



Chapter 2

Definition of the Security Level

1. Introduction

The effects of a disaster on a health facility are not restricted to the panic that may ensue among the staff and patients—or even the partial or total physical damage the facility may suffer. Consequences may also include the partial or total loss of the operational capacity of the facility and, therefore, its ability to meet the demand for healthcare when it is most needed by the affected community. Technical and financial restrictions often faced by the health sector in many countries in the Americas aggravate matters by delaying recovery and rehabilitation of such facilities. Even 10 or more years after a disaster occurs, it is not uncommon to see the effects of that disaster in health centers.

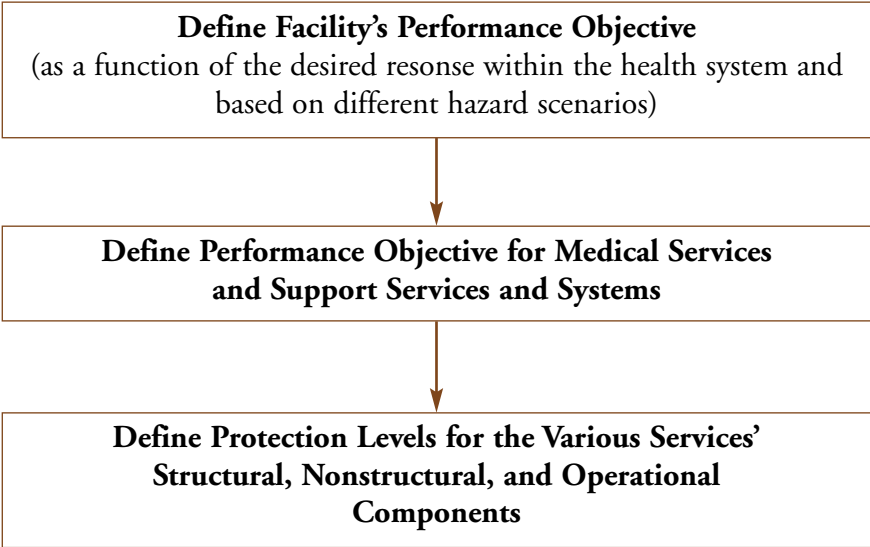
Technological advances and changes in design philosophy and quality assurance techniques for the construction and maintenance of health infrastructure now make it possible to limit the damage caused by disasters, even to set different levels of protection for the infrastructure and operations. However, it is not always possible to achieve the protection levels one might desire, owing to a variety of factors. Natural or technical barriers may exist, as, for example, in the case of a small island where there is significant volcanic activity and the community needs a health center. Health sector funding in the public sector is another example. The need to expand the system in order to meet national health targets may clash with the need to guarantee the safety of the facilities. Finally, there are social and political restrictions, such as when the development and location of facilities are chosen to satisfy community expectations.

Even though funding may be limited, and other circumstances may impose technical barriers to the fulfillment of performance objectives, a detailed assessment is still required in order to ensure the optimal utilization of available resources. And the starting point should be a clear assessment of the existing health services network—its operational characteristics, geographical distribution, the degree to which it meets health policies and targets, the epidemiological and demographic profile of the population served, and the natural hazards that threaten it. The effective function-

al capacity of all existing health facilities must be taken into account, considering as fully as possible all factual information on the natural or man-made hazards they face and their current level of vulnerability.

Once the actual characteristics of the health services network and the hazards to which it is exposed have been identified, and the need to build a new health facility in a specific location has been established, it is still necessary to define the role that the new facility will play, both in normal times and during emergencies of various kinds and intensities. Based on all this information, the level of overall functional performance must be set for the contemplated health facility. Is it meant to continue providing its vital services as smoothly as possible even as the emergency is unfolding? Less ambitiously, is the structure to withstand the disaster in such a way that recovery and rehabilitation can take place after a reasonably brief interruption of services? The level of overall performance is a function of the level of protection selected for each of the services provided. All this will have a bearing on the characteristics of the site, the specifics of the infrastructure to be built, and the basic services it can realistically be expected to provide based on different scenarios as shown in the following chart:

Definition of Protection Services



In practical terms, three broad performance objectives can be listed: functional protection, investment protection, and life safety.

Functional protection	Investment protection is implicit in this objective, which in addition calls for the development of systems that can remain operational during a disaster or recover their functional capacity in a relatively short time.
Investment protection	The protection of all, or at the very least the key components of, the health facility's infrastructure and equipment, even if the facility itself cannot continue to function. Based on this criterion, it is possible to design and build infrastructure that can resume operations within a reasonable time at a cost that can be met by the client institution.
Life safety	The minimum requirement for any infrastructure, and the criterion most commonly used in the design and construction of health facilities.

