be reviewed.

Effects on health services

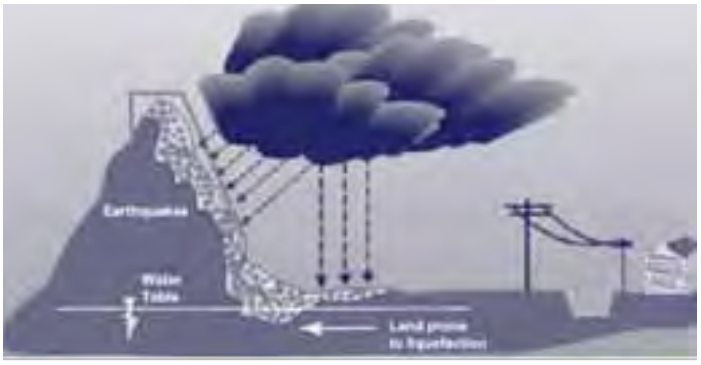
Flooding can have following impacts:

- Increased mortality;
- Possible increase in injuries and trauma patients requiring complex treatment;
- Serious damage to health facilities is possible depending on their proximity to rivers or the coastline and location on floodplains. Equipment and lifelines can be affected, and building foundations weakened where soil settlement occurs;
- Disruption of access roads and the provision of basic services.

B.4 Landslides and soil saturation

Certain landslides are manifested as the fast or slow movement of surface material of a slope, due to the presence of high moisture.

Using geologic maps and inspection of the surroundings, identify the hazard level to which the facility is exposed in relation to landslides caused by soil saturation.



There are many factors that affect the impact of landslides caused by soil saturation, among them are rainfall, topography, erosion, soil type (drainage and filtration), and human factors.

Effects on health services

Depending on the magnitude of the event, this type of phenomenon can cause:

- limited number of deaths;
- increased demand for services for severe injuries requiring complex treatment;
- serious damage to health facilities is possible due to: deterioration because of massive volumes of mud or debris, possible damage to foundations, interruption of lifelines, among others;
- disruption of access roads and the provision of basic services.

C. What social phenomena can affect health facilities?

C.1 Population concentrations

Dense concentrations of people and overcrowding—whether in organized or spontaneous settlements—can lead to lack of security, violence, and social disorder, thereby affecting the routine activities of a community and its services, including the delivery of health services. When a health facility is located in or near an area that is overcrowded, its ability to provide services will be affected.

When evaluating the facility's exposure to this hazard consider the type of population it serves, its proximity to areas that have large concentrations of people, and how prior events have affected the facility.

Effects on health services

High population concentrations will affect the demand for services and disaster response, in particular:

- Congested transit services make access to a facility difficult;
- People may damage or cause disorder to health facilities or services;
- Where the network of health services is inadequate, there is increased demand in densely populated and overcrowded areas;
- A health facility's functional capacity may collapse in an event with mass casualties.

C.2 Displaced persons

Displaced persons have been forced to leave their homes or permanent residence to escape war, civil conflict, persecution, or because of adverse events caused either by natural forces or by human activity. Internally displaced persons have not crossed international borders but have moved to neighboring communities or isolated areas.

After reviewing relevant information, record the facility's hazard level related to people displaced by war, social and political movements, immigration and emigration, and the impact of natural or human-caused disasters.

Effects on health services

- Possible increase in illnesses related to overcrowding and undernutrition;
- Increased demand for health services, which has a greater impact on the functional aspects of the facilities.

C.3 Other social phenomena (specify)

If other social phenomena (such as workers' strikes, protests, proximity to a high security prison, etc.) affect the level of safety of the facility, specify the hazard and indicate the potential impact.

D. What environmental health phenomena can affect the health facility?

D.1 Epidemics

Epidemics involve the outbreak and widespread incidence of disease. They occur when the number of cases of a disease in a given population over a given period of time significantly exceeds the expected number.

Based on information about prior epidemics and specific pathogens that the facility has dealt with, evaluate the degree to which epidemics would pose a hazard to the facility.

Effects on health services

- The epidemic leads to increased rates of morbidity and mortality, with a possible collapse of the health system because of the increased demand for patient care.

D.2 Pollution

Pollution refers to the presence of any agent (physical, chemical, or biological) in places, forms and concentrations that can be harmful to health, safety or welfare of the population.

Effects on health services

Depending on the type of pollution, effects that can result are:

- increased morbidity and possible mortality;
- water pollution, which without proper management, can lead to chronic illness in the population;
- the presence in the air of sulfur dioxide and nitrogen dioxide which can lead to a variety of health problems, ranging from irritated eyes, nose and throat to respiratory infections like bronchitis and pneumonia. Long-term effects include chronic respiratory infections, lung cancer, heart problems, and even damage to the brain and nervous system.

In assessing pollution hazards, one should consider external factors (for example, air pollution or contaminated water sources) that can compromise lifelines and other systems that are essential to the functioning of the facility.

Based on past incidents involving pollution, rate the level of hazard to which the facility is exposed.

D.3 Pests

Review the location and background of the facility to determine the level of hazard presented by infestations of animals and insects, including flies, fleas, rodents, mosquitoes, cockroaches, etc.

D.4 Other (specify)

Review the history of other environmental health issues in the area where the facility is located, and indicate the level of environmental health hazards not already mentioned.

E. What chemical and technological phenomena can affect the health facility?

E.1 Explosions

Explosions are the violent release of energy, most commonly resulting from a chemical reaction that causes the sudden escape of gas under high pressure into the environment. Energy generated by the chemical discharge may be extremely fast, generating a shock wave.

To evaluate the level of threat to which the facility is exposed, inspect the area surrounding the facility, inspect potential explosion hazards inside the facility, and seek out information on any prior events.

Effects on health services

Depending on the type of event and the exposure of individuals or health services, explosions cause:

- a limited number of deaths;
- increased demand for health services because of severe injury or trauma requiring complex treatments, as well as harm to the eyes, skin, and respiratory function;
- severe damage to health facilities, including damage to the structure and to nonstructural elements (broken windows, damaged doors, etc.) and to the facility's ability to function.

E.2 Fires

Fire hazards are uncontrolled fires that cause damage to property and endanger lives.

To evaluate the level of fire hazard to which the facility is exposed, inspect the area surrounding the facility, inspect potential fire hazards inside the facility, and seek out information on any prior events.

Effects on health services

Depending on the type of event and exposure of individuals or health services, fire can cause:

- a limited number of deaths;
- burns and injuries that require complex treatments;
- effects to the eyes, skin and respiratory tract;
- severe effect on health services if there is a major influx of victims.

E.3 Hazardous materials

Hazardous materials are items or agents (biological, chemical, or physical) which have the potential to cause harm to humans and the environment. These materials can be corrosive, reactive, explosive, toxic, inflammable, or biologically infectious either by themselves or through interaction with other factors. Improper handling of these materials can result in accidents, including contamination, fires, explosions, leaks, and spills.

Effects on health services

Depending on the type and level of contamination, leaks and spills of hazardous products can cause:

- the number of possible victims to vary according to the density of the population exposed to the toxic cloud that may result from the leak or spill of hazardous materials. This number is also contingent on the effectiveness of emergency measures taken, including evacuation of persons at risk;
- increased demand for treatment will result from injuries to eyes and skin (ranging from minor irritation to severe tissue damage), the respiratory tract (ranging from acute or chronic damage), and the digestive tract (resulting from ingestion of contaminated foods);
- possible carcinogenic effects for the liver, kidneys, lungs, bloodstream, etc.;
- severe impact on structural, nonstructural, and functional components of the health facility, whether because the structure is compromised or because of a massive influx of victims needing specialized detoxification treatment.

To evaluate the hazard level of the health facility to accidents involving hazardous materials, it is necessary to inspect the area surrounding the facility, determine whether prior accidents involving hazardous materials have occurred, and consult different sources of information. Take into account sites where chemicals and other potentially hazardous materials are stored (both on the grounds of the facility and in the surrounding area), and take note of roads or other hazardous material transport routes in the vicinity of the facility.

E.4 Other (specify)

Specify the level of other chemical or technological hazards in the area where the facility is located.

1.2 Geotechnical properties of soil

This section addresses general aspects of soil mechanics and geotechnical properties of soil as they relate to structural problems in health facilities.

F. What geotechnical problems can pose a hazard for the health facility?

F.1 Liquefaction

With liquefaction, the soil loses its capacity to bear loads and behaves like a liquid. This happens when unconsolidated soils (non-cohesive or readily disaggregated) are saturated with water and separate, usually because of an earthquake. The sediment moves downward and saturating water moves toward the surface, like a spring. The result is that the soils have greater fluidity and buildings will suffer from cracks and settling.

With information on the geotechnical analysis of the soil where the facility is located, determine the hazard level of the facility to loose subsoils.

Effects on health services

- A health facility built on unconsolidated soils can suffer serious structural damage. The damage is evident from settling, leaning, or through large cracks that can cause building failure. In extreme cases, buildings can tip over.

F.2 Clay soils

In clay soils that are deposited through wind and water action (also known as sedimentary soils), the space between mineral particles is large. A slight increase in moisture can destroy the bond or cohesion between particles, resulting in ground subsidence or settling. Expansive soils that are clayey, dry, or compact, swell when they become wet. This causes a significant increase in soil volume, which can force slabs or walls that are not bearing heavy loads upwards.

Buildings can be damaged by cracks in floors and walls when clay soil is saturated and expands.

Based on soil analysis and evidence from the buildings, indicate the hazard level of the facility exposed to clay soil.

Effects on health services

- A health facility built on sensitive or soft soil can develop severe cracks in walls and floors, which endanger the structure.

F.3 Unstable slopes

The stability of a slope depends on geological and material characteristics of the terrain, the angle of the slope, hydrological and climatic conditions, and the intensity of seismic conditions in the area. Slopes can be made unstable by filling or excavation, including from civil works and mining. Unstable slopes are considered a potential hazard since they are related to the movement of soil or rock mass.

A health facility built on or near an unstable slope is in danger of being damaged or destroyed.

Using information from geological maps and prior events in the area, specify the level of hazard that unstable slopes pose for the health facility.

Effects on health services

Depending on the magnitude of an event, the failure of a slope can have the following impact on health facilities:

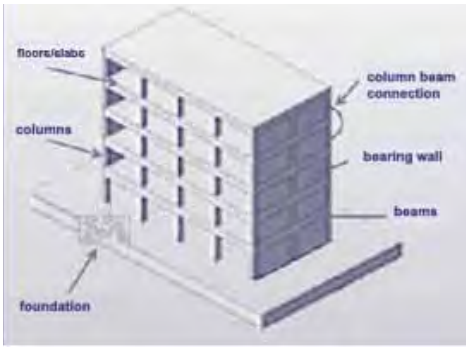
- Severe but localized damage to structures, including structure instability due to damage or deterioration of foundations; destruction of part of the structure; mud or debris inside the building which would damage nonstructural items, among others;
- Likely interruption of access roads and the provision of basic services.

Structural Aspects 2

The structural components of a building are those parts that keep the building standing. They include foundations, columns, load-bearing walls, beams, slabs (floors and roofs) and roof frames. Loads are transferred to the ground through the beams, columns, and foundations. The failure of one of these elements can cause serious problems, including total destruction of the building.

The behavior of buildings when exposed to different hazards varies depending on their structural design as well as the type and strength of the construction materials. While it is true that many health facilities are built with reinforced concrete,[7] this document also describes different construction techniques[8] most commonly used in Latin America and the Caribbean, such as masonry, steel, wood, earth,[9] or a combination of materials.

Floor structures or slabs differ according to the type of material and type of structure: they can be concrete (such as solid or lightweight slabs), steel, or wood. A variety of construction systems can be good. It all depends on whether they were designed for different demands, competently constructed, and adequately maintained. If this is not the case, they can be damaged by an adverse event.



Many structural deficiencies cannot be seen with the naked eye. It is therefore important for a specialist to participate directly in the evaluation in order to identify the type and level of vulnerability or damage possible and the respective measures of protection. The structural vulnerability assessment of a facility and background on the design, construction, and current condition of the structure are essential for rapidly and assertively identifying damage that could occur as a result of an adverse event and to intervene before such damage occurs.

It is preferable that structural elements are assessed by structural engineers, but because it may be difficult to find individuals with these qualifications in all areas of the region, the information in this chapter is simplified so that health personnel can identify warning signs indicating that a detailed structural study should be made.

7. The term "reinforced concrete" refers to concrete that uses steel rods to resist tensile stresses.
8. For clarification of technical terms used, see the glossary.
9. Earthen constructions can be made of adobe, rammed earth, taquezal, daub, or thatch.

The material in this chapter follows what is presented in the Hospital Safety Index, but it includes information on assessing reinforced concrete buildings as well as buildings constructed of materials that are most frequently used in local health facilities.

Here, two structural sub-modules are addressed: the structural safety level taking into account the facility's history, and the degree of safety taking into account the structural design and type of materials used in the building. The level of safety is ranked as: Low, Average, or High. For each item considered, members of the evaluation team should mark the safety level in the corresponding cell in the forms included in Annex 2 of this manual.

2.1. Degree of safety in relation to the history of a health facility

1. Has the facility suffered structural damage in the past?

It is important to know the effects of any prior events, including earthquakes, torrential rain leading to floods, hurricanes, or landslides that may have weakened the structure. The events of interest are those of comparable severity to current design requirements. The lack of damage during lesser events is not indicative of adequacy of the structure. These events may have caused settling, cracks in supporting walls, separation between structural elements, cracks in columns, beams and slabs, etc. This damage might not be visible because of repairs or remodeling that has taken place subsequent to any damage.

Structural damage sustained in a disaster can be hidden by subsequent repairs.

It is advisable to interview staff members, regardless of their position, who have worked in the facility the longest and who can recount what occurred in the facility during adverse events. Ask specifically about damage to structural elements, since people tend to be more impressed with nonstructural damage, as they are often more numerous or common. If the facility was damaged recently, published information on the subject may be available.

Determine whether an expert structural report has been filed that indicates whether the safety level has been compromised and at what level. If such a report does not exist, determine if following the event there were cracks or settling in the building, if there is evidence of change in the structure, or whether damage did not occur.

Depending on the effect prior events have had on the structure, mark: *Low = Major damage; Average = Moderate damage; or High = Minor damage. Low indicates that there has been partial collapse of the structure, destruction of nonstructural elements, evidence of settling, presence of large cracks and/or failures in the support elements of the building, with evacuation of the building; Average indicates that there has been damage to nonstructural elements, minor settling, and cracks in some columns and/or beams; High refers to small cracks and limited damage to nonstructural elements*.

2. Has the facility been constructed, repaired, remodeled, or adapted in a way that is affecting the behavior of the structure?

As a result of changes that are needed over time, facilities are sometimes modified without taking into account how those changes will affect a structure's resistance to natural hazards. The result is that the facility and its occupants are exposed to a new set of hazards.

The emergency stairwell of a hospital (A), was "anchored" to the main building structure (B). In an earthquake this created a torsional response.

Some examples of this are:

- Eliminating a load-bearing wall in order to expand a space, or hanging a door or window in a load-bearing wall can compromise structural stability.
- The insertion of walls or rigid partitions can change the distribution of forces in the structure which may lead to distress.
- A new building that is constructed too close to an existing building can result in pounding or collisions between the two buildings if there is ground shaking during an earthquake.
- When windows are placed at a high level between two columns, or an open space between two columns is filled in with a masonry wall (for example to provide windows in rooms) failure of columns can result (the "short column" effect).

Verify whether modifications have been made that might affect the facility.

Depending on the potential effect of these modifications mark: *Low = Renovations or adaptations have been poorly designed or executed poorly (e.g., removing a load-bearing wall, construction of a building in close proximity, opening for a new window, etc.); Average = Moderate adaptations (e.g., openings for doors and small windows); High = Minor adaptations that have been well done (e.g., columns and/or beams added) or were not necessary.*

2.2. Degree of safety related to the structural system and type of materials

Since the structural system is usually hidden by dividing walls, cladding, or other nonstructural elements, when possible it is important to inspect the stairs, kitchen, laundry, and other areas where structural elements are more exposed.

3. What is the condition of the building?

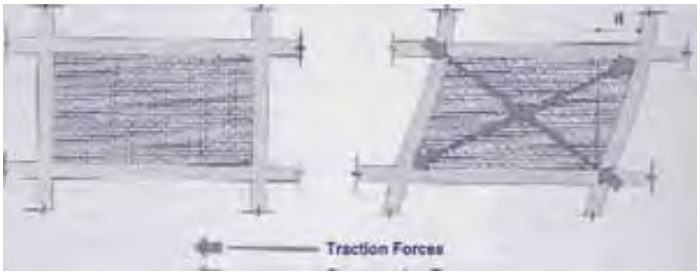
This aspect is closely related to the type of construction materials used for the facility's structural elements.

Cracks in concrete columns.

It is important to check whether the health facility has suffered damage, such as loss of cladding, cracks or settling of structural elements. A crack may have several causes, some serious (design flaws leading to structural overload, settling) and others less important (changes due to fluctuations in volume and temperature, or weathering).

In reinforced concrete buildings the presence of cracks in columns, beams and beam-column connections need special attention. It is important to assess where cracks are located, their width and angle, any loss of covering concrete, and exposure of steel to determine the level of maintenance or safety of the building.

In masonry construction, depending on the reinforcement system, a building's exposure to the weather or the quality of the construction may cause cracks in the walls. Cracks can move diagonally, following the mortar bed joints; others are nearly straight, breaking pieces of masonry. There are also horizontal and vertical cracks that appear at the junctions of the wall with beams and columns respectively. Special attention should be given to the load-bearing walls (which transmit the gravity loads to the foundation), as well as to confined beams and columns (where they exist) and the floor and roof structures or slabs.



Typical failures in masonry walls. From Julio Kuroiwa, *Disaster reduction, living in harmony with nature*, Lima: Editorial NSG, 2004.

In buildings with steel structures special attention should be given to the connections of structural elements, whether they are welded, riveted or bolted. Any failures in these connections should be noted, as well as cracks in the columns and beams around corresponding connections.

Metal structure that failed as the result of an earthquake.

When inspecting wooden structures, special attention must be given to the presence of cracks in the columns and beams, as well as displacement in the connections of the structural elements.

Among all the building systems, earthen constructions are the most vulnerable to seismic forces. One should check for the presence of cracking in the walls, either horizontal (at the base of the wall or in the middle), vertical (in the center of the wall), or diagonal (which may extend to the corners of the wall). Deformation or noticeable leaning must also be noted. Cracks indicate the need for structural reinforcement throughout the building.

Typical failures in adobe construction.

The evaluator should try to determine the causes of deterioration, interviewing, where possible, the staff responsible for maintaining the facility and inspecting damaged structural elements in order to attempt to determine what effect any damage has on the stability of the structure.

Remember that the signs of damage described above can be warning signs about the safety of the building, and indicate that a detailed study of the structure, conducted by specialists, is required.

Safety ratings for the condition of the building are: *Low = Deterioration caused by weathering, cracks present in areas of special concern (depending on type of construction material), or evidence that settling has occurred; Average = Two of three conditions are present (deterioration and/or cracks, and/or weathering); High = Good; no evidence of deterioration, cracks, or settling.*

4. What is the condition of construction materials used for the structure?

With regard to the quality of the construction, it is necessary to establish whether or not the building has been constructed with materials of the required quality and strength, and if a good maintenance schedule is being observed.

This aspect is closely related to the previous one. For example, in a building in which reinforced concrete is predominantly used, which is an excellent construction material, the presence of cracks and rust in structural elements may be a sign that the concrete ingredients (cement, stone, sand, and water) are inadequate. As a result, permeability may be high (leading to the rusting of embedded steel) and strength low, which increases the vulnerability of structural elements, putting the structure as a whole in jeopardy.

Steel exposed by loss of covering.

In the case of reinforced concrete, evaluators should take note of the presence of sufficient concrete covering and the condition of the reinforcing bars. The levels of rust or deterioration in the materials should be noted, since these can be evidence of significant loss of strength.[10] Either oxidation of the steel or cracks in the concrete might be present, or both conditions. For example, the reinforcing assembly might show rust, but cracks can be present with or without signs of rust.

In concrete masonry structures, it is necessary to consider the quality, type, and nature of the blocks, as well as the thickness, continuity, and uniformity of the joints. Another important aspect is the presence of pipes and other materials that pass through load-bearing walls.

Crack in a load-bearing wall breaks the masonry brick.

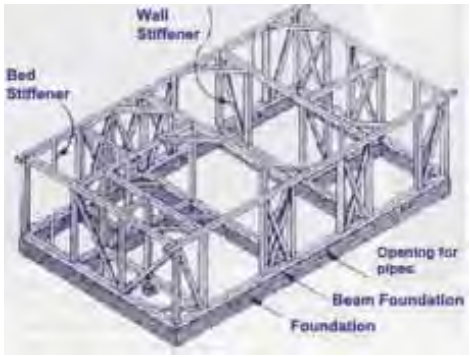
Special care is required for those walls which are subject to moisture and humidity. If the material used in these circumstances is of low quality, it is possible that there may be weaknesses in these walls. The stability of the building is at risk if this problem is evident in the load-bearing walls.

Steel structures can behave positively in earthquakes, but they can be vulnerable to hurricane strength winds

10. See Alcaldía de Manizales—OMPAD, Manual de campo para la inspección de edificios después de un sismo, Manizales, Colombia, 2003.

and prolonged exposure to fire. Oxidation weakens steel, and failure of these structures is seen when foundation and connections of supporting elements rust.[11] However, it must be noted that any material (with appropriate design, analysis, detailing, construction and maintenance) can be used to make safe buildings.

Earth constructions are highly vulnerable to earthquakes, floods, and landslides. They do not have seismic resistant properties, and the construction materials deteriorate over time. Prolonged exposure to water can cause an earthen structure to collapse.



Wooden structure of a building.

Buildings with wooden structures are generally resistant to seismic forces, but they are very vulnerable to fires, floods, landslides, and high winds. Contact with moisture directly affects wood, can cause deterioration, and create an environment for bacteria. It is important to emphasize the need to treat wood adequately to prevent deterioration and prolong its useful life.

The evaluator must determine whether materials that are in poor condition pertain to elements that would jeopardize the structural integrity of a health facility.

Depending on the construction materials used in the building, the level of safety of materials are: *Low = Rusting reinforcement in concrete with large cracks; sections of construction material lost; diagonal cracking in walls; visible deformation in steel, wood, or concrete elements; missing elements at connections; Average = Small cracks or evidence of rusting reinforcement; beginning of diagonal cracks in wall; missing elements in connections of steel and wood structures; High = Fine or no cracks; no rust apparent in concrete; minimal cracking in walls; no visible deformation in steel and wood elements. (This section depends on the experienced judgement of a structural engineer.)*

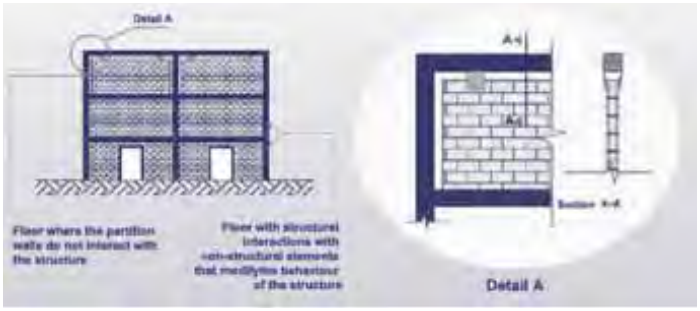
5. How do nonstructural elements interact with the structure?


