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Requirements and recommendations for the construction of emergency medical facilities

Exigences et recommandations relatives à la construction d'installations médicales d'urgence

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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International Workshop Agreement IWA 38 was approved at a series of workshops hosted by the Standardization Administration of China (SAC), in association with China IPPR International Engineering Co., Ltd., held in Beijing, China, between January and April, 2021.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Over the past few decades, natural disasters, industrial accidents and severe epidemics have frequently occurred and caused great losses of human life and properties. In order to deal with these emergency issues, the construction of emergency medical facilities is very important and has practical significance.

In China, the Beijing Xiaotangshan Hospital (612 beds) was constructed in 7 days when SARS broke out in 2003. In 2020, the Wuhan Huoshenshan Hospital (1 000 beds) and the Wuhan Leishenshan Hospital (1 600 beds) were constructed in 10 days. These emergency medical facilities played an important role in fighting COVID-19.

This document summarizes the successful experiences accumulated from the construction of several emergency medical facilities including the projects mentioned above, studies the new problems revealed in different types of emergencies in the past, and develops a set of technical guidelines for the design of emergency medical facilities.

This document is intended to provide technical support for the safe, appropriate and rapid construction of emergency medical facilities. In the design of an emergency medical facility, its function and scale are determined by the type, characteristics, rescue plans and actual needs of the emergency. The site plan is set in a scientific and reasonable way. The various traffic flows in the facility are organized efficiently, and it should have a degree of flexibility, so as to meet the uncertainty in emergencies.

Requirements and recommendations for the construction of emergency medical facilities

1 Scope

This document provides requirements and recommendations for the rapid construction of emergency medical facilities, including various categories of public health emergencies, for handling large numbers of casualties and patients. The functional composition of emergency medical facilities is determined by the characteristics of the emergencies.

This document is applicable to new projects built on new sites or within existing medical institutions, where emergency medical facilities are constructed rapidly from steel-frames and prefabricated standard plates or box structures.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 16890-1, *Air filters for general ventilation — Part 1: Technical specifications, requirements and classification system based upon particulate matter efficiency (ePM)*

ISO 29463-1, *High efficiency filters and filter media for removing particles from air — Part 1: Classification, performance, testing and marking*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
emergency medical facility
medical facility which is built rapidly and completed in limited time in response to public health issues

3.2
reception area
area where patients and the injured are received for preliminary assessment, screening, triaging and filling in related forms

3.3
clean area
area where medical staff rest and live

Note 1 to entry: Respiratory infectious disease facilities are divided into different zones based on different sanitation and safety levels.

3.4
semi-contaminated area
working area for medical staff, which is accessible via the *hygienic pass-through area* (3.8)

EXAMPLE Offices, meeting rooms, treatment preparation rooms.

3.5
contaminated area
area where medical staff wearing personal protective equipment treat patients, including where patients enter or stay

EXAMPLE Consultation rooms, exam rooms, wards, waste storage.

3.6
negative pressure ward
separated ward equipped with a ventilation system which controls the air flow direction to ensure that its indoor static pressure is always lower than that of surrounding areas

3.7
buffer room
isolated small room where air flow in adjacent spaces is directed to form a sanitation and safety barrier

3.8
hygienic pass-through area
passage space set up at the entrance of *contaminated areas* (3.5), connecting areas of different sanitation and safety levels, where medical staff change shoes, put on/remove gowns, wash hands, shower, put on/remove personal protective equipment, etc.

3.9
medical quarantine area
buildings and facilities that are suitable for individual quarantine and medical observation in accordance with relevant regulations and requirements for epidemic prevention and control

4 Abbreviated terms

CT Computerized Tomography

5 Basic principles

5.1 Sustainability

With case-specific considerations on local resources and actual needs for medical treatment, emergency medical facilities shall respond to local conditions, make the best use of local materials, collaborate and share resources with local health systems, and operate efficiently.

5.2 Programme and circulation

In emergency medical facilities, spaces for rapid screening, triaging and treatment shall be strengthened. Access to imaging tests such as computerized tomography (CT) scan and surgical operation shall be unobstructed and efficient. For respiratory infectious disease facilities, negative pressure wards, negative pressure intensive care units and negative pressure operating rooms shall be set up when necessary.

5.3 Structure, mechanical and electrical systems

Reliable technology shall be adopted for the structural, mechanical and electrical systems of emergency medical facilities. Prefabricated modular structures, integrated components and pre-wired cabinets should be used.

5.4 Products and components

Products and components selected for emergency medical facilities shall be reliable and easy to maintain.

5.5 Information technology

Emergency medical facilities shall be equipped with information and intelligent technology systems, so as to collect and analyse timely information, to provide tele-consultation, diagnosis and treatment services, to deliver intelligent building management, and to promote data sharing and coordination in the emergency medical service network.

