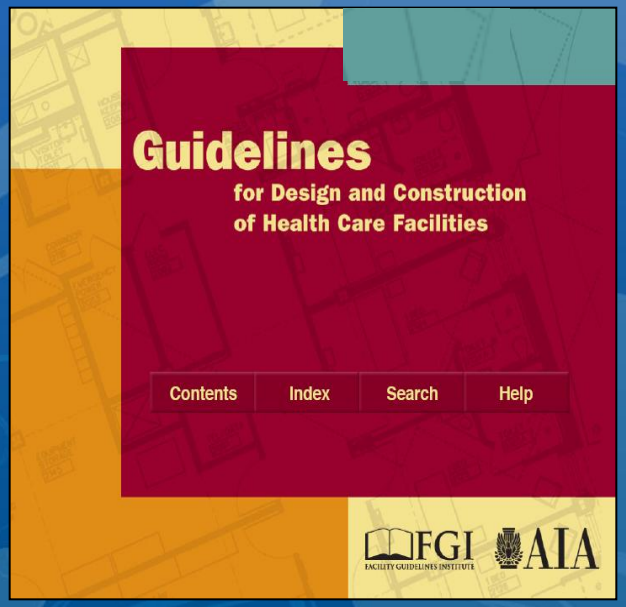
AIA Guidelines for Design and Construction of Health Care Facilities

อาจารย์ อรรณพ กิ่งขจี

Asst. Managing Director

EEC Engineering Network

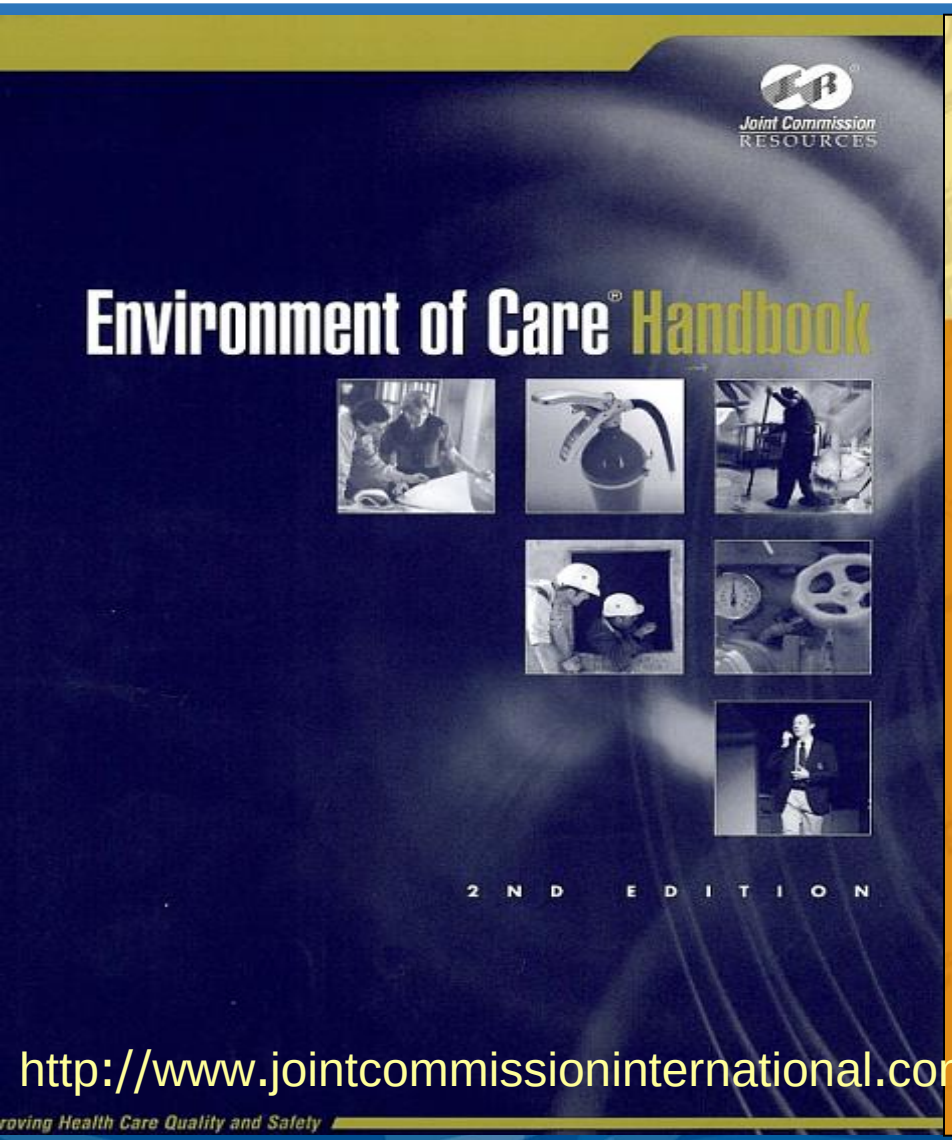
ประธานกรรมการวิชาการฯสมาคมปรับอากาศแห่งประเทศไทย