Representation of the behavior of nonstructural elements during an earthquake.

Evaluators must carefully examine whether there are nonstructural elements that can, because of weight (of the structure itself, equipment, furnishings, and occupants in multi-story facilities) and rigidity, affect the performance of certain structural elements, putting the stability of a structure at risk. This requires an exami-

11. Pan American Health Organization, Is your hospital safe? Questions and answers for health personnel, Quito: PAHO, 2007.

nation of whether nonstructural elements are completely tied to the structure, "short columns" are present (for example, because of the position of windows), piping has flexible connections, and expansion joints have been used. Evaluators should identify heavy items that are not supported properly by the structure, such as heavy medical equipment and water storage tanks. Equally important is to assess the effect on the vulnerability of non-structural components by the response to earthquakes of the structure.



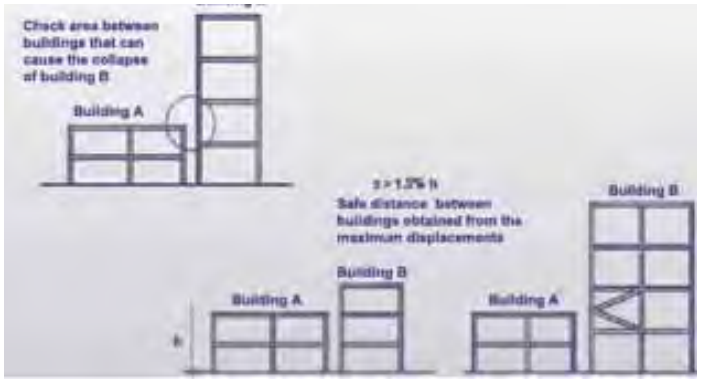
Partition walls can affect the behavior of the structure.

An example of nonstructural-structural interaction is as follows: a non-structural dividing wall falls during an earthquake because of bad anchorage; the wall falls onto a staircase beam, obstructs the staircase, and, in the worst case, destroys it.

Safety ratings for the interaction of structural and nonstructural elements are: *Low = Two or more instances of the examples mentioned above (or others) have been identified; Average = Only one instance of the examples mentioned above (or others) has been identified; High = There are no instances of the examples mentioned above (or others).*

6. Are the buildings attached or closely spaced?

Structures that are closely spaced can cause different problems depending on the forces that affect them. For example, in the case of an earthquake, buildings which, according to their height, are too closely spaced, can pound against each other until one or both collapse. In the case of hurricanes, there are wind tunnel effects between closely spaced buildings. Pressure from the wind can build around certain sections of a structure, placing much greater force than the load for which a multi-story building was designed.



Types of impact between buildings and ways of preventing or avoiding it.

Evaluators should inspect the exterior of the hospital to determine whether such problems might arise, and analyze the space between the health facility and neighboring buildings.

The level of safety can be evaluated as: *Low = There is almost no separation between buildings or separation is less than 0.5% of the height of the shorter of two adjacent buildings; Aver-*

age = Separation is between 0.5% and 1.5% of the height of the shorter of two adjacent buildings; High = Separation is more than 1.5% of the height of the shorter of two adjacent buildings.

7. Is there redundancy in the structure of the facility?

Building design must take into account that a structure's resistance to forces depends on the distribution of those forces among the greatest possible number of structural elements (such as load-bearing portal frames, columns, or walls). When there is little redundancy (i.e., a reduced number of elements) the failure of any of these elements can mean the partial or total collapse of the building. It is important that resistance to seismic forces be distributed among as many elements as possible.[12]

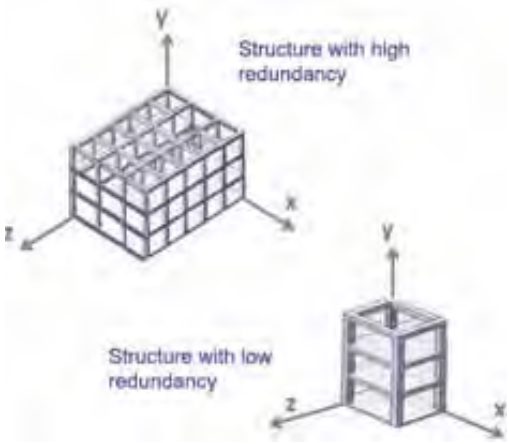


Diagram of structures showing high and low redundancy.

Several problems relating to structural redundancy in the design of health facilities should be emphasized:

- The use of too few columns in large, open areas (few columns and large spans) becomes extremely critical. This is often found in reception areas, treatment and diagnosis areas, cafeterias, etc.
- Location of openings (doors, windows, etc.) in inside and outside shear walls causing large forces to concentrate in certain weak elements.
- A sudden interruption in the uniformity of the structural system along the length and breadth of large areas.

Redundancy of elements is essential for the safety of health facilities since it ensures that the facility can resist the lateral forces generated by earthquakes and hurricanes in the two principal orthogonal directions of the building. A building with less than three lines or axes of resistance in any of the principal directions, is a structure with a high level of vulnerability.

When examining lines of resistance, it is important to consider portal frames, load-bearing walls, and column-beam connections, among other elements.

The level of safety can be evaluated as: *Low = Fewer than three lines of resistance in each direction; Average = Three lines of resistance in every direction or lines with no orthogonal orientation; High = More than three lines of resistance in each orthogonal direction of the building.*

12. Pan American Health Organization, *Fundamentals of disaster mitigation in health facilities,* Washington, D.C.: PAHO, 2004.

8. What is the condition of the connections or joints between structural elements?

Experience has shown that the most vulnerable structural elements of a building, depending on the structural system designed, are:[13]

Structural System	Structural Elements
Portal frames of reinforced concrete	Beams, columns, joints, and floors/roofs
Portal frames with supporting walls of reinforced concrete	Beams, columns, joints, walls, and floors/roofs
Steel structures	Beams, columns, joints, and floors/roofs
Timber structures	Beams, columns, joints, and floors/roofs
Masonry	Load-bearing walls (with confining columns and beams) and floors/roofs
Earthen structures	Load-bearing walls and floors/roofs

Among structural elements, connections or joints are, in general, the most critical points of design in resisting loads caused by earthquakes and hurricanes. The evaluator should attempt to verify, through examination of the actual structure and review of structural plans, the characteristics of structural connections to be able to establish an informed view about them, especially in seismic and hurricane areas.

In reinforced concrete buildings, structural elements are of structural concrete or concrete with steel reinforcement. In this type of structure it is important to look for cracks in beam-column connections, as well as broken or missing cover concrete in these areas.


Severe damage in beam/column connection.

In masonry building, walls are built of concrete block or clay bricks joined by mortar. In confined masonry construction, unreinforced masonry walls are confined with reinforced concrete tie-columns and tie-beams. In this type of structure, vulnerability of the joints will depend on the connection between confining elements (i.e., beams and columns). Alternatively, there is reinforced concrete-block masonry construction. In this form steel reinforcement is placed horizontally and vertically throughout the masonry walls without the need for confining columns and beams.

In steel or wood frame structures, the evaluator must carefully examine the connections, since there will be more of them, they will include a variety of components, and generally

13.Adapted for this document from OMPAD, Office of the Mayor of Manizales, *Field manual for the inspection of buildings after an earthquake*, Manizales, Colombia: 2003.

will have welds, rivets, bolts, etc. They should all be inspected to verify that there are no cracks, fissures, or missing connections. In hurricane-prone regions, roofs on steel and wood frame structures are particularly vulnerable to high winds, so techniques used to attach the roof to the structure of the building must be assessed.

In adobe and earthen constructions the intersection of walls are generally weak, the connections between the floor and load-bearing walls are often inadequate, elements are very heavy, and walls lack reinforcement. These problems can be aggravated by poor quality material, large and poorly distributed openings for doors and windows, and unsatisfactory foundations. Health facilities built of adobe or other earth materials should, where possible, be replaced entirely or reinforced to protect the lives of users.

Safety ratings for the condition of connections are: *Low = Connections are in poor condition; Average = Connections are in average condition; High = Connections are in good condition.*

9. What is the condition of the building's foundation?

Foundations are the elements that allow the transfer of the load of the structure and its contents to the ground. They are the most difficult structural elements to evaluate. Typically, foundations are neither accessible nor visible and plans for the foundations are often not available. These plans provide valuable information about specifications, the type of foundation (shallow, deep, isolated, combination, etc.), and whether foundations are unified or isolated.

Information about the site of the structure (included in the first chapter of this manual in the section "Aspects of the geographic location of the health facility") is essential to evaluating the foundations. This information allows the evaluator to understand properties of the interaction between the soils and the structure and to make a more comprehensive evaluation.

Some important aspects that the evaluator can consider, are as follows:

- The ground water level and type of soil at the building site play a critical role in determining the facility's vulnerability to floods and differential settlement of the foundation.
- Liquefaction, which can cause severe damage to infrastructure, can occur if the building is on saturated, unconsolidated soils (as in the case of sand beds, saturated silt, or uncompacted fill, among others). Where liquefaction occurs, soils lose their ability to support buildings, resulting in cracks and settlement of buildings.

- Evidence of subsidence in relation to the soil surface. Presence of cracks in the floors.
- Differential settlement of material and gradual downward movement of foundations due to consolidation of soil. This leads to damage if settlement is uneven and is evident where there is vertical deformation (leaning of the building) or cracks where floor levels change.
- Loss of foundation support.

In areas that are exposed to flooding and landslides, special care must be given to protecting foundations from possible undercutting that would put the stability of the building at risk. In multi-story buildings the anchorage of the structure to its foundation is generally critical in earthquakes and hurricanes.

Evidence of deficient support elements for the building.

In earthen constructions it is common to see shallow, inadequate foundations on uncompacted soils. To protect walls from soil moisture and rains, it is preferable to build them on raised foundations and waterproof them.

This last observation also applies to wood and steel frame buildings; their foundations should be raised and waterproofed to avoid rust or deterioration of the wood by moisture.

Evaluators should assess the condition of the foundation. If plans are available, check the material used and the depth and identify evidence of settling and cracks in the floors. If no information is available on the foundation, assume a low level of safety.

Safety ratings for building's foundations are: *Low = Information is lacking or foundation is of uncemented stones; Average = Foundation is of concrete, it is too shallow and there is evidence of damage; High = Foundation is of concrete, it is adequate depth and there is no evidence of damage.*

10. Are there irregularities in the plan?

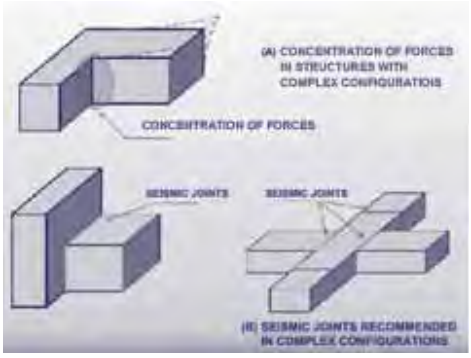
The irregularity of a health building can be expressed in terms of its form, configuration and the eccentricity of torque.[14]

During their tours of the facility, the evaluators should pay particular attention to:

14. For more information, review these terms in the attached glossary.

- Irregularity in the facility's floor plan in terms of rigidity and distribution of mass. For example, where the original design of the plan has been changed because adjoining structures have been added to the existing structure, seismic joints (i.e., space between structures that accommodates the movement of buildings during seismic events) should be present.
- Where irregular configurations exist (for example, L-shaped, T-shaped, C-shaped, cruciform, or more complicated plans), make an on-site inspection to determine whether seismic joints or expansion joints are used to divide the structure into regular parts (for example, to divide an L-shaped building into two rectangles).
- Look for concentrations of weight or mass. For example, locating a water storage tank on the edge of the roof can cause torsional eccentricity during a seismic event which could result in collapse of the roof.

Evaluators should determine whether the shape of the building is regular (i.e., square, rectangular), that the structure is uniform (for example, seismic joints are used, there are no interior patios, columns and load-bearing elements are symmetrically positioned, etc.), and whether there are elements that would cause torsion during an earthquake (for example, water tanks located at the edge of a roof).



Using seismic joints for buildings with complex configurations.

The level of safety can be evaluated as: *Low = The facility has two or more of these conditions: (a) irregular shape, (b) lack of structural uniformity in the plan, or (c) presence of elements that could cause torsion; Average = Facility presents one of the above conditions; High = Facility presents none of the above conditions.*

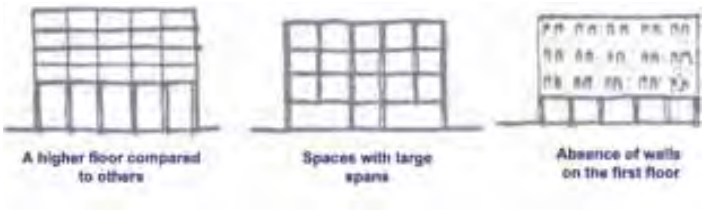
11. Are there irregularities in elevation?

In elevation, as in the plan, the irregularity of a building can be expressed in terms of its shape, configuration, and torsional eccentricity.

The evaluators should take note of the following:

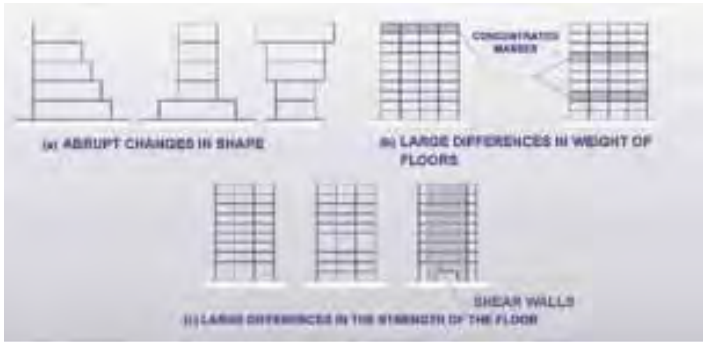
- Discontinuity in structural components and abrupt changes in shape.
- Variations in the type of material used for structural elements in a multi-story building which can affect resistance (for example, concrete columns on the ground level and wood or steel on the second level— this is not always unfavourable).

- Differences in height between floors, producing a "soft story". This occurs most often in the lobby and lower floors of the building.
- Major differences in the weight of floors. For example, mass concentrated on the upper levels of the building because of the presence of heavy machinery and equipment, water storage tanks, etc.
- The presence or absence of short columns. An infill wall can transform a column designed to provide lateral support along its entire height into a short column.
- Supporting elements (columns and walls) are symmetrically distributed in height, to the edges of the plan, providing rotational stiffness.



Different types of a "soft story" in a building.

"Soft storeys" are particularly vulnerable in earthquakes. A "soft storey" is one which has a lower stiffness than the storey above it.



Different examples of discontinuity in elevation.

To summarize, the evaluator should identify discontinuity in configuration and structural components (for example, different construction materials used on different levels, the second floor overhangs the ground floor); concentrated mass (for example, water tank is located on the roof); soft stories (for example, floors of different height whether for the lobby, parking garage, or waiting room); or short columns.

Safety ratings relating to the elevation of facilities are: *Low = The facility has two or more of these conditions: (a) discontinuity in elevation, (b) concentrations of mass, (c) soft stories, (d) short columns; Average = Facility presents one of the above conditions; High = Facility presents none of the above conditions.*

12. Is the structure able to withstand the effects of a variety of natural hazards?

Considering the hazards present in an area, evaluators must determine whether the health facility as a whole can continue to provide services in the case of an adverse event, taking into account results of the analysis of geographic location.

It is necessary to determine if the health facility is adequately designed to resist phenomena that may affect it, or if preventative or corrective measures have been carried out to improve the facility's level of safety.

Structure built with loss mitigation measures against flooding.

To make this determination, evaluators should assess the possible behavior of the entire structure in the case of a range of hazards, not limited to earthquakes. For example, a health facility might be built on an unstable slope and be at risk of complete collapse. Or a facility might be located on an unstable slope, but a retaining wall has been built that stabilizes the slope and protects the building. A building might be appropriately designed to resist seismic forces but be very vulnerable to hurricanes or floods.

In keeping with the principles laid out in the previous chapter ("Aspects of the geographic location of the health facility"), and damage prevention or mitigation measures that have been carried out, rate the capacity of the facility as a whole to resist different hazards.

Safety ratings relating to overall capacity of the facility to resist hazards are: *Low = High vulnerability of structural components to hazards in area where facility is located; Average = Average vulnerability of structural components to hazards; High = Low vulnerability of structural components to hazards.*

3 Nonstructural Aspects

Nonstructural elements are those that do not form part of the load-bearing system of the health facility. These components may or may not be attached to the load-bearing structure, and include architectural elements (for example, partition walls, facades, windows, doors, ceilings, etc.); systems that are critical to the function of a facility (such as the electrical system, water and sewerage systems, communications, and heat, ventilation, and air conditioning systems); and the contents of the building (including medical and laboratory equipment and supplies, office equipment, and furniture). In the case of health care facilities, the cost of these nonstructural elements is higher than the cost of the structure. Studies indicate that nonstructural components generally account for more than 60% of the total cost of a health care facility.[15]

With certain exceptions, the failure of nonstructural elements does not pose a risk to the stability of a structure. However, failure of these elements can put the lives and well-being of the facility's occupants at risk. When assessing the safety of nonstructural elements, evaluators look at whether items are properly anchored so that they will not become dislodged or detached. If certain items fall or tip over they can damage strategic structural elements. The ability of critical (lifeline) systems to function in the event of a disaster and the presence of alternative or back-up systems must be assessed.

This chapter examines the following groups of nonstructural elements:

1. **Critical (lifeline) systems**, which include electrical systems, telecommunications, water supply, fuel storage, medical gases, wastewater and storm drains, all of which are essential for a health facility to function. Interruption of these services in the event of an emergency could shut down the facility.
2. **Systems for heating, air conditioning, ventilation, and/or hot water**, including equipment, ductwork, and pipes.
3. **Furniture, storage units, and office equipment**, including support and anchoring methods, and protection of the contents.

15. Pan American Health Organization, *Is your hospital safe? Questions and answers for health personnel*, Quito: PAHO, 2007.

4. **Medical and laboratory equipment and supplies used for diagnosis and treatment,** taking into account their current condition and degree of safety.
5. **Architectural elements**
    - Components of the building envelope (such as windows, doors, awnings, balconies, among others) which must be protected from the impact of strong winds, water, flying objects, seismic forces, etc.
    - The condition and safety of access routes, and safety of movement both inside and outside of the facility must be considered. Lighting, fire protection, and suspended ceilings, among other elements, are included in this grouping.

It is important to emphasize that failure to carry out preventative and corrective maintenance directly impacts on the vulnerability of the building, which can become critical in an emergency situation, and can even contribute to a disaster.

For example, it is common to find that failures in wastewater and storm water drainage systems affect other elements such as walls and partitions, electrical connections, ceilings, equipment, etc. Faulty electrical wiring is a fire hazard that will put the entire facility at risk, including the lives of occupants. Poorly maintained ventilation systems can give rise to hospital-acquired infections.

It is advisable to evaluate in detail the condition of lifeline systems and equipment, and to ensure that there is a plan for routine maintenance, with a budget exclusively assigned to maintenance.

3.1. Lifelines

3.1.1 Electrical System

13. Is there a back-up power source (generator) capable of supplying uninterrupted electricity for at least 72 hours in critical areas of the health facility?

It is vital that a health facility have an alternative power source that can handle requirements when service from the local power supply network is interrupted; this might be a common occurrence even without disaster conditions. Depending on the facility's role in the health services network, it may or may not have a backup electrical generator. Where present, the evaluator should check the condition and fuel reserves for the generator. If a

backup generator is not present, the evaluator should verify that there are emergency lights, with charged batteries, that are ready to use should the need arise.

Safety ratings for the alternative power source are: *Low = There is no alternative power source that can meet the needs of the facility; Average = There is an alternative power source that meets the needs of the facility but it is not functional (it is in poor condition and/or fuel reserve or batteries are lacking); High = There is an alternative power source that meets the needs of the facility, it is operational and is regularly maintained.*

14. Is the alternative power source adequately protected from natural hazards?

To ensure that the back-up power generator will operate when needed, the evaluators should assess:

- The location of the back-up generator taking into account any hazards that make the facility vulnerable, for example, flooding, strong winds carrying debris, and earthquakes. It is also important to consider security of the generator (from theft or vandalism, for example) and how easy it is to access.
- The methods used to brace and/or anchor the generator to protect it from shifting or tipping over.
- The type of fuel lines and electrical cables used; these should be flexible so they do not break if the generator shifts or tips over.
- The possibility that exits can be blocked by fuel lines, electrical cable, or the generator itself because it has shifted or tipped over.

Depending on the level of the health facility within the corresponding health network, verify what the backup source of power is (electrical generator, batteries with inverters, or other) and if it is located in a secure and accessible place, with the necessary bracing and/or anchoring elements.

Safety ratings for the protection of the alternative power source are: *Low = There is no alternative power source; Average = There is an alternative power source but it is not adequately protected from known hazards; High = There is an alternative power source and it is protected from known hazards.*

15. Is the facility's electrical system protected against adverse events?

Components of the electrical system should be protected from the hazards that the facility is exposed to. It is not uncommon to see that electrical systems have been expanded over time to meet the demands of facilities. However, these changes can put the entire system at risk.

Evaluators should inspect the condition of the facility's electrical system, giving special attention to the following items:

- The main breaker and those of different circuits must be adequate for the installed load. Short circuits are the most common cause of fires in health facilities and occur, among other reasons, because cables or wires have overheated, causing the cable jacket or insulation to deteriorate. This overheating can go undetected, but evidence of its effects includes sparks, burn marks on electrical outlets, heat at electrical switches, among others.
- Temporary electrical installations can cause fires because they overload the system as it was originally designed. This is usually seen where installation was done with inadequate materials or improper techniques. It is important to replace provisional installations with permanent ones that incorporate safety measures for the entire electrical system.
- Irregular voltage (commonly seen in certain cities and towns) can cause overheating of the electrical system and can damage equipment. Evidence of irregular voltage includes varying levels of brightness of lighting fixtures, equipment damage, and continual activity of voltage regulator, or by measuring voltage, among others.
- The electrical network should be completely anchored and protected from strong winds and flooding, and channeled through electric cable racks or conduits that protect cables from twisting, breaking, or from general deterioration.
- In areas of the facility that are prone to flooding, the location of substations, electrical panels, and electrical outlets should be inspected and evaluators should determine whether they should be raised above potential flood levels.
- It is important to keep electrical networks separated from water supply or sewage systems. They should also be isolated from lightning protection systems.
- Utility poles located on the property and transformers and any hardware attached to these poles should be inspected to ensure that they are properly anchored to prevent them from falling. It is advisable for electrical distribution lines within the

boundaries of the healthcare facility to be placed underground to reduce their vulnerability during hurricane conditions.

