HCAI Department of Health Care Access and Information
2020 West El Camino Avenue, Suite 800
Sacramento, CA 95833
hcai.ca.gov

Hospital Building Safety Board
Ad hoc "HCAI Design Guide for Planning and Preparing for Disasters" Webinar Development Subcommittee

AGENDA
March 11, 2026
10:00 a.m. – 4:00 p.m.

The Subcommittee may not discuss or act on any matter raised during the public comment section that is not included on this agenda, except to place the matter on a future meeting agenda. (Government Code §§ 11125, 11125.7, subd. (a).)

Note: All Subcommittee members will attend this meeting virtually.

Locations:
2020 West El Camino Ave, Conference Room 930, Sacramento, CA 95833
355 South Grand Avenue, Conference Room 2000, Los Angeles, CA 90071
Teams Meeting Access; Meeting ID: 254 041 475 117 46; Passcode: gU9YQ2cy
Call in: (916) 535-0978; Phone Conference ID: 593 775 413#

Item #1 Call to Order and Welcome
Facilitator: Teresa Endres, AIA, ACHA, EDA, AAH, Principal, Sr. Medical Planner, HOK; Subcommittee Chair (or designee)

Item #2 Roll Call and Meeting Advisories/Expectations
Facilitator: Veronica Yuke, HCAI; HBSB Executive Director (or designee)

Item #3 Review and approve the draft January 22, 2026, meeting report/minutes
- Discussion and public input

Facilitator: Teresa Endres (or designee)

Item #4 Review slide deck for Topic 1: Power Independence
- Discussion and public input

Facilitators: John Griffiths, PE, Electrical Engineer, CONTECH-CA; David Bliss, MD, Faraday Microgrids; and Jamie Schnick, PE, Senior Electrical Engineer, HCAI (or designees)

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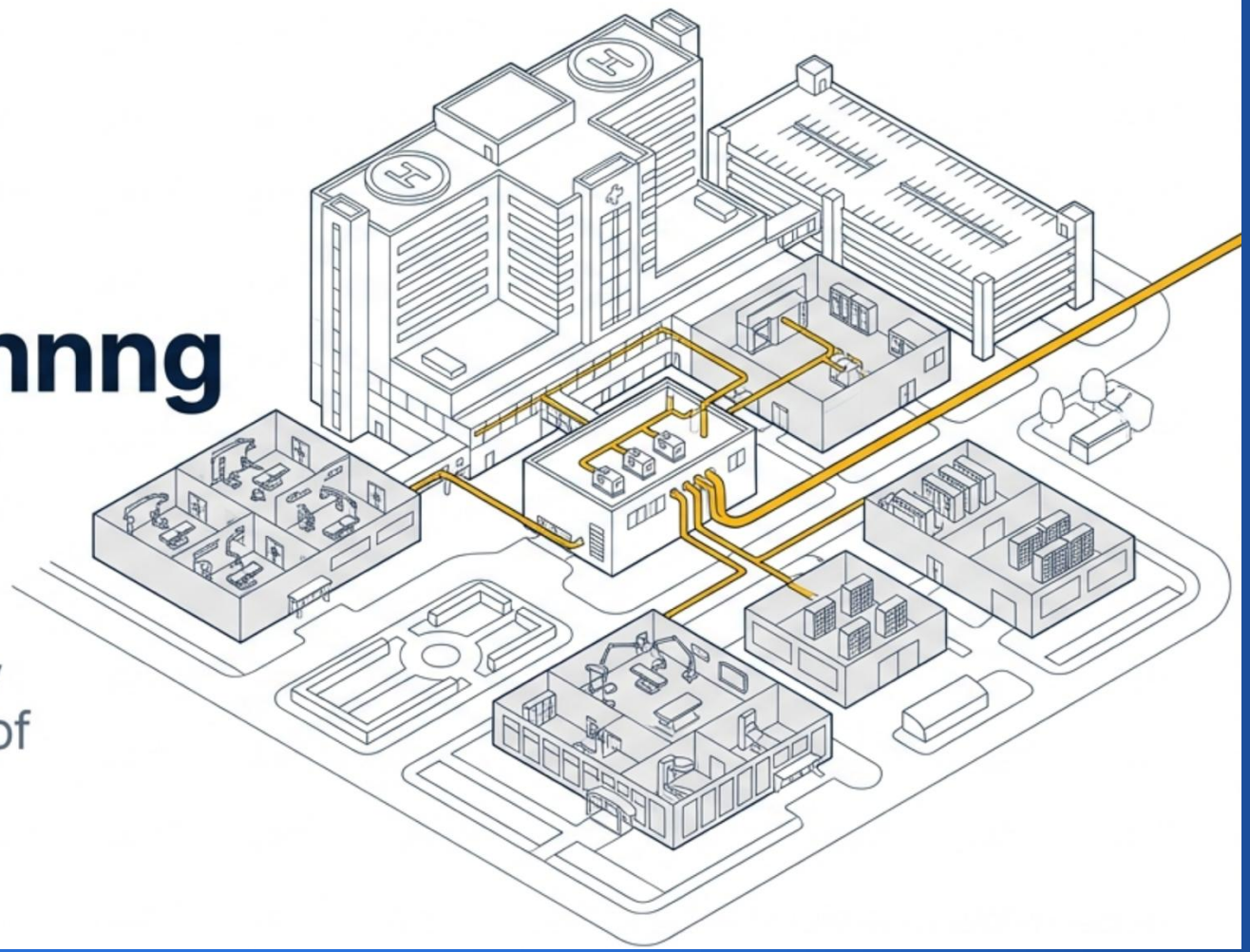
HCAI Design Guide for Plannng Preparing for Disasters

Power Resilience, Regulatory Compliance, and the Future of Healthcare Infrastructure.



Agenda

- Defining Resilience
- Emerging Threats
- Solutions & Opportunities
- Implementation Timeline
- Feasibility & Real-World Examples
- Q&A
- Next Steps

Presenters

- *John Griffiths, PE, Electrical Engineer, CONTECH-CA*
- *David Bliss, MD, Faraday Microgrids*
- *Jamie Schnick, PE, Senior Electrical Engineer, HCAI*

Definition of Resilience?

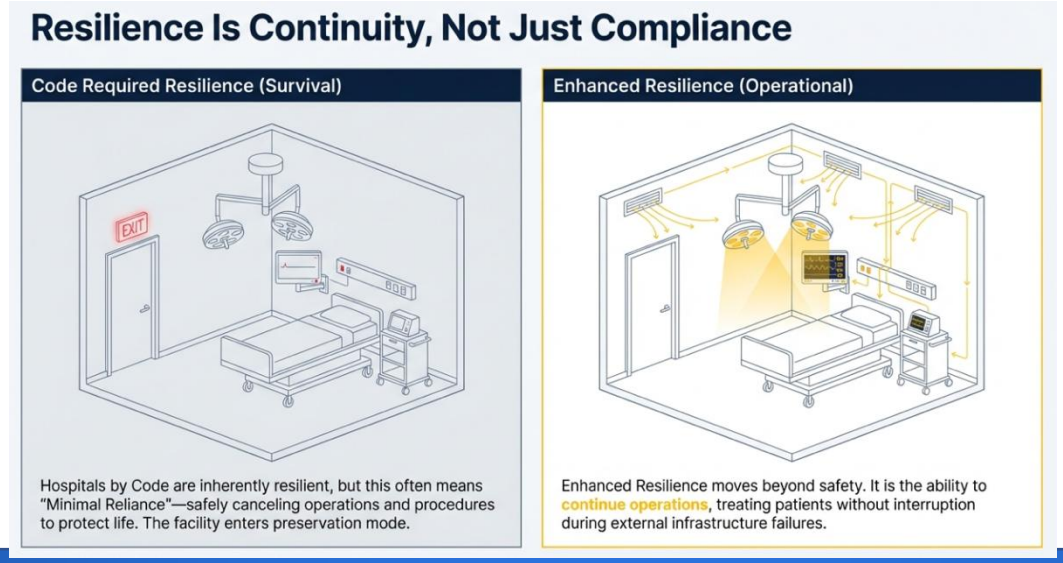
What does it mean to be resilient?