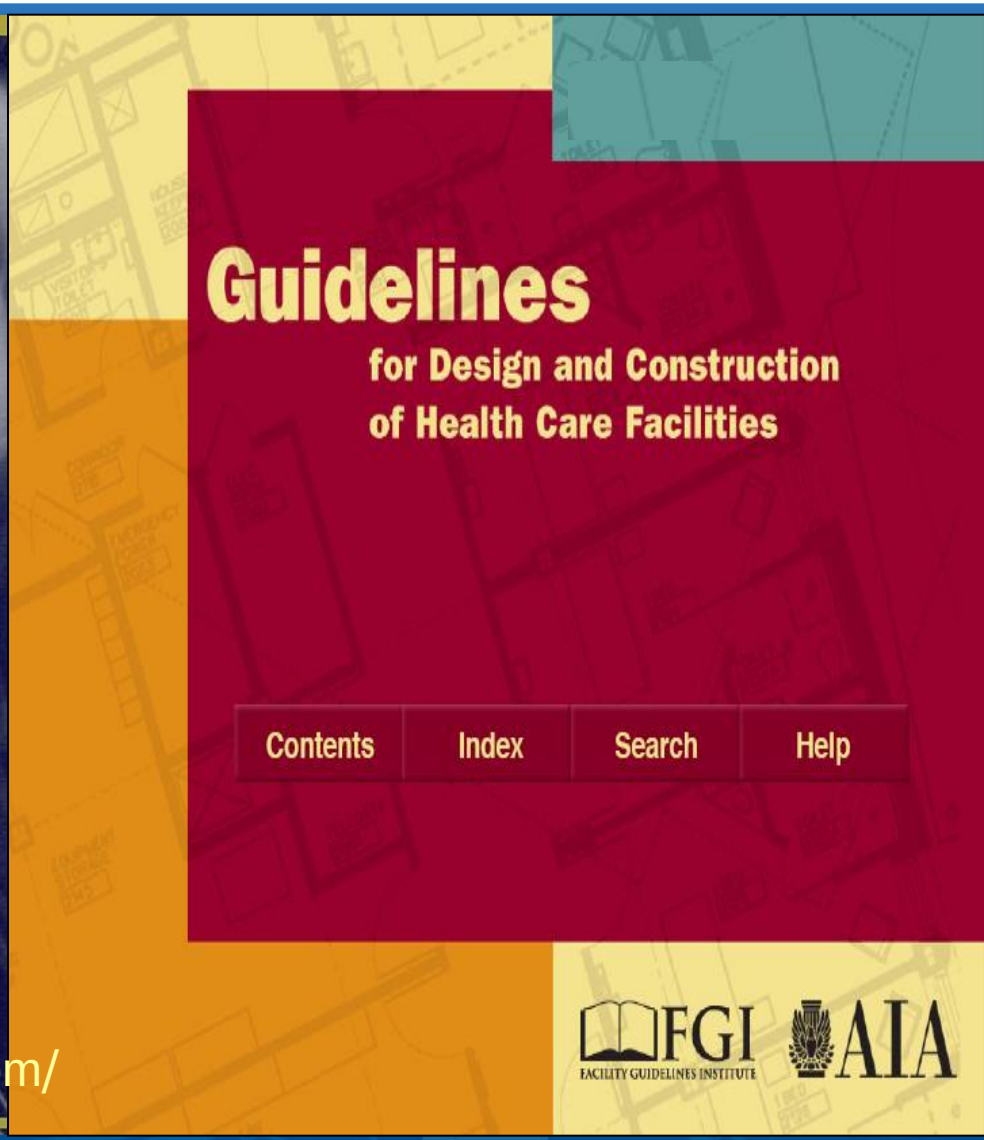


สถาบันพัฒนาและรับรองคุณภาพโรงพยาบาล

http://www.ha.or.th

Joint Commission International (JCI)
AIA Guidelines





http://www.jointcommissioninternational.com/

Joint Commission International (JCI)

- Joint Commission International (JCI) is a division of Joint Commission Resources (JCR), the subsidiary of The Joint Commission. For more than 50 years, The Joint Commission and its predecessor organization have been dedicated to improving the quality and safety of health care services. Today the largest accreditor of health care organizations in the United States, the Joint Commission surveys nearly 20,000 health care programs through a voluntary accreditation process. The Joint Commission and its subsidiary are both not-for-profit corporations.

http://www.jointcommissioninternational.com/

Joint Commission International (JCI)

Preconstruction ("Infection Control") Risk Assessment

Joint Commission standards require hospitals, ambulatory care facilities, behavioral health care organizations and long term care organizations to use the American Institute of Architects (AIA) *Guidelines for Design and Construction of Hospital and Health Care Facilities (Guidelines)* or other appropriate regulations, standards, and guidelines. In the 2001 edition of the *Guidelines,* more than half of Chapter 5, "Construction," is new material related to infection control, including the "infection control risk assessment." It acknowledges the hazards that construction and renovation activities can pose for the patient, resident, and client population and

PART 1 - 1.2 Environment of Care

- *(5) Safety and security. The safety and security of patients or residents, staff, and visitors shall be addressed in the overall planning of the facility consistent with the functional program.
- *(6) Finishes. The effect of materials, colors, textures, and patterns on patients or residents, staff, and visitors shall be considered in the overall planning and design of the facility.Maintenance and performance shall be considered when selecting these items.

* อ้างอิงข้อมูลจากเอกสาร AIA Guideline for Design & Construction of Healthcare Facilities

PART 1 - 1.2 Environment of Care

*3 Sustainable Design

- Sustainable design, construction, and maintenance practices to improve building performance shall be considered in the design and renovation of health care facilities.

PART 1 - 1.2 Environment of Care

*3 Sustainable Design

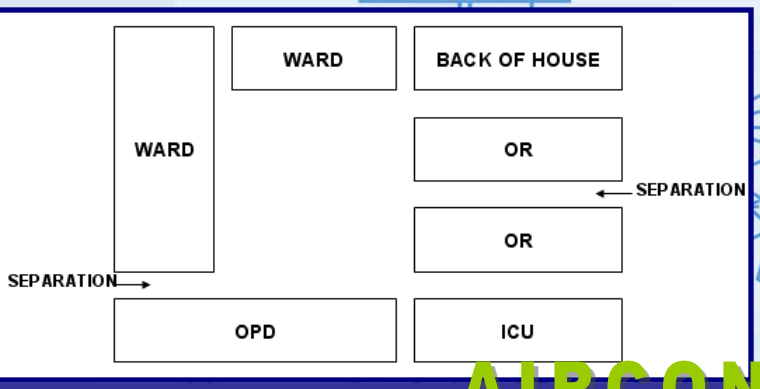
- *3.1.1 Site Selection and Development
- *3.1.2 Waste Minimization
- *3.1.3 Water Quality and Conservation
- *3.1.4. Energy Conservation

»Proper planning and selection of mechanical and electrical systems, as well as efficient utilization of spaceand climatic characteristics, can significantly reduceoverall energy demand and consumption.

PART 1 - 1.5 Planning, Design, and Construction

- **1.2.1 Infection Control Risk Assessment (ICRA)**
- During the planning phase of a project, after considering the facility's patient population and programs, the owner shall provide an infection control risk assessment. An ICRA is a determination of the potential risk of transmission of various air- and waterborne biological contaminants in the facility.

Design of Health Care



AIRCONDITIONING ZONE

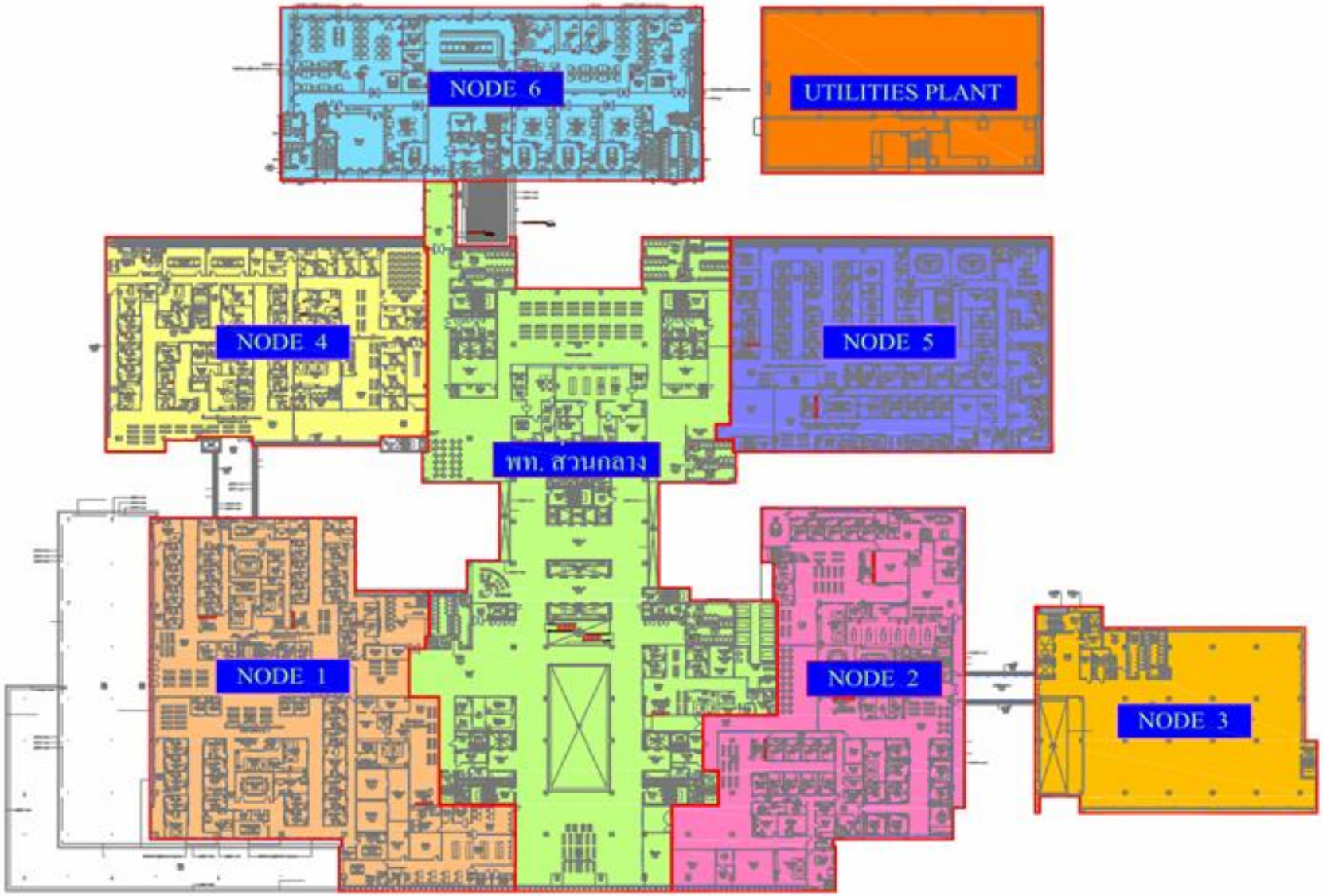
Low risk	Medium risk	High risk	Highest risk
• Office areas	• Cardiology • Echocardiography • Endoscopy • Nuclear medicine • Physical therapy • Radiology/MRI • Respiratory therapy	• Critical-care unit • Emergency room • Labor and delivery • Laboratories (specimen) • Newborn nursery • Outpatient surgery • Pediatrics • Pharmacy • Post-anesthesia-care unit • Surgical units	• Any area caring for immunocompromised patients • Burn unit • Cardiac-catheterization lab • Central sterile supply • Intensive-care units • Medical unit • Negative-pressure isolation rooms • Oncology • Operating rooms, including C-section rooms