- Anchors and braces for general distribution boards, panels, and corresponding equipment should be inspected.
- Evaluators should ensure that panels are labeled to indicate which control devices serve circuits in different areas.
- Connections to the emergency back-up system should be inspected.

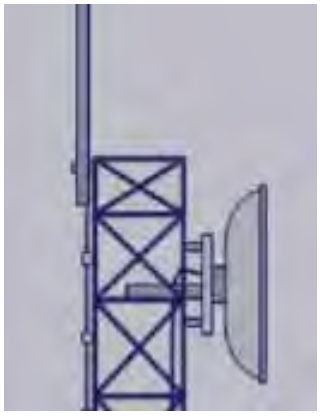
The electrical network should have circuits separated according to the areas and or services they serve, so that when there are shortages power can be directed to priority areas.

It is advisable to consult an electrician to identify any corrective measures necessary.

Verify the operation, labeling, means of anchoring and protection of the different components of the electrical system. Among these are general circuits and networks, panels and their connections, installations, ducts and electrical cables. Take into account the presence of trees and poles that can jeopardize cables and ducts.

Safety ratings for the protection of electrical components are: Low = Electrical components are not protected; Average = Electrical components are partially protected; High = Electrical components are protected.

16. Is the electrical system protected against electrical discharges?



Evaluators should determine whether the facility has measures to protect it against electric discharges. Where these measures are not in place, professional advice should be sought about installing a system to avoid damage to or loss of equipment because of electrical discharge in the facility.

Typically, circuits are grounded and lightning rods are installed to protect electrical networks and equipment in facilities. The evaluator should check that grounds are functional and properly installed, and ensure that lightning rods (conductors) are in good condition and well anchored.

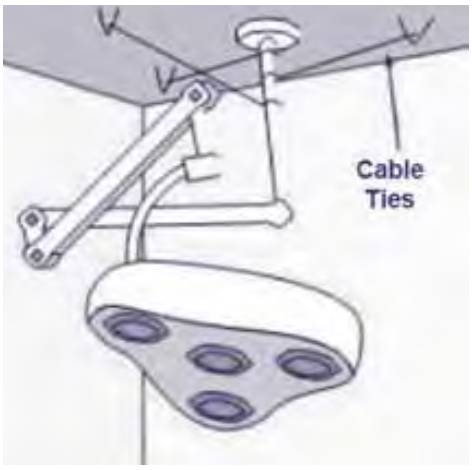
Safety ratings for protection against electrical discharges are: *Low = The facility's electrical system is not grounded and/or lightning rods are necessary but have not been installed; Average = The electrical network is grounded but grounding is not maintained, and/or lightning rods are not properly anchored; High = Devices to prevent electrical discharges are installed and they are regularly maintained.*

17. Is the lighting system in critical areas of the facility secure?

Particularly in areas affected by seismic activity, it is essential to restrict movement of lighting fixtures and prevent them from falling due to earthquake motions or shaking of the structure.

Evaluators should inspect lighting systems in critical areas of the facility to ensure that the following conditions exist:

- Lighting fixtures are securely braced or anchored.
- Some lighting fixtures are suspended from ceilings, others are fastened to structural beams. Manufacturer's recommendations should be followed for securing specialized lighting fixtures used in surgery or obstetrics rooms.
- Lighting fixtures must be not supported by suspended ceilings, especially where there are seismic hazards. Where such fixtures exist, they should be braced by cables to limit their movement (see illustration).



- There is no potential for water leaks on upper floors that could possibly cause short circuits in lighting fixtures.
- Lighting is connected to the emergency power system.
- Devices used for fastening lamps and other lighting fixtures are of adequate strength.

Safety ratings for security of lighting systems are: *Low = Lighting fixtures are not adequately secured; Average = Lighting fixtures are only partially secured and pose a hazard for people; High = Lighting fixtures are properly secured.*

3.1.2 Telecommunications system

18. Are the communications systems in the facility operating?

Depending on the size of the facility, the internal communications systems (loudspeakers, public address systems, speaker systems, intercoms, bells, sirens, etc.) and external systems

(internet, two-way radio, telephone, etc.) are the instruments used for contacting different facilities in a health service network.

Where a facility has telephone service, telephone exchange or computer network, the condition of cables connecting devices should be inspected to ensure that they will function in case of an emergency. Telephone wires must be isolated from electrical wiring to prevent overloading the telephone system; the same applies to wiring for internal communications systems.

Evaluators should ensure that both internal and external communications systems are connected to the backup power source in the facility, and verify that the communications system is operational.

Safety ratings for communications systems are: *Low = The communications system is in poor condition or there is no communications system. Average = A basic communications system is in place and it is in fair condition; High = A basic communications system is in place and it is in good condition.*

19. Is there a backup communications system?

A basic component of emergency planning is the communication that occurs at the time of the emergency. In addition to the basic system, an alternative system must be functional and maintained in good condition.

Evaluators should check that a backup system for outside communications exists and is in good working order. This includes systems for radio communications, cellular telephone, internet access, etc.

Evaluators should also check the condition of antennas, their bracings and supports. Antennas and lightning rods are exposed and attached to the highest part of the structure, and are vulnerable to strong winds. There should be at least three tie-downs, spaced 120 degrees apart; four tie-downs should be spaced 90 degrees apart. Grounding devices for lightning rods should be correctly installed and not be used to anchor other systems.

Safety ratings for the backup communications systems are: *Low = There is no backup communications system; Average = A backup communications system is in place but it does not function correctly; High = A backup communications system is in place, it is in good condition, and operates independently of the basic installed communications.*

20. Are communications equipment and cables protected?

When evaluating communications equipment, including cables, it is important to determine their level of vulnerability to a variety of hazards including earthquakes, hurricanes, and flooding. The evaluator must check that equipment has the anchors or braces needed to prevent it from falling or tipping in case of seismic activity or strong winds. Doors and windows in the facility should be checked for their resistance to flooding and strong winds. Cables should be encased in conduit tubing to prevent deterioration.

Evaluate the safety of the areas where communications systems are located as well as the condition of fasteners and bracing.

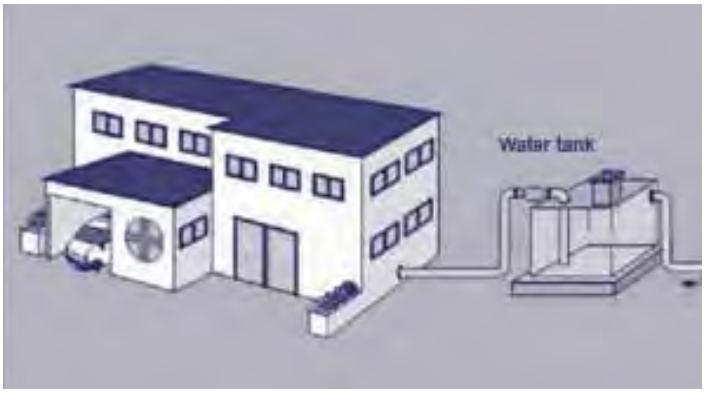
It is advisable for external telecommunication cables within the boundaries of the healthcare facility to be placed underground to reduce their vulnerability during hurricane conditions.

Safety ratings for communications systems are: *Low = Communications equipment is not protected; Average = Communications system has some protective measures in place; High = Communications equipment is protected.*

3.1.3 Water supply system

21. Is a system for water storage in place that has a permanent reserve sufficient to provide at least 60 liters per day for each resident patient, and supply approximately 15 liters per day for each outpatient for a three-day period?

Water supply is essential for the operation of health care facilities, primarily for cleaning and maintaining sanitary conditions.



Evaluators should verify that water storage is sufficient to satisfy demand for 72 hours, at a minimum. Typically, water storage for health care facilities is in reserve tanks on the ground floor, elevated tanks, or holding tanks. There may be alternative storage where the reserve tank does not have necessary

capacity. If wells exist on the grounds of the facility, evaluators should determine what portion of the supply they provide and whether they are used regularly or as reserves.

If a prolonged suspension of water service is expected, there should be plans for saving water and distributing it to the most critical services (for example, surgery, emergency, and sterilization services). This requires knowledge of the distribution network, and mechanisms to shut off water supply intermittently to certain areas.

Other options for emergency situations include temporary storage in areas such as swimming pools or plastic bladders. Plans for incorporating stored supply to that of the main facility should be in place.

Safety ratings for water reserves are: *Low = There are no water reserves; Average = There are sufficient reserves for less than three days; High = There are sufficient reserves for at least three days.*

22. Are water storage sites protected and tanks in good condition?

To ensure that water reserves are protected from different hazards, including from contamination, evaluators should inspect water storage sites (whether water tanks or reserve tanks on the ground floor, elevated tanks, or holding tanks).

- To avoid contamination, water storage tanks should not be located in areas prone to flooding. If flooding is a potential hazard, tank access (cover or opening) should be above the reference flood height to prevent contaminated water from entering the tank. This should be accompanied by installation of plastic or metal covers, with watertight seals in the opening or inspection areas, and use of covers at ventilation locations.
- The pump should be located above the reference flood level, and joints sealed with neoprene.
- Water storage facilities should be located away from potential landslide areas or slopes.
- There should be secure covers for access points to tanks for inspection, cleaning, and maintenance.
- Elevated tanks should be supported above structural roof elements.
- Special attention should be given to how plastic tanks are supported and anchored. In high winds they can tip over if they are empty, which will affect the attached pipes.

- Tank covers should be inspected to ensure they are in good condition and are properly fastened.

Inspect that the storage and/or elevated tank are covered, have necessary supports and anchoring, are protected from potential contamination, and that there is no evidence of cracks or leaks in the tank.

Safety ratings for protection of water tanks are: *Low = Location, fastenings, and condition of tanks are inadequate; Average = Location, fastenings, and condition of tanks are adequate; High = Location, fastenings, and condition of tanks are good.*

23. Is there an alternative water supply system in place that can supplement the main distribution system?

All critical systems should have redundancy, and it is advisable for the facility's main water tank to be supplemented by at least two sources that can maintain necessary reserve capacity. The availability of private wells that can supply the facility is an option that should be examined.

To avoid contamination of underground wells, reinforced concrete walls should be built around the well opening. The well opening should be above the reference flood height and covered. The pump, if not submersible, should be protected and neoprene seals used.

(1) Wellhead raised above maximum flood level; (2) cover to prevent entry of polluted water into the well; (3) reinforced concrete rings to enhance the well's mouth; (4) protection of the pit walls (reinforced concrete rings).

Evaluators should identify the entity responsible for restoring local water supply should it fail. It is also important to check the access for tanker trucks to fill water storage tanks. Evaluators should verify the existence of additional water sources, besides that of the main local distribution network, and determine the coverage that it could provide in the event that it is necessary.

Safety ratings for alternative water sources are: *Low = There is no alternative source or it can provide less than 30% of demand; Average = Alternative system can provide 30% to 80% of demand; High = Alternative system can provide more than 80% of daily demand.*

24. What is the condition of the facility's internal water distribution system?

Evaluators must check the condition and performance of all aspects of the facility's water distribution system including storage tanks, valves, pipes, and connections. This includes piping to the faucets at different service points and the main connection to the local water service. One potential problem area is the tank float valve which controls the amount of water that enters the tank and shuts off flow when the tank is full. If the valve does not work properly, water will be wasted, and if this wasted runoff is not channeled, over time it can erode structural supports for the water tank.

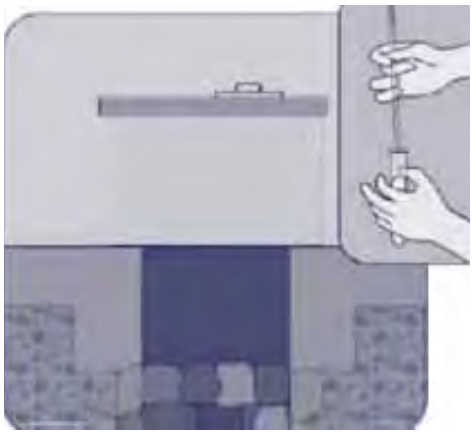
It is important that evaluators check the general condition of the facility's distribution system to ensure that water reaches the necessary service points. Leaking pipes can cause damage in any of the areas where they are located: along ceilings, behind walls, and underground. Stains on walls and ceilings and water on floors are evidence of leaks. Where moisture is present, a thorough inspection of pipes and pipe connections should be carried out to check for signs of deterioration.

It is important to check that flexible connections are used, for example, between outside tanks and the building and between pumps and pressurized pipes. Connections that are in contact with structural elements must be firmly anchored to the structure.

Review the condition of water distribution networks to ensure that water reaches necessary service points, there are no leaks, and that flexible connections cross seismic joints in the facility.

Safety ratings for facility's internal water system are: *Low = Less than 60% of components are in operational condition; Average = Between 60% and 80% of components are in good condition; High = Over 80% of components are in good condition.*

25. What programs are in place to maintain water quality in the facility?



Supplying safe water is essential in a health care facility. There must be a water quality control program in place that would be accelerated in the case of a disaster, when water sources might be contaminated and other factors might affect the safety of the water. This program should ensure the safety of water at supply points, storage, and distribution. Regular water sampling should be carried out, and any necessary corrective measures identified. Attention should be given to maintenance issues such as regular cleaning and disinfection of water storage tanks, among other tasks.

Ensure that the facility has a water quality control program in place that includes necessary corrective measures.

Safety ratings for water quality control in the facility are: *Low = Water quality control program does not exist; Average = Water samples are taken sporadically but follow-up with corrective measures is lacking; High = Water samples are taken regularly and corrective measures are applied.*

3.1.4 Fuel storage (gasoline, diesel)

26. Is fuel stored in safe conditions and is there a five-day fuel reserve?

The health facility must maintain fuel supply equipment in good working order. Because different types of fuel are used for different purposes, fuel storage areas on the premises must be clearly labeled. Evaluators should inspect the reserve of each kind of fuel, taking into account the demand, the capacity of tanks, and the frequency of fuel deliveries. Tanks must be anchored so they cannot tip over and spill.

It is important that evaluators verify that the tanks containing flammable liquids are at a safe distance from the facility and its electrical plant, boilers, kitchens, and other areas that could pose a fire risk. Storage areas should be labeled, fenced, and protected from windborne debris, flooding, landslides, and liquefaction. Evaluators should check fire protection equipment associated with the fuel storage. It is also important to have information on the distance to the supplier.

Verify that the facility has a five-day fuel reserve. The fuel must be located in a safe, labeled, and fenced area, and containers must be anchored to avoid spills.

Safety ratings for fuel reserve are: *Low = Fuel reserves are not adequate and storage area is not secured; Average =Fuel storage area has some security and there are at least three days of reserves; High = Fuel storage is in a secure area and there is a five-day reserve.*

3.1.5 Medical gases (oxygen)

27. Are there enough medical gases to last for at least three days?

Evaluators should check the reserve capacity for medical gases used in the facility. It is also important to confirm how frequently gases are delivered.

Taking into account routine use and the potential number of victims that would use the facility in the event of a disaster, verify the medical gas reserve capacity and the distance from the gas supplier.

Safety ratings for medical gas reserves are: *Low = There is less than one day of reserve; Average = There are one to three days of reserve; High = There are at least three days of reserve.*

28. Are medical gas tanks properly anchored?

Medical gas tanks must be well anchored to keep them from falling. Tank valves are easily damaged if they tip over.

Solutions to proper storage depend on the type of containers used. Oxygen cylinders should be attached to permanent walls or structures, using adjustable tie-downs, chain, or other fasteners, taking into account that the cylinders must be easy to move when needed, but prevented from falling. The major danger if gas tanks fall is that the valves will break and there will be an uncontrolled flow of gases, with dangerous consequences.

Vertical oxygen tanks should be well anchored in three or four directions, with welded connections or bolts. Evaluators should ensure that anchoring is adequate and the materials are in good condition. Narrow vertical oxygen tanks should be secured with three, evenly

spaced tie-downs, separated by 120 degrees, in case of high winds or seismic activity. Horizontal tanks should be anchored to walls so they cannot slide during seismic events.

Evaluate whether medical gas tanks have fixed or removable fasteners.

Safety ratings for medical gas tank anchors/fastenings are: *Low = Anchors and/or fasteners are lacking; Average = Quality of anchors and/or fasteners is inadequate; High = Anchors and/or fasteners are of good quality.*

29. Are medical gas tanks stored in safe areas?

Storage for oxygen tanks should be located outside of the main health care building because of the risk of explosion. The storage site should be easily accessible, in an area unlikely to flood, at a distance from any heat sources, and protected from flying or falling objects.

Evaluators should ensure that these storage areas are used only to store medical gas tanks, and that there is enough space to handle the tanks or cylinders, and to move them from the delivery point to where they are being used. The area should be fenced and signs posted that warn of the explosion hazard. Fire protection equipment should be readily available, and personnel should be trained in handling the equipment.

Inspect the area set aside for storage of medical gases and ensure that the site is accessible, is away from any heat sources, that signs are posted, and that fire-fighting equipment is available.

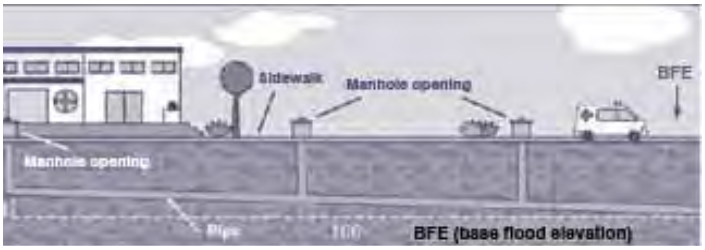
Safety ratings for storage site for medical gases are: *Low = No area has been set aside to store medical gases or the enclosure is not accessible; Average = Areas have been set aside for storage of medical gases, but safety measures are inadequate or access to the enclosures poses a risk; High = Appropriate storage areas are in place, enclosures are accessible, and they do not pose a hazard.*

3.1.6. Sanitation system

30. Has the health facility been flooded because of poor wastewater drainage?

If the facility has had sewage flooding, the evaluator should contact the entity responsible

for wastewater drainage (cesspool, field, sewer, among others). There may (blockages, low pressure for wastewa



To prevent penetration by drain wa matter, manholes and vents for sewer

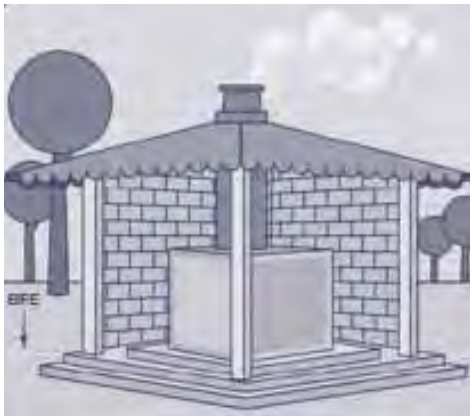
The storm drainage system is built to handle flooding whether it results from heavy rain, river overflow, or sea surges, and should be separate from sewage drains. The objective is to prevent drainage from latrines built at lower levels and sewer drains should saturation occur. This can be accomplished in some cases by using backflow prevention valves.

Where there have been previous sewage flood events, determine what measures have been used to solve the issue.

Safety ratings for drainage are: *Low = History of sewage flooding in the facility; Average = Corrective measures allow the drainage of wastewater; High = The facility has no history of sewage flooding and/or corrective measures have been taken to solve the problem.*

31. Are waste collection sites (for regular and medical waste) protected?

Earthquakes, floods, and strong winds, among other events, can impact infrastructure where medical and pathogenic waste is collected. To protect waste and collection sites the enclosure, containers and lids must be secured to keep them from tipping over. It is preferable for medical waste containers to be permanent structures. However, if they are portable, they must be in covered, protected areas, so that there is no chance of rain or flood water mixing with the waste. Spills or leaking of medical waste into drainage areas or water sources creates a major contamination hazard.



To protect waste from floods, there should be walls forming an enclosure to prevent water from entering, and the floor of the enclosure should be raised. Medical waste should be enclosed by fencing to prevent animal or unauthorized human access, and pits or tanks must be sealed.

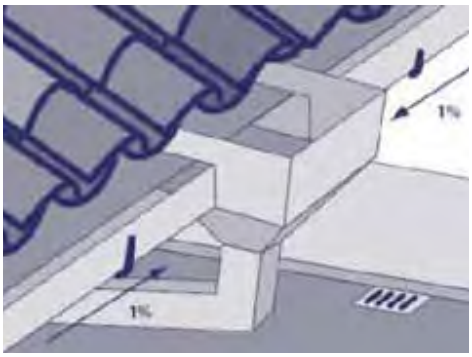
It is important to have plans in place for dealing with medical and other solid waste following an adverse event, taking into account that access to the collection site might be difficult, and that there will be an increase in the volume of waste. In critical cases, waste collection could be carried out by third parties or by facility staff.

Evaluators should inspect the safety of the waste collection site for the case of floods, strong winds, earthquakes, etc.

Safety ratings for waste collection sites are: *Low = Waste sites are not protected; Average = There is a certain level of protection for waste sites; High = Waste sites are well protected.*

3.1.7 Storm drainage system

32. Is the facility's storm drainage system in good condition?



In periods of intense rainfall or in events related to the El Niño phenomenon, storm water drainage is critical to avoid flooding in the facility. Evaluators should inspect roofs and gutters to ensure that there is enough of a slope for water to drain away from the building. Generally any drainage element should be sloped by at least 1% (for concrete surfaces) and 2% (for other surfaces) to allow water drainage. Where necessary, gutters or channels should be increased in size to accommodate storm water.

Where flat roofs are surrounded by walls, evaluators should ensure that there is a system for rapid water drainage. This would include ensuring that the roof has a slope, that the number and diameter of drains are sufficient for the area draining into them, and that drains are completely unobstructed and protected by screens or grills. Additional holes can be made in drains, or the number of drain openings can be increased.

In areas subject to volcanic ash fall, the slope of the roof and/or drainage gutters should be checked. In addition, the strength of the structure supporting the gutters and roof should be checked to ensure that it can support the weight and removal of ash without causing damage.

Failures in the storm drainage system can have consequences for other elements of the facility. Connections of the system should be checked regularly and to avoid deformation, chains, hooks, or other supporting elements should be used. Components that might fail because of corrosion should be replaced, and they should be maintained with anti-corrosive materials. Roofs, gutters, drains, and downspouts must be regularly cleaned to avoid blockages. These activities should be completed without fail before the rainy season.

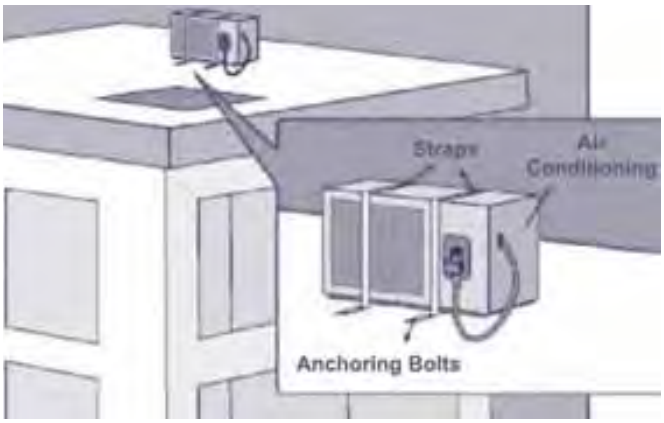
Ensure that there is an adequate system for storm water drainage. This includes inspection of the slope of the roof and gutters, and confirmation that maintenance of drainage components is adequate.