Code Resilience (The Baseline):

- Current Code ensures hospitals are "inherently resilient" but focuses on minimal reliance,.
- Goal: Maintain basic operations, often requiring the cancellation of elective procedures.

• Enhanced Resilience (The Goal):

- Designing beyond the code.
- Goal: Operations and procedures can continue without interruption.



Emerging Threats

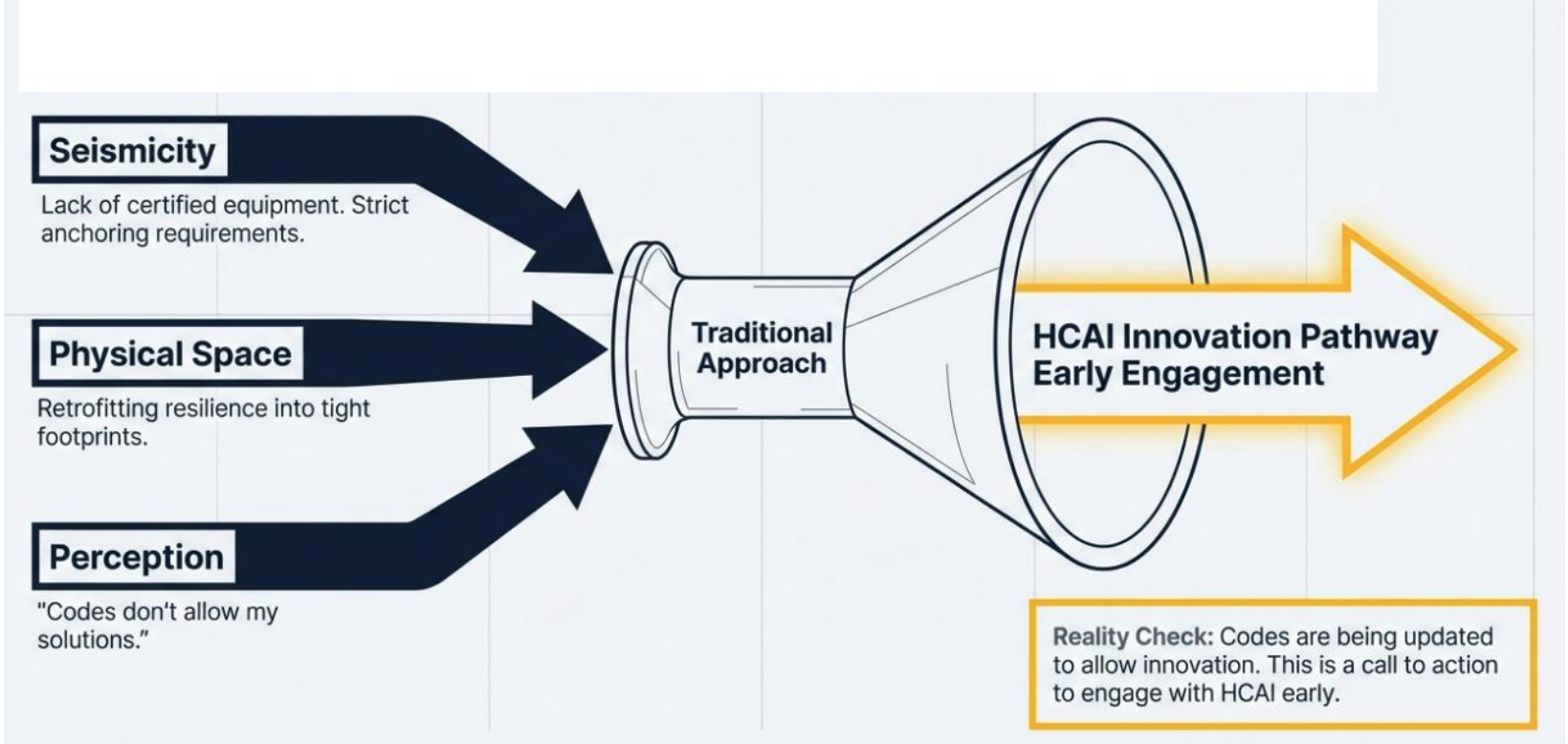
- Internal Threats
- Aging equipment
  - Increasing reliance on reliable power to deliver healthcare
  - Deferred maintenance budget
  - Shortage of skilled maintenance s
- External Risk
  - Unreliable utility

Emerging Threats

- External Risk
  - Unreliable utility
  - Increasing extreme climatic events
  - Supply chain limiting availability of critical components

Constraints & Solutions

- Constraints
  - Money
  - Space to install systems
  - Equipment needs to be seismically certified
  - ~~"Codes don't allow my solutions“~~
    - (call to action for people to engage with HCAI; Code is being updated to allow)
  - New solutions are not a one-size-fits-all
  - Fragmented supply chain


Seismicity
Lack of certified equipment. Strict anchoring requirements.
Physical Space
Retrofitting resilience into tight footprints.
Perception
"Codes don't allow my solutions."
Traditional Approach
HCAI Innovation Pathway
Early Engagement
Reality Check: Codes are being updated to allow innovation. This is a call to action to engage with HCAI early.

Solutions

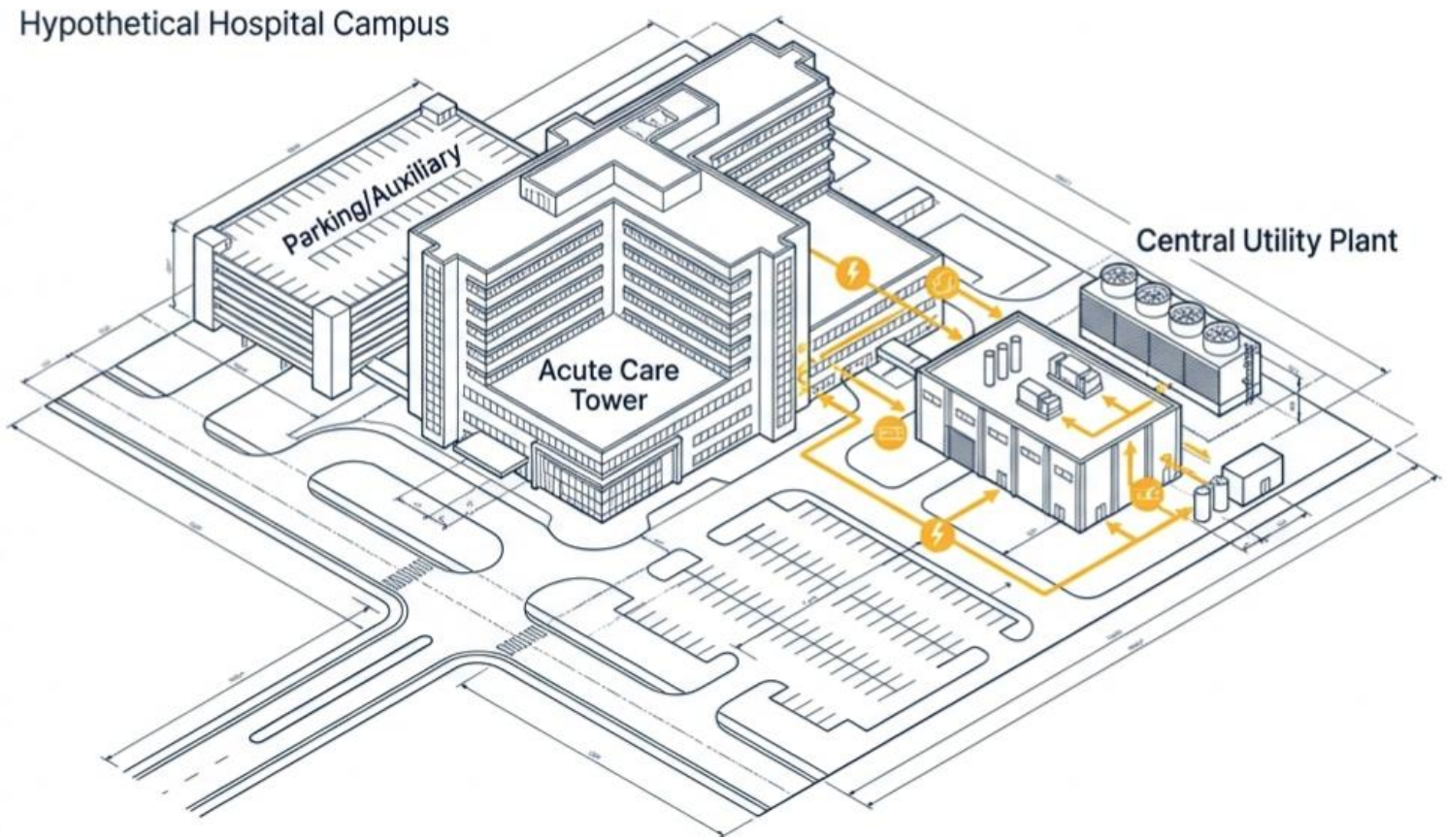
- Future proofing systems
  - Designed for forward compatibility with emerging systems
- Distributed generation resources (DER)
  - Many emerging solutions that provide facilities the opportunity for additional revenue, streams, and funding of projects
- HCAi support
  - HCAi have a significant amount of knowledge and expertise supporting the delivery of these projects
- Supportive codes
  - Codes are being updated to support creative resilience solutions

