



General Awareness Information

Disaster Inspections of Medical Facilities

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**U.S. Public Health Service
Engineer Professional Advisory Committee
Emergency Preparedness Subcommittee**

Disclaimer

This document provides guidance on the Engineering Professional Advisory Committees (EPAC) current thoughts on the subject. An alternative approach may be used if such approach satisfies the situation. Periodically, EPAC will review this document and modify it according to comments submitted.

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Purpose

This document describes the factors that make healthcare facilities different from office buildings and discusses the need for careful planning and preparation when dealing with post-disaster situations. Healthcare facilities must be operational and have the capacity to deal with the undesirable effects of a disaster.

This document also reviews the knowledge required to make a preliminary safety inspection following a disaster event. Because disasters affect all facilities within a certain geographical area, a systematic review and inspection of critical facilities, such as hospitals, is needed to ensure continuation of service.

Background

Healthcare is an evolving industry that requires facility managers and engineers to know the latest healthcare planning, design and construction technologies, and related issues. Hospital accreditation involves compliance with the Ambulatory Healthcare and Business Occupancy building codes and standards, infection control standards and medical safety issues, and life safety standards (National Fire Protection Association [NFPA] 101, Life Safety Code) for patients and other occupants.

Healthcare facilities contain unique features and are more difficult to analyze than commercial buildings. For example:

- Healthcare facilities contain contaminated medical wastes, hazardous laboratory wastes, and regular solid wastes. Dealing with this waste is a formidable challenge.
- Specialized equipment and chemicals such as radiology equipment, medical diagnostic and treatment equipment, medical gases and piping (NFPA 99, Standard for Healthcare Facilities), and pharmaceuticals have critical storage requirements.
- The electrical system (NFPA 70, National Electric Code), especially related to patient care activities (NFPA 99), requires greater reliability (NFPA 110, Standard on Emergency and Standby Power Systems) and added redundancy within its power distribution system.
- Because of the risk of exposure to contagious patients, traffic patterns and indoor air pathways must be preserved as designed (AIA Guidelines, Hospital and Healthcare Facilities, Table 2, Ventilation Requirements for Areas Affecting Patient Care) to protect all the occupants.
- Most medical treatment and support spaces have specific adjacency criteria for optimal functionality and fire code safety requirements. However, not all engineers have the expertise to inspect and evaluate the complex safety issues unique to hospitals and clinics.

Healthcare Occupancy

Hospitals have a unique challenge related to evacuation of patients. Facility safeguards such as special construction features and materials, sprinklers, and strategically located fire barriers within the healthcare facility protect against fire or other disasters. Past

experiences and corroborating fire safety research have shown that it is impractical to evacuate patients, especially if it involves a vertical movement. Therefore, fire codes have dictated the necessary physical protection needed to protect patients in case of fire, but without being evacuated.

Continuous Access to Hospital Following Disaster

A hospital is in great demand following a disaster. It serves as a treatment center and a command center during the recovery period. All hospitals and health centers with 24-hour emergency rooms are structurally upgraded to withstand earthquakes and be fully operational within 24 hours. Because a hospital is an essential facility, it is seismically designed to a higher standard, which is referred to as immediate occupancy.

The fire safety upgrades mentioned earlier coupled with the seismic reinforcing enhances the suitability of hospitals to meet the continuous access requirement. This requirement would probably need additional security considerations, but probably could be implemented with a minimum of structural changes. Some scenarios would have to be evaluated for certain disasters such as floods or hurricanes but the building itself seems suited for the continuous access requirement.

The health facility must have an emergency operation/security plan in place to meet the demands placed on it in a post-disaster situation. The organized plan must contain sufficient detail to allow areas of the health facility to operate effectively and efficiently to meet these disaster emergency demands. Because the healthcare facility is designated as an essential facility for disaster recovery, coordination with local and regional emergency agencies should also be reviewed and made part of the emergency plan.

Codes and Standards

Specific building codes and standards must be followed by all healthcare facilities in order to retain Joint Commission on Accreditation of Healthcare Organizations (JCAHO) Accreditation. Following is a brief list of the major codes and standards that the healthcare facility must comply with under periodic review to maintain its JCAHO accreditation:

- NFPA Standards 70, 99, 101, 110 and 111
- ASHRAE Standards
- ANSI Standards
- AIA Guidelines for Design and Construction of Hospitals and Healthcare Facilities
- JCAHO Environment of Care Essentials for Healthcare

Attachments

Healthcare Facility Inspection

Attached are instructions and checklists for two separate post-disaster inspections, the preliminary Health Facility Rapid Safety Evaluation and the more comprehensive Health Facility Disaster Evaluation. The preliminary Rapid Safety Evaluation is intended for health facilities with slight damage or as a screening tool for hospitals exhibiting extensive visual damage. The more comprehensive Disaster Evaluation, performed by a professional engineer or registered architect, would contain a determination for each item on the checklist portion. The completed evaluation would then be used to determine the specific safety condition and serviceability of the health facility.