Safety ratings for storm drainage system are: *Low = Storm drainage does not exist, or it is in poor condition; Average = The storm drainage system is in average condition; High = Storm drainage system is in good condition and it receives regular maintenance.*

3.2 Heating, ventilation, air conditioning (HVAC) and/or hot water

33. Are the components of these systems protected?

All the components of HVAC and hot water systems must be protected from adverse events. Equipment, piping, ducts, tubing, etc., must be correctly fastened and anchored to prevent them from moving, particularly in seismic zones.



Evaluators should inspect the following:

- Equipment is completely fastened to structural elements, taking care that anchors are in good physical and mechanical condition so that they cannot be affected by strong winds or seismic forces. Generally, straps, metal bands, and bolts are used, taking into account that should they fall they will not injure anyone or cause damage to other equipment.
- Air conditioning equipment that is exposed to the elements must be protected, especially from flooding, and taking into account that protective measures must not impede equipment operation.
- Enclosures for boilers should be located away from the main building, preferably have roof coverings, be isolated from fuel tanks, be easily accessible, not subject to being blocked, and not subject to flooding. Control panels should be protected from boiler temperatures, and have necessary fire protection equipment.

To lessen hazards of contamination in the facility, special attention should be given to the maintenance and cleaning of ducts and filters for ventilation and air conditioning systems.

Ensure that ducts and pipes are properly fastened and anchored, that connections to equipment are flexible, and that components of the systems are not subject to damage from flooding, strong winds or earthquakes.

Depending on the type of components for heating, ventilation, air conditioning, and/or hot water systems in use, safety ratings are: *Low = Equipment is not protected from potential hazards; Average = Equipment is partially protected from potential hazards; High = Equipment is adequately protected from potential hazards.*

34. Are components for HVAC and/or hot water systems in good condition?

Given the importance of heating, ventilation, air conditioning, and/or hot water equipment for the facility's operation, special attention must be given to maintenance and keeping them in good working order.

Depending on the type and location of pipes, ductwork, and cables, they should be enclosed in conduits. Evaluators should inspect the performance of safety and control valves on boilers and the condition of piping and ductwork for the air conditioning equipment. They should also ensure that condensation will not affect suspended ceilings and other equipment that come in contact with pipes or ducts and that leaks from upper floors will not affect components. Piping should have flexible connections where it crosses expansion joints of the building.

Evaluators should review the maintenance logs for this equipment to ensure that regular maintenance is being carried out.

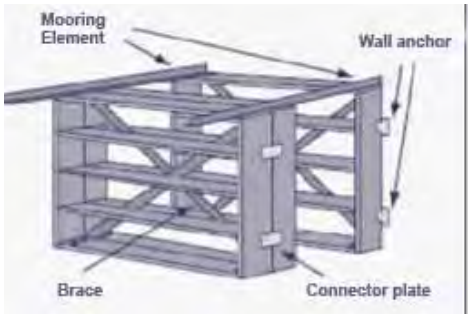
Check the condition of all components of the system and review the maintenance.

Safety ratings relating to the condition of components for heating, ventilation, air conditioning, and/or hot water systems are: *Low = Equipment is in poor condition; Average = Equipment is in average condition; High = Equipment is in good condition.*

3.3 Furniture and fittings, office, and storage equipment

35. Is shelving anchored and are contents protected?

To protect the lives of occupants of the health facility and to preserve the contents of the facility, furniture and fittings must have fastenings and anchors to prevent them from moving or falling as a result of seismic forces, strong winds, or flooding through doors and windows.



Evaluators should check that shelving is fixed to walls or floors with cables, bolts, or straps. It is advisable to place heavy items on lower shelves to give more stability. Shelves should have lips, railings, or bars to prevent their contents from falling.

In offices, libraries, and archives of clinical records, many shelving units have glass doors. These units should be fastened to each other and glass doors replaced with unbreakable material. Rows of high, free-standing shelves, which are frequently found in storerooms and pharmacies, must be anchored to the floor, connected to each other at the top by ties that cross the room, and attached to the wall at either end of the row of shelves. Connecting the shelves increases lateral stability, lessening the chance that they will fall.

It is also important to determine whether exits could be blocked by falling shelves or other furnishings.

Safety ratings for shelving and shelf contents are: *Low = Shelving is not anchored to walls and the contents are not secured; Average = Shelving is anchored but contents are not secured; High = Shelving is anchored and contents are secured.*

36. Is office equipment secure?

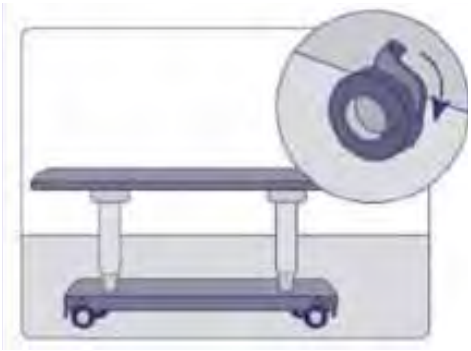
Because so much of a health facility's information is stored on computers, this equipment must be protected from damage. Evaluators should ensure that computers, servers, and printers are fastened to tables or that the tables have railings or lips that can prevent equipment from sliding off.

Inspect office equipment to ensure that there are fasteners, straps, or other mechanisms to keep them from falling.

Safety ratings for office equipment are: *Low = Less that 20% of equipment is anchored; Average = Between 20% and 80% of equipment is anchored; High = More than 80% of equipment is anchored.*

37. Are furniture and fittings in the health facility secured?

Evaluators should ensure that furniture and fittings are fixed, and check that access, doors, and hallways are always free of potential obstacles.



Chairs and tables with wheels should have brakes locked and personnel should be aware of how the locking mechanisms work. Filing cabinets on wheels should have chocks or be attached to walls to keep them from shifting, and filing drawers should have latches to keep them from sliding open, particularly in seismic areas.

It is common for articles to be hung on walls and above desks or placed on the top of shelving (clocks, pictures, televisions, etc.). Such objects must be completely anchored; nothing should hang directly above a work station or door.

Evaluators should ensure that measures are in place to keep furnishings from moving (for example, brakes are engaged, cables, straps, or other anchoring devices are in place).

Safety ratings for furniture and fittings are: *Low = Furniture and fittings are not anchored and wheels on furniture are not locked; Average = Some furniture and fittings are anchored and wheels on furniture are locked in some cases; Good = Furniture and fittings are anchored and wheels on furniture are locked.*

3.4 Medical and laboratory equipment and supplies used for diagnosis and treatment

Application of recommendations in this section depends on the level of complexity of the health facility being evaluated, the services provided, and the equipment available.

38. Are medical and laboratory equipment protected from the impact of adverse events?

Depending on the size and purpose of the equipment, there should be anchors and fastenings to prevent their movement because of seismic shaking, strong winds, or flooding. In addition, protection against voltage surges and overload of electric lines should be in place.

Fixed equipment must be completely anchored. Brakes on mobile equipment must be applied; when mobile equipment is not in use it should be placed against a wall, with brakes

applied, and in some cases strapped to the wall. Personnel should be aware of how braking mechanisms work as well as anchoring used to support oxygen tanks. Evaluators should check that X-ray tables and equipment are fastened and that they are protected from flooding. Mobile equipment (which is common in dentistry) should have functional brakes as well as mechanisms to fasten them to walls.

Evaluators should ensure that basic equipment and supplies in emergency departments are protected. Equipment on shelves must be anchored, and the contents of shelves protected. In the case of laboratories, protecting potentially dangerous samples from falling or leaking in the case of adverse events should be emphasized, since these materials can pose a contamination hazard to personnel and patients.

Ceiling light fixtures in operating and delivery rooms must be well anchored to prevent them from swinging and falling. The operating or delivery table must be completely immobilized and equipment should be attached to rolling carts, which in turn should be secured to the operating table and brakes applied when in use. Straps, latches, and brakes on all equipment should be inspected.

Life support equipment should be completely anchored to eliminate the possibility of being disconnected from the patient. Because this equipment must continue to function even when there are power outages, they should be connected to alternative power sources during emergencies. Evaluators should ensure that grounds are in place to protect equipment from electrical discharge.

Evaluators must ensure that equipment is protected, that bracing and anchoring devices are in use (for both stationary and mobile equipment). Equipment stored on shelves should be braced and portable equipment must have brakes applied on wheels. Confirm that equipment is located above flood level and could not be exposed to strong winds.

Safety ratings for medical and laboratory equipment and supplies are: *Low = 20% or less of equipment is protected; Average = Between 20% and 80% of equipment is protected; High = More than 80% of equipment is protected.*

39. Is medical and laboratory equipment in good condition?

Basic and auxiliary equipment in the emergency unit should be checked to ensure it is good condition. In surgery rooms, lamps should be inspected for adequate illumination. Anesthesia, monitoring, and life support equipment, among others, must be inspected. In the pharmacy, refrigeration for medications must be inspected. Evaluators should check for leaks from any source that might damage equipment, including from water systems, or condensation relating to air conditioning units.

In settings where maximum sanitation is maintained, inspection must be rigorous. Sanitation and hygiene levels must be inspected throughout the facility to prevent contamination.

Evaluate the condition of the medical and laboratory equipment and review scheduled maintenance.

Safety ratings for the condition of medical and laboratory equipment and supplies are: *Low = 20% or less of equipment is in good condition; Average = Between 20% and 80% of equipment is in good condition; High = More than 80% of equipment is in good condition.*

3.5. Architectural components

40. Are doors or entrances to the facility secure and functional?

Evaluators should check the condition of doors, screening, or other elements used to close entrances in different areas of the facility and their ability to withstand wind, seismic, and other forces. They should be completely attached to their frames, and the frames, in turn, must be firmly anchored to the surrounding walls or panels.

Doors and entrances should be free of obstacles and wide enough to allow rapid movement of patients and health staff in emergency situations. Evaluators should pay special attention to doors and entrances to critical areas (such as the emergency department).

On lower levels that are susceptible to flooding, it is recommended that doors and screening made of wood and other materials that can be damaged by water be replaced by materials that do not deteriorate in wet conditions, such as plastic, aluminum and/or steel (which should be protected from rust). If replacement is not feasible, these elements should be protected with water proofing. In areas exposed to strong winds, metal storm doors can prevent damage to the facility from wind pressure. Where external doors are not provided with storm shutters, they should have 3 hinges along one side and a latch and 2 bolts (top and bottom) along the opposite side.

Examine the condition of doors and ensure that they are free of obstacles and they will not impede safety in the facility.

Safety ratings for doors and entrances of the facility are: *Low = Doors and entrances are not secure and they impede safe movement in the facility; Average = Doors and entrances are not secure or they impede safe movement in the facility; High = Doors and entrances are secure and they do not impede safe movement in the facility.*

41. Are windows of the facility secure and in good condition?

As in the case of doors, windows must be able to resist wind pressures and wind-borne debris produced by hurricanes, primarily in the critical areas of the facility.

Where possible, evaluators should check the thickness and type of glass in the windows, since these two parameters, along with the area of glass exposed to wind, determine the resistance of glass windows. It is advisable to use laminated glass or polycarbonate windows in critical areas. Where wood windows are used, they should be checked for moisture and termite damage. If windows are not secure, wind and rain can destroy or damage medical equipment.

Evaluators often fail to take into account rain and wind damage to patient rooms and underestimate the impact of these losses on patients. Even when there is no noticeable breach in the building envelope, wind-driven rain may still enter the facility.

Inspect the condition of windows and ensure that they will not have a negative effect on the facility.

Safety ratings for windows of the facility are: *Low = Windows are subject to damage and damage would compromise the ability of the facility to function; Average = Windows are subject to damage but damage would not compromise the ability of the facility to function; High = Windows are subject to no or minor damage that would compromise the ability of the facility to function.*

42. Are the elements of the building envelope (outside walls, facings, fencing, etc.) in good condition?

Outside walls of health facilities are constructed of different materials such as masonry, glass, wood, or aluminum, and sometimes they are of mixed materials. It is recommended that in seismic areas facings should not be veneered, but should be integrated into the wall.

The evaluators should review the technical and construction status of the building envelope components to ensure that they are not cracked, damaged, or loose. In relation to this last point, exterior walls should be appropriately attached to the structural components, so that they resist seismic movements or strong hurricane wind forces. (These forces can be inward or outward.) Inspection should be much more rigorous in the critical areas of the facility. Where the envelope has fixed sections using glass or wood, the evaluator should apply the same considerations as when looking at windows made of these materials.

Poor conditions of the facility's grounds also have an impact on its safety. During disasters the condition of the facility's boundaries and fencing can impact on performance. For example, if many people trespass on the grounds, this can affect access and other performance issues. This should be carefully reviewed when evaluators inspect the exterior of the facility. Viewing the grounds and neighboring areas from upper floors of the building will help in assessing the condition of the perimeter of the facility.

Evaluate whether outside walls, bars, facades, and fencing around the facility are properly anchored to the structure, are in good condition, and will not have a negative impact on how the facility functions.

Safety ratings for elements of the building envelope are: *Low =Subject to damage and damage to element(s) would impede the performance of the health facility; Average = Subject to damage but damage to element(s) would not impede performance of the health facility; High = No or minor potential for damage that would impede the performance of the health facility.*

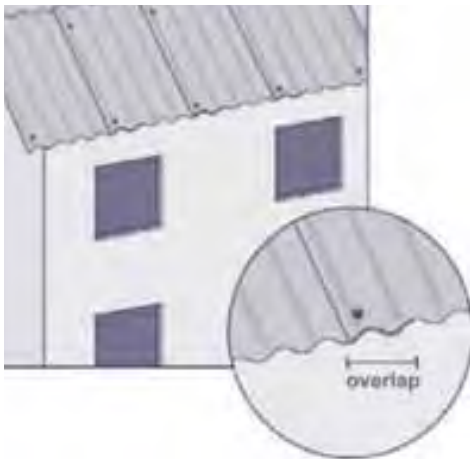
43. Is roofing safe and in good condition?

The evaluators should go up on the roof of the facility to make a thorough assessment. Leakage from water storage systems on the roof, or problems with waterproofing can put sections of a facility out of service, which would have grave consequences for critical areas. Equipment located on the roof and storm water drainage should be assessed at this time.

Strong winds can lift and destroy the roofing, so it is advisable to close any openings under the roof deck with masonry or other materials. Even membrane waterproofing attached to timber and concrete roof decks can be lifted off from the decks by the wind. This should be complemented with the use of hurricane straps or clips that fasten roof structures to structural elements such as supporting walls, beams, and columns.

In areas with high rainfall, extending the eaves on roofs to cover exterior walkways protects the structure and personnel. It is important to ensure that eaves are braced for strong winds and that there is adequate storm water drainage.

If the facility is an area exposed to volcanic eruptions, the condition of the roof and its ability to withstand the extra weight of ash fall must be considered. When volcanic ash gets wet it prevents water from draining through gutters, which adds to the weight.



If there is evidence of leaks in tile or concrete roofing and roofs, the evaluators should look for cracks and areas where joints with masonry are faulty (epoxy resins and waterproofing materials are recommended). For leaks in lightweight, metal roofing, evaluators should ensure that roofing panels overlap. The presence of holes or cracks in roofing material should also be checked. Depending on the material, angles of 20% to 25% are recommended to assist in water runoff and to lessen wind pressure.

Evaluators should check that anchors for roof sheets are sealed with silicone or other waterproofing material. All roofing materials should be reviewed for their ability to withstand strong winds, ash fall, or intense rainfall.

Safety ratings for roofing are: *Low = Roofing is in poor condition and/or damage would affect the performance of the facility; Average = Roofing is in average condition and/or damage would not affect the performance of the facility; High = Roofing is in good condition and/or there is no or minor potential for damage that could affect performance of the facility.*

44. Are parapets and other outside elements in good condition?

The evaluator should inspect the condition and construction of parapets (which include walls or railings placed to prevent falls from the roof, bridges, stairs, etc.) and other outside elements (including cornices, ornaments, etc.) to ensure that they are not cracked, damaged, or loose. They must be properly attached to the structural components so that they resist seismic movements or strong wind forces. Parapets are especially important if they are used to protect staircases and walkways in the facility. Evaluators should determine whether the failure of one of these elements can put the lives of occupants at risk, giving special attention to items in the areas with the greatest concentration of people.

Special attention should be given to the condition of anchors and supports of exterior architectural elements such as cornices and ornaments. Seismic shaking can cause them to fall, resulting in considerable damage and even deaths. It is not advisable to use window (flower) boxes on the exterior of buildings, since besides the risk posed by falling, these elements can increase seismic loads.

Evaluators should inspect the condition of exterior elements of the building, and determine whether parapets, railings, cornices, ornaments, etc., are properly anchored and do not pose a hazard to the facility.

Safety ratings for outside elements are: *Low =Subject to damage and damage to element(s) would impede the performance of the health facility; Average = Subject to damage but damage to element(s) would not impede performance of the health facility; High = There is no or minor potential for damage which would impede the performance of the health facility.*

45. Are areas for pedestrian and vehicle traffic outside of the facility safe and in good condition?

There must be a good flow of traffic outside of the hospital so that pedestrians, ambulances, and supply transport can access the facility quickly during disasters. Evaluators should determine whether there are elements that could fall because of natural forces, obstructing circulation routes and impeding access to the facility. The condition of pavement on the health facility grounds should be checked for potholes or other

obstacles that could interrupt pedestrian and vehicle traffic.

Evaluators should verify that that there are no trees, utility poles, signs, vehicles, walls, etc., that could obstruct traffic outside of the facility.

It is important to determine whether fire-fighting trucks can have access on all sides of the facility. In this respect the headroom required for these trucks with their equipment must be taken into account.

Safety ratings for circulation of vehicles and pedestrians outside of the facility are: *Low = Damage to the road and walkways will impede access to buildings or endanger pedestrians; Average = Damage to road and walkways will not impede pedestrian access, but will impede vehicle access; High = There is no or minor potential for damage which could impede pedestrian or vehicle access.*

46. Are conditions safe for movement inside the building?

The evaluators must verify that conditions are safe for movement throughout the facility. Inside corridors should be spacious and free of obstacles to ensure ease of movement for personnel, gurneys, and medical equipment.

Special attention should be given to stairways and exits because of their importance should evacuation be required in an emergency. Adequate signage must be present to facilitate movement of staff, patients, and visitors. Areas with restricted access should be under the surveillance of hospital security personnel.

Evaluators should inspect corridors, stairways, exit doors, etc., to make sure they are clear of any obstacles. Emergency exit doors must be able to be opened from the inside by anyone legitimately seeking to escape from a hazardous situation in the facility.

Safety ratings for conditions for safe movement inside the facility are: *Low = Damage to interior passageways will impede movement inside building and endanger occupants; Average = Damage to interior passageways will not impede movement of people but will impede movement of gurneys and other wheeled equipment; High = There is no or minor potential for slight damage which could impede movement of people or wheeled equipment.*

47. Are internal walls or partitions safe and in good condition?

Internal walls and partitions in health facilities can be a variety of materials, such as masonry, glass, wood, metal, etc., and can be a combination of these materials. The evaluators should review technical and construction aspects of these elements to ensure they are not cracked, deformed, or loose. Interior walls should be adequately braced by structural elements so that they can resist seismic shaking and wind forces. (Wind forces on internal partitions are a problem mainly after there is a breach in the building envelope. However, even without such a breach, there can be significant pressure differentials between adjacent rooms in a building.)

In areas that are prone to flooding, lightweight materials that would be damaged by water should not be used for partitions. Cracks or other damage to these partitions would affect electrical and other systems that are behind the walls. Masonry partition walls are preferable on lower floors that are prone to water damage. However, the way masonry partition walls will affect the behavior of the structure if there is an earthquake must be taken into account.

The evaluation of internal walls should be more rigorous in critical areas (emergency rooms, operating rooms, laboratories, etc.).

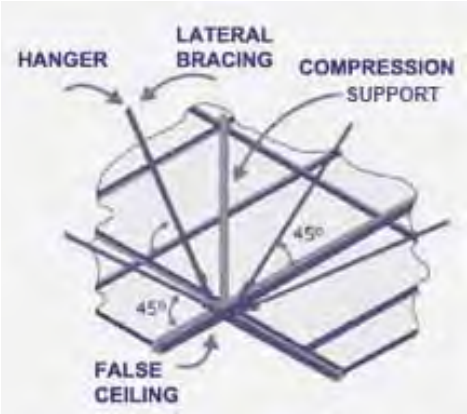
Examine the condition of internal partitions to ensure that they are anchored to the structure and that they will not affect the behavior of the building.

Safety ratings for condition of internal walls are: *Low = Damage to these elements would affect the facility's functional capacity; Average = Damage to these elements would not affect the facility's functional capacity; High = There is no or minor potential for damage that would affect the facility's functional capacity.*

48. Are the facility's false or suspended ceilings safe and in good condition?

There are a wide variety of false or suspended ceilings used in buildings. They are non-structural elements but if they are poorly fastened they can fall and obstruct movement in the facility, which will affect its ability to function. Suspended ceilings made of metal are the heaviest and cause the greatest damage when they fall. Because bracing for suspended ceilings usually is not visible, evaluators will have to take some ceiling sections apart so the condition of the anchors can be checked.

In seismic zones both angled and vertical bracing should be used to protect ceilings from horizontal seismic forces. In areas where these elements are subjected to strong winds, they can fall, become projectiles, collide with other objects, break windows, and, in the worst case, cause serious injuries.



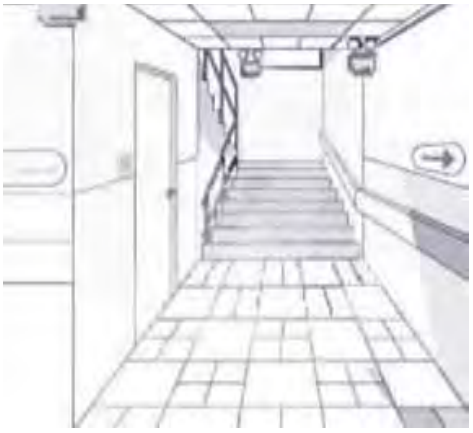
Evidence of moisture damage and detached suspended ceilings can be caused by problems with roofing or in water, HVAC, or electrical systems that pass through the space above the ceiling.

Evaluators should ensure that there are no breaks or signs of moisture damage and that suspended ceilings are well anchored.

Safety ratings for condition of suspended ceilings are: *Low = Damage to these elements would affect the facility's functional capacity; Average = Damage to these elements would not affect the facility's functional capacity; High = There is no or minor potential for damage that would affect the facility's functional capacity.* [NOTE: Leave blank if these ceilings are not present.]

49. Is the lighting system (interior and exterior lighting) for the facility safe and in good condition?

Lighting systems are one of the major nonstructural elements in a health facility. If lighting does not function correctly, especially in critical areas, it will have a major effect on how the facility functions.