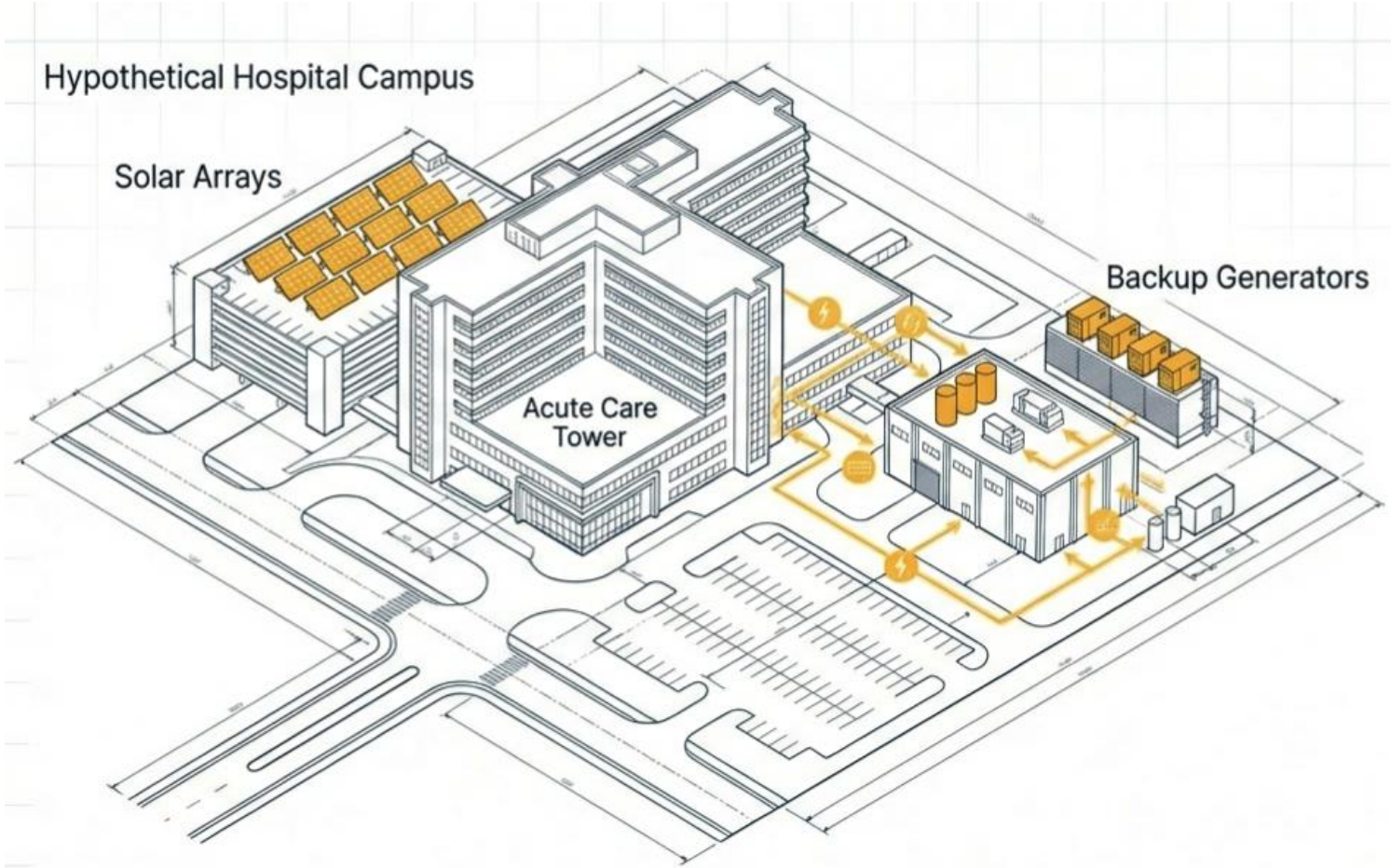
The Design Strategy: A Site-Specific Approach

Core Principle:
There is no one-size-fits-all solution.

Design Inputs:

- Seismic Zone Requirements
- Available Footprint for Generation
- Utility Connection Points
- Critical Load Demand





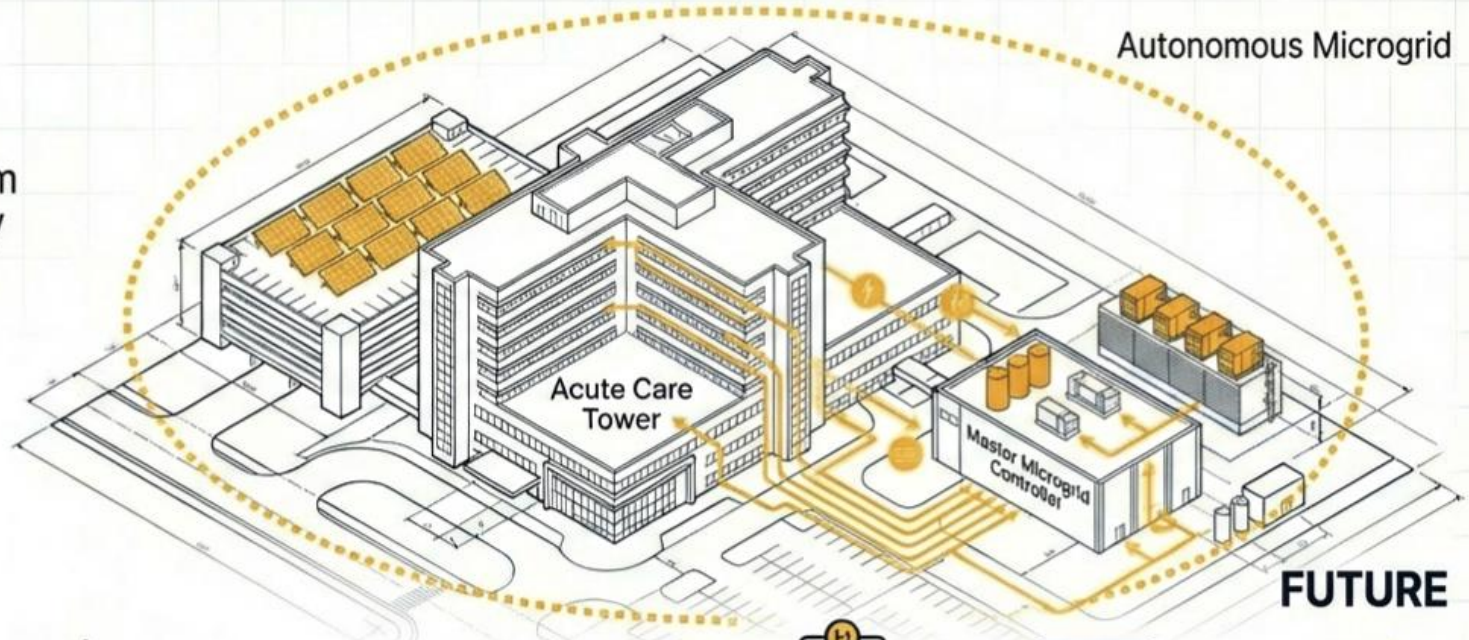
Generation Mix

- Diversifying power sources to avoid single points of failure.
- Seismic Considerations: All generation assets require specific anchoring and certification for their location.
- Engineer's Perspective: Redundancy through independent generation.