SMOKE COMPARTMENT

FIRE COMPARTMENT

AIRBORNE CONTAMINATION CONTROL

* อ้างอิงข้อมูลจากโครงการพัฒนารามาธิบดีสู่คณะแพทย์ศาสตร์ชั้นนำในเอเชีย



* อ้างอิงข้อมูลจากโครงการพัฒนารามาธิบดีสู่คณะแพทย์ศาสตร์ชั้นนำในเอเชีย

PART 1 - 1.5 Planning, Design, and Construction

- ***4 Commissioning**
- **4.1 Mechanical Systems**
- Acceptance criteria for mechanical systems shall be specified.
- 4.1.1 Crucial ventilation specifications for air balance and filtration shall be verified before owner acceptance.
- 4.1.2 Areas requiring special ventilation (such as surgical services, protective environments, airborne infection isolation rooms, laboratories, and local exhaust systems for hazardous agents) shall be recognized as requiring mechanical systems that ensure infection control. Ventilation deficiencies shall not be accepted.
- 4.1.3 Acceptance criteria for local exhaust systems dealing with hazardous agents shall be specified and verified.

PART 1 – 1.6 Common Requirements

- **2.2 Heating, Ventilating, and Air-Conditioning (HVAC) Systems**
- **2.2.2.1** HVAC ductwork
- (1) General
- (a) Air-handling duct systems shall be designed with accessibility for duct cleaning and shall meet the requirements of NFPA 90A.
- (3) Fire and smoke dampers
- (a) Fire and smoke dampers shall be constructed, located, and installed in accordance with the requirements of NFPA 101, 90A, and the specific damper's listing requirements.

PART 2-2.1 General Hospitals

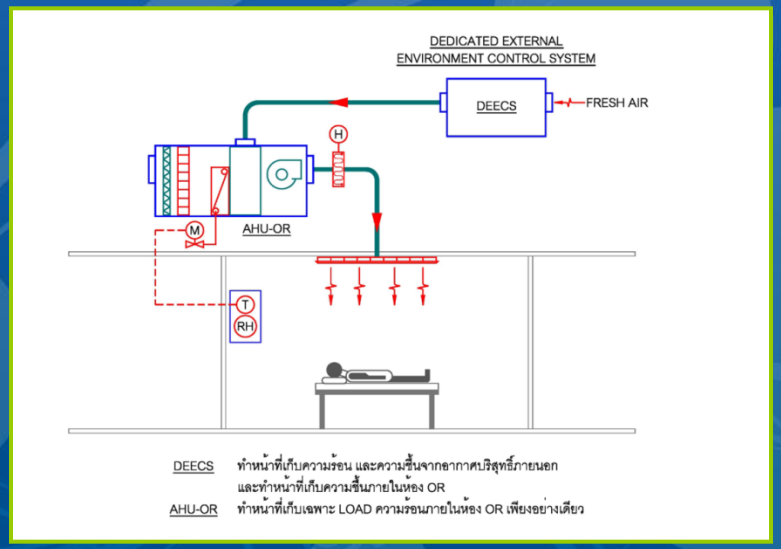
- 3 Nursing Locations
- 3.1.1 Typical Patient Rooms
- Each patient room shall meet the following standards:
- 3.1.1.1 Capacity
- (1) In new construction, the maximum number of beds per room shall be one unless the functional program demonstrates the necessity of a two-bed arrangement. Approval of a two-bed arrangement shall be obtained from the licensing authority.

PART 2-2.1 General Hospitals

- 3.3.3 Airborne Infection Isolation Room
- Access to at least one airborne infection isolation room shall be provided unless provided elsewhere in the facility. The number of airborne infection isolation rooms shall be determined on the basis of an infection control risk assessment (ICRA).

PART 2-2.1 General Hospitals

- (d) Construction requirements. Operating room perimeter walls, ceiling, and floors, including penetrations, shall be sealed.



PART 2-2.1-10.1 Plumbling

- **10.1.2.5** Drainage systems
- (1) Piping
- (c) Insofar as possible, drainage piping shall not be installed within the ceiling or exposed in operating and delivery rooms, nurseries, food preparation centers, food-serving facilities, food storage areas, central services, electronic data processing areas, electric closets, and other sensitive areas.Where exposed overhead drain piping in these areas is unavoidable, special provisions shall be made toprotect the space below from leakage, condensation, or dust particles.

PART 2-2.1-10.1 Plumbling

PART 2-2.1-10.1 Plumbling

- (2) Floor drains
- (a) Floor drains shall not be installed in operating and delivery rooms.

- (3) Autopsy table drain systems. Drain systems for autopsy tables shall be designed to positively avoid splatter or overflow onto floors or back siphonage and for easy cleaning and trap flushing.