Evaluators should ensure that both internal and external lighting is operational and correctly designed. They should ensure that emergency lighting systems are adequate for the level and type of use of an area, especially in the critical units of the hospital. They should also check that there are sufficient reserves (such as replacement light bulbs and flashlights) in case of emergency.

Assess the condition and performance of the lighting system, including the emergency lighting system, and ensure that damage to elements will not affect safety in the facility.

Safety ratings for the lighting system are: *Low = Damage to these elements would affect the facility's functional capacity; Average = Damage to these elements would not affect the facility's functional capacity; High = There is no or minor potential for damage that would affect the facility's functional capacity.*

50. Is there a fire protection system and is it in good condition?

The health facility must be completely protected against fire. Fire can place patients and health workers in extreme danger and bring services in a facility to a halt when they are most needed.

Evaluators should inspect the fire protection measures in areas at highest risk for fire. These include boiler rooms, fuel tank storage areas, medical gas supplies, electrical panels, document storage, pharmacy, etc. Fire extinguishers should be accessible, in usable condition, and well anchored so they do not fall.

Evaluators should check the expiration dates on extinguishers and confirm that they are maintained as necessary. They must also confirm that personnel responsible for using the equipment actually know how to use it.

Where there are fire hydrants, evaluators should check that they are sufficient in number, are operational, and that they have a permanent supply of water.

Evaluators must confirm that fire extinguishers are located in high-risk areas, that they are functional, easy to access, are well anchored, and are well labeled. Expiration dates on extinguishers must also be checked.

Safety ratings for condition of fire protection system are: *Low = There is no fire protection equipment, and/or it is out of date, and/or it is not accessible; Average = There is insufficient equipment and/or it is not anchored, and/or it is not labeled; High = There is enough fire protection equipment and it is operational, accessible, properly anchored, and properly labeled.*

51. Are staircases and/or ramps safe and in good condition?

Evaluators should pay special attention to the condition of staircases and ramps because of their importance especially in the case of evacuation. They should be well anchored and free of any obstacles that would impede their use, or of objects that might fall and block them during an earthquake. Railings must be present and in good condition so that staircases can be safely used at maximum capacity, taking into account that patients are generally at their most vulnerable during an evacuation. Stairs should be of an anti-slip material or have strips of anti-slip material to prevent falls or accidents.

Evaluators should ensure that these areas are in good condition, clear of objects, and have railings or other measures that would make them safe to use in disaster situations.

Safety ratings for condition of staircases and ramps are: *Low = They are in poor condition, and would affect the facility's ability to function; Average = They are in average or poor condition, but their condition would not affect the facility's ability to function; Good = They are in good condition and would not affect the facility's ability to function.* [NOTE: If staircases or ramps are not present in the facility, leave boxes blank.]

52. Is flooring safe and in good condition?

Flooring can be of a variety of materials, including terrazzo, concrete, ceramic or clay tile, linoleum, wood, etc. It can be attached to the subfloor with adhesives, be laid over a membrane (such as a floating floor), or suspended.

The evaluator should inspect flooring to ensure that it is watertight, anti-skid, and free of cracks or loose sections, especially in critical and high traffic areas. There should be no uneven sections or depressions where people could trip or that would cause carts and equipment to tip over. In areas where suspended flooring is used, evaluators should ensure that it is attached to the structural slab and has horizontal bracing that can resist seismic loads.

Assess the condition of flooring to ensure that there are no cracks, uneven, or slippery areas that would increase vulnerability of the facility.

To reduce the incidence of hospital-acquired infections, seamless floor coverings are preferred in healthcare facilities.

Safety ratings for the condition and safety of flooring are: *Low = Flooring is in poor condition which could affect the facility's ability to function; Average = Flooring is in poor to average condition but it will not affect the facility's ability to function; Good = Flooring is in good condition and it will not affect the facility's ability to function.*

53. Are access routes to the facility in good condition?

Access is essential if the health facility is to function properly. Evaluators should determine the effectiveness of the hospital's security system in terms of vehicle and pedestrian access to the facility. They also need a detailed understanding of the main access routes to the facility. Interviews with employees, patients, and, where possible, people living near the facility, can provide information about the types of routes and at what times routes are most congested.

Evaluators should take note of trees and structures along the access routes that would block traffic if they fell. It is also important to review the condition of neighboring buildings: buildings in poor condition could collapse and block access to the facility. Alternative routes should be identified in case major access routes are obstructed. It is important to determine whether alternative routes are taken into account in the hospital's disaster preparedness plan. Evaluators should also note the presence and condition of storm drains that service the area, and determine whether storm runoff would flood certain routes, making them impassable.

Ascertain that access routes are free of obstacles (e.g., kiosks, street vendors, barriers); that there are no elements that could obstruct the routes (trees, utility poles, possible flooding, etc.); and that traffic lights are present to control traffic. Ensure that there are alternative access routes to the facility.

Safety ratings for the condition of access routes are: *Low = There is potential for damage that would block routes and impede access to the facility; Average = Damage would not impede access by pedestrians, but would prevent vehicle access; High = There is slight or no potential for damage which would affect access by pedestrians or vehicles.*

54. Does the facility have signs showing evacuation routes and are they understood by facility personnel?

Evaluators should ascertain that there are signs showing evacuation routes, both inside and outside the facility. They should also verify that security personnel understand these signs, since during a crisis they are responsible for directing and protecting everyone on the grounds of the facility.

Verify that the evacuation routes are marked by signs, and that personnel understand these signs.

Safety ratings for emergency signs are: *Low = There are no signs for evacuation; Average = Signs exist but they are not understood by personnel; High = Signs are in place and the personnel understand them.*

55. Are other architectural elements of the facility safe and in good condition?

For this point, the evaluator should inspect any other architectural elements that have not been considered in the above sections. For example, chimneys of incinerators should be in good technical condition, that is, be resistant to seismic or wind forces and have the stability required for their height. The evaluator should also consider whether there are signs that could fall and affect the facility or injure persons on the grounds of the health facility.

Determine whether there are other architectural elements whose condition or vulnerability might compromise the safety of the facility.

Safety ratings for architectural elements are: *Low = Damage to element(s) would affect the facility's capacity to function; Average = Damage to element(s) would not affect the facility's capacity to function; Good = There is no or minor potential for damage which would affect the facility's capacity to function.* [NOTE: If other architectural elements are not identified, leave boxes blank.]

Functional Aspects 4

Health care facilities are essential to providing health care in an effective, efficient, and timely manner. Providing treatment for the ill has technical, administrative, ethical, and legal implications which are present at all times and under all circumstances.

For a facility to remain safe and continue to function in an emergency situation, certain features that can make them especially vulnerable should be taken into account:

- They generally function 24 hours a day, without interruption;
- They accommodate a diverse public, including patients who need specialized care;
- Hazardous materials are found in the facilities;
- They depend on a network of basic services to function;
- Expensive equipment and other supplies are necessary to save patients' lives.

Health care facilities require a wide range of human, material, economic, and technological resources to function. These elements come together as a whole, and the structure sustains the processes which, in turn, support the outcomes. In this ensemble of resources, everything is linked, and what effects one element has implications on the whole facility and on treatment and care outcomes.

There have been cases where health care facilities have ceased to function even though the structure and other elements of the building were not affected. Functional collapse, which occurs not only as the result of adverse events, can be attributed to many things, from saturation of services to the lack of emergency preparedness.

Coordination between a health facility and other institutions in the health delivery network is essential if services are to be provided to populations in emergency situations. For these reasons, it is important to improve a facility's preparedness, taking into account the functional aspects described here.

Functional capacity of the health facility during and after a severe natural (or other) hazard event also depends on the technical and administrative organization of its personnel and how this affects their ability to respond to such situations. This chapter addresses the general organization of the facility's authorities, implementation of plans and programs,

availability of resources, the level of development and preparedness of its personnel, and the level of safety of the priority services needed for the facility to function. It is essential for the managers of the facility being assessed to provide the evaluators with their disaster plan and all relevant documentation.

This chapter addresses the most common aspects of functional vulnerability pertaining to the health facilities, emphasizing organizational details related with emergency and disaster preparedness. This refers primarily to the level of preparedness for major emergencies and disasters of the personnel in the facility, and to what degree the disaster plan has been implemented.[16]

4.1 Organization of the disaster committee

Evaluation of a facility's level of organization for responding to disasters begins with an assessment of the disaster committee.

The functional organization of the committee defines levels of authority, roles, and responsibilities within a facility, so that activities are in line with the institution's goals and efforts are not duplicated. The committee must promote collaboration between individuals in the group and improve the efficiency and effectiveness of communication.

The disaster committee defines the processes and strategies that are put into practice in major emergencies and disasters and outlines the methods for carrying out actions efficiently (for example, by using action cards).

56. Is there a committee for emergencies and disasters in the facility?

Someone must be responsible for any activity carried out in the facility. Given the importance of emergencies and disasters, all units, services, and employees should be involved in appropriate response, and a disaster committee should be in place to ensure that response is carried out in an orderly manner.

Depending on the structure of the emergency and disaster plan and the type of health facility, a committee should be established that is responsible for developing and implementing disaster response activities. The director/administrator of the facility should coordinate the committee, and representatives from the critical services and administrative divisions should be on the committee. Some of the committee's responsibilities, besides executing the emergency plan, are to update and promote the disaster plan, carry out simulations, sup-

16. See Pan American Health Organization. *Hospital safety index: guide for evaluators*, PAHO: Washington, D.C., 2008.

port the safety evaluation of the facility, issue warnings about possible events, assemble employees as necessary for specific activities, design and develop training sessions, manage the provision of supplies, etc.

Evaluators should confirm that personnel from different categories and specialties are represented on the committee, for example, the director of the facility, chief engineer, chief of nursing, chief of maintenance, head of the emergency department, medical director, chief of surgery (if such a position exists at the facility), chief of the laboratory, chief of support services, among others.

Evaluators should obtain a copy of the committee's terms of reference and verify that the list of members and signatures correspond to current personnel, and that the committee is multidisciplinary.

Safety ratings for composition of the disaster committee: *Low = Committee does not exist or there is no documentation on the committee; Average = Committee exists with three or less disciplines represented, but it is not functioning; High = Committee exists with four or more disciplines represented, and is functioning.*

57. Is each member of the disaster committee aware of his/her specific responsibilities?

Evaluators will verify that members' assigned responsibilities are in writing, and there are descriptions of their specific roles.

Safety ratings for assignment of disaster committee roles are: *Low = Responsibilities have not been assigned or these responsibilities are not documented; Average = Responsibilities have been officially assigned but members are not familiar with them and/or they have not been implemented; High = All members know and meet the terms of their assigned responsibilities.*

58. Has a space been designated and equipped for the facility's Emergency Operations Center (EOC)?

Evaluators will verify that a room has been designated for activities related to decision making during an emergency or disaster. This will include meetings of the disaster committee, gathering and processing information, etc. Important information regarding the area

should be available in the EOC, including epidemiological background of the area, risk maps, disaster history for the area, information about contacts, the structure of the health delivery network, forms for damage and needs assessment, etc.

The EOC must be located in an accessible, protected and secure area, and all means of communication should be installed (telephone, fax, internet, etc.) as well as necessary furnishings.

Evaluators must confirm that there is a designated room to be used for the EOC, that it is located in a safe area of the facility (this should be corroborated by a structural engineer), and that necessary information is available.

Safety ratings for designation of space for the facility's Emergency Operations Center are: *Low = A space has not been designated for the emergency operations center or it cannot be verified; Average = A space has been designated but it is not in a secure area, it is not properly equipped, or important documentation is not available; High = A space has been designated in a secure area, it is properly equipped, and important documentation is readily available.*

59. Is an updated telephone directory of authorities (internal and external) and other contacts available?

Evaluators should ensure that there are directories with the names, positions, and contact information for responsible parties in the facility. Directories should also include contact information for local authorities who can provide additional assistance in disaster situations (e.g., police, fire department, water and power authorities, etc.). Evaluators should randomly check telephone numbers.

The directory should be reviewed with staff to ensure that it includes the names, positions, and permanent telephone numbers of responsible parties as well as support services needed in an emergency.

Safety ratings for availability of directory or authorities are: *Low =Directory does not exist or is not available for inspection; Average = Directory exists but it is not updated, committee members are not familiar with it, or it only contains contact information for facility staff; High = Directory of internal and external authorities exists, it is updated, and committee members are familiar with it.*

60. Are action cards available for all facility personnel?

Evaluators should check that action cards describe the assigned duties of each facility staff member in the context of a disaster. It is advisable to randomly ask staff members about the contents of cards assigned to them.

Safety ratings regarding availability of actions cards are: *Low = Action cards do not exist or they are not available for inspection; Average = There are not enough cards, they are of low quality, and/or personnel are not familiar with them; High = All staff members have cards and know their contents.*

4.2 Operational plan for internal and external disasters

The health facility's disaster plan should accomplish the following:

- Take into account previously identified hazards;
- Establish cooperation with other services and institutions;
- Address referral and counter-referral of patients (to and from other facilities);
- Consider technical and logistical support that is appropriate for the type of organization and complexity of the facility;
- Integrate the health facility's plan with the community disaster plan.

The purpose of the disaster plan is to identify measures that should be put into practice before, during, and after a disaster so that essential health facility services continue to function.

61. Does the facility have an emergency and disaster plan?

After identifying hazards, it is important that the entire health delivery network prepare a plan for taking action in the case of emergency or disaster. Generally all facilities have a plan, but it is not enough for the plan to exist: it must be updated, adapted, and distributed among all health facility employees.

The plan must be tested through simulation exercises and drills that include personnel from the entire facility as well as with other facilities that make up the health services network.

Evaluators should ascertain that a plan exists, that it has been updated, it is operational, and that health facility personnel are familiar with it.

Safety ratings for existence of disaster plan are: *Low = The plan does not exist or a document is not available; Average = The plan exists but it is not operational, and/or it is not updated, and/or it has not been distributed, and/or it has not been used in simulation exercises. High = The plan exists, it is operational, it is updated, it has been distributed, and it has been used in simulation exercises.*

62. Does the emergency and disaster plan address both internal and external emergencies?

The evaluator should ascertain that the plan addresses the possibility of both internal and external events, and that the facility has estimated the number of victims that could present in the case of an emergency or disaster. In general, internal events affect the facility so the plan must address how the facility will be organized so that it can continue to deliver health services. External events involve the treatment of mass casualties, so the disaster plan must address the need for space and supplies, actions of personnel, and the patient referral system.

Evaluators should ensure that the disaster plan addresses the possibility of both internal and external events.

Safety ratings for addressing internal and external emergencies in the disaster plan are: *Low = The plan does not address either or there is no supporting documentation; Average = The plan addresses only internal emergencies or only external emergencies; High = The plan addresses both internal and external emergencies.*

63. Does the plan identify specific actions that will strengthen essential services in the facility?

Evaluators should verify that the plan specifies actions to be taken before, during, and after a disaster to strengthen the treatment capacity of the facility's critical services (emergency room, surgery department, among others). The disaster plan should specify the type of actions that will be taken.

Safety ratings for actions to strengthen essential services are: *Low = Actions are not included or are addressed only in document; Average = Actions are included and but are only partially implemented; High = Actions are included and have been completely implemented.*

64. Does the plan specify procedures for activating and deactivating the plan and are personnel familiar with procedures?

Evaluators should review procedures for activating and deactivating the disaster response plan. In particular, they should ascertain:

- The type of signal used and the criteria used for activating the plan,
- That the director of the health facility is responsible for activating the plan, and
- Whether activation is requested directly by civil defense and public safety agencies, a central agency responsible for medical emergencies, or others.

Safety ratings for procedures in plan to activate and deactivate the plan are: *Low = Procedures are not addressed or are addressed only in a document; Average = Procedures are included in the plan, but personnel have not been trained; High = Procedures are included and personnel are familiar with them.*

65. Does the plan address special administrative procedures for disasters?

Evaluators should verify that the plan includes specific procedures for staffing personnel in essential services for the first 72 hours after an event, how procurements will be handled, and necessary logistics for executing the plan.

The plan must address measures to ensure the well-being of staff during the emergency, including where they will rest and provision of drink and food. The disaster plan (when it refers to region-wide events such as hurricanes and earthquakes) should take into account the real possibility that several of the facility's personnel would be unable or unwilling to report for duty at the healthcare facility because their domestic situations would be in disarray.

Safety ratings for special administrative procedures in disaster plan are: *Low = Procedures are not addressed or are addressed only in document; Average = Procedures are included in plan, but process is very slow; High = Procedures are included and personnel are familiar with how to implement them.*

66. Have funds been specifically allocated to carry out the disaster plan?

It is important to verify that funds specifically for emergencies have been allocated and guaranteed. This budget should be consistent with activities outlined by the facility's disaster committee. While financing for public health facilities is limited and generally directed to immediate needs, it is critical that funds be permanently assigned for emergency and disaster preparedness.

Evaluators should confirm the following:

- The budget is sufficient to implement measures outlined in the plan;
- Cash is available for immediate purchases, and there is a list of suppliers who will extend credit to the facility;
- Additional financial resources are calculated annually for emergencies based on local vulnerability, potential hazards for the health facility, and prior experience with disasters.

Safety ratings for funds budgeted for emergency and disaster preparedness and response are: *Low = Funds have not been budgeted or there is no documentation showing budget; Average = Budget exists but it guarantees funds only for disaster and emergency preparedness activities or only for disaster and emergency response activities; High = Funds are budgeted for both disaster and emergency preparedness and response activities.*

67. Are procedures in place for expanding space when needed for emergencies and/or expanding space for critical services?

Evaluators should confirm that the plan identifies physical spaces that can be equipped to treat an influx of mass casualties, taking into account the provision of lifelines (water, power, sanitation, etc.), logistics, and necessary staffing.

Safety ratings for plans for expansion of space during emergencies are: *Low = Space for expansion has not been identified or there is no documentation regarding expansion; Average = Space has been identified and personnel have been trained to carry out the expansion, but there are no resources to carry out expansion; High = Procedures exist, personnel have been trained, and resources are in place to carry out expansion of space.*

68. Does the plan include procedures for admitting patients to the emergency unit, including forms and protocols for treating mass casualties?

Evaluators must confirm that the facility has measures in place to deal with an emergency or disaster involving a massive influx of victims to health centers. A variety of processes related to mass casualties are needed to avoid incorrect classifications or interpretations of triage, duplicated registrations, erroneous information, missing information about treatments already undertaken, etc. Protocols for treating mass casualties simplify the organization of tasks and, therefore, improve quality of treatment and patient outcomes. Assigning responsibilities to the facility's health care staff will ease the process from the moment that casualties begin to arrive at the facility.

Safety ratings for preparedness for mass casualties are: *Low = Procedures are not in place or there is no relevant documentation; Average = Procedures are in place, but only forms are available or only protocols available; High = Procedures are in place and both forms and protocols are available.*

69. Are procedures in place for triage, resuscitation, stabilization, and treatment?

According to the type of facility, evaluators should confirm that procedures have been defined, that staff have been trained, that equipment is available, and that personnel have action cards for triage, resuscitation, stabilization, and treatment of victims.

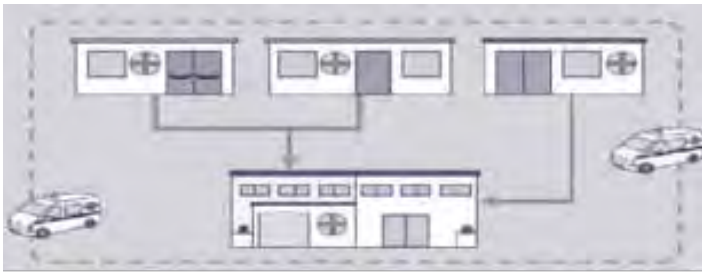
Safety ratings for triage, resuscitation, stabilization, and treatment are: *Low = Procedures have not been defined or there is no documentation on procedures; Average = Procedures are defined and personnel have been trained, but there are no resources to implement procedures; High = Procedures exist, personnel have been trained, and resources are in place to implement them.*

70. Does the plan address transport of patients and logistical support?

Evaluators should verify that the facility has vehicles available (owned by the facility or from other sources) as well as logistical support for patient transport.

Safety ratings for patient transport and logistical support are: *Low = Vehicles for patient transport and logistical support are not available or there is no relevant documentation; Average = There are insufficient vehicles and insufficient logistical support; High = Sufficient vehicles and logistical support are available.*

71. Is coordination in place with other facilities in the local health services network and with entities providing prehospital emergency care?



For good health sector response to disasters, institutional plans must include coordination among public and private agencies and agencies that provide rescue and prehospital emergency care, under the coordination of the local health sector authority. Facilities must be able to function jointly as a health delivery network. In this context, less complex health facilities should coordinate very closely with the closest hospital, and the service network should address how to assist remote communities.

No health facility, however large and complex, will be able to offer all services, and treatment capacity might be limited as a result of a major emergency or disaster. For this reason, coordination within the health services network, together with a very strong classification and distribution of patients, will optimize the existing health network in a region, as well as making additional staff available, when necessary.

Evaluators should confirm that there are written protocols for this coordination and that facility personnel confirm that coordination is in place.

Safety ratings for health network coordination plans in disaster situations are: *Low = Coordination plan is absent or there is no documentation that demonstrates coordination; Average = There is communication in the network, but there are no established procedures or protocols for disaster or emergency response; High = There is communication and coordination with other facilities in the health services network, and procedures and protocols are in place for disaster response.*

72. Is the health facility's disaster response plan linked to the local emergency response plan?

To provide coordinated response in emergency situations, organization at the local level (i.e., municipality, region, or district) must be linked with that of health facilities of the relevant jurisdiction, taking into account both their resources and limitations. This linkage allows for unified efforts and optimization of resources with the aim of serving the affected population. Examples of this would include the role of health units with respect to

emergency shelters set up by the municipality, or use of municipal vehicles for transporting patients. This coordination must be documented in a written agreement for parties involved.

Safety ratings for linkage between health facility and local emergency response plans are: *Low = The plans are not linked or there is no documentation that demonstrates linkage; Average = Plans are linked but not operational; High = Plans are linked and operational.*

73. Does the disaster plan address specific procedures for referral of patients?

The health facility's disaster plan should include mechanisms for registering admissions and referrals of patients. These include specific procedures for the transfer and reception of patients to and from other health facilities inside and outside of the geographical area where the facility is located.

Evaluators should ascertain whether there are specific procedures that include mechanisms for registering and referral of patients.

Safety ratings for registration and referral of patients are: *Low = Procedures do not exist or there is no documentation on the procedures; Average = Procedures exist but only on paper; High = Procedures are documented and personnel have been trained in process.*

74. Does the plan include procedures for communicating with the public and media?

The disaster plan must specify who is responsible for communicating with the public and media in case of disaster. Generally, this is the person who is highest in the chain of command at the time of the event.

Safety ratings for communication with public and media are: *Low = Procedures do not exist or there is no documentation that demonstrates procedures; Average = Procedures exist but personnel have not been trained; High = Procedures exist and personnel have been trained.*

75. What procedures are in place for disaster response during evening, weekend, and holiday shifts?

Addressing staffing for disaster response during evening, weekend, and holiday shifts is especially important in facilities that do not provide 24-hour services.