The Integrated Solution: Microgrids & Future Proofing

The Microgrid Concept: A self-sufficient energy system that operates independently during disasters.

Future Proofing: We design for adaptability, not just immediate compliance.



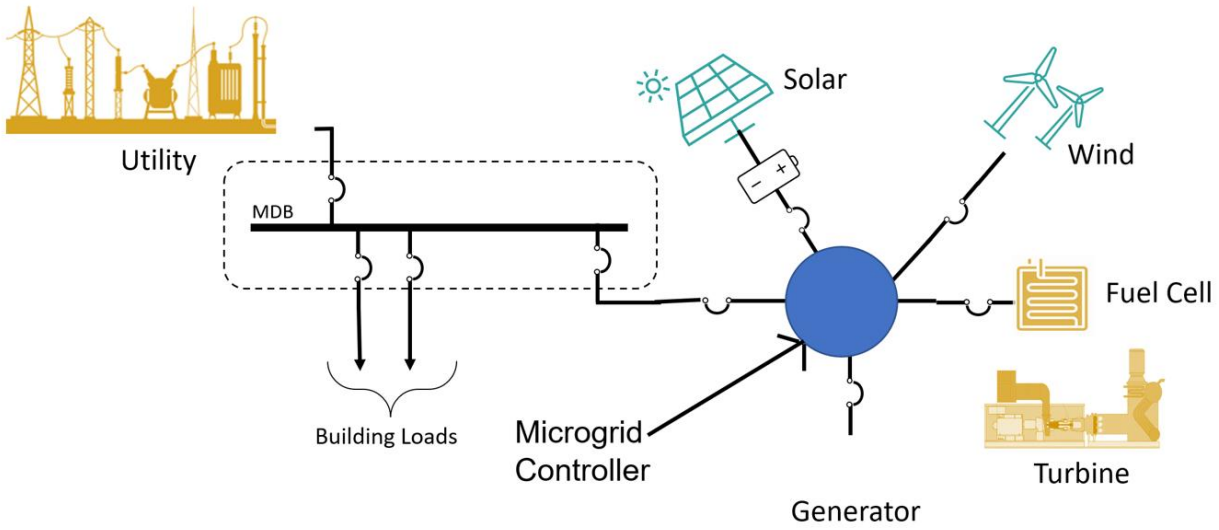
NOW

FUTURE

Designing infrastructure now with 'hooks' for the technology of 2030.

HCAI's Role in the Project Lifecycle

Healthcare Microgrids

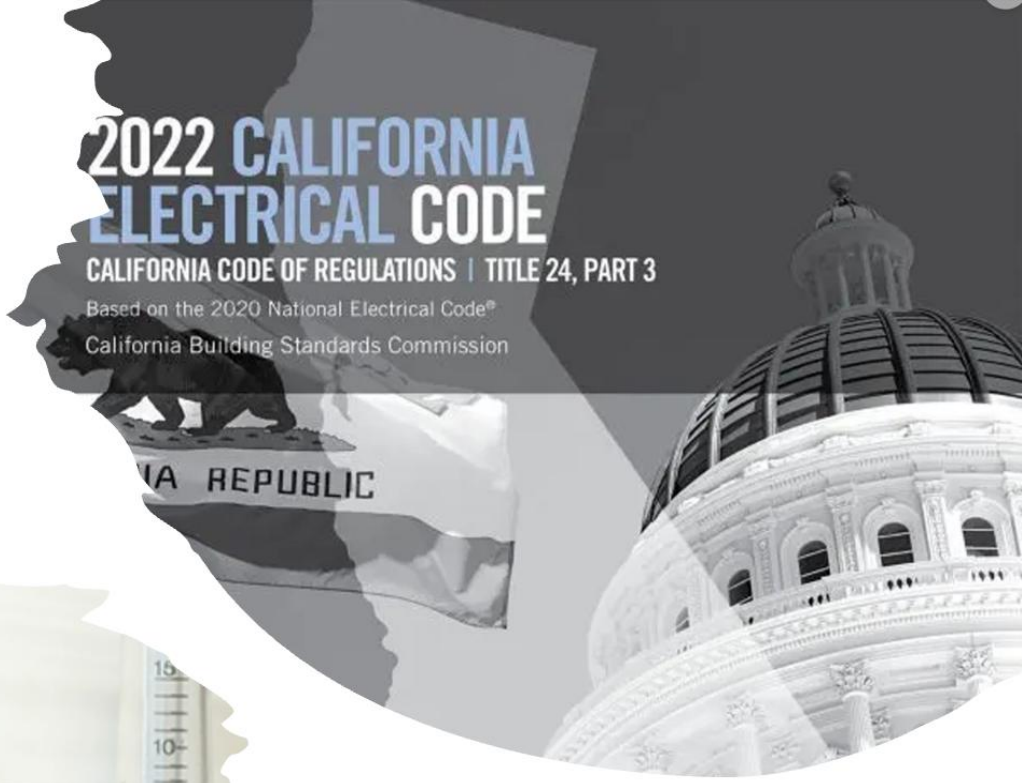


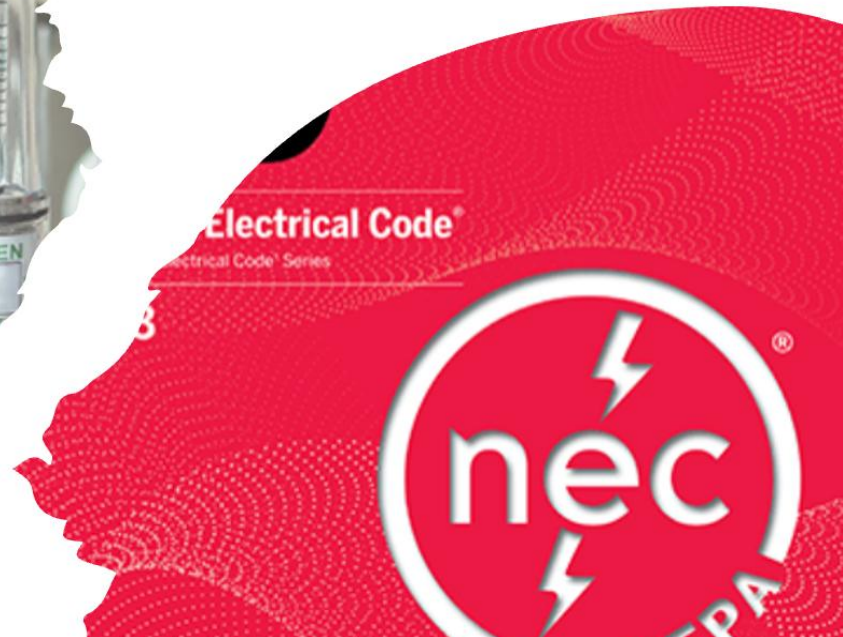
A group of interconnected loads and distributed energy resources (DER's) within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid.