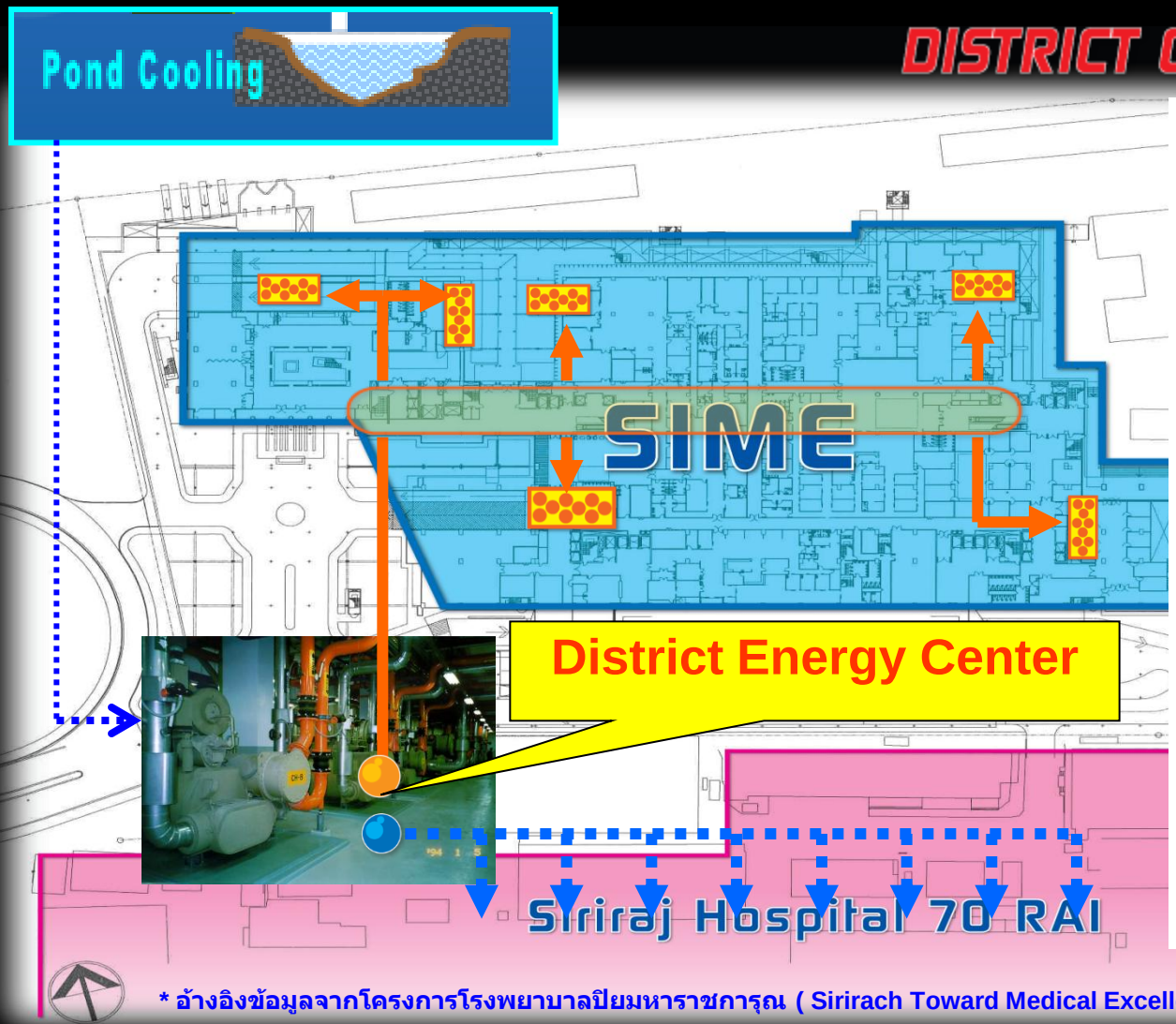
PART 2-2.1-10.1 Plumbling

- **10.1.3.1** Clinical sinks
- (1) Clinical sinks shall be trimmed with valves that can be operated without hands. Single-lever or wrist blade devices shall be permitted. Handles on clinical sinks shall be at least 6 inches (15.24 centimeters) long.
- (2) Clinical sinks shall have an integral trap wherein the upper portion of the water trap provides a visible seal.

PART 2-2.1-10.2 HVAC Systems

- **10.2 Heating, Ventilating, and Air-Conditioning (HVAC) Systems**
- **10.2.1.1** Mechanical system design
- (1) Efficiency. The mechanical system shall be designed for overall efficiency and appropriate life-cycle cost.

Energy Saving & Reliability
(District Energy Center Design)



District Energy Center

- Load Sharing Design
- Saving Investment
- Energy Saving
- Operation Cost

- Reliability &Stability
- Easy Maintenance
- Flexible & Support to Siriraj 70 rai

- Support Renewable Energy

* อ้างอิงข้อมูลจากโครงการโรงพยาบาลปิยมหาราชการุณ (Sirirach Toward Medical Excellence in Southeast Asia)


가톨릭대학교 의과대학
만차
주차장

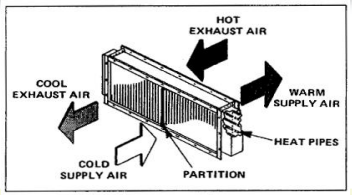

대중교통을 이용하셔도 편리합니다.
2013 고객가치최우수상품

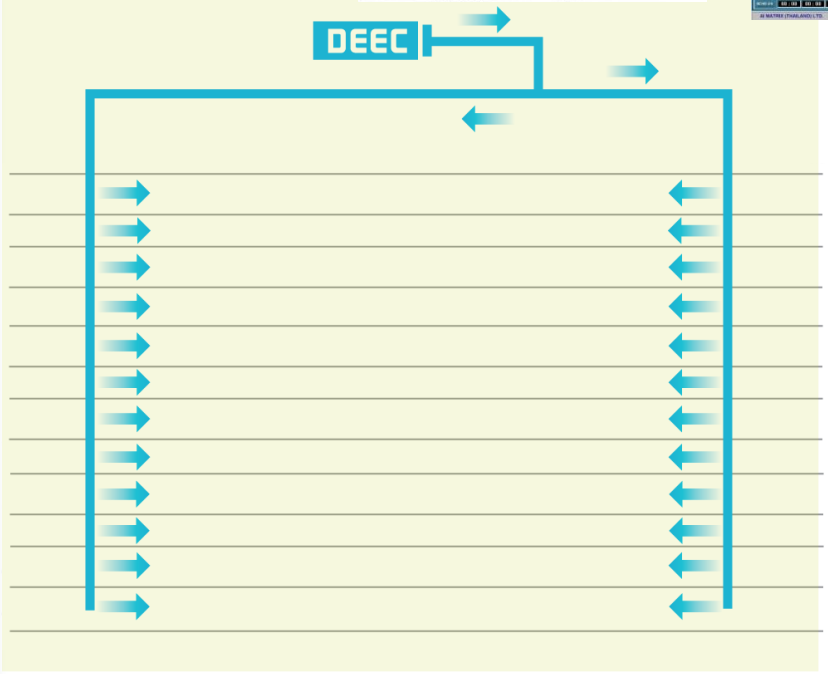
PART 2-2.1-10.2 HVAC Systems

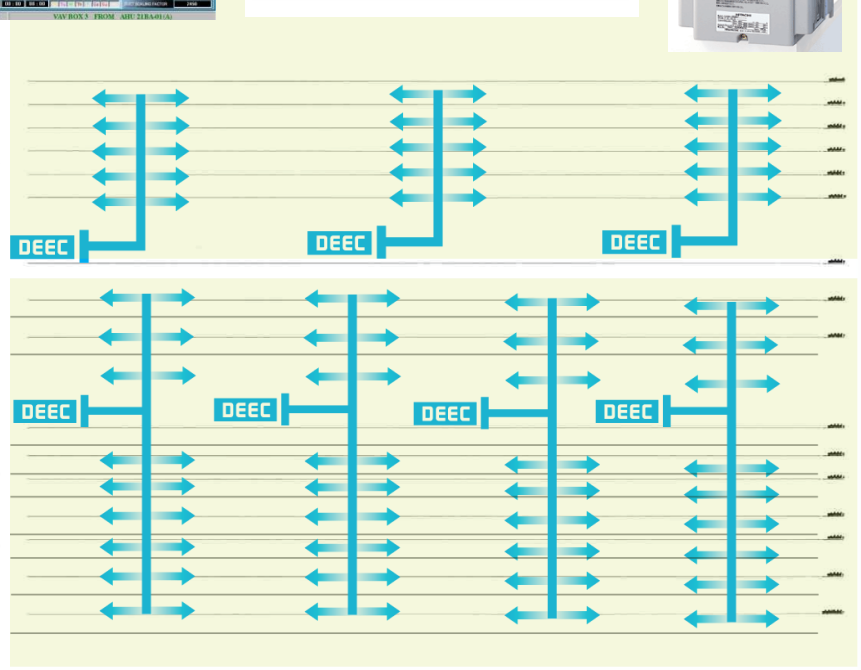
- (2) Air-handling systems
- (b) VAV systems. The energy-saving potential of variable-air-volume systems is recognized, and the standards herein are intended to maximize appropriate use of those systems. Any system used for occupied areas shall include provisions to avoid air stagnation in interior spaces where thermostat demands are met by temperatures of surrounding areas.