Depending on the role of the facility in the health delivery network, evaluators should ascertain whether there are procedures for staffing in case of emergencies and disasters.

The disaster plan (when it refers to region-wide events such as hurricanes and earthquakes) should take into account the real possibility that several of the facility's personnel would be unable or unwilling to report for duty at the healthcare facility because their domestic situations would be in disarray.

Safety ratings for staffing procedures during emergencies or disasters are: *Low = Procedures do not exist or there is no documentation that demonstrates procedures; Average = Procedures are in place but personnel have not been informed; High = Procedures are in place and personnel are aware of procedures.*

76. Does the disaster plan address procedures for both internal and external evacuation of the facility?

While the aim of this material is to avoid situations that demand evacuation of a health facility, events might require moving patients and workers from one part of the facility to another, or outside of the facility. Fires, leaks of hazardous materials, structural failure, among other causes, may demand the rapid and orderly relocation of patients and staff. Signs must indicate evacuation routes and hallways, and exits must be clear and capable of handling evacuations at all times. Once the danger has passed, the disaster plan should address the return of patients and staff to the facility.

Evaluators should ascertain if the plan includes evacuation procedures for occupants of the facility.

Safety ratings for evacuation procedures are: *Low = Procedures do not exist or there is no documentation for procedures; Average = Procedures are in place but personnel have not been trained, and/or evacuation routes are not adequate; High = Procedures are in place, personnel have been trained, and evacuation routes are clearly marked and unobstructed.*

77. Are health personnel prepared to act in disaster situations?

It is important to design a training plan for the facility's staff that includes, among others, the following topics: knowledge of the facility's disaster plan, treatment of mass casualties, vulnerability of the facility, mental health care, information management, damage assessment, fire prevention and suppression, etc.

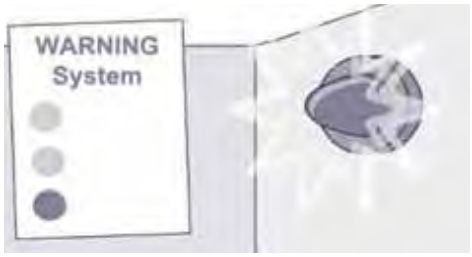
An emergency medical team trained in treating mass casualties must be able to rapidly organize the arrival of large numbers of victims. An administration team must

be prepared to provide for a variety of immediate needs such as expanding treatment areas, procurement of supplies, etc. None of this will be possible without a training program that addresses the different phases of an emergency or disaster.

Evaluators should confirm that there is an ongoing training program. It is advisable to corroborate the level of training directly with staff.

Safety ratings for staff training in disaster prepared are: *Low = Personnel are not trained or there is no training program; Average = There is sporadic training but less than half of the staff is trained; High = There is an ongoing training program and more than 85% of personnel are trained.*

78. Does the facility have an emergency warning system and are personnel trained in the system?



Emergency warnings are used to launch specific actions to address a given situation. In the health sector they are generally identified by colors that advance from green to red. Knowledge of the system will allow each member of staff to know what to do in a given event.

Evaluators should confirm that the facility has an emergency warning system and that staff have been trained to respond appropriately.

Safety ratings for facility emergency warning system are: *Low = Emergency warning system does not exist or there is no documentation for system; Average = Emergency warning system is in place but personnel have not been trained in system; High = Emergency warning system is in place and personnel have been trained in how to respond.*

79. Does the facility have an alarm system and have staff been trained in how to respond?

Alarms are a broadcast signal indicating the need for immediate actions such as evacuation, moving patients and staff, suspension of activities, failure of electrical systems, etc. The ability to identify different alarms and their meaning allows an appropriate response.

Emergency and disaster plans should include the codes for alarms for different situations, so that each person will know exactly how to proceed.

Evaluators should confirm that the facility has an alarm system in place and that all staff in the facility are trained to respond.

Safety ratings for the facility alarm system are: *Low = Alarm system does not exist or there is no documentation about system; Average = Alarm system is in place but personnel have not been trained in system; High = Alarm system is in place and personnel have been trained in how to respond.*

80. Has the facility carried out emergency simulation exercises and drills in the last year?

There should be regular emergency simulations and drills as a part of staff training in the health facility. These are fundamental for the personnel to practice assigned responsibilities and to adapt the disaster plan where necessary.

Simulations and drills should follow specific scripts for different kinds of emergencies and all staff must participate. The exercises must be followed by an evaluation process that analyzes items that need improvement in the plan and in the actions of each department. The expectation is not for simulations to always be successful: the aim is to find weaknesses in order to improve them.

Evaluators should confirm that simulation exercises and drills are conducted and their frequency.

Safety ratings for emergency simulation exercises and drills are: *Low = Emergency simulation exercises do not take place or there is no documentation about exercises; Average = Emergency simulations are carried out, but not each year; High = Emergency simulations are carried out at least once each year and the plan is updated according to the outcome of the exercises.*

4.3 Emergency plans for medical treatment in disasters

81. Are contingency plans in place for medical treatment in different types of events?

Contingency or emergency plans include specific actions that must be taken to deal with different events that can affect a health facility. Among others, these might include rationing of water or power, general strike among health workers, flooding, or a massive influx of patients.

Contingency plans allow a facility to determine responsibilities and tasks that will guarantee continuity in services and medical treatment. Depending on the hazards, evaluators should determine whether there are plans for natural hazards such as earthquakes, tsunamis, hurricanes, etc. The evaluators must also confirm that personnel know how to perform in these situations and whether the facility has necessary resources to carry out the plan.

Depending on the type of event, evaluators should confirm that specific plans are in place, that they are updated, that staff has been trained for specific contingencies, and that the facility has the resources to implement the actions.

Safety ratings for contingency planning are: *Low = Contingency plans do not exist or they exist only on paper; Average = Contingency plans are in place but they are not updated and/or personnel have not been trained; High = Contingency plans are in place, they are updated, personnel have been trained, and there are resources to implement them.*

4.4 Plans for preventative maintenance and repair of critical services

Evaluators should assess whether the preventative maintenance that is needed is being provided for each of the lifeline or critical systems of the facilities, as outlined below. They should ascertain that maintenance plans are accessible and up to date, that maintenance is being carried out, that specific personnel are assigned and trained for this purpose, that they have the necessary tools, and the facility has a specific budget for maintenance and repair.

82. Is there a maintenance plan for the facility's electrical system?

The evaluators should verify that the maintenance plan for the electrical system is in place and should review the maintenance log. They should ensure that personnel are assigned to and trained in maintenance, that appropriate tools are available, and that funds are budgeted for maintaining the system.

In addition to regular maintenance, the plan should address testing of alternative sources of available power (generators, batteries, power inverters, etc.).

Records should be kept and available for inspection of the periodic checking of the safety of the electrical circuitry of the facility.

Safety ratings for the electrical system maintenance plan are: *Low = The plan does not exist, or the plan is only on paper; Average = The plan exists but personnel are not assigned to and/or not trained in maintenance, and/or appropriate tools are lacking, and/or funds have not been budgeted for maintenance; High = The plan exists, personnel are assigned to and trained*

in maintenance, appropriate tools are available, and funds have been budgeted for maintenance activities.

83. Is there a maintenance plan for the facility's drinking water supply system?

The maintenance department should provide evaluators with the operations manual for the drinking water supply system as well as logs showing preventative maintenance and water quality control activities.

The evaluators ensure that personnel are assigned to and trained in maintenance, that appropriate tools are available, and that funds are budgeted for ongoing maintenance.

Safety ratings for the water supply system maintenance plan are: *Low = The plan does not exist, or the plan is only on paper; Average = The plan exists but personnel are not assigned to and/or not trained in maintenance, and/or appropriate tools are lacking, and/or funds have not been budgeted for maintenance; High = The plan exists, personnel are assigned to and trained in maintenance, appropriate tools are available, and funds have been budgeted for maintenance activities.*

84. Is there a maintenance plan for the facility's communications system?

It is important to review the standards and procedures for maintaining the communications system in emergencies and disasters.

The evaluators should verify that the maintenance plan is in place and review the maintenance log. They should ensure that personnel are assigned to and trained in maintenance of the system, that appropriate tools are available, and that funds are budgeted for ongoing maintenance.

Safety ratings for maintenance plan for the facility's communications system are: *Low = The plan does not exist, or the plan is only on paper; Average = The plan exists but personnel are not assigned to and/or not trained in maintenance, and/or appropriate tools are lacking, and/or funds have not been budgeted for maintenance; High = The plan exists, personnel are assigned to and trained in maintenance, appropriate tools are available, and funds have been budgeted for maintenance activities.*

85. Is there a maintenance plan for the facility's wastewater system?

The maintenance department should demonstrate that the facility's wastewater drains into the public sewerage system and that measures are in place to prevent contamination of other water systems.

The evaluators should verify that the maintenance plan is in place and review the maintenance log. They should ensure that personnel are assigned to and trained in maintenance, that appropriate tools are available, and that funds are budgeted for ongoing maintenance.

Safety ratings for maintenance plan for the facility's wastewater system are: *Low = The plan does not exist, or the plan is only on paper; Average = The plan exists but personnel are not assigned to and/or not trained in maintenance, and/or appropriate tools are lacking, and/or funds have not been budgeted for maintenance; High = The plan exists, personnel are assigned to and trained in maintenance, appropriate tools are available, and funds have been budgeted for maintenance activities.*

86. Does the facility have a maintenance plan for its fire protection system?

In addition to ensuring that a maintenance plan is in place for maintaining the fire protection/suppression system, evaluators should verify that:

- Training manuals are available for managing the fire protection/suppression system;
- There is a preventative maintenance log for equipment (extinguishers, hydrants);
- Equipment is where it should be, it is functional, and is easily accessible;
- Personnel are trained and fire drills are carried out; and
- Activities assigned to the fire control and mitigation team are carried out as stated in the plan.

The evaluators should ensure that personnel are assigned to and trained in maintenance, that appropriate tools are available, and that funds are budgeted for ongoing maintenance.

Safety ratings for maintenance plan for the facility's fire protection system are: *Low = The plan does not exist, or the plan is only on paper; Average = The plan exists but personnel are not assigned to and/or not trained, and/or appropriate tools are lacking, and/or funds have not been budgeted for maintenance; High = The plan exists, personnel are assigned to and trained in maintenance, appropriate tools are available, and funds have been budgeted for maintenance activities.*

4.5 Availability of medications, supplies, instruments, and equipment for disaster situations

Evaluators should cross-check the list of available supplies with those that are essential in emergencies.

87. Are there reserves of medications available for emergency response?

Evaluators should verify the availability of medicines for emergencies. The World Health Organization (WHO) list of essential drugs can be used as a reference.

Safety rating for medication supplies for an emergency are: *Low = There is no reserve or there is no documentation demonstrating reserve; Average = Medication reserves are sufficient only for daily, conventional use; High = There are sufficient reserves for emergency response.*

88. Does the facility have reserves of supplies and treatment materials for emergency response?

Depending on the role of the facility in the local health delivery system, it should be prepared to provide medical supplies for mass casualty treatment. This can be accomplished by maintaining a reserve of supplies or by having established procedures to procure them immediately. It is important to ensure that these supplies are stored in a safe location and that they are regularly restocked. If that is not feasible, arrangements should be made with suppliers who can make supplies available when they are needed.

Evaluators should ascertain whether the facility has supplies in reserve or if arrangements are in place to procure them in an emergency.

Safety ratings for emergency supply reserves are: *Low = There are no reserves or there is no documentation regarding emergency supplies; Average = Reserves are adequate only for regular, daily use; High = Reserves are in place for emergency response.*

89. Does the facility have instruments needed for emergency response?

Evaluators should verify the reserves and maintenance of specific instruments used for response to emergencies and disasters.

Safety ratings for instruments used in emergency and disaster response are: *Low = There are no reserves or there is no documentation regarding instruments; Average = Reserves are adequate only for regular, daily use; High = Reserves are in place for emergency response.*

90. Does the facility have life support equipment?

Depending on the facility's level of complexity, evaluators should ascertain the presence, location, number, and conditions of life support equipment for critical patients.

Safety ratings for life support equipment are: *Low = The facility does not have this equipment; Average = Equipment is available but there is only enough for regular, daily use; High = Facility has sufficient equipment for use in an emergency or disaster.*

91. Does the facility have personal protection equipment for epidemics (disposable)?

Evaluators should check the facility's reserves of disposable personal protection equipment for staff working in areas of initial contact and treatment.

Safety ratings for personal protection equipment are: *Low = The facility does not have this equipment or there is no relevant documentation; Average = Equipment reserves are only sufficient for regular, daily use; High = Facility has sufficient equipment for use in an emergency or disaster.*

92. Are the facility's storage areas and warehouses protected from effects of earthquakes, flooding, fire, and strong winds?

Storage areas and warehouse where emergency supplies are kept must be protected from different hazards. It is common for storage areas to be located on the lower floors of a facility or in locations outside of the main building, and disaster mitigation measures are frequently overlooked for these areas. Damage to or loss of these supplies will limit the effectiveness of emergency or disaster response efforts.

Evaluators should ensure that storage areas are protected from the effects of earthquakes, flooding, fire, and strong winds, and that supplies are protected.

Safety ratings for safety of storage areas are: *Low = Storage areas are not protected from hazards; Average = Only half of storage areas are protected; High = Storage areas are well protected.*

93. Are supplies and equipment protected from hazards?

Evaluators should ensure that shelves located in critical areas of the facility are connected firmly to the walls or have safety fastenings, and that they have lips or railings that prevent containers and other objects from falling. Shelving units should be attached to each other, especially in seismic areas. Rows of high, free-standing shelves must be anchored to the floor, connected to each other at the top by ties that cross the room, and attached to the wall at either end of the row of shelves. Connecting the shelves increases lateral stability, lessening the chance that they will fall.

Shelving that stores sterilized equipment and materials must be safely anchored so that equipment does not fall and sterilization is not compromised if, for example, a seismic event causes sudden shaking.

Evaluators should ensure that the fire protection equipment is located near exits of critical areas, as required by the types of materials kept in these areas. They should also inspect the location of and the materials used for windows and doors that would be vulnerable to hazards, as well as the proximity of potentially vulnerable supplies and equipment to doors and windows.

Evaluators should ensure that supplies and equipment are not exposed to the effects of floods, earthquakes, and other hazards, and that fire protection equipment is in place.

Safety ratings for protection of equipment and supplies are: *Low = 20% or less of supplies and equipment are protected from being damaged should shelving collapse or overturn; Average = 20% to 80% of supplies and equipment are protected from being damaged should shelving collapse or overturn; High = More than 80% of supplies and equipment are protected because shelves are stable, contents are secured, and/or shelf bracing is not needed.*

Annex 1

Form 1

General information about the health facility

(This must be completed by the health facility, preferably by the disaster committee of the facility being evaluated.)

Notice:

This version of the form is for reference only. To complete the evaluation and provide necessary information, print Annex 1 from the *Forms for the evaluation of small and medium-sized facilities* document.

1. **Facility Name**: .....

2. **Address**: .....

3. **Phone** (include city code): .....

4. **E-mail**: .....

5. **Total number of beds** (if not applicable put "0"): .....

6. **Bed occupancy rate in normal situations** (if applicable): .....

7. **Description of the institution** (general features, institution to which it belongs, type of facility, position in the network of health services, type of structure, population served, area of influence, service and administrative personnel, etc.):

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8. **Physical Distribution**: List and briefly describe the main buildings in the facility. Provide a diagram in the box below showing physical distribution of the services and the facility's surroundings. Use additional pages, if necessary.

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9. **Capacity of the health facility**: Health facility capacity: Indicate the total number of beds and the capacity to expand service in emergencies, according to the facility's organization (by department or specialized services).

Department or Service	Number of beds	Additional capacity	Remarks
Emergency			
Pediatrics			
General Medicine			
Gynecology/Obstetrics			
Others (Specify)			
Total			

If the facility does not have patient beds, insert "0" for number of beds, but indicate whether it is possible to accommodate cots or stretchers for patient observation.

10. **Areas that can be used to increase functional capacity**: Indicate the features of areas and spaces that can be used to increase the facility's capacity in case of an emergency or disaster. Specify square meters, available services and any other information that can be used to evaluate its suitability for emergency medical services.

Location	Area (m^2)	Water		Power		Telephone		Remarks
		Yes	No	Yes	No	Yes	No	

Note: Specify how each space can be adapted for different uses (for example, patient care, triage, outpatient care, observation, etc.).

11. **Additional information**:

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Annex 2

Form 2

Checklist for evaluation of the safety level of the health facility

Notice:

The evaluation team leader should distribute a copy of the checklist to each evaluator. Do not use the following version (Annex 2), which only serves as a reference tool. To complete the checklist and provide necessary information, print Annex 2 from the *Forms for the evaluation of small and medium-sized facilities* document.

1. Hazard levels as determined by geographic location of the health facility (mark appropriate box with an "X").

1.1 Hazards (Consult hazard maps)	Hazard level				Comments
	No Hazard	Hazard level			
		Low	Average	High	
1.1.1 Geological phenomena					
Earthquakes Using the geologic analysis of the soil and history of earthquakes in the area, identify the hazard level of the facility to earthquakes.	☐	☐	☐	☐	
Volcanic eruptions Based on the history of similar events in the area, proximity to volcanoes, and volcanic activity, identify the hazard level of the facility to lava, pyroclastic flows, and ash fall.	☐	☐	☐	☐	
Landslides Based on inspections of the facility's surroundings, prior events, and information from the hazard map, identify the hazard level of the facility to instable slopes in the area.	☐	☐	☐	☐	
Tsunamis Refer to hazard maps and prior events in the area to determine the hazard level of the facility to tsunamis.	☐	☐	☐	☐	
1.1.2 Hydrometeorological phenomena					
Hurricanes Based on the history of hurricanes in the area and using available wind hazard maps, indicate the hazard level for the facility to hurricanes.	☐	☐	☐	☐	
Torrential rains Based on the history of such events and available hazard maps, rate the hazard level for flooding due to intensive rainfall for the facility.	☐	☐	☐	☐	
Storm surge or river flooding Based on previous events that did or did not cause flooding in or around the facility, rate the facility's level of exposure to storm surge or river flooding.	☐	☐	☐	☐	
Landslides Refer to geological maps and inspections of the facility's surroundings to rate its level of exposure to landslides caused by saturated soil.	☐	☐	☐	☐	

1.1.3 Social phenomena					
Population density Rate the facility's exposure to hazard as influenced by the type of population it serves, its proximity to major population concentrations, and prior events that have affected the facility.	☐	☐	☐	☐	
Displaced populations Based on information collected, rate the facility's exposure to hazard in terms of people who have been displaced as a result of war, socio-political circumstances, or due to population migrations.	☐	☐	☐	☐	
Others (specify) If other social phenomena affect the safety of the facility (such as workers' strikes, protests, proximity to high security prison, etc.), specify them and rate the level of hazard for the facility.	☐	☐	☐	☐	
1.1.4 Environmental health phenomena					
Epidemics With reference to any past incidents at the facility and specific pathogens, rate the facility's exposure to hazards related to epidemics.	☐	☐	☐	☐	
Contamination (systems) With reference to any past incidents involving contamination, rate the facility's exposure to hazards from contamination of its systems.	☐	☐	☐	☐	
Infestations With reference to the location and past incidents at the facility, rate the facility's exposure to hazards from infestations (flies, fleas, rodents, etc.).	☐	☐	☐	☐	
Others (specify) With reference to any past incidents at the facility, specify and rate the hazard of any other environmental phenomena not included above.	☐	☐	☐	☐	
1.1.5 Chemical and/or technological phenomena					
Explosions After inspecting the facility's surroundings, reviewing any prior events, and consulting a variety of sources, rate the facility's exposure to explosion hazards.	☐	☐	☐	☐	
Fires After inspecting the facility's surroundings, reviewing any prior events, and consulting a variety of sources, rate the facility's exposure to fire hazards.	☐	☐	☐	☐	

Hazardous material spills/leaks Rate the facility's exposure to hazardous material spills or leaks after inspecting the facility's surroundings, reviewing any prior events, and consulting a variety of sources. Take into account both storage and transport routes for hazardous materials.	☐	☐	☐	☐	
Others (specify) Indicate the hazard level of other chemical or technological hazards in the area where the facility is located.	☐	☐	☐	☐	
1.2 Geotechnical properties of soils					
Liquefaction Refer to the geotechnical soil analysis and other evidence from the area to rate the facility's level of exposure to hazards from saturated and loose subsoil.	☐	☐	☐	☐	
Clay soils Refer to soil maps and evidence from buildings at the site to rate the facility's exposure to hazards from sensitive or soft clay soils.	☐	☐	☐	☐	
Unstable slopes Refer to geologic maps and evidence from the area to rate the facility's exposure to hazards from the presence of unstable slopes.	☐	☐	☐	☐	

Comments about Section 1. The evaluator should use the space below to comment on the results of this section, and provide his/her name and signature.

.....

Name of evaluator(s) .....

Signature of evaluator .....