Evolving Codes

<u>Microgrids as EPSS added to the code in:</u>

- 2021 NFPA 99
- 2023 NEC
- 2022 California Intervening Electrical Code





DEPARTMENT OF HEALTH & HUMAN SERVICES
Centers for Medicare & Medicaid Services
7500 Security Boulevard, Mail Stop C2-21-16
Baltimore, Maryland 21244-1850

CENTERS FOR MEDICARE & MEDICAID SERVICES

Center for Clinical Standards and Quality

Ref: QSO-23-11-LSC

DATE: March 31, 2023

TO: State Survey Agency Directors

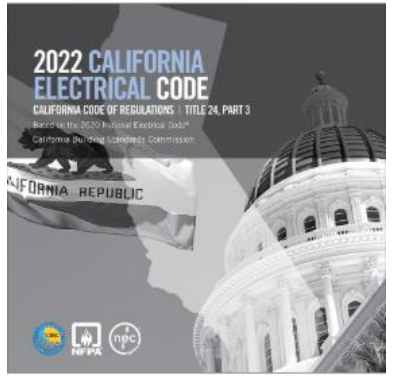
FROM: Directors, Quality, Safety & Oversight Group (QSOG) and Survey & Operations Group (SOG)

SUBJECT: Categorical Waiver – Health Care Microgrid Systems (HCMSs)

Memorandum Summary

- Various CMS regulations governing certain providers and certified suppliers require compliance with the 2012 edition of the National Fire Protection Association (NFPA) Health Care Facilities Code (NFPA 99).
- 2012 edition of NFPA 99 requires emergency power for an essential electric system (EES) to be supplied by a generator or battery system.
- 2021 edition of the NFPA 99 permits emergency power for an EES to be supplied by sources other than a generator or battery system, including a health care microgrid system (HCMS)
- HCMSs are small-scale electrical grids where the sources of electricity can be provided by clean energy technologies (e.g., fuel cells, solar, wind, energy storage, etc.).
- Except as noted below, CMS is issuing a categorical waiver permitting new and existing health care facilities subject to CMS requirements to utilize alternate sources of power other than a generator set or battery system only if in accordance with the 2021 edition of the NFPA 99, 2023 edition of the National Electric Code (NFPA 70), and associated references.

517.30(B)(5) Health Care Microgrid. EES shall be permitted to be supplied by a health care microgrid…Health care microgrid systems shall be designed with sufficient reliability to provide effective facility operation..



OSHPD CAN 3-517.30(B.1)(4) – The requirements to meet "sufficient reliability" status for health care microgrids utilized as EES shall include, but not be limited to, the following:

- Special Seismic Certification
- Comply with NFPA standards for the sources utilized (i.e. NFPA 111 for batteries NFPA 853 for fuel cells etc.)
- Classified at type 10 Class X, Level 1 per NFPA 99 6.7.1.2.1
- Sequence of Operation and Commissioning required

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Advisory Guide Series

A7

MICROGRIDS FOR HEALTH CARE FACILITIES

FOR HOSPITALS, ACUTE PSYCHIATRIC, SKILLED NURSING FACILITIES, INTERMEDIATE CARE FACILITIES AND CLINICS [OSHPD 1, 2, 3 & 5]