The following materials are provided:

- Health Facility Rapid Safety Evaluation (1 page)
 - ATC-20 Rapid Evaluation Safety Assessment Form (1page)
 - ATC-20 Fixed Equipment Checklist (1page)
- Health Facility Disaster Evaluation with checklist (3 pages)

HEALTH FACILITY RAPID SAFETY EVALUATION

1. The table below lists examples of systems failures that may be encountered in a rapid safety evaluation.
2. The following forms were developed by Applied Technology Council (ATC) for the ATC 20-1 Field Manual and include the following:
 - Rapid Evaluation Safety Assessment Form
 - Fixed Equipment Checklist

These forms can be used as a guide for rapid preliminary inspection of a health facility after a disaster. These documents are not a comprehensive or detailed survey of conditions but a preliminary reference. The remarks columns should be used to alert more qualified specialists of potential problems.

3. The ATC form and checklist were developed primarily for a seismic disaster but can also be applied to all disasters where serious facility damage is anticipated (e.g., tornados, flooding, hurricanes).

EXAMPLES OF SYSTEM FAILURES IN A DISASTER TO ASSIST IN A RAPID SAFETY EVALUATION

Hospital System	Symptom of System Failure
Computer Systems, Hospital Network	No response, system down
Main Electrical Power & Emergency Gen.	Many lights out, only emergency (red) outlets work. All outlets in OR, ICU/PCU, and NICU are on emergency power.
Elevators Malfunctioning	Alarm indicates stoppage between floors
Fire Alarm System	No detectors or alarm operable
Sprinkler System	No water; non-operable
Medical Gases	Gas alarms; no oxygen, medical air, nitrous or nitrogen
Medical Vacuum	Vacuum alarm; no vacuum
Natural Gas Supply	Gas odor if leak; no flame at kitchen stoves
Nurse Call System	No contact on patient call system
Patient Care Equipment Systems	All equipment in non-function mode
Sewer/Drain System	Drain lines backing up/odor in lower areas
Steam Generation and Distribution	Absence of building heat and sterilizers inoperable
Telephone System	Local or regional network inoperable
Potable Water	Reduced or no pressure at faucets; potential flooding at lower areas of building/site
Ventilation System	No air movement; loss of temperature control

Block _____ Parcel No. _____

ATC-20 Rapid Evaluation Safety Assessment Form

<p>BUILDING DESCRIPTION: Name: _____ _____ Address: _____ _____ No. of stories: _____ Basement: Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/></p> <p>Primary Occupancy: Dwelling <input type="checkbox"/> Other Residential <input type="checkbox"/> Commercial <input type="checkbox"/> Office <input type="checkbox"/> Industrial <input type="checkbox"/> Public Assembly <input type="checkbox"/> School <input type="checkbox"/> Government <input type="checkbox"/> Emer. Serv. <input type="checkbox"/> Historic <input type="checkbox"/> Other _____</p>	<p>OVERALL RATING: (Check One)</p> <p>INSPECTED (Green) <input type="checkbox"/> ___ Exterior only ___ Exterior and Interior</p> <p>LIMITED ENTRY (Yellow) <input type="checkbox"/> UNSAFE (Red) <input type="checkbox"/></p> <hr/> <p>INSPECTOR: Inspector ID _____ Affiliation _____</p> <p>INSPECTION DATE: Mo/day/year _____ Time _____ am pm</p>
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Instructions: Review structure for the conditions listed below. A "yes" answer to 1, 2, 3, or 5 is grounds for posting entire structure UNSAFE. If more review is needed, post LIMITED ENTRY. A "yes" answer to 4 requires posting AREA UNSAFE and/or barricading around the hazard. Hazards such as a toxic spill or an asbestos release are covered by 6 and are to be posted and/or barricaded to indicate AREA UNSAFE.

Condition	Yes	No	More Review Needed
1. Collapse, partial collapse, or building off foundation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Building or story noticeably leaning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Severe racking of walls, obvious severe damage and distress	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Chimney, parapet or other falling hazard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Severe ground or slope movement present	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Other hazard present	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Recommendations:

No further action required

Detailed Evaluation required (circle one) Structural Geotechnical Other _____

Barricades needed in the following areas: _____

Other: _____

Posted at this Assessment: Yes No

Comments: _____

ATC-20 Fixed Equipment Checklist

FACILITY: Name: _____ Address: _____ _____ _____	INSPECTOR: Inspector ID _____ Affiliation _____ INSPECTION DATE: Mo/day/year _____ Time _____ am pm
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CHECKLIST:	Equipment Damaged			Comments
	No	Yes <i>Operable</i>	Yes <i>Inoperable</i>	
General Items:				
Main boilers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Chillers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Emergency generators	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Fuel tanks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Battery racks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Fire pumps	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
On-site water storage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Communications Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Main transformers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Main electrical panels	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Elevators (traction)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other fixed equipment:				
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