2. Safety level as determined by structural aspects of the health care facility (mark the corresponding safety level with an "X")

2.1 Prior events affecting safety of the health facility	Safety level			Comments
	Low	Average	High	
1. Has there been prior structural damage to the facility? Determine whether structural reports indicate that the level of safety has been compromised and at what level. If there are no reports, determine whether there are cracks, evidence of settling, or structural changes as the result of a prior adverse event (see section 2.1.1 of Guide). *If no damage has occurred, leave the boxes blank. Low = Major damage; Average = Moderate damage; High =Minor damage.*	☐	☐	☐	
2. Was the facility built, remodeled, and/or repaired in a way that will affect the behavior of the structure? Determine what changes have been made that could affect structural integrity of the facility. *Low = There is evidence of poorly executed modifications (for example, elimination of load-bearing wall, insertion of walls, construction that is too close to existing building, unreinforced window opening, etc.); Average = Evidence of moderate modifications (for example, small opening for windows or doors); High = Minor remodeling or modifications of good quality (for example, placement of columns and/or beams) or no adaptations have been necessary.*	☐	☐	☐	
2.2 Safety of structural elements and construction materials used				
3. What is the condition of the building? Inspect for missing concrete cover, cracks, or evidence of settling. *Low = Deterioration caused by weathering, cracks present in areas of special concern (depending on type of construction material), or evidence that settling has occurred; Average = Two of three conditions are present (deterioration and/or cracks and/or weathering and/or settling); High = Good; no evidence of deterioration, cracks, or settling.*	☐	☐	☐	
4. What is the condition of construction materials used for the building? Determine whether construction materials for elements that are in poor condition affect the structural integrity of the building. *Low = Rusting reinforcement in concrete with large cracks; sections of construction material lost; diagonal cracking in walls; visible deformation in steel, wood, or concrete elements; missing elements at connections; Average = Small cracks or evidence of rusting reinforcement; beginning of diagonal cracks in wall; missing elements in connections of steel and wood structures; High = Fine or no cracks; no rust apparent in concrete; minimal cracking in walls; no visible deformation in steel and wood elements. (This section depends on the experienced judgment of a structural engineer.)*	☐	☐	☐	

5. How do nonstructural elements interact with the structure? Determine whether there are unsafe interactions, such as: window placement that produces short columns; rigid piping that crosses expansion joints; weight affecting a structural element of the building (for example, a water tank on the roof), etc. *Low = Two or more instances of the examples mentioned above (or others) have been identified; Average = Only one instance of the examples mentioned above (or others) have been identified; High = There are no instances of the examples mentioned above (or others).*	☐	☐	☐	
6. Are buildings attached or very close to each other? Assess the distance between the main building of the facility and adjacent buildings. *Low = There is almost no separation between buildings or separation is less than 0.5% of the height of the shorter of two adjacent buildings; Average = Separation is between 0.5% and 1.5% of the height of the shorter of two adjacent buildings; High = Separation is more than 1.5% of the height of the shorter of two adjacent buildings.*	☐	☐	☐	
7. Is there structural redundancy in the facility? Take into account portal frames, load-bearing walls, and column-beam connections, among other elements, when determining the lines of resistance to lateral forces in the structure. *Low = Fewer than three lines of resistance in each direction; Average = Three lines of resistance in each direction or lines without orthogonal orientation; High = More than three lines of resistance in each orthogonal direction of the building.*	☐	☐	☐	
8. What is the condition of connections between structural elements? Inspect the condition of connections between structural elements, checking for cracks in beam-column connections, as well as broken or missing concrete cover in these areas. *Low = Connections are in poor condition; Average = Connections are in average condition; High = Connections are in good condition.*	☐	☐	☐	
9. What is the condition of the building's foundations? Evaluate the condition of the foundations. If building plans are available, confirm materials used and depth of foundation; inspect for evidence of sinking, cracks in the floors and possible settling. If plans are not available, assume a low safety level. *Low = Information is lacking or foundation is of uncemented stones; Average = If foundation is of concrete, it is too shallow and there is evidence of damage; High = If foundation is of concrete, it is of adequate depth and there is no evidence of damage.*	☐	☐	☐	

10. Are there irregularities in the facility's plan? Evaluate the shape of the building and uniformity of its elements (for example, seismic joints are used, there are no interior patios, columns and load-bearing elements are connected, etc.). Inspect for the presence of elements that can cause torsion (for example, water tanks placed on the edge of a roof). *Low = The facility has two or more of these conditions: (a) irregular shape, (b) lack of structural uniformity in the plan, or (c) presence of elements that could cause torsion; Average = Facility presents one of the following conditions: (a) irregular shape, (b) lack of structural uniformity in the plan, or (c) presence of elements that could cause torsion; High = Facility presents none of the above conditions.*	☐	☐	☐	
11. Are there irregularities in the elevation of the facility? Identify discontinuity in configuration and structural components (for example, different construction materials used on different levels, the second floor overhangs the ground floor); concentrated mass (for example, water tank is located on the roof); soft stories (for example, floors of different height whether for the lobby, parking garage, or waiting room); or short columns. *Low = The facility has two or more of these conditions: (a) discontinuity in elevation, (b) concentrations of mass, (c) soft stories, (d) short columns; Average = Facility presents one of the following conditions: (a) discontinuity in elevation, (b) concentrations of mass, (c) soft stories, (d) short columns; High = Facility presents none of the above conditions.*	☐	☐	☐	
12. Is the structure able to withstand the effects of a variety of natural hazards? Considering the issues addressed in the section on geographic location of the facility, and loss prevention or mitigation measures that have been carried out, rate the capacity of the facility as a whole to resist different hazards. *Low = High vulnerability of structural components to hazards in area where facility is located; Average = Average vulnerability of structural components to hazards; High = Low vulnerability of structural components to hazards.*	☐	☐	☐	

Comments about Section 2. The evaluator should use the space below to comment on the results of this section, and provide his/her name and signature.

.....

Name of evaluator(s) .....

Signature of evaluator .....

3. Safety level as determined by nonstructural elements of the health care facility (mark the corresponding safety level with an "X")

3.1 Critical systems	Safety level			Comments
	Low	Average	High	
3.1.1 Electrical system				
13. Is there an alternative source that can provide a steady supply of electricity for 72 hours in critical areas of the facility? Depending on the facility's role in the health services network, determine whether there is an alternative source of energy that allows for uninterrupted power in case of an emergency. Where a back-up generator is available, check its condition and fuel reserves. If a backup generator is not present, the evaluator should verify that there are emergency lights with charged batteries. *Low = There is no alternative power source that can meet the needs of the facility; Average = There is an alternative power source that meets the needs of the facility but it is not functional (it is in poor condition and/or fuel reserve or batteries are lacking); High = There is an alternative power source that meets the needs of the facility, it is operational and is regularly maintained.*	☐	☐	☐	
14. Is the alternative power source adequately protected from natural hazards? Depending on the facility's role in the health services network, verify the kind of alternative source of power (electrical generator, batteries, or other), if it is located in a secure and accessible place, and if it has the necessary bracing and/or anchoring elements. *Low = There is no alternative power source; Average = There is an alternative power source but it is not adequately protected from known hazards; High = There is an alternative power source and it is protected from known hazards.*	☐	☐	☐	
15. Is the facility's electrical system protected from hazards? Verify the operation, labeling, means of anchoring, and protection of different components of the electrical system, among them, general circuits and networks, panels and their connections, ducts and electrical cables. Take into account the presence of trees and poles that can jeopardize cables and ducts. *Low = Electrical components are not protected; Average = Electrical components are partially protected; High = Electrical components are protected.*	☐	☐	☐	

16. Is the electrical system protected against electrical discharges? Check that grounding apparatus are functional and properly installed, and ensure that lightning conductors are in place where needed, are in good condition and well anchored. *Low = The facility's electrical system is not grounded and/or lightning rods are necessary but have not been installed; Average = The electrical network is grounded but grounding is not maintained, and/or lightning rods are not properly anchored; High = Devices to prevent electrical discharges are installed and they are regularly maintained.*	☐	☐	☐	
17. Is the lighting system secure in critical areas of the facility? Ensure that lighting fixtures are properly fastened. *Low = Lighting fixtures are not adequately secured; Average = Lighting fixtures are only partially secured and pose a hazard for people; High = Lighting fixtures are properly secured.*	☐	☐	☐	
3.1.2 Telecommunications system				
18. Are communications systems in the facility functional? Verify that a basic communications system is installed and is in good working order. *Low = The communications system is in poor condition or there is no communications system; Average = A basic communications system is in place and it is in fair condition; High = A basic communications system is in place and it is in good condition.*	☐	☐	☐	
19. Is there a backup communications system? Check the existence of a backup communications system, whether it is operational, and steps taken to protect it; including the condition of antennas and the devices used to anchor them. *Low = There is no backup communications system; Average = A backup communications system is in place but it does not function correctly; High = A backup communications system is in place, it is in good condition, and operates independently of the basic installed communications system.*	☐	☐	☐	
20. Are communications equipment and cables protected? Evaluate the safety of the areas where communications systems are located as well as the condition of fasteners and bracing. *Low = Communications equipment is not protected; Average = Communications system has some protective measures in place; High = Communications equipment is protected.*	☐	☐	☐	

3.1.3 Water supply system				
21. Is there a permanent water reserve that can provide at least 60 liters per day per resident patient, and supply approximately 15 liters per day per outpatient for a three-day period? Check that there are water reserves, and determine the demand they will satisfy. *Low = There are no water reserves; Average = There are sufficient reserves for less than three days; High = There are sufficient reserves for at least three days.*	☐	☐	☐	
22. Are water storage locations protected and tanks in good condition? Inspect that the cistern and/or elevated tank are covered, have necessary supports and anchoring, are protected from potential contamination, and that there is no evidence of cracks or leaks in the tank. *Low = Location, fastenings, and condition of tanks are inadequate; Average = Location, fastenings, and condition of tanks are adequate; High = Location, fastenings, and condition of tanks are good.*	☐	☐	☐	
23. Is there an alternative water supply system that can supplement the main local distribution system? Verify that there are water sources capable of supplementing the main local distribution network, and determine how much they can provide if needed. *Low = There is no alternative source or it can provide less than 30% of demand; Average = Alternative system can provide 30% to 80% of demand; High = Alternative system can provide more than 80% of daily demand.*	☐	☐	☐	
24. What is the condition of the facility's internal water distribution system? Review the condition of the water distribution networks to ensure that water reaches necessary service points, there are no leaks, and that flexible connections cross seismic joints in the facility. *Low = Less than 60% of components are in operational condition; Average = Between 60% and 80% of components are in good condition; High = Over 80% of components are in good condition.*	☐	☐	☐	
25. What programs are in place to maintain water quality in the facility? Ensure that the facility has a water quality control program in place that includes necessary corrective measures. *Low = Water quality control program does not exist; Average = Water samples are taken sporadically but follow-up with corrective measures is lacking; High = Water samples are taken regularly and corrective measures are applied.*	☐	☐	☐	

3.1.4 Fuel storage (gasoline, diesel)				
26. Is fuel stored in safe conditions and is there a five-day fuel reserve? Verify that the facility has a five-day fuel reserve. The fuel must be located in a safe, labeled, and fenced area, and containers must be anchored to avoid spills. *Low = Fuel reserves are not adequate and storage area is not secured; Average =Fuel storage area has some security and there are at least three days of reserves; High = Fuel storage is in a secure area and there is a five-day reserve.*	☐	☐	☐	
3.1.5 Medical gases (oxygen) (Leave this section blank if facility does not provide services requiring medical gases.)				
27. Are there enough medical gases to last for at least three days? Verify the medical gas reserve capacity, taking into account the facility's routine use of gases and the potential number of victims that would use the facility in the event of a disaster. *Low = There is less than one day of reserves; Average = There are one to three days of reserves; High = There are at least three days of reserves.*	☐	☐	☐	
28. Are medical gas tanks properly anchored? Evaluate whether medical gas tanks have adequate anchors or fasteners. *Low = Anchors and/or fasteners are lacking; Average = Quality of anchors and/or fasteners is inadequate; High = Anchors and/or fasteners are of good quality.*	☐	☐	☐	
29. Are medical gas tanks stored in safe areas? Inspect the area set aside for storage of medical gases and ensure that is accessible, is a safe distance from heat sources, has signs posted, and that fire-fighting equipment is available. *Low = No area has been set aside to store medical gases or the enclosure is not accessible; Average = Areas have been set aside for storage of medical gases, but safety measures are inadequate or access to the enclosures poses a risk; High = Appropriate storage areas are in place, enclosures are accessible, and they do not pose a hazard.*	☐	☐	☐	
3.1.6. Sanitation system				
30. Has the health facility been flooded because of poor wastewater drainage? Where there have been previous sewage flood events, determine what measures have been used to solve the issue. *Low = History of sewage flooding in the facility; Average = Corrective measures have been taken (allow the drainage of wastewater); High = The facility has no history of sewage flooding and/or corrective measures have been taken to solve the problem.*	☐	☐	☐	

31. Are waste collection sites (regular and medical waste) protected? Evaluators should inspect the safety of the waste collection site. *Low = Waste sites are not protected; Average = There is a certain level of protection for waste sites; High = Waste sites are well protected.*	☐	☐	☐	
3.1.7 Storm drainage system				
32. Is the facility's storm drainage system in good condition? Inspect the efficiency of the storm drainage system, including roofing, gutters, and drains. *Low = Storm drainage does not exist, or it is in poor condition; Average = The storm drainage system is in average condition; High = Storm drainage system is in good condition and it receives regular maintenance.*	☐	☐	☐	
3.2 Heating, ventilation, air conditioning, and/or hot water systems				
33. Are components for heating, ventilation, air conditioning, and/or hot water systems protected? Ensure that ducts and pipes are properly fastened and anchored, that connections to equipment are flexible, and that components of the systems are not subject to flooding, strong winds or earthquakes. *Low = Equipment is not protected from potential hazards; Average = Equipment is partially protected from potential hazards; High = Equipment is adequately protected from potential hazards.*	☐	☐	☐	
34. Are components for heating, ventilation, air conditioning, and/or hot water systems in good condition? Check the condition of all components of the system and review the maintenance that is being carried out. *Low = Equipment is in poor condition; Average = Equipment is in average condition; High = Equipment is in good condition.*	☐	☐	☐	
3.3 Furniture and fittings, office and storeroom equipment				
35. Is shelving anchored and are contents protected? Inspect shelves for anchors and fastenings and measures used to protect shelf contents (lip, railings, elastic bands, etc.). *Low = Shelving is not anchored to walls and the contents are not secured; Average = Shelving is anchored but contents are not secured; High = Shelving is anchored and contents are secured.*	☐	☐	☐	
36. Is office equipment secured? Inspect office equipment (computers, printers, calculators, etc.) to ensure that there are fasteners or straps to keep them from falling. *Low = Less that 20% of equipment is anchored; Average = Between 20% and 80% of equipment is anchored; High = More than 80% of equipment is anchored.*	☐	☐	☐	

37. Are furniture and fittings in the health facility secured? Measures must be in place to keep furniture and fittings from moving (for example, brakes are engaged, cables, straps, or other anchoring devices are in place). *Low = Furniture and fittings are not anchored and wheels on furniture are not locked; Average = Some furniture and fittings are anchored and wheels on furniture are locked in some cases; Good = Furniture and fittings are anchored and wheels on furniture are locked.*	☐	☐	☐	
3.4 Medical and laboratory equipment and supplies used for diagnosis and treatment				
38. Is medical and laboratory equipment protected from the impact of adverse events? Evaluators must ensure that equipment is protected from adverse events. In seismic areas, fasteners and anchoring devices should be used for stationary and mobile equipment, equipment stored on shelves should be contained to prevent it from falling, portable equipment must have brakes on wheels. Confirm that equipment is located above flood level and would not be exposed to strong winds. *Low = 20% or less of equipment is protected; Average = Between 20% and 80% of equipment is protected; High = More than 80% of equipment is protected.*	☐	☐	☐	
39. Is medical and laboratory equipment in good condition? Evaluate the condition of the medical and laboratory equipment and review scheduled maintenance. *Low = 20% or less of equipment is in good condition; Average = Between 20% and 80% of equipment is in good condition; High = More than 80% of equipment is in good condition.*	☐	☐	☐	
3.5. Architectural components				
40. Are doors or entrances to the facility secure and functional? Inspect the condition of the doors, make sure they are free of obstacles, and that they cannot negatively affect safety of the facility (avoid the use of glass, etc.). *Low = Doors and entrances are not secure and they impede safe movement in the facility; Average = Doors and entrances are not secure or they impede safe movement in the facility; High = Doors and entrances are secure and they do not impede safe movement in the facility.*	☐	☐	☐	
41. Are windows of the facility secure and in good condition? Inspect the condition of windows and ensure that they will not have a negative effect on the facility. *Low = Windows are subject to damage and damage would compromise the ability of the facility to function; Average = Windows are subject to damage but damage would not compromise the ability of the facility to function; High = Windows are subject to no or minor damage that would compromise the ability of the facility to function.*	☐	☐	☐	

42. Are the elements of the building envelope (outside walls, facings, etc.) in good condition? Evaluate whether outside walls, bars, facades, and fencing around the facility are properly anchored to the structure, are in good condition, and will not have a negative impact on the facility. *Low =Elements are subject to damage and damage would impede the performance of the health facility; Average = Elements are subject to damage but damage would not impede performance of the health facility; High = No or minor potential for damage that would impede the performance of the health facility.*	☐	☐	☐	
43. Are roofs and roofing safe and in good condition? Evaluators should check the condition of roofs and roofing (including bracing, drainage) and its vulnerability to strong winds, earthquakes, ash fall, or intense rains. *Low = Roofs and roofing are in poor condition and/or damage would affect the performance of the facility; Average = Roofs and roofing are in average condition and/or damage would not affect the performance of the facility; High = Roofs and roofing are in good condition and/or there is no or minor potential for damage that would affect performance of the facility.*	☐	☐	☐	
44. What is the condition and safety of parapets and other outside elements? Inspect the condition of exterior elements of the building, and determine whether parapets, railings, cornices, ornaments, etc., are properly anchored and whether they pose a hazard to the facility. *Low =Subject to damage and damage to element(s) would impede the performance of the health facility; Average = Subject to damage but damage to element(s) would not impede performance of the health facility; High = There is no or minor potential for damage to element(s) which could impede the performance of the health facility.*	☐	☐	☐	
45. Are areas for traffic outside of the facility safe and in good condition? Verify that there are no trees, utility poles, signs, vehicles, walls, etc., that could obstruct vehicle and pedestrian traffic outside of the facility. *Low = Damage to the road and walkways will impede access to buildings or endanger pedestrians; Average = Damage to road and walkways will not impede pedestrian access, but will impede vehicle access; High = There is no or minor potential for damage which could impede pedestrian or vehicle access.*	☐	☐	☐	

46. Are conditions safe for movement inside the building? Inspect corridors, stairways, exit doors, etc., to make sure they are clear of any obstacles. *Low = Damage to interior passageways will impede movement inside building and endanger occupants; Average = Damage to interior passageways will not impede movement of people but will impede movement of gurneys and other wheeled equipment; High = There is no or minor potential for slight damage which would not impede movement of people or wheeled equipment.*	☐	☐	☐	
47. Are internal walls or partitions safe and in good condition? Examine the condition of internal partitions and ensure that they are anchored to the structure and that they will not affect the behavior of the building. *Low = Damage to these elements would affect the facility's functional capacity; Average = Damage to these elements would not affect the facility's functional capacity; High = There is no or minor potential for damage that would affect the facility's functional capacity.*	☐	☐	☐	
48. Are the facility's suspended ceilings safe and in good condition? Ensure that there are no breaks or signs of moisture damage and that suspended ceilings are well anchored so that will not affect the facility's functional capacity. [NOTE: If these elements are not present in the facility, leave boxes blank.] *Low = Damage to these elements would affect the facility's functional capacity; Average = Damage to these elements would not affect the facility's functional capacity; High = There is no or minor potential for damage to these elements that would affect the facility's functional capacity.*	☐	☐	☐	
49. Is the lighting system (interior and exterior lighting) for the facility safe and in good condition? Assess the condition and performance of the lighting system, including the emergency lighting system, and ensure that elements will not affect safety in the facility. *Low = Damage to these elements would affect the facility's functional capacity; Average = Damage to these elements would not affect the facility's functional capacity; High = There is no or minor potential for damage to these elements that would affect the facility's functional capacity.*	☐	☐	☐	

50. Is there a fire protection system and is it in good condition? Confirm that fire extinguishers are located in high-risk areas, that they are functional, easy to access, are well anchored, and are properly labeled. Check expiration dates on extinguishers. *Low = There is no fire protection equipment, and/or it is out of date, and/or it is not accessible; Medium = There is insufficient equipment and/or it is not anchored, and/or it is not labeled; High = There is enough fire protection equipment and it is operational, accessible, properly anchored, and properly labeled.*	☐	☐	☐	
51. Are staircases and/or ramps safe and in good condition? Ensure that these areas are in good condition, clear of objects, and have railings or other measures that would make them safe to use in disaster situations. [NOTE: If staircases or ramps are not present in the facility, leave boxes blank.] *Low = They are in poor condition, and would affect the facility's functional capacity; Average = They are in average or poor condition, but their condition would not affect the facility's functional capacity; Good = They are in good condition and would not affect the facility's functional capacity.*	☐	☐	☐	
52. Is flooring safe and in good condition? Assess the condition of flooring to ensure that it would not make the facility more vulnerable in a disaster (no cracks, uneven or slippery areas, etc.). *Low = Flooring is in poor condition which could affect the facility's functional capacity; Average = Flooring is in poor to average condition but it will not affect the facility's functional capacity; Good = Flooring is in good condition and it will not affect the facility's functional capacity.*	☐	☐	☐	
53. Are access routes to the facility in good condition? Ensure that access routes are free of obstacles (e.g., kiosks, street vendors, barriers), that there are no elements that could obstruct the routes (trees, utility poles, possible flooding, etc.); and that traffic lights are present to control traffic. Determine availability of alternative access routes to the facility. *Low = There is potential for damage that would block routes and impede access to the facility; Average = Damage would not impede access by pedestrians, but would prevent vehicle access; High = There is slight or no potential for damage which would affect access by pedestrians or vehicles.*	☐	☐	☐	

54. Does the facility have signs showing evacuation routes and are they understood by staff? Verify that the evacuation routes are marked by signs, and that staff understand these signs. *Low = There are no signs for evacuation; Average = Signs exist but they are not understood by personnel; High = Signs are in place and personnel understand them.*	☐	☐	☐	
55. Are other architectural elements of the facility safe and in good condition? Identify other architectural elements whose condition or vulnerability might compromise the safety of the facility. [NOTE: If other architectural elements are not identified, leave boxes blank.] *Low = Damage to element(s) would affect the facility's capacity to function; Average = Damage to element(s) would not affect the facility's capacity to function; Good = There is no or minor potential for damage which would affect the facility's capacity to function.*	☐	☐	☐	

Comments about Section 3. The evaluator should use the space below to comment on the results of this section, and provide his/her name and signature.

.....

Name of evaluator(s) .....

Signature of evaluator .....