Office of Statewide Hospital Planning and Development

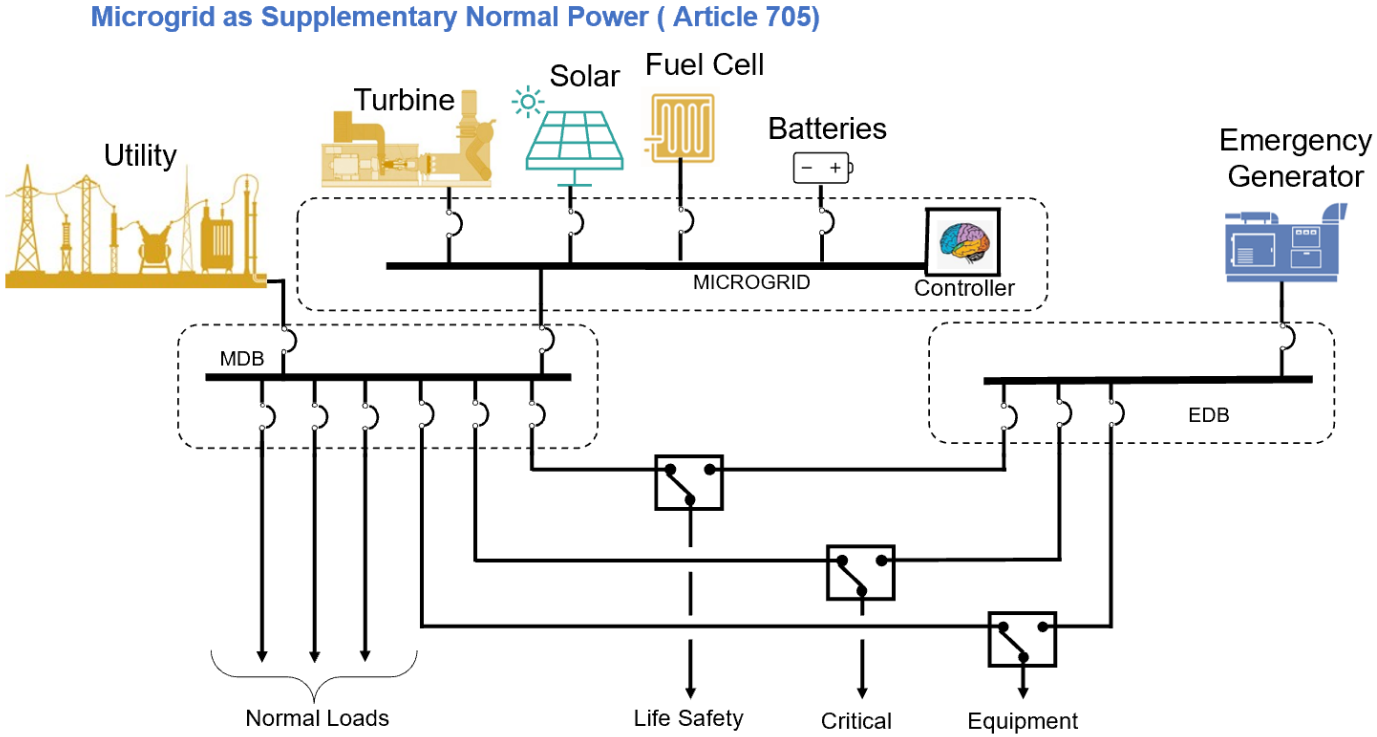
April 2025 Version 1.0

TABLE OF CONTENTS

	Requirements/Codes/Standards - Applicable Codes Matrix	Microgrid Power Source					
		Solar (PV's)	Wind	Fuel Cells	CHP	Energy Storage	Gas Turbine
	Codes/ Requirements						
1	CARB - California Air Resources Board - Air Quality Requirements	no	no	no	yes	no	yes
2	CPUC - California Public Utility Commission (Rule 21)	yes	yes	yes	yes	yes	yes
3	OSHPD CAN 2-0 Local Approval	yes	yes	yes	yes	yes	yes
4	CBSC - California Standards Building Code (Title 24)						
4a	CBC - California Building Code	yes	yes	yes	yes	yes	yes
4b	CFC - California Fire Code						
4b-1	1207 Electrical Energy Storage Systems	no	no	no	no	yes	no
4b-2	1205 Solar Photovoltaics Power Systems	yes	no	no	no	no	no
4b-3	1206 Stationary Fuel Cell Power Systems	no	no	yes	no	no	no
4c	CEC - California Electrical Code						
4c-1	517 Healthcare Facilities	Only if in OSHPD building and/or serving as alternate source					
4c-2	690 Solar Photovolatic (PV) Systems	yes	no	no	no	no	no
4c-3	692 Fuel Cell Systems	no	no	yes	no	no	no
4c-4	694 Wind Electric Systems	no	yes	no	no	no	no
4c-5	700 Emergency Power	Only if in OSHPD building and/or serving as alternate source					
4c-6	705 Interconnected Electric Power Production Sources	yes	yes	yes	yes	yes	yes
4d	CMC - California Mechanical Code						
4d-1	407 - Outdoor Air Intakes	no	no	no	yes	no	yes
5	NFPA - Guides and Standards						
5a	NFPA 30 - Flammable and Combustible Liquids Code	no	no	yes	yes	no	yes
5b	NFPA 37 - Stationary Combustion Engines and Gas Turbines	no	no	no	yes	no	yes
5c	NFPA 54 - National Fuel Gas Code	no	no	yes	yes	no	yes
5d	NFPA 58 - Liquid Petroleum Gas Code	no	no	yes	yes	no	yes
5e	NFPA 59A - Production/ Storage/ Handling of Liquified Natural Gas LNG	no	no	yes	yes	no	yes
5f	NFPA 99 - Healthcare Facilities Code	yes	yes	yes	yes	yes	yes
5g	NFPA 101 - Life Safety Code	yes	yes	yes	yes	yes	yes
5h	NFPA 110 - Emergency and Standby Power	no	no	yes	yes	no	yes
5i	NFPA 111 - Stored Electrical Energy Emergency and Standby Power Systems	no	no	no	no	yes	no
5j	NFPA 400 - Hazardous Materials Code	no	no	yes	yes	yes	yes
5k	NFPA 853 - Installation of Stationary Fuel Cell Power Systems	no	no	yes	no	no	no
5l	NFPA 855 - Standard for the Installation of Stationary Energy Storage Systems	no	no	no	no	yes	no
6	Advisory Guide A9 - Sitework Under OSHPD Jurisdiction	yes	yes	yes	yes	yes	yes

Figure 1. *Applicable Requirements/Codes/Standards Matrix for Health Care Microgrid Implementation*

OSHPD-1 (Hospital) Single Line Diagram



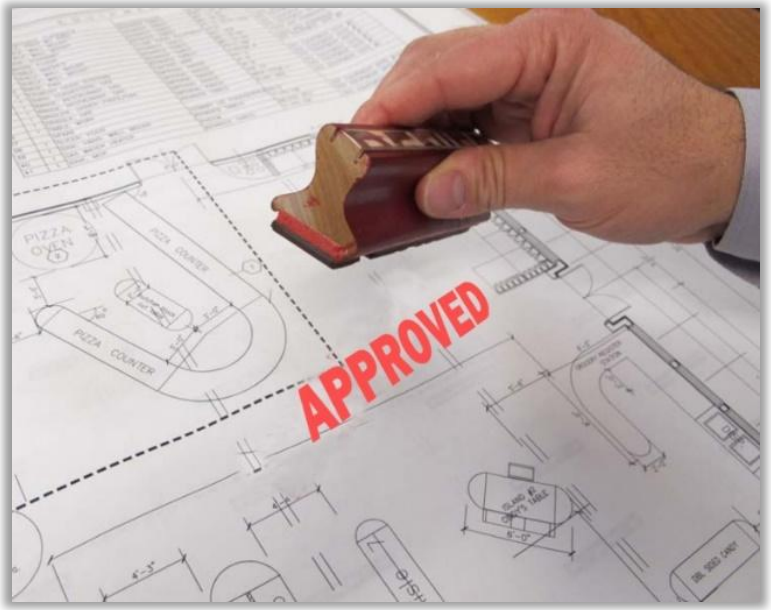
Basis of Design for this example – The proposed design is to install a microgrid as supplementary normal power source(s) at an existing or new hospital. The concept is to install DERs that are configured as a microgrid and that produce energy 24/7 to offset utility costs and provide the capability of transitioning to island mode to provide power during a utility outage. DERs for this example include a gas turbine, a solar photovoltaic (PV) system, a fuel cell, and storage batteries. The code mandated EES power requirements will be met by either new or existing emergency generator(s) and an essential electrical distribution system that meets CEC Article 517 requirements for a Type 1 EES.

Permitting of Microgrids has been Achievable at Health Care Facilities

- Dozens of projects have been installed with DER's
- Under current codes, Microgrids can be configured/installed to:

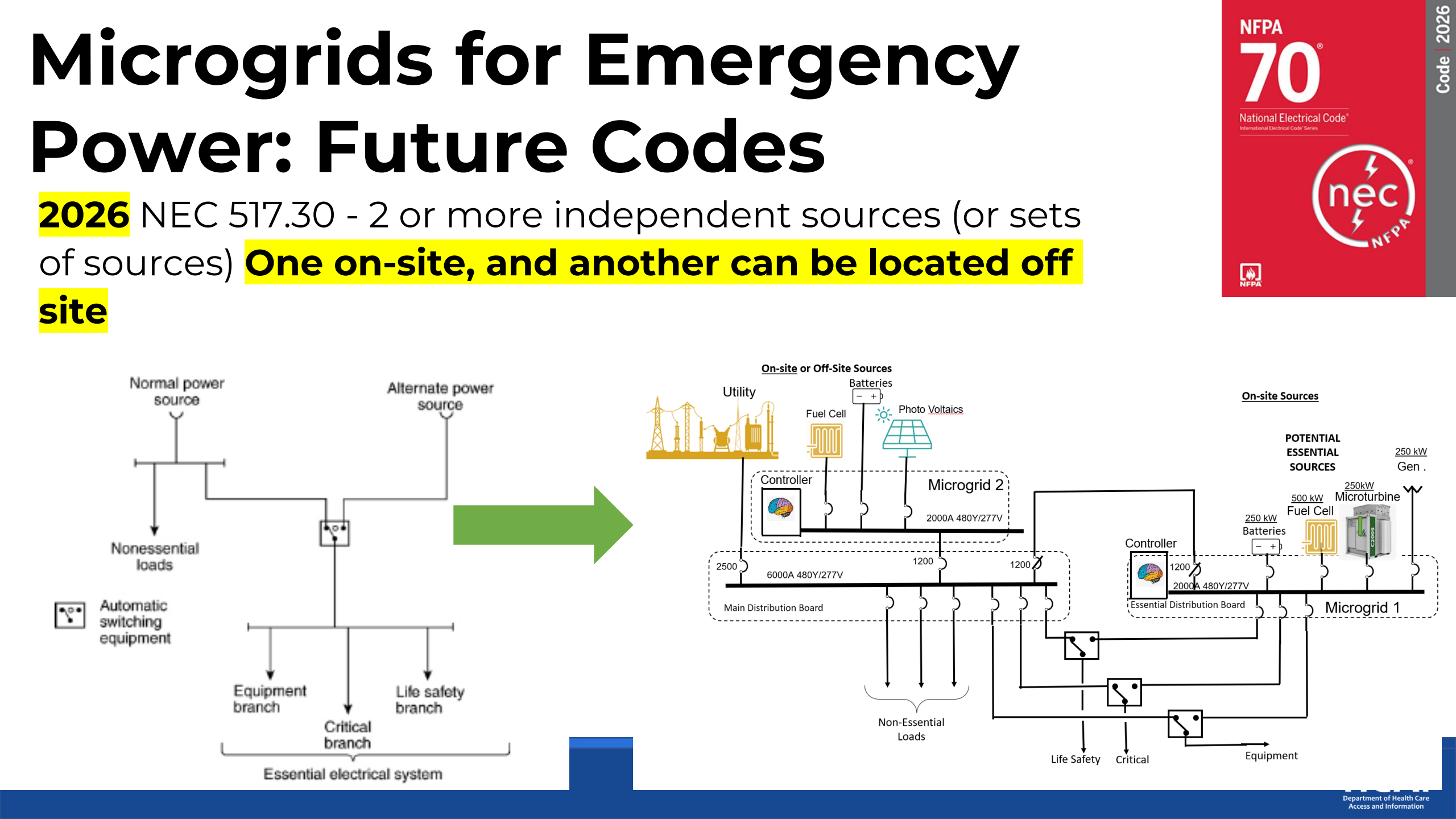
Permitting of Microgrids as EESS is Allowed by current codes