Special Concerns for Hospitals and Other Health Care Facilities:

Radiation equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Toxic chemical storage:				
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Liquid oxygen tanks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
Other: _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

Recommendations/Comments: _____

HEALTH FACILITY DISASTER EVALUATION

Date _____
Facility Name _____
Facility Location _____
Reviewer _____

Purpose

The following table is used to evaluate the condition of a health care facility after a disaster has occurred. Its purpose is to collect IMMEDIATE data after a specific disaster. Government staff will use this data to determine the current condition of the facility and to help them determine if facility is operational and safe.

Evaluation

The table should be completed by a professional engineer/architect (PE/A) or a certified facility maintenance engineer should complete the table and then forward it to the local health care administrator (HCA). The PE/A should make a recommendation to the HCA if the facility should be either labeled as having “limited entry” or “no entry” to the public. For limited entry, the PE/A must define what areas should be limited. The PE/A must clearly post the signs with appropriate signage or plastic ribbon tape. Following are recommendations for appropriate signage:

LIMITED ENTRY

Warning: This structure/system/equipment has been damaged and its safety is questionable.

NO ENTRY

Warning: This structure/system/equipment has been seriously damaged and is unsafe.

After the completion of this table and appropriate signage posting, a thorough engineering evaluation of the facility is recommended. A team of registered architects and engineers with appropriate knowledge in their particular area of specialty should perform this investigation. The makeup of this team would be based upon the results that have been entered into table, and the need for repairing the damaged and/or securing the safety of the facility. This team should not only review the damage that has occurred throughout the facility, but also make appropriate contacts to all service contracts that the facility uses in its daily operation.

	N/A	Structure/System/Equipment Damage		
		NO	YES	
			Operable/Safe	Inoperable/Unsafe
CIVIL SYSTEMS CHECK LIST				
Domestic Water Supply Main				
Fire Supply Main				
On-Site Water Storage				
Sewer Line				
Storm Water Piping from Roof				
Surface Water Drainage				
Road Access				
Facility Parking				
Facility Sidewalks				
ELECTRICAL SYSTEMS CHECK LIST				
Electrical Service to Facility				
Main Power Transformer				
Main Electrical Panels				
Emergency Generator				
<i>Communication Systems</i>				
▪ Telephone				
▪ Computer Local Area Network				
▪ Public Address System				
▪ Fax Machines				
<i>Fire Alarm System</i>				
▪ Smoke Detectors				
▪ Strobe Lights				
Emergency Lighting System				
Normal Lighting System				
MECHANICAL SYSTEMS CHECK LIST				
Building HVAC Control System				
<i>HVAC System Components</i>				
▪ Main Boilers				
▪ Chillers				
▪ Pumps				
Fire Sprinkler System				
Fuel Supply (Oil, Propane, Natural Gas, Diesel)				
Medical Gas				
Vacuum Gas				
Fire Pumps				
Seismic Shut-Off Valves				
Motor Starters				

	N/A	Structure/System/Equipment Damage		
		NO	YES	
			Operable/Safe	Inoperable/Unsafe
STRUCTURAL SYSTEMS CHECK LIST				
<i>Foundations</i>				
▪ Building off foundation				
▪ Fractured foundation				
<i>Vertical Support</i>				
▪ Columns not Plumbed/Buckled				
▪ Bearing Walls				
▪ Beams/Trusses				
▪ Connections				
<i>Horizontal Lateral Support</i>				
▪ Shear Walls				
▪ Diaphragms				
▪ Cross Bracing				
▪ Connections				
<i>Roof Support</i>				
▪ Beams				
▪ Trusses				
▪ Connections				
NON-STRUCTURAL SYSTEMS CHECK LIST				
<i>Exterior Facade</i>				
▪ Bldg. Skin/Walls				
▪ Windows/Doors				
Roof System				
Elevators				
Fuel Tanks				
Toxic Chemical Tanks				
Liquid Oxygen Tanks				
Battery Racks				
MEDICAL EQUIPMENT CHECK LIST				
X-Ray Equipment				
CAT Scanner				
MRI Units				
Ultra Sound Units				
Laboratory Equipment				
Radiation Equipment				
Other Fixed Equipment				

REVIEWER RECOMMENDATIONS

* LIMITED ENTRY INTO FACILITY: Yes No

Authorized entry areas include _____

Off-limit areas include _____

* NO ENTRY TO FACILITY: Yes No