The approach hereby proposed, which focuses on setting performance objectives for each of the services to be provided by the facility, given the various hazards present in the region and their likely intensity, calls for two potential intensity levels to be considered when designing a facility: the traditional design level for each hazard, and a maximum credible scenario, which would call for exceptional protection measures. Basing the protection strategy on the latter scenario is the most desirable approach.

In the case of earthquakes, for instance, the minimum protection level should shield the facility from a seismic event with a 10 percent probability of being exceeded over a 50-year period. On the other hand, the high-protection level would withstand an earthquake so exceptionally strong that it would only have a 2 percent probability of being exceeded in 50 years. A minimal objective is to avoid a sudden, forced evacuation following an event.

In order to sensitize all project participants concerning the need for disaster mitigation, it is advisable that the various stakeholders agree in writing on the performance objective to be met, defining protection goals for the facility in normal times and in the event of various disaster scenarios. The form *Security objectives for the facility (Annex 2.1)* may help in this awareness-raising effort. For each hazard present in the area where the infrastructure will be sited, one such form should be filled, bearing in mind the recovery time expected for the facility.

2. Basic services

The overall performance objective for the facility should be directly dependent on the level of protection its services will require. *Tables 2.1a* and *2.1b* list some of the medical and support services for which protection levels should be set. The level of protection must likewise be aligned with the overall performance objective desired for the facility. However, it is not necessary for all services to enjoy the same level of protection established for the facility as a whole. The level of protection should be defined for one or more intensity levels for each hazard.

Table 2.1a - Typical medical services in a hospital

Blood Bank	Kinesiotherapy	Pediatric Neurology
Cardiology	Laboratory	Pediatric Surgery
Dental Services	Neonatology	Pharmacy
Dermatology	Nuclear Medicine	Plastic Surgery - Burns
Ear, Nose and Throat	Obstetrics and Gynecology	Pneumology
Emergencies - Adults	Oncology	Psychiatry
Emergencies - Children	Ophthalmology	Recovery Rooms
Endoscopy	Ophthalmology	Sterilization
General Inpatient Care	Orthopedics and Traumatology	Surgery
Hemodialysis	Other Medical Services	Surgical Wings
ICU/ITU	Outpatient Clinic	Urology
Imaging, Diagnostic	Pathological Anatomy	
Internal Medicine	Pediatrics	

Table 2.1b - Typical Support Services and Systems

Administration	Emergency Standby Electrical System	Mobilization and Transport
Air Conditioning (HVAC)	Escape Routes	Non-sterile Materials Storage
Boilers, Thermal Power Station	Filing and Case Management	Oxygen System
Clinical Gases	Fire Alarm/Supression System	Sewerage
Communications	Food Services	Sterile Materials Store-Rooms
Drinking Water	Industrial Gases	Elevator/Scalator System
Electrical Distribution	Industrial Water	Other Support Services, Systems
Electrical Power Station	Laundry	

3. Classification of medical and support services

In order to properly choose the correct protection objective for each service, it is advisable to consider the risks to which it will be exposed, the activities involved in providing the service, the characteristics of its components, and its relative importance:

Classification of medical and support systems

Critical Services and Systems	Must be classified as specified below:
Critical services involving life-saving or other essential functions	Those services that must remain in operation to meet the vital healthcare needs of inpatients and provide first aid and other services to the victims of the disaster. Also included in this group are services whose failure could cause prolonged delays in the recovery of critical services.
Critical services involving hazardous or harmful materials	Damage to these services increases the risk of fires, explosions, air pollution, or water contamination that could injure the staff, patients, or visitors.
Critical services whose failure may cause the patients or staff to panic	Those services whose failure may cause alarm, chaos or confusion among the staff, patients, or visitors to such a degree that the quality or even the provision of health care may be compromised.
Special Services and Systems	Services that, while not critical, involve components that would be difficult or expensive to replace.
Other Services and Systems	Those services that can suffer minor failure and can be repaired quickly, without causing significant decreases in health service quality.

4. Protection levels required for each service

Just as a performance objective must be set for the facility as a whole, its services and support systems should also be classified in accordance with the performance goals and various hazard scenarios that may affect them:

Definition of service protection levels

Functional protection (FP)	The facility is able to operate normally immediately after an emergency. Losses in functional capacity, if any, are temporary and do not endanger patients or staff. To meet this goal, infrastructural (structural and nonstructural) components and organizational or functional components must perform with a similar degree of success. Such components are only allowed a limited degree of damage. The functional protection objective implicitly incorporates the investment protection and life-safety performance objectives.
Investment protection (IP)	At this intermediate level of protection, the goal is to prevent damage to the infrastructure of those services that it would be difficult or costly to replace. To meet this goal, both the structural and the nonstructural components must perform similarly. In some cases, investment protection may result indirectly in functional protection.
Life safety (LS)	It is acceptable for the service to suffer considerable damage to its structural or nonstructural components as long as such damage does not put lives at risk. As a result, it may be necessary to carry out significant repairs after the disaster. Such repairs may not be economically feasible.