- All products used will need to have UL listing
- DER's and distribution equipment will need to have Special Seismic Certification
- Commissioning is required
- On-Site storage of "fuel" is required
  - 72 hrs for hospitals
  - 6 hrs (96 hrs in CA) for Skilled Nursing Facilities (SNFs)
  - 90 min for clinics (Special Seismic Certification is not required)



Microgrids for Emergency Power: Future Codes

2026 NEC 517.30 - 2 or more independent sources (or sets of sources) **One on-site, and another can be located off site**



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Microgrid Practicalities and Demonstration projects

Microgrid Finance and ROI

PROS

- Tax Equity is available for FOR-PROFITS ***and*** NON-PROFITS
  - NON: "DIRECT PAY"
  - FOR:
    - TAX CREDITS – 6% to 60% of eligible cost - use, sell
    - ACCELERATED DEPRECIATION - year one 65% to 97%
- Operational Savings
  - Direct offset of utility supply cost: $0.05 - $0.5/kWh)
  - Direct reduction of peak/coincident demand fees: $5 - $35/kW +
  - Participation in utility/ISO marketplace
- Indirect Value
  - Healthcare operations continuity

CONS

- High cost equipment
  - Solar: $2-$10/Watt
  - Batteries: $400-$750/kWh
  - Fuel Cell – proprietary
- "Complex" Controls and Integration
  - Coordination of assets (complexity)
  - Realtime visualization and intervention (cost)
- Other O&M
- Performance loss over time

SALUTARY OUTCOMES

QUANTITATIVE

- REDUCE UTILITY COST UP TO 40-60%
- REALIZE 6-7 FIGURE ANCILLARY MARKET REVENUE
- SIMPLE RECAPTURE – as early at 18 months
- IRR – 15-25%

QUALITATIVE

- RESILIENCY
- “GREENING”
- SHADE/AESTHETICS
- UTILIZATION OF ”DEAD” SPACES
- HEDGE AGAINST UTILITY INCREASES

TIPS FROM EXPERIENCE

TECHNICAL

- OPTIMIZE RATIO STORAGE/GENERATION/LOAD vs. TARIFF – expert analysis
- ZERO EXPORT - Expedited interconnection
- INDEPENDENT, FAST, SECURE REMOTE DIGITAL ACCESS
  - Cybersecurity
- CONTROLLER INTELLIGENCE
- ISLANDABLE VS. NON?

FINANCIAL

- LEVERAGE
  - On-bill finance
  - State loan, loan-loss programs
  - Traditional finance
- TAX EQUITY OPTIMIZATION
  - Prevailing wage – reach 30%
  - Domestic Content – added 10%
  - Energy Community – added 10%
  - Low Income/Tribal – added 10%
- CONSTRAIN O&M RISK
  - Extended warranties
  - LTSA

Kaiser Ontario


Valley Childrens Hospital
Artist Rendering

KAISER PERMANENTE
SAN MARCOS CAMPUS

Salas O'Brien

- New central plant
- New hospital
  - 430,000 SF
  - 168 beds
  - LEED platinum

U.S. GREEN BUILDING COUNCIL LEED PLATINUM USGBC

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Conclusion

- **Is it allowed by Code**
- **Is it fiscally viable**
  - New construction
  - Remodel
- **Is it doable to add these systems?**
- **Yes it is ...**
  - Kaiser Ontario, Kaiser San Marcos, Valley Children's
  - and …. what about by your system?
- **Call to action?**
  - Regulatory
  - Financially Viable
  - Is it technically possible

The Path Forward: Actions for Engineers and Administrators

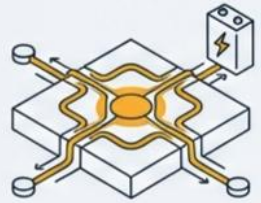
Regulatory

Engage HCAI now. Do not assume 'Code' is a blocker. **Use the Design Guide**.

Financial

Evaluate fiscal viability. Account for the cost of business interruption, not just construction costs.

Technical



Start with a **site-specific analysis** and design for future technology integration.

Resilience is a choice to continue care when the world stops.

Item #5 Review slide deck for Topic 2: Wildland Urban Interface - 2025 Title 24, Part 5

- Discussion and public input

Facilitators: Gary Dunger, Executive Director, Design and Construction, Cedars-Sinai Health System; and Janice Cheung, PE, CSP, Fire Marshal, Redwood City (or designees)

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Wildfire & WUI Readiness for Healthcare Facilities

Design + Operations for Continuity During Wildfire Events

Purpose and Learning Objectives

- Understand Wildland-Urban Interface (WUI) exposure and Fire Hazard Severity Zones (FHSZ)
- Identify how Title 24, Part 7 applies to hospital facilities
- Recognize operational vulnerabilities during wildfire events
- Develop coordinated design + emergency planning strategies to reduce downtime

Why This Matters Now

- Wildfires are increasing in frequency and intensity
- Ember exposure is the primary driver of structure ignition
- Hospitals are essential infrastructure and community refuges
- Facilities must plan for continuity, not closure
- Regulatory expectations under Title 24 are evolving

AGENDA

- Welcome & Framing
- What is WUI? Title 24 and the New Part 7
- Are You in a Fire Hazard Severity Zone?
- The Hazard & The Why
- Operations & Emergency Planning
- Q&A

What is the Wildland Urban Interface (WUI?)

- Geographic areas where structures and wildland vegetation meet
- Designated by Fire Hazard Severity Zones (FHSZ)
- Includes State Responsibility Areas (SRA) and Local Responsibility Areas (LRA)
- Other areas designated by the local enforcing agency to be at a significant risk from wildfires

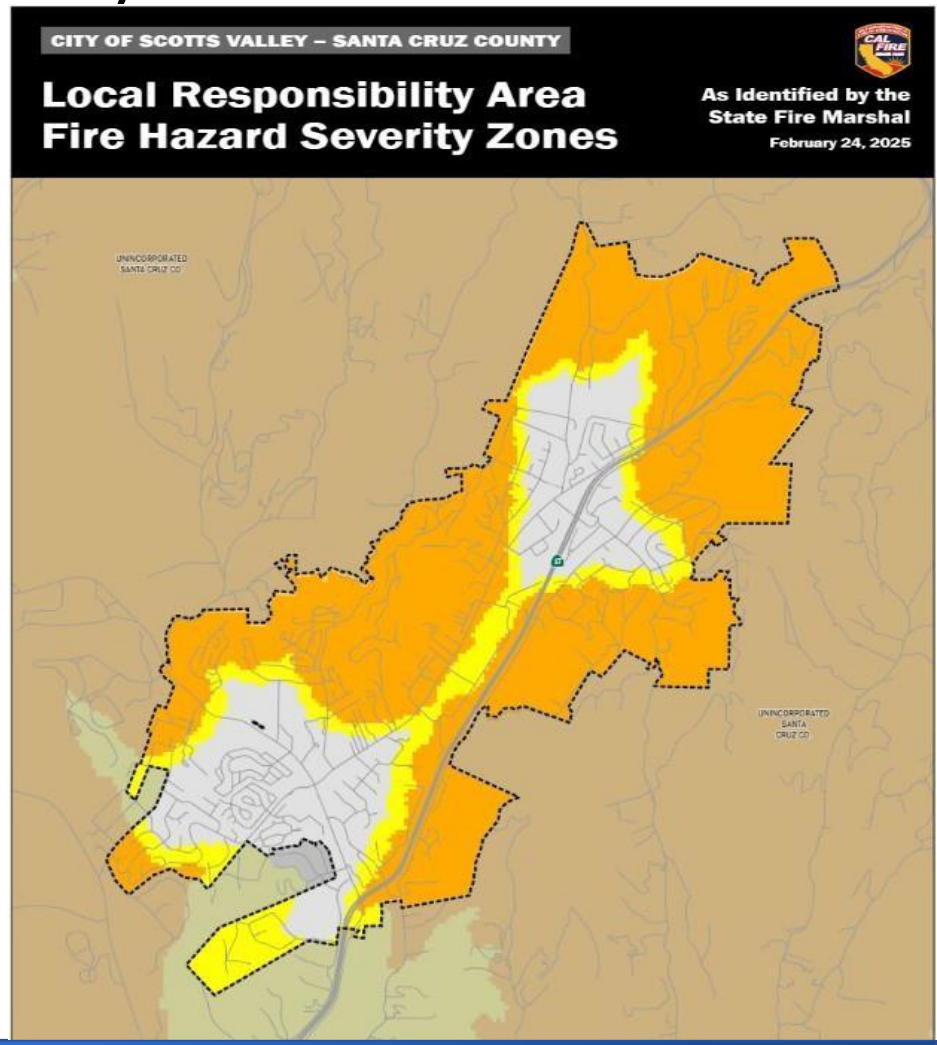
What is the Wildland Urban Interface (WUI?)