PART 2-2.1-10.2 HVAC Systems

- (c) Noncentral air-handling systems (i.e., individual room units used for heating and cooling purposes, such as fan-coil units, heat pump units, etc.). These units may be used as recirculating units only. All outdoor air requirements shall be met by a separate central air-handling system with proper filtration, as noted in Table 2.1-3.







SiMR BUILDING

SiMC BUILDING

PRECOOLED FRESH AIR SUPPLY DIAGRAM (DEEC SYSTEM)

PART 2-2.1-10.2 HVAC Systems

- (3) Temperature and humidity. Space temperature and relative humidity shall be as indicated in Table 2.1-2.

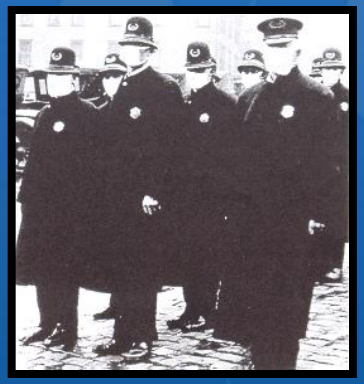
- (4) Air movement direction. To maintain asepsis control, airflow supply and exhaust shall generally be controlled to ensure movement of air from “clean” to “less clean” areas, especially in critical areas.

Control directional of airflow movement in zone

PART 2-2.1-10.2 HVAC Systems

- **10.2.2 Requirements for Specific Locations**
- 10.2.2.1 Airborne infection isolation rooms. The infectious disease isolation room is used for isolating the airborne spread of infectious diseases, such as measles, varicella, or tuberculosis.

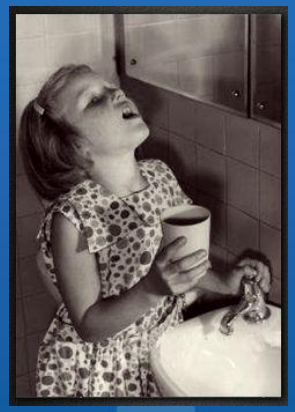
Influenza Pandemics in the 20th Century



1918: “Spanish Flu”

40-50 million deaths

H1N1



1957: “Asian Flu”

1 million deaths

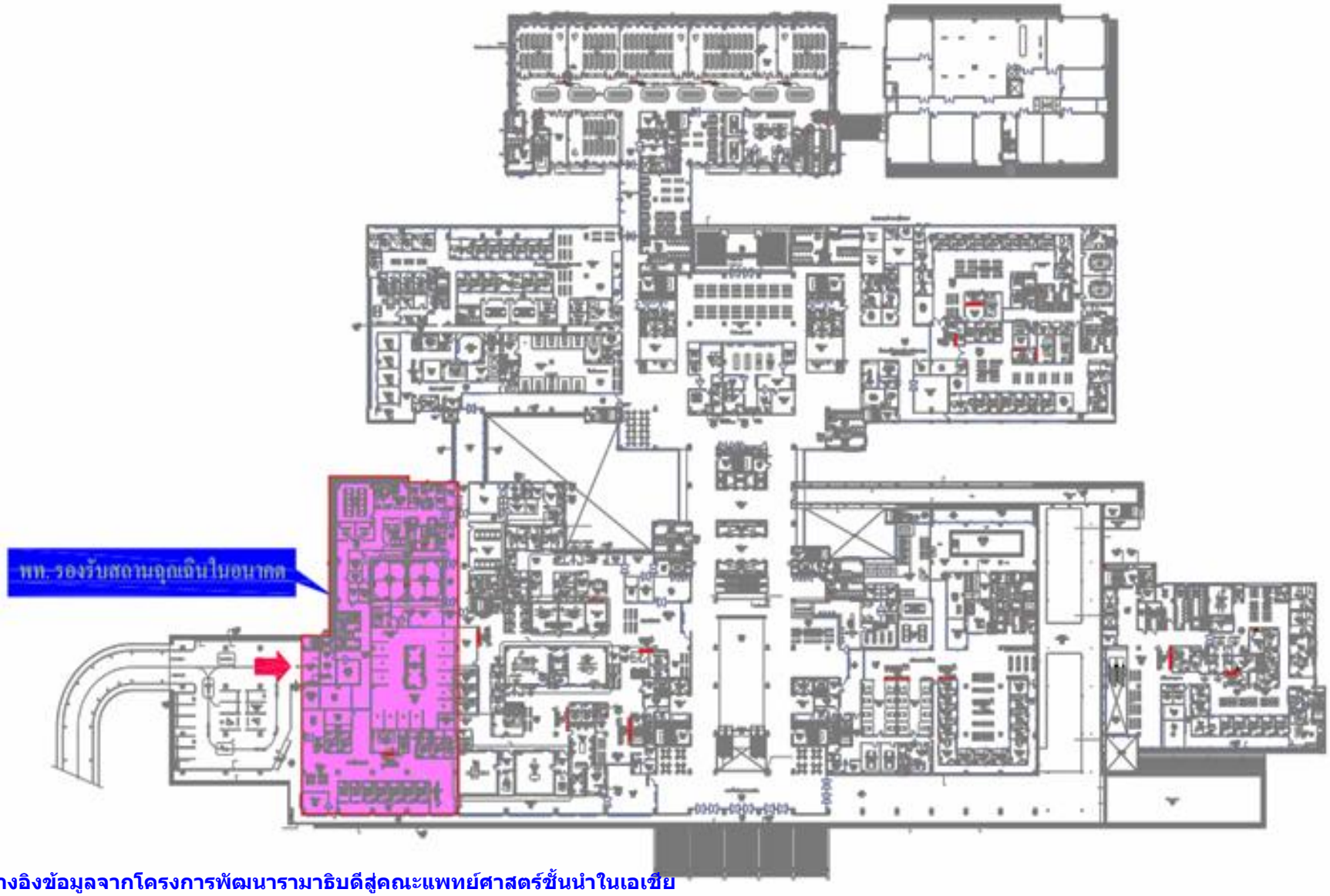
H2N2

1968: “Hong Kong Flu”

1 million deaths

H3N2

ที่มา : เอกสารประกอบการบรรยายเรื่อง ความสำคัญของการควบคุมการแพร่กระจายเชื้อโรคทางอากาศในสถานพยาบาล โดย พญ.จริยา แสงสัจจา สถาบันบำราศนราดูร 13 ต.ค. 2548



* อ้างอิงข้อมูลจากโครงการพัฒนารามาธิบดีสู่คณะแพทย์ศาสตร์ชั้นนำในเอเชีย

PART 2-2.1-10.2 HVAC Systems

- (3) Rooms with reversible airflow provisions for the purpose of switching between protective environment and All functions are not acceptable.