Depending on the classification of each service, as dictated by the importance of the activities and components of the service in question, performance objectives such as those recommended in *Table 2.2* should be set.

Table 2.2 Protection objectives for the services

Classification of the Service	Protection objective		
	FP	IP	LS
Critical services			
Vital or essential	✓		
Hazardous or harmful	✓		
Likely to cause chaos or confusion	✓		
Special services		✓	
Other services		✓	✓

The protection goals contained in *Table 2.2* may be redefined, as agreed upon by the project coordination committee, depending on the economic capacity of the client institution and the project's role and importance within the overall health network. In any case, priority should be given to functional protection.

5. Definition and characterization of objectives for protecting infrastructural components

Once a protection objective has been set for the facility as a whole, as well as for each of its services, it should determine the organizational, safety, and control performance criteria for the prevention or mitigation of any damage to infrastructural components. Infrastructure is typically divided into two groups: the structural, and the nonstructural elements. The structure comprises all those essential elements that determine the overall safety of the system, such as beams, columns, slabs, walls, braces, or foundations. The nonstructural elements are those that ultimately enable the facility to operate; they are divided into architectural elements, equipment and content, and services or lifelines.

A reasonable level of protection for the nonstructural components of each service should be chosen:

Protective systems for the facility's systems, equipment and components

Protection of Operations (PO)	The structural system must perform in such a way that the building can continue to be used safely both during, and immediately after, an adverse event. The structural elements must remain nearly as rigid and resistant as before the emergency. Any damage that occurs should be minimal, with no repairs required for operational continuity (what is known as controlled damage). Nonstructural components should continue to function without alteration, both during and after the emergency. Any damage should be minimal and allow for immediate occupancy of the premises.
Infrastructure Protection (IP)	Damage to the structural system is acceptable so long as the replacement of service components is not unduly arduous or expensive. It should be possible to repair any damage that occurs, at a reasonable expense and in a short period of time, so as to minimize interference with the functions ordinarily performed.
Life Safety (LS))	Damage to structural and nonstructural components is acceptable so long as it does not endanger the patients, visitors, or staff. Repairs may be expensive and interfere severely with the operations of the facility in the medium and even long term.

The protection objective for any component must be at least equal to that established for the overall service to which it belongs, or with which it interacts.

6. Setting the protection objective for each service

The form *Performance objectives for support systems and services*, in Annex 2.2 may be used to define the disaster mitigation performance objective for the health facility as a whole and the services it provides. This form should be completed jointly by the client institution’s representatives and the professionals involved in the design and execution of the project. A similar form should be completed for each likely disaster scenario, as well as for each protection objective contemplated.

7. Degree of detail of the project

The protection objective set for the facility as a whole, together with the level of risk estimated by the multidisciplinary group of specialists who participate in its conception, should determine the degree of detail with which the project is to be designed. Broadly speaking, two levels of detail may be considered—each having significant implications for the site studies to be carried out, the design procedures to be followed, and the qualifications of the professionals hired to build the project or practice quality assurance. *Table 2.3* below, shows the available options in relation to the protection objective chosen.

Table 2.3 - Level of detail of the required studies

Protection objective	Level of risk	
	High	Low
Functional protection	D	D
Infrastructure protection	D	B
Life safety	D	B

D: Detailed Study
B: Basic Study

Table 2.4, in turn, summarizes the main features of the studies referred to in the previous table, including the requirements that must be met by the various teams.

Table 2.4 - Project requirements

	Degree of Detail of the Study	
	Detailed Study	Basic Study
Requirements that must be met by the participating professional teams	(See <i>Chap. 5</i>)	(See <i>Chap. 5</i>)
Site studies required		
Pre-selection of siting options	✓	✓
Compilation of information on hazards present at the regional level	✓	✓
Compilation of information on hazards present at the local level for each of the potential sites	✓	
Definition of facility protection options	✓	
Identification of minimum services requiring protection		
Definition of the level of protection for the various services and their components	See <i>Table 2.2</i> and <i>Annex 2.2</i>	See <i>Table 2.2</i> and <i>Annex 2.2</i>
Design requirements for structural components, nonstructural components, and medical and industrial equipment		
Requirements based on national and international standards	✓	✓
Requirements specific to the project or to health facilities in general	✓	
Expected results (See Chapter 6)		
Detail drawings	✓	✓
Technical specifications	✓	✓
Tender documents	✓	✓
Certificates	✓	✓
Financial reports	✓	✓
Typical completion schedule¹	8-12 months	6-10 months
Quality assurance program for the project (See Chapter 6)	✓	✓