5.6 Safety

In emergency medical facilities, structural safety, non-structural system safety, biosafety, fire safety and environmental safety shall be ensured.

6 Site selection and planning

6.1 Site selection

For sites of emergency medical facilities, vacant spaces in existing medical facilities or their adjacent plots should be selected; reserved open spaces in urban disaster preparedness plans, such as city squares, parks and undeveloped land, can also be utilized. In general, the following conditions shall be met.

a) Geotechnical conditions shall be assessed with relevant standards to meet construction requirements.

b) Comprehensive municipal infrastructure shall be available.

c) There shall be a good transport network.

d) Respiratory infectious disease facilities shall be kept far away from densely-populated or environmentally-sensitive areas. An isolation zone no less than 20 m wide shall be set surrounding the campus, or other effective measures shall be taken to meet biosafety requirements.

6.2 Building layout

The configuration of emergency medical facilities shall be appropriately determined by functional programming. Their building layout and circulation shall be organized to be safe and efficient.

6.3 Circulation

In emergency medical facilities, the circulation patterns of people, logistics and vehicles shall be identified and planned in a scientific way.

6.4 Entrances

An ambulance cleaning and decontamination station shall be set up at the entrance of emergency medical facilities.

6.5 Preventing cross-contamination

Respiratory infectious disease facilities shall respect the following basic principles:

— control the source of infection;

— break the transmission chain;

— segregate high-risk groups.

The circulation paths of medical staff and patients shall be strictly separated. Different transportation routes for clean and contaminated goods shall be provided and they shall not intersect with each other.

6.6 Medical staff living area

When possible, a health professions staff living facility should be set up within or near the emergency medical facility, including a dormitory for on-duty staff and a designated medical quarantine area for staff who are about to leave the facility.

7 Architecture and structure system

7.1 General provisions

7.1.1 Zoning

The functional zones of emergency medical facilities shall include reception areas, medical technology areas (such as CT, point-of-care testing, etc.), ward areas, staff living areas and logistics areas.

7.1.2 Accessibility

The patient transfer route shall be barrier-free.

7.1.3 Construction method

Prefabricated built-in and modular units should be used for construction. For some special functional areas and areas connected to them, prefabricated components can be assembled on site based on actual needs.

7.1.4 Vertical circulation

For emergency medical facilities of two or more floors, ramps or bed elevators shall be set up at central traffic routes depending on the conditions. For facilities with biosafety risks, their vertical circulation for clean and contaminated areas shall be planned separately.

7.1.5 Interior fittings and surfaces

Materials of indoor fittings and surfaces shall be resistant to abrasion and corrosion, leak-proof and easy to clean and maintain. Anti-condensation and anti-seepage technical features shall also be adopted.

7.1.6 Structural reliability

The structural reliability target and seismic protection criterion of emergency medical facilities shall be determined by their service life, service requirements and construction period.

7.1.7 Structural system

The structural system shall be selected in consideration of local conditions, and should be easily fabricated, transported and installed. Prefabricated, light-weight structures should be used. Light-weight structures shall be wind-resistant, and the connection between their components shall be safe and reliable.

7.1.8 Leak-proof

The main structure of emergency medical facilities shall be impermeable and leak-proof.

7.1.9 Light-weight structure

When a light-weight building structure is adopted, the foundation and support frames of equipment such as air blowers and exhaust fans should be detached from the building structure. When a multi-storey light-weight building structure is adopted, heavy medical equipment such as CT shall be installed on the ground floor. If the ground floor is built above the ground, its bearing capacity and deformation shall be calculated.

7.2 Specific requirements for respiratory infectious disease facilities

7.2.1 Zoning

Facilities shall be arranged according to their medical procedures, and functional zoning shall be strictly implemented. The areas for medical staff and patients should be divided into clean areas, semi-contaminated areas and contaminated areas according to their sanitation and safety levels, and the three areas should be arranged in a sequential order in the direction of local prevailing winds. A hygienic pass-through area or buffer room shall be set up between two adjacent areas of different hygienic levels in the medical staff working area.

7.2.2 Preventing cross-contamination

The circulation paths of medical staff and patients shall be strictly separated. Different transportation routes shall be established for clean and contaminated goods. Any mixing or intersection shall be avoided.

7.2.3 Building layout and airflow management

The facility's layout shall be adapted to ensure effective air distribution. The indoor air should be strictly controlled to flow from clean areas to semi-contaminated areas and then to contaminated areas, creating a pressure gradient specified in relevant regulations.

7.2.4 Negative pressure ward

Negative pressure wards shall be located at the far-end of the indoor air distribution system. A double-door interlocked pass box shall be used for the transfer of materials between the ward and the staff corridor.

7.2.5 Medical waste

A temporary medical waste storage shall be set up on campus. The medical waste shall be collected, sealed, disinfected and temporarily stored before being shipped to a medical waste treatment station for centralized treatment.