PART 2-2.1-10.2 HVAC Systems

- **10.2.2.2** Protective environment rooms. The protective environment (PE) room is used to protect the patient from common environmental airborne infectious microbes (i.e., Aspergillus spores).
- (1) These special ventilation areas shall be designed to provide directed airflow from the cleanest patient care area to less clean areas.

INDOOR DESIGN CRITERIA

Recirculating Air for OR

TA = 30 ACH

OA = 5 ACH

Patient Room

TA >= 12 ACH

OA >= 2 ACH

Isolation Rooms

TA >= 15 ACH (PE)

TA >= 12 ACH (AII)

OA >= 2 ACH

Health Care Facilities

Table 3 General Pressure Relationships and Ventilation of Certain Ho

Function Space	Pressure Relationship to Adjacent Areas[a]	Minimum Air Changes of Outdoor Air per Hour[b]	Minimum Total Air Changes per Hour[c]	Air Exhausted Directly to Outdoors	Air Recirculated Within Room Units[d]
SURGERY AND CRITICAL CARE					
Operating room (all	P	15[e]	15	Yes	No
(re	P	5	25	Optional	No
Delivery room (all	P	15	15	Optional	No
(re	P	5	25	Optional	No
Recovery room	E	2	6	Optional	No
Nursery suite	P	5	12	Optional	No
Trauma room[f]	P	5	12	Optional	No
Anesthesia storage (s	-	Optional	8	Yes	No
NURSING					
Patient room	±	2	4	Optional	Optional
Toilet room[g]	N	Optional	10	Yes	No
Intensive care	P	2	6	Optional	No
Protective isolation[i]	P	2	15	Yes	Optional
Infectious isolation[h]	±	2	6	Yes	No
Isolation alcove or anteroom	±	2	10	Yes	No
Labor/delivery/recovery/postpartum (LDRP)	E	2	4	Optional	Optional
Patient corridor	E	2	4	Optional	Optional
ANCILLARY					
Radiology X-ray (surgery and critical care)		3	15	Optional	No
X-ray (diagnostic and treatment)		2	6	Optional	Optional
Darkroom		2	10	Yes[j]	No
Laboratory, general	N	2	6	Yes	No
Laboratory, bacteriology		2	6	Yes	No
Laboratory, biochemistry		2	6	Optional	No
Laboratory, cytology		2	6	Yes	No
Laboratory, glasswashing		Optional	10	Yes	Optional
Laboratory, histology		2	6	Yes	No
Laboratory, nuclear medici		2	6	Yes	No
Laboratory, pathology		2	6	Yes	No
Laboratory, serology		2	6	Optional	No
Laboratory, sterilizing		Optional	10	Yes	No
Laboratory, media transfer		2	4	Optional	No
Autopsy		2	12	Yes	No
Nonrefrigerated body-holdi		Optional	10	Yes	No
Pharmacy	P	2	4	Optional	Optional

PART 2-2.1-10.2 HVAC Systems

- **10.2.2.4** Operating and delivery rooms
- (1) Air supply
- (a) In new construction and major renovation work, air supply for operating and delivery rooms shall be from non-aspirating ceiling diffusers with a face velocity in the range of 25 to 35 fpm (0.13 to 0.18 m/s), located at the ceiling above the center of the work area. Return air shall be near the floor level, at a minimum. Return air shall be permitted high on the walls, in addition to the low returns.

PART 2-2.1-10.2 HVAC Systems

- (b) Each operating and delivery room shall have at least two return-air inlets located as far from each other as practical.

- (c) Turbulence and other factors of air movement shall be considered to minimize the fall of particulates onto sterile surfaces.

รพ.ปิยมหาราชการุณย์
คณะแพทย์ศาสตร์ศิริราชพยาบาล

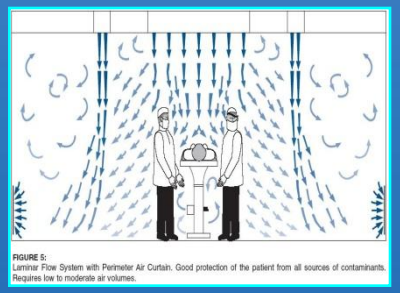


FIGURE 5:
Laminar Flow System with Perimeter Air Curtain. Good protection of the patient from all sources of contaminants. Requires low to moderate air volumes.

Operating Theatre 18’C./55%RH.

PART 2-2.1-10.2 HVAC Systems

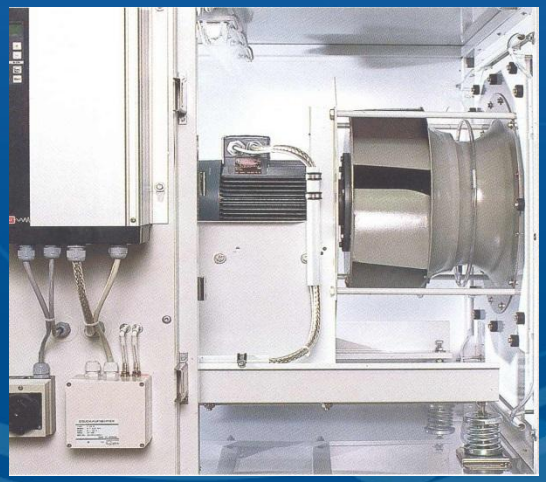
- (3) Ventilation rates
- *(a) Operating and delivery room ventilation systems shall operate at all times, except during maintenance and conditions requiring shutdown by the building's fire alarm system.

PART 2-2.1-10.2 HVAC Systems

- **10.2.4 HVAC Air Distribution**
- 10.2.4.1 Return air systems. For patient care areas, return air shall be via ducted systems.

PART 2-2.1-10.2 HVAC Systems

- **10.2.5.2** Filter bed location.Where two filter beds are required, filter bed no. 1 shall be located upstream of the air conditioning equipment and filter bed no. 2 shall be downstream of any fan or blowers.



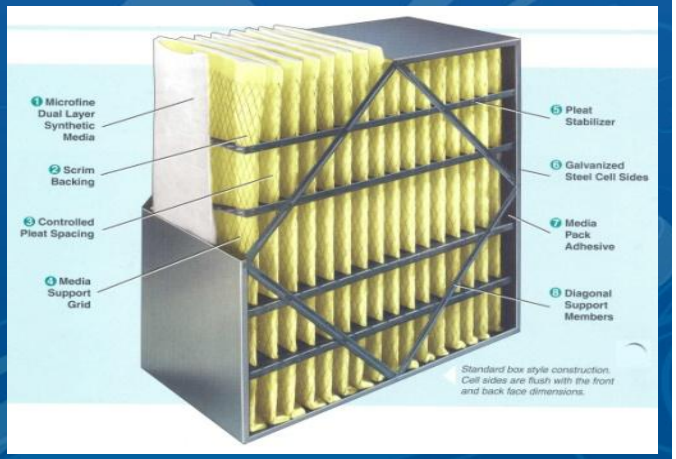
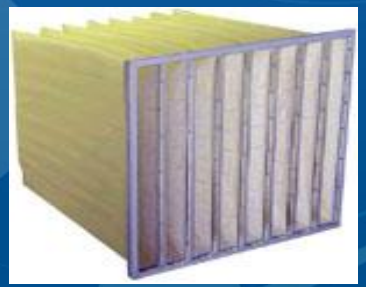


Table 2.1-3
Filter Efficiencies for Central Ventilation and Air Conditioning Systems in General Hospitals

Area designation	*No. filter beds*	*Filter bed no. 1 (MERV, %)*	*Filter bed no. 2 (MERV, %)*
All areas for inpatient care, treatment, and diagnosis, and those areas providing direct service or clean supplies such as sterile and clean processing, etc.	2	8 (30%)	14 (90%)
Protective environment room	2	8 (30%)	17 (99.97%)
Laboratories	1	13 (80%)	–
Administrative, bulk storage, soiled holding areas, food preparation areas, and laundries	1	8 (30%)	–

PART 2-2.1-10.2 HVAC Systems

- **10.2.5.5** Filter manometers. A manometer shall be installed across each filter bed having a required efficiency of 75 percent or more, including hoods requiring HEPA filters. Provisions shall be made to allow access to the manometer for field testing.