4. Safety level as determined by functional aspects of the health care facility (mark the corresponding safety level with an "X")

4.1 Organization of the health facility's disaster committee	Safety level			Comments
	Low	Average	High	
56. Does the facility have a disaster committee? Obtain a copy of the committee's terms of reference and verify that the committee is multidisciplinary. *Low = Committee does not exist or there is no documentation about the committee; Average = Committee exists with three or less disciplines represented, but it is not functioning; High = Committee exists with four or more disciplines represented, and it is functioning.*	☐	☐	☐	
57. Is each member of the disaster committee aware of his/her specific responsibilities? Verify that members' assigned responsibilities are in writing, describing their specific roles. *Low = Responsibilities have not been assigned or these responsibilities are not documented; Average = Responsibilities have been officially assigned but members are not familiar with them and/or they have not been implemented; High = All members know and meet the terms of their assigned responsibilities.*	☐	☐	☐	
58. Has a space been designated and equipped for the facility's Emergency Operations Center (EOC)? Confirm that there is a designated room to be used for emergency management, that it is located in a safe area of the facility, and that all necessary documentation is available. *Low = A space has not been designated for the Emergency Operations Center or it cannot be verified; Average = A space has been designated but it is not in a secure area, or it is not properly equipped, or important documentation is not available; High = A space has been designated in a secure area, it is properly equipped, and important documentation is readily available.*	☐	☐	☐	
59. Is an updated telephone directory of authorities (internal and external) and other contacts available? Ensure that a directory exists with contact information for support services needed in an emergency. *Low =Directory does not exist or is not available for inspection; Average = Directory exists but it is not updated, committee members are not aware of it, or it only contains contact information for facility staff; High = Directory of internal and external authorities exists, it is updated, and committee members are familiar with it.*	☐	☐	☐	

60. Are action cards available for all facility personnel? Check that action cards describe the assigned duties of each facility staff member in the context of a disaster. Randomly ask staff members about the contents of cards assigned to them. *Low = Action cards do not exist or they are not available for inspection; Average = There are not enough cards, they are of low quality, and/or personnel are not familiar with them; High = All staff members have cards and know their contents.*	☐	☐	☐	
4.2 Operational plan for internal or external disasters				
61. Does the facility have an emergency and disaster plan? Ascertain that a plan exists, that it has been updated, is operational, and that health facility personnel are familiar with it. *Low = The plan does not exist or a document is not available; Average = The plan exists but it is not operational, and/or it is not updated, and/or it has not been distributed, and/or it has not been used in simulation exercises. High = The plan exists, it is operational, it is updated, it has been distributed, and it has been used in simulation exercises.*	☐	☐	☐	
62. Does the emergency and disaster plan address both internal and external emergencies? Ensure that the disaster plan addresses the possibility of both internal and external events. *Low = The plan does not address either or there is no supporting documentation; Average = The plan addresses only internal emergencies or only external emergencies; High = The plan addresses both internal and external emergencies.*	☐	☐	☐	
63. Does the plan identify specific actions that will strengthen critical care services in the facility? Verify that the disaster plan specifies actions that will be taken. *Low = Actions are not included or are addressed only in document; Average = Actions are included but are only partially implemented; High = Actions are included and have been completely implemented.*	☐	☐	☐	
64. Are there procedures for activating and deactivating the plan and are personnel familiar with procedures? Verify that the plan indicates the type of signal as well as how, when, and who is responsible for activating and deactivating the plan. *Low = Procedures are not addressed or are addressed only in the document; Average = Procedures are included in the plan, but personnel have not been trained; High = Procedures are included and personnel are familiar with them.*	☐	☐	☐	

65. Does the plan address special administrative procedures for disasters? Ascertain that the plan includes specific procedures for attaining logistics support needed to respond to an emergency, and confirm the process with relevant personnel. *Low = Procedures are not addressed or are addressed only in the document; Average = Procedures are included in the plan, but administrative process is slow; High = Procedures are included and personnel are familiar with how to implement them.*	☐	☐	☐	
66. Have funds been specifically allocated to carry out the disaster plan? Verify that the facility has funds budgeted specifically for use in the case of disasters and that the budget includes disaster and emergency preparedness activities as well as response. *Low = Funds have not been allocated or there is no documentation showing budget; Average = Budget exists but it guarantees funds only for disaster and emergency preparedness activities, or only for disaster and emergency response activities; High = Funds are allocated for both disaster and emergency preparedness and for disaster and emergency response.*	☐	☐	☐	
67. Are procedures in place for expanding space when needed for emergency response and/or expanding space for critical care services? Confirm that the plan identifies spaces that can be equipped and expanded to respond to an emergency. *Low = Space for expansion has not been identified or there is no documentation regarding expansion; Average = Space has been identified and personnel have been trained to carry out the expansion, but there are no resources for expansion; High = Procedures exist, personnel have been trained, and resources are in place to carry out expansion of space.*	☐	☐	☐	
68. Does the plan include procedures for admitting patients in the event of emergencies, including forms and protocols for treating mass casualties? Procedures should specify the places and persons responsible for processing admissions as well as the forms and protocols available. *Low = Procedures are not in place or there is no relevant documentation; Average = Procedures are in place but only forms are available or only protocols available; High = Procedures are in place and both forms and protocols are available.*	☐	☐	☐	

69. Are procedures in place for triage, resuscitation, stabilization, and treatment? According to the type of facility, confirm that procedures have been defined, that staff has been trained, and that equipment and triage cards are available. *Low = Procedures have not been defined or there is no documentation on procedures; Average = Procedures are defined and personnel have been trained, but there are no resources to implement procedures; High = Procedures exist, personnel have been trained, and resources are in place to implement procedures.*	☐	☐	☐	
70. Does the plan address transport of patients and logistical support? Verify that the facility has vehicles available (owned by the facility or from other sources) as well as logistical support for patient transport. *Low = Vehicles for patient transport and logistical support are not available or there is no relevant documentation; Average = There are insufficient vehicles and/or insufficient logistical support; High = Sufficient vehicles and logistical support are available.*	☐	☐	☐	
71. Is coordination in place with other facilities in the local health services network and with entities providing prehospital emergency care? Ascertain that there are written protocols for this coordination and that facility personnel confirm that coordination is in place. *Low = Coordination plan is absent or there is no documentation that demonstrates coordination; Average = There is communication in the network, but there are no established procedures or protocols for disaster or emergency response; High = There is communication and coordination with other facilities in the health services network, and procedures and protocols are in place for disaster response.*	☐	☐	☐	
72. Is the health facility's disaster response plan linked to the local emergency response plan? Verify that there is a written record that demonstrates this cooperation. *Low = The plans are not linked or there is no documentation that demonstrates linkage; Average = Plans are linked but not operational; High = Plans are linked and operational.*	☐	☐	☐	
73. Does the disaster plan address specific procedures for referral and counter-referral of patients? Review specific procedures that include mechanisms for registering patients. *Low = Procedures do not exist or there is no documentation on the procedures; Average = Procedures exist but only on paper; High = Procedures are documented and personnel have been trained in process.*	☐	☐	☐	

74. Does the plan include procedures for communicating with the public and media? Verify that the plan states who is responsible for communicating with the public and the media. *Low = Procedures do not exist or there is no documentation that demonstrates procedures; Average = Procedures exist but personnel have not been trained; High = Procedures exist and personnel have been trained.*	☐	☐	☐	
75. What procedures are in place for staffing for disaster response during evening, weekend, and holiday shifts? Depending on the role of the facility in the health delivery network, review staffing procedures for nights, weekends, and holidays in case of emergencies and disasters. *Low = Procedures do not exist or there is no documentation that demonstrates procedures; Average = Procedures are in place but personnel have not been informed; High = Procedures are in place and personnel are aware of procedures.*	☐	☐	☐	
76. Does the disaster plan address procedures for both internal and external evacuation of the facility? Verify that the plan includes evacuation procedures for occupants of the facility. *Low = Procedures do not exist or there is no documentation for procedures; Average = Procedures are in place but personnel have not been trained, and/or evacuation routes are not adequate; High = Procedures are in place, personnel have been trained, and evacuation routes are clearly marked and unobstructed.*	☐	☐	☐	
77. Are health personnel prepared to act in disaster situations? Confirm that there is an ongoing training program and that the training is carried out. Corroborate the level of training directly with staff. *Low = Personnel are not trained or there is no training program; Average = There is sporadic training but less than half of the staff is trained; High = There is an ongoing training program and more than 85% of personnel are trained.*	☐	☐	☐	
78. Does the facility have an emergency warning system and are personnel trained in the system? Confirm that the facility has an emergency warning system and that staff have been trained to respond appropriately. *Low = Emergency warning system does not exist or there is no documentation for system; Average = Emergency warning system is in place but personnel have not been trained in system; High = Emergency warning system is in place and personnel have been trained in how to respond.*	☐	☐	☐	

79. Does the facility have an alarm system and have staff been trained to respond? Verify that the facility has an alarm system in place and that all staff in the facility are trained to respond. *Low = Alarm system does not exist or there is no documentation about system; Average = Alarm system is in place but personnel have not been trained in system; High = Alarm system is in place and personnel have been trained in how to respond.*	☐	☐	☐	
80. Has the facility carried out emergency simulation exercises and drills in the last year? Confirm that simulation exercises and drills are conducted and their frequency. *Low = Emergency simulation exercises do not take place or there is no documentation about exercises; Average = Emergency simulations are carried out but not each year; High = Emergency simulations are carried out at least once each year and the plan is updated according to the outcome of the exercises.*	☐	☐	☐	
4.3 Contingency plans for medical treatment in disasters				
81. Are contingency plans in place for different types of events? Confirm that specific plans are in place, that they are updated, that staff have been trained for specific contingencies, and that the facility has the resources to implement the actions. *Low = Contingency plans do not exist or they exist only on paper: Average = Contingency plans are in place but they are not updated and/or personnel have not been trained; High = Contingency plans are in place, they are updated, personnel have been trained, and there are resources to implement them.*	☐	☐	☐	
4.4 Plans for preventive maintenance and repair of essential services (lifelines)				
82. Is there a maintenance plan for the facility's electrical system? Verify that the maintenance plan is in place and review the maintenance log; ensure that personnel are assigned and trained in maintenance, that appropriate tools are available, and that funds are budgeted for maintaining the system. The plan should address testing of alternative sources of available power (generators, batteries, power inverters, etc.). *Low = The plan does not exist, or the plan is only on paper; Average = The plan exists but personnel are not assigned to and/or not trained in maintenance, and/or appropriate tools are lacking, and/or funds have not been budgeted for maintenance; High = The plan exists, personnel are assigned to and trained in maintenance, appropriate tools are available, and funds have been budgeted for maintenance activities.*	☐	☐	☐	

83. Is there a maintenance plan for the facility's drinking water supply system? Verify that the maintenance plan is in place and review the maintenance log; ensure that personnel are assigned and trained in maintenance, that appropriate tools are available, and that funds are budgeted for maintaining the system. *Low = The plan does not exist, or the plan is only on paper; Average = The plan exists but personnel are not assigned to and/or not trained in maintenance, and/or appropriate tools are lacking, and/or funds have not been budgeted for maintenance; High = The plan exists, personnel are assigned to and trained in maintenance, appropriate tools are available, and funds have been budgeted for maintenance activities.*	☐	☐	☐	
84. Is there a maintenance plan for the facility's communications system? Verify that the maintenance plan is in place and review the maintenance log; ensure that personnel are assigned and trained in maintenance, that appropriate tools are available, and that funds are budgeted for maintaining the system. *Low = The plan does not exist, or the plan is only on paper; Average = The plan exists but personnel are not assigned to and/or not trained in maintenance, and/or appropriate tools are lacking, and/or funds have not been budgeted for maintenance; High = The plan exists, personnel are assigned to and trained in maintenance, appropriate tools are available, and funds have been budgeted for maintenance activities.*	☐	☐	☐	
85. Is there a maintenance plan for the facility's wastewater system? Verify that the maintenance plan is in place and review the maintenance log; ensure that personnel are assigned and trained in maintenance, that appropriate tools are available, and that funds are budgeted for maintaining the system. *Low = The plan does not exist, or the plan is only on paper; Average = The plan exists but personnel are not assigned to and/or not trained in maintenance, and/or appropriate tools are lacking, and/or funds have not been budgeted for maintenance; High = The plan exists, personnel are assigned to and trained in maintenance, appropriate tools are available, and funds have been budgeted for maintenance activities.*	☐	☐	☐	

86. Does the facility have a maintenance plan for its fire protection/suppression system? Verify that the maintenance plan is in place and review the maintenance log; ensure that personnel are assigned and trained in maintenance, that appropriate tools are available, and that funds are budgeted for maintaining the system. *Low = The plan does not exist, or the plan is only on paper; Average = The plan exists but personnel are not assigned to and/or not trained in maintenance, and/or appropriate tools are lacking, and/or funds have not been budgeted for maintenance; High = The plan exists, personnel are assigned to and trained in maintenance, appropriate tools are available, and funds have been budgeted for maintenance activities.*	☐	☐	☐	
4.5 Availability of medications, supplies, instruments and equipment for disaster situations				
87. Are there reserves of medications available for emergency response? Verify the availability of medicines for emergencies. *Low = There is no reserve or there is no documentation demonstrating reserve; Average = Reserves of medications are sufficient only for daily, conventional use; High = There are sufficient reserves of medications for emergency response.*	☐	☐	☐	
88. Does the facility have reserves of supplies and treatment materials for emergency response? Ascertain whether the facility has sufficient supplies in reserve for emergencies. *Low = There are no reserves or there is no documentation regarding emergency supplies; Average = Reserves are adequate only for regular, daily use; High = Sufficient reserves are in place for emergency response.*	☐	☐	☐	
89. Does the facility have a reserve of instruments for emergency response? Ascertain whether the facility has sufficient instruments in reserve for emergencies. *Low = There are no reserves or there is no documentation regarding emergency instruments; Average = Reserves are adequate only for regular, daily use; High = Sufficient reserves are in place for emergency response.*	☐	☐	☐	
90. Does the facility have life support equipment? Depending on the facility's level of complexity, evaluators should ascertain the presence and coverage of life support equipment. *Low = The facility does not have this equipment; Average = Equipment is available but there is only enough for regular, daily use; High = Facility has sufficient equipment for use in an emergency or disaster.*	☐	☐	☐	

91. Does the facility have personal protection equipment for epidemics (disposable)? Check the facility's supply of disposable personal protection equipment for staff working in areas of initial contact and treatment. *Low = The facility does not have this equipment or there is no relevant documentation; Average = Reserves of this equipment are only sufficient for regular, daily use; High = Facility has sufficient equipment for use in an emergency or disaster.*	☐	☐	☐	
92. Are the facility's storage areas and warehouses protected from effects of earthquakes, flooding, fire, and strong winds? Ensure that storage areas are protected from the effects of earthquakes, flooding, fire, and strong winds, and that supplies are protected. *Low = Storage areas are not protected from hazards; Average = Only half of storage areas are protected; High = Storage areas are well protected.*	☐	☐	☐	
93. Are supplies and equipment protected from hazards? *Low = 20% or less of supplies and equipment are protected from being damaged should shelving collapse or overturn; 20% to 80% of supplies and equipment are protected from being damaged should shelving collapse or overturn; High = More than 80% of supplies and equipment are protected because shelves are stable, contents are secured, and/or shelf bracing is not needed.*	☐	☐	☐	

Comments about Section 4. The evaluator should use the space below to comment on the results of this section, and provide his/her name and signature.

.....

Name of evaluator(s) .....

Signature of evaluator .....

Annex 3

Form 3

Intervention plan to improve the level of safety

Notice:

This version of the form is for reference only. To complete the evaluation and provide necessary information, print Annex 3 from the *Forms for the evaluation of small and medium-sized facilities* document.

Name of facility: .....

Location of facility: .....

Date of evaluation: .....

Elements evaluated			Problems	Actions	Priorities*	Comments
Structural elements						
Nonstructural elements	Essential services	Electrical system				
		Telecommunications system				
		Water supply system				
		Fuel storage				
		Medical gases				
		Sewage system				
		Storm drainage				
	Heating, ventilation, air conditioning, hot water					
	Furniture and fittings, office equipment, and storage					
	Medical and laboratory equipment and supplies					
	Architectural elements					
Functional aspects	Organization of disaster committee					
	Operational disaster plan					
	Contingency plans					
	Maintenance plans					
	Medications, supplies					

* Priorities should be ranked between 1 (high priority) and 3 (low priority) depending on the need, importance of problem, and available resources.

Glossary of terms[17]

Accelerants
Substances that act as catalysts in speeding a chemical reaction; commonly associated with starting or spreading fire.

Adverse event
Changes in human, economic, social and environment systems, caused by natural phenomena, generated by human activity or a combination of both, that require an immediate response from the affected community. An adverse event can become an emergency or a disaster depending on the extent of damage and response capacity.

Base flood elevation (BFE)
The water elevation is expected to rise during the base flood, which has a 1% chance of being equaled or exceeded in any given year.

Black water
Waste water containing human fecal matter or urine (distinguished from grey water which is waste water that has been used for washing).

Brace
Structure that supports a structural element (made of metal, wood, etc.)

Brake system
System that keeps wheeled equipment or furniture from sliding.

Brick
Masonry used in construction made of baked clay.

Check valve
Mechanism that allows fluid to flow in only one direction, preventing the return or backflow of liquid in a water distribution or sewerage system.

Concrete
A construction material made up of cement, aggregates such as crushed rock and sand, and water.

Critical care services
Areas of a health facility that provide essential, life-saving services, that contain hazardous or harmful equipment or materials, or whose failure may generate chaos and confusion among patients or staff.

17. This list of terms was compiled from various sources and adapted for the work of PAHO/WHO in technical assistance for disaster reduction.

Deflection
An often imperceptible displacement, normally vertical, of structural horizontal elements such as beams or slabs in response to vertical loads. This can be caused by the weight of the element itself or because of live loads in a building (for example, equipment on a roof or number of people on a staircase).

Development
The cumulative and sustainable increase of quantity and quality of goods, services, and resources of a community along with social changes aimed at maintaining or improving the safety and the quality of human life without compromising the resources of future generations.

Diaphragm
A horizontal structural system, such as the slab or roof, which transfers lateral loads (usually caused by earthquakes or wind forces) to shear walls and frames. Where there is equal stiffness among all elements attached to the diaphragm, equal horizontal displacement can be expected.

Disaster
An event or combination of events that causes serious disruption in people's lives and wellbeing, having a negative impact on the goods, services, economic resources, social systems, and the environment. Disasters may be caused by natural phenomena, generated by human activity, or by the combination of both. Disasters may exceed the response capacity of the affected community.

Disaster (or adverse event) cycle
Prevention: Risk is zero
Mitigation: Reduced risk
Preparedness: Improve response capacity
Response: Humanitarian assistance
Rehabilitation: Temporary or provisional recovery
Reconstruction: Complete recovery

Disaster management
A systematic process that includes planning, organization, administration, and control of all disaster related activities. Disaster management is achieved through prevention, mitigation, preparedness, response, rehabilitation, and reconstruction activities.

Disaster risk reduction
Set of measures aimed at minimizing damage caused by adverse phenomena to such a level that the affected community can meet needs using its own resources, without outside assistance. This is achieved by eliminating (preventing) or reducing (mitigating) the hazard, the vulnerability, or both, and increasing the community's ability to respond (preparedness).

Drift
Lateral displacement of a building generally caused by seismic activity or wind.

Emergency (see "disaster")
The affected community generally has the resources to respond to an emergency.

Essential services (also, lifelines)
Basic services that allow a health care facility to function, including drinking water supply, medical gases, power, communications, sanitation, etc.

Floor plan configuration
The architectural arrangement of spaces in the floor plan of a building.

Geology
The science and study of the physical matter and energy that constitute the earth.

Hazard
A risk factor that represents the potential for a phenomenon or event of natural origin, generated by human activity, or a combination of both to occur in a specific place with a given intensity and duration.

Longitudinal reinforcement
Steel placed longitudinally in structural concrete elements to improve the load-bearing capacity of beams, slabs, and columns.

Masonry wall
Block construction which may be of brick, adobe, concrete (including pre-formed, hollow blocks), or mud/cement blocks. Mortar used to join blocks consists of lime, sand, cement and water.

Medical gases
Includes oxygen, anesthesia, nitrogen, etc.

Mitigation of damage
Activities that aim to lessen the likelihood of damage resulting from hazards. Mitigation of damage is achieved by reducing the hazards, vulnerability, or both. In general, one cannot mitigate natural hazards such as earthquakes and hurricanes.

Mortar joint
Space between masonry bricks or blocks filled with mortar or grout, a mixture of cement, sand, and water. Sand gives volume to the mixture and the cement bonds particles. Mortars have different hardness depending on the proportions of sand, cement, or lime.

Nonstructural components
Elements that do not form part of the support system of the structure. These include architectural elements (such as cladding, interior partitions, ceilings), equipment (such as industrial, medical, and laboratory equipment and furnishings), and systems that are essential for the facility's operation (such as power system, water distribution and drainage, heating and cooling systems, staircases, etc.).

Nonstructural detailing
The combination of measures derived from theory, experience, and observation that aim to protect and improve the behavior of nonstructural components of a building.

Overlap
Extend two elements, such as fiber cement sheets of a roof, so that one covers part of the other both lengthwise and crosswise.

Partitions
Lightweight elements used to divide rooms or spaces in a building.

Plumbing
Installation of systems for water supply and for draining waste water.

Preparedness
Actions and measures taken to increase the capacity to effectively anticipate, respond to, and recover from damage caused by adverse events. Preparedness is achieved by developing disaster response plans, training concerned personnel, and establishing necessary resources to carry out response activities.

Prevention
Actions aimed at avoiding damage as a consequence of adverse phenomena. Prevention is achieved by eliminating the hazard, the vulnerability, or both.
Punching shear failure: Failure of concrete slabs subjected to high localized forces. In flat slab structures this occurs at column support points.

PVC pipe
Rigid and highly resistant plastic pipe made of polyvinyl chloride. It is commonly used for piping in drinking water distribution and sanitary sewers.

Reconstruction
Complete repair of physical, social, and economic damage to a level of safety that is higher than existed prior to an event. Reconstruction incorporates disaster risk reduction measures when restoring damaged infrastructure, systems, and services.

Rehabilitation
Provisional or temporary restoration of essential services (lifelines) in a community affected by a disaster. Rehabilitation is achieved by providing services at pre-disaster levels.

Reinforced concrete
Cement, sand, aggregates, and water are mixed to become a permanently hardened material, which is very resistant to compression. Reinforcement bars of steel are incorporated into the concrete (lengthwise or crosswise) to resist the tension forces in the element.

Relationship between risk, hazard, and vulnerability
Risk is the result of the interaction of hazard and vulnerability. This is a dynamic and complex relationship that changes according to the probability of an adverse event occurring at a given time and place with a given magnitude, intensity, and duration, and the predisposition of people, infrastructure, services and goods to be affected by said phenomenon. This relationship can be expressed in the formula $R = H \times V$, where R is risk, H is hazard, and V is vulnerability.

Response
Actions taken in emergencies or disasters, or when damage is imminent, to save lives, reduce suffering, and limit economic and social losses by mobilizing humanitarian assistance to cover essential needs of the affected population.

Risk
Probability of social, environmental, and economic damage occurring in a specific community and in a given period of time with a magnitude, intensity, cost, and duration determined by the interaction between hazard and vulnerability.

Rubber joint
Gasket or connection made of synthetic rubber which adapts to movement and tolerates high temperature.

Safe hospital
A health services facility that remains accessible, is able to function at full capacity, and can depend on its own infrastructure during and after an adverse event.

Septic tank
Pit or tank that collects sewage, which decomposes through anaerobic digestion.
Sewage inspection chambers: Concrete structures installed in strategic areas of the sewage system and accessed by manholes, making it possible to inspect and repair connections, valves, etc.

Sewerage inspection chambers
Concrete structures installed in strategic areas of the sewerage system and accessed by manholes, making it possible to inspect and repair connections, valves, etc.

Structural components
Supporting or load bearing elements of a building, including the columns, beams, load bearing walls, foundations, slabs, etc.

Structural detailing
The combination of measures derived from theory, experience, and observation that aim to protect and improve the behavior of structural components of a building.

Topography
The study of the location of natural or man-made features on the earth.

Truss
Support structure of metal or wood generally used in roofing, consisting of a bottom chord, top chord, vertical studs, and diagonal bracing.

Uninterruptible Power Supply (UPS)
Backup equipment, typically powered by batteries, that provides immediate protection from electrical outage. The battery runtime is short (15 to 30 minutes), but sufficient to backup computerized data or establish an alternative power source.

Unreinforced masonry structures
Masonry structures that are unreinforced or are not attached to columns and beams. Masonry types include adobe, brick, cement block, rammed earth, blocks with mud and cement mixture, and stone walls.

Vulnerability
The risk factor for a person, object, or system exposed to a hazard. This corresponds to the predisposition or level of susceptibility to damage resulting from that hazard.

Water table
Depth underground at which point the ground is totally saturated with water.

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www.paho.org/disasters

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