Notes: 1 Completion schedules are only meant to serve as examples. The duration of any given study will depend, among other variables, on the dimensions and protection objectives of the facility and the natural hazards prevalent in the area

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- Departments of The Army, The Navy and The Air Force, *NAVY NAVFAC P-355.2: Seismic Design Guidelines for Upgrading Existing Buildings*, Technical Manual, Washington, D.C., September 1988.
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- Federal Emergency Management Agency, “*FEMA 74: Reducing the Risk of Nonstructural Earthquake Damage, A Practical Guide*”, Washington, D.C., September 1994.
- Office of Statewide Health Planning and Development (OSHPD), *Building Standard Administrative Code, Part 1, Title 24, C.C.R.*, December 2001.
- U.S. Army Corps of Engineers, Engineering Division, Directorate of Military Programs, *TI 809-4: Seismic Design for Buildings*, Technical Instructions, Washington, D.C., December 1998.

Annex 2.1

Form: Facility safety objectives

FACILITY'S SAFETY OBJECTIVES

Name

Location

Health System

Natural Hazard

DESIRED RECOVERY TIME
Level of Demand

	Max. Feasible	Min. advisable
Immediate (hours)	<input type="text"/>	<input type="text"/>
Brief (weeks)	<input type="text"/>	<input type="text"/>
Moderate (months)	<input type="text"/>	<input type="text"/>
Long (over 1 year)	<input type="text"/>	<input type="text"/>
Very long (never)	<input type="text"/>	<input type="text"/>

PROTECTION LEVEL
For maximum possible demand or desired level

<input type="text"/>	<input type="text"/>	<input type="text"/>
FUNCTIONAL PROTECTION INFRASTRUCTURE PROTECTION LIFE SAFETY	INFRASTRUCTURE PROTECTION LIFE SAFETY	LIFE SAFETY

For minimum recommended level

<input type="text"/>	<input type="text"/>	<input type="text"/>
FUNCTIONAL PROTECTION INFRASTRUCTURE PROTECTION LIFE SAFETY	INFRASTRUCTURE PROTECTION LIFE SAFETY	LIFE SAFETY

.....
Signature 1

.....
Signature 2

Annex 2.2

Form: Performance objectives for support systems and services

Hazard level¹:

Likely or credible maximum

Minimum recommended

Type of hazard

Variable that characterizes the hazard

Hospital performance objective¹:

Functional protection (FP) Investment protection (IP) Life safety (LS)

Performance objectives for medical and support systems and services²:

Medical services

	FP	IP	LS
Blood bank			
Cardiology			
Clinical gases			
Dental services			
Dermatology			
Ear, Nose and Throat			
Emergencies - Adults			
Emergencies - Children			
Endoscopy			
General In-patient Care			
Hemodialysis			
ICU/ITU			
Imaging, Diagnostic			
Internal Medicine			
Kinesiotherapy			
Laboratory			
Neonatology			
Non-sterile Storage			
Nuclear medicine			
Obstetrics and Gynecology			

	FP	IP	LS
Oncology			
Ophthalmology			
Orthopedics and Traumatology			
Oxygen System			
Outpatient Clinic			
Pathological Anatomy			
Pediatric Neurology			
Pediatric Surgery			
Pediatrics			
Pharmacy			
Plastic Surgery - Burns			
Pneumology			
Psychiatry			
Recovery rooms			
Sterile Storage Area			
Sterilization			
Surgery			
Surgical Wings			
Urology			
Other Medical Services			

Continued
→

Support systems and services:

	FP	IP	LS
Administration			
Air Conditioning (HVAC)			
Boilers, Thermal Power Station			
Communications			
Drinking water			
Electrical distribution			
Stand-by electrical System			
Escape Routes			
Filing and Case Management			
Fire Alarm/Suppression System			

	FP	IP	LS
Food Services			
Industrial Gases			
Industrial Water			
Laundry			
Mobilization and Transport			
Electrical Generator			
Sewerage			
Vertical Transport System			
Other Support Systems/Services			

Performance objectives of other support systems and services²:

	FP	IP	LS
Critical services or components			
Life-saving or essential			
Hazardous or harmful			
Likely to cause panic or chaos			
Special services or components			
Other services			

Notes: 1 For each facility that is to be part of a national or local healthcare network, a general performance objective must be set.
 2 The protection objectives cited provide a minimum of protection. It would be desirable that safety systems be built with functional protection as their performance objective. In any case, the performance objectives must be the result of a joint agreement by the client institution, the medical team and the project specialists. Functional protection necessary implies infrastructure protection and life safety. Investment protection often implies protection of the operation.