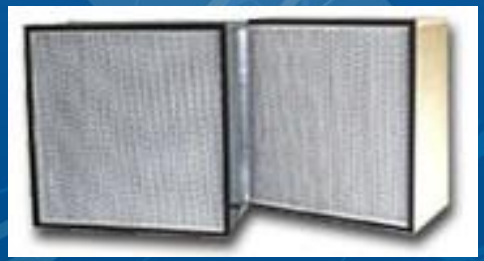


Table 2.1-3
Filter Efficiencies for Central Ventilation and Air Conditioning Systems in General Hospitals

Area designation	*No. filter beds*	*Filter bed no. 1 (MERV, %)*	*Filter bed no. 2 (MERV, %)*
All areas for inpatient care, treatment, and diagnosis, and those areas providing direct service or clean supplies such as sterile and clean processing, etc.	2	8 (30%)	14 (90%)
Protective environment room	2	8 (30%)	17 (99.97%)
Laboratories	1	13 (80%)	–
Administrative, bulk storage, soiled holding areas, food preparation areas, and laundries	1	8 (30%)	–

PART 2-2.1-10.3 Electrical Systems

- **10.3 Electrical Systems**
- **10.3.1 General**
- **10.3.1.1** Applicable standards
- All electrical material and equipment, including conductors, controls, and signaling devices, shall be installed in compliance with applicable sections of NFPA 70 and NFPA 99.

PART 2-2.1-10.3 Electrical Systems

- **10.3.3.2** Panelboards
- (1) Panelboards serving critical branch, equipment system, or normal system loads shall be located on the same floor as the loads to be served.

- (3) New panelboards shall not be located in public access corridors.

PART 2-2.1-10.3 Electrical Systems

- ***10.3.6.3** Hand-washing stations and scrub sinks. If operation of a scrub sink or a hand-washing station in critical care areas, emergency departments, labor and delivery, and surgical suites is dependent on the building electrical service, it shall be connected to the essential electrical system.

PART 2-2.1-10.3 Electrical Systems

- **(2) Intermediate care rooms.** These shall have at least four duplex outlets per bed. The outlets shall be arranged to provide two duplex outlets on each side of the head of the bed.

- **(3) Critical care areas.** As defined by NFPA 99 and NFPA 70, including pediatric and newborn intensive care units, critical care areas shall have at least seven duplex outlets at the head of each bed, crib, or bassinet. Approximately 50 percent of critical care outlets shall be connected to emergency system power and be so labeled.

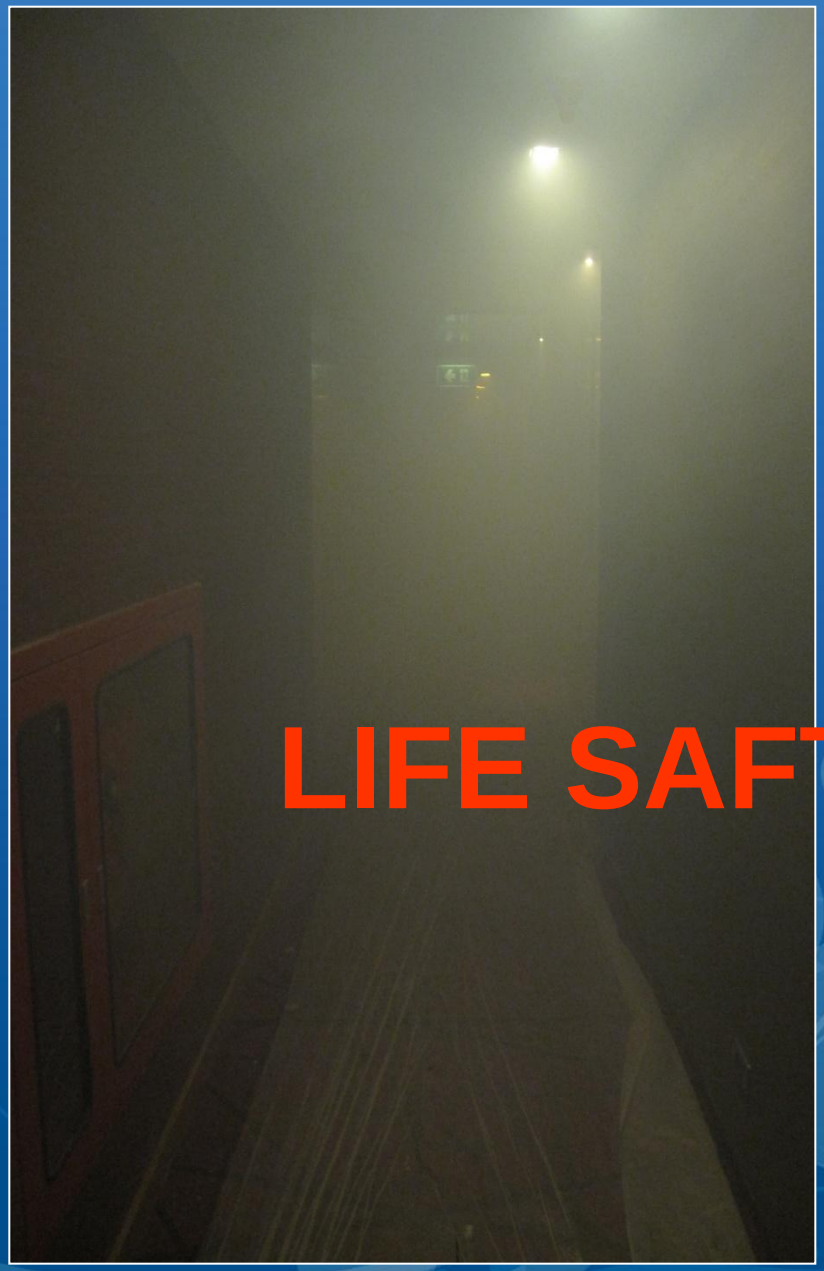
PART 2-2.1-10.3 Electrical Systems

- **(6) Trauma and resuscitation rooms.** These shall have eight duplex outlets located convenient to the head of each bed.

- **(7) Emergency department.** Examination and treatment rooms in the emergency department shall have a minimum of six duplex outlets located convenient to the head of each bed. Approximately 50 percent of emergency care outlets shall be connected to emergency system power and be so labeled.

PART 2-2.1-10.3 Electrical Systems

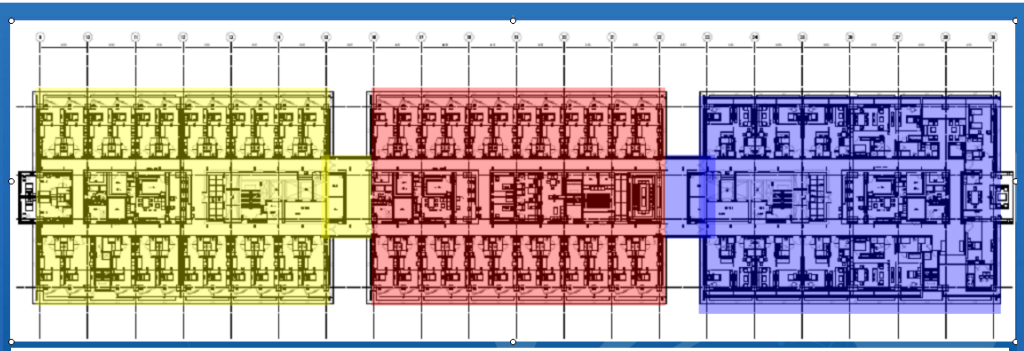
- **10.3.7.3** Emergency system receptacles. Electrical receptacle cover plates or electrical receptacles supplied from the emergency systems shall be distinctively colored or marked for identification. If color is used for identification purposes, the same color shall be used throughout the facility.



LIFE SAFTY SYSTEM

The Life Safety Approach

Fire/Smoke Compartment – Fire Alarm system

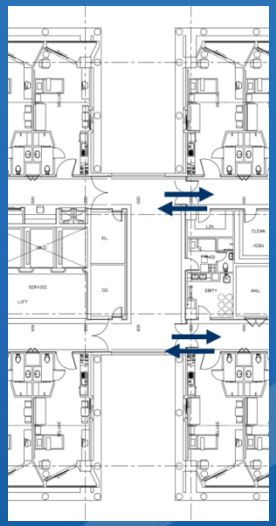


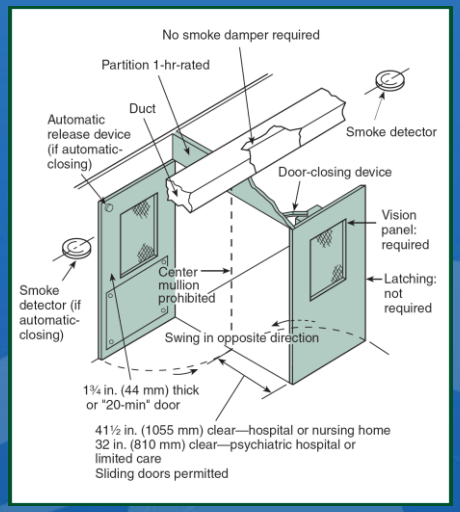
Smoke Compartment A (1,100 ตารางเมตร)

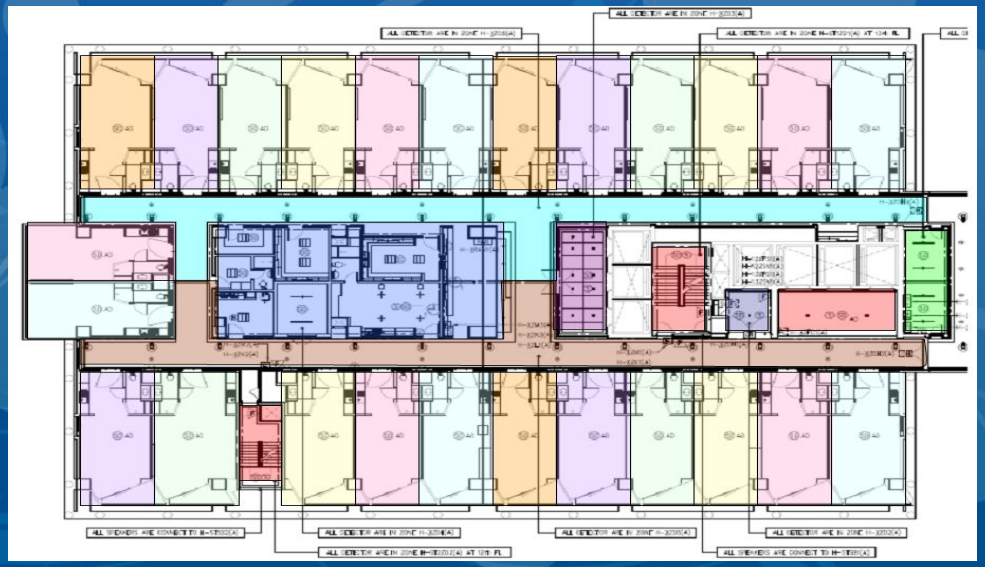
Smoke Compartment B (1,100 ตารางเมตร)

Smoke Compartment C (1,100 ตารางเมตร)

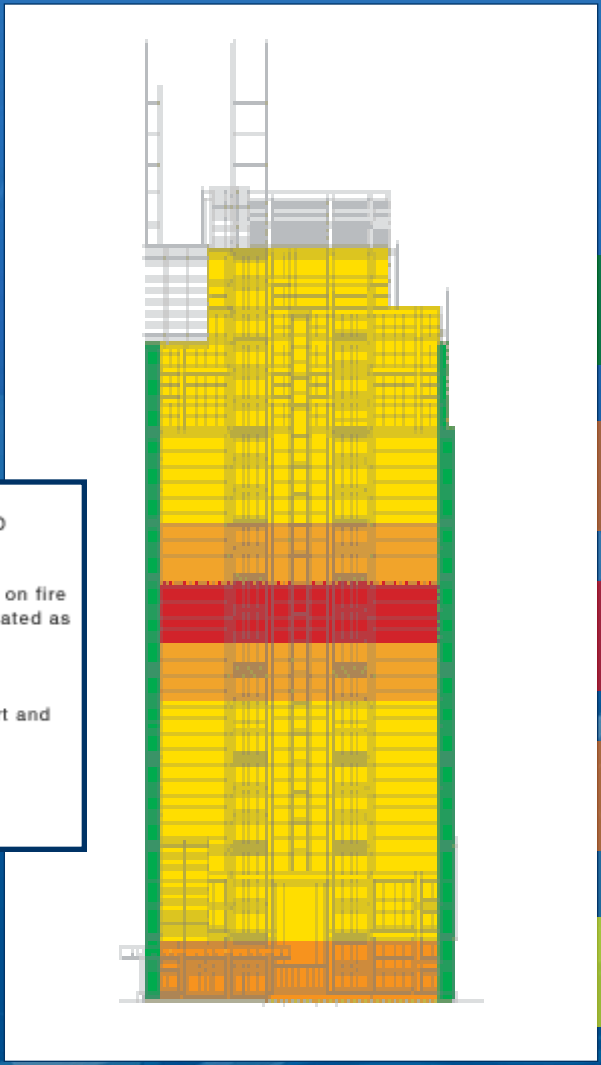
พื้นที่ Inpatient for sleeping (IPD) จะต้องจัดแบ่งเป็น Smoke Compartment อย่างน้อย 2 compartment โดยมีขนาดต่อ หนึ่ง Compartment ไม่มากกว่า 2100 ตารางเมตรและระยะทางจากจุดใดๆ ไปถึง Smoke Compartment จะต้องไม่เกิน 60 เมตร







Voice Evacuation System



Staircase Message

Please stay calm, be careful with the stairs, help the children and elderly leave the building safety.

Evacuation Massage 1

Attention Please. There is an emergency situation in the building. Please evacuate through Exit staircase A. Do not use the lifts.

Evacuation Massage (Alarm Floor)

Attention Please. There is an emergency situation in the building. Please evacuate through the nearest exit staircase. Do not use the lifts.

Evacuation Massage 2

Attention Please. There is an emergency situation in the building. Please evacuate through Exit staircase B. Do not use the lifts.

Warning Massage

Attention Please. We are investigating an emergency in building. Please remain calm and standby for further instruction. Thank you.

AIA Guidelines

รพ.ปิยมหาราชการุณย์
คณะแพทย์ศาสตร์ศิริราชพยาบาล

QUESTION & ANSWER

https://www.facebook.com/unnop.kingkachee