Hospitals located in or near WUI areas face:

- Ember exposure
- Radiant heat
- Smoke infiltration
- Access challenges

Fire Hazard Severity Zones (FHSZ)

- Designated as: Moderate, High, Very High
- Mapped by CAL FIRE (SRA)
- Local agencies designate LRA zones
- FHSZ designation triggers regulatory requirements
- Applies to new construction and certain site conditions



Title 24 Part 7 Overview – What Changed?

- Consolidation of CBC 7A, CFC 49, and Title 14
- One-stop WUI reference; previously scattered across many codes
- Creates a unified WUI overlay code

- CCR Title 14 Minimum Fire Safe Regulations
- CFC Ch 49 Defensible Space
- Fire Smart Vegetation
- IWUIC Model Code

- CBC Ch 7A building materials, systems and assemblies
- Exterior design and construction of buildings
- Retrofitting of buildings

- Local ordinance
- Reference Matrix
- Cross references
- Fire Hazard Severity Zones

Application to Hospitals

- Applies to new buildings in FHSZ/WUI areas
- Hospitals classified as essential facilities (Risk Category IV)
- Higher performance expectations
- Enforcement authority: HCAI / OSHPD 1
- Not retroactive for construction, but defensible space, vegetation requirements may apply

Access & Water Supply Requirements

- Fire apparatus access roads required
- Approved water supply capable of required fire flow
- Emergency water storage may be required
- Standby power for pumps and water systems
- Address and road marking requirements for existing facilities

Ignition-Resistant Construction – Key Areas

High-risk exterior components include:

- Roof assemblies
- Eaves and soffits
- Vents
- Exterior walls and wall coverings
- Glazing and doors
- Decks and projections
- Underfloor areas

Goal: Reduce ember intrusion and direct flame spread

Roof & Eave Vulnerabilities

- Class A roof coverings required
- Enclosed eaves preferred
- Metal flashing at roof valleys
- Debris accumulation prevention
- Gutter protection to reduce ember ignition

Vents and Openings

- Vents must resist ember intrusion (ASTM E2886)
- Mesh size limitations (1/16”–1/8”)
- CSFM-listed WUI vents recommended
- Underfloor and attic ventilation openings are critical pathways

Exterior Walls, Glazing & Doors

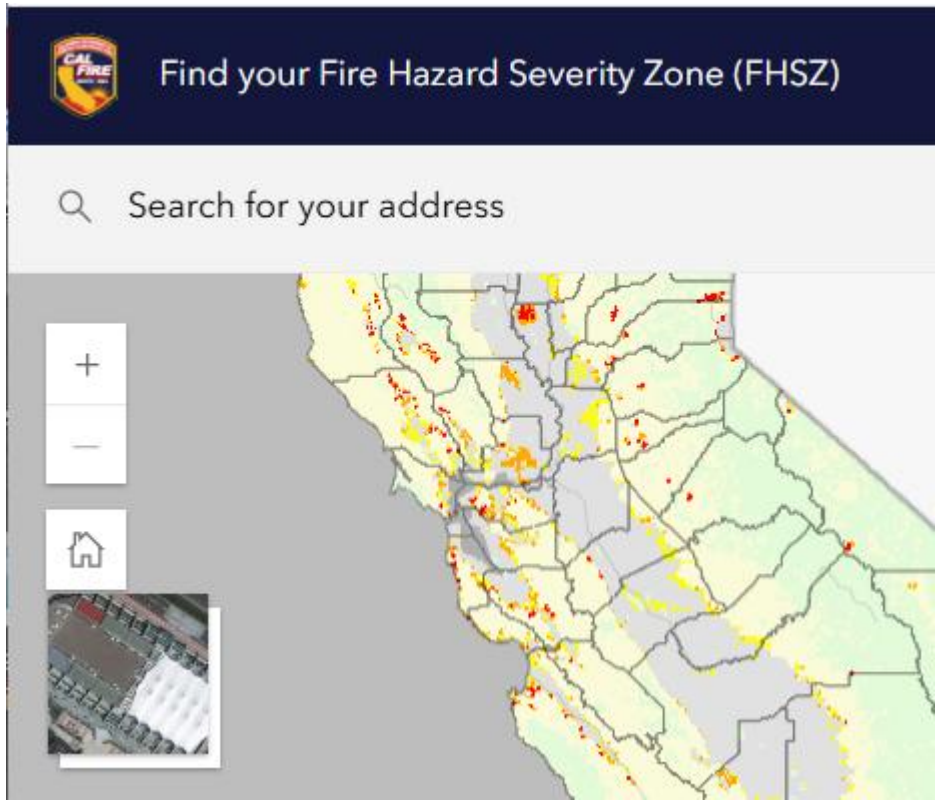
- Ignition-resistant or noncombustible exterior materials
- 6” noncombustible base flashing
- Multilayer tempered glazing or rated assemblies
- Solid-core or rated exterior doors
- Attention to gaps at perimeter and penetrations

Why FHSZ Matters

- Determines applicability of construction requirements
- Impacts capital planning
- Influences insurance and risk assessment
- Affects defensible space compliance
- Guides long-term campus hardening strategy

How to Determine Your Facility's FHSZ

- Use CAL FIRE FHSZ maps
- Review HCAI GIS layers



Wildfire Exposure Pathways

Hospitals may be affected by:

- Ember cast traveling miles ahead of flame front
- Radiant heat exposure
- Smoke infiltration and PM2.5 accumulation
- Blocked road access
- Electrical grid failure

Hospitals Are Not Typical Buildings

- 24/7 operations
- Critical care patients
- Limited mobility populations
- Infection control dependencies
- Regional safety net role

Failure impacts extend beyond campus!

Operational Impacts of Wildfire

- Indoor air quality degradation
- HVAC performance challenges
- Power outage and generator strain
- Water pressure and pump disruption
- Staff shortages and transportation barriers
- Evacuation complexity

Smoke Readiness Planning

Develop a formal Smoke Readiness Plan:

- Pre-event HVAC assessment
- Filter upgrades (MERV 13+ or HEPA where feasible)
- Indoor air monitoring
- Supplemental filtration strategies
- Operations checklist

HVAC Adjustments During Smoke Events

- Limit economizer outside air intake
- Increase recirculation when appropriate
- Balance infection control vs smoke mitigation
- Consider activated carbon filters for odor/gas removal
- Verify system capacity before event

Portable Filtration & Cleaner Air Spaces

- Portable HEPA units for critical areas
- Designate “clean air” rooms
- Develop written operational protocols
- Consider redundancy for ICU and ED areas

Testing Before Wildfire Season (Year-Round)

- Test HVAC in smoke-ready mode
- Verify damper control
- Confirm filter seating and sealing
- Evaluate pressure relationships
- Identify failure points before emergency

Standby Power Considerations

- Generator capacity and duration
- Fuel storage logistics
- Emergency water pump backup
- Cooling system redundancy
- Electrical load management

Infrastructure Dependencies

Wildfire resilience depends on:

- Power
- Water supply
- Fuel delivery
- Communications
- Transportation access

Redundancy planning is critical

Surge Capacity During Wildfire Events

Wildfires may cause:

- Community displacement
- Respiratory illness spikes
- Regional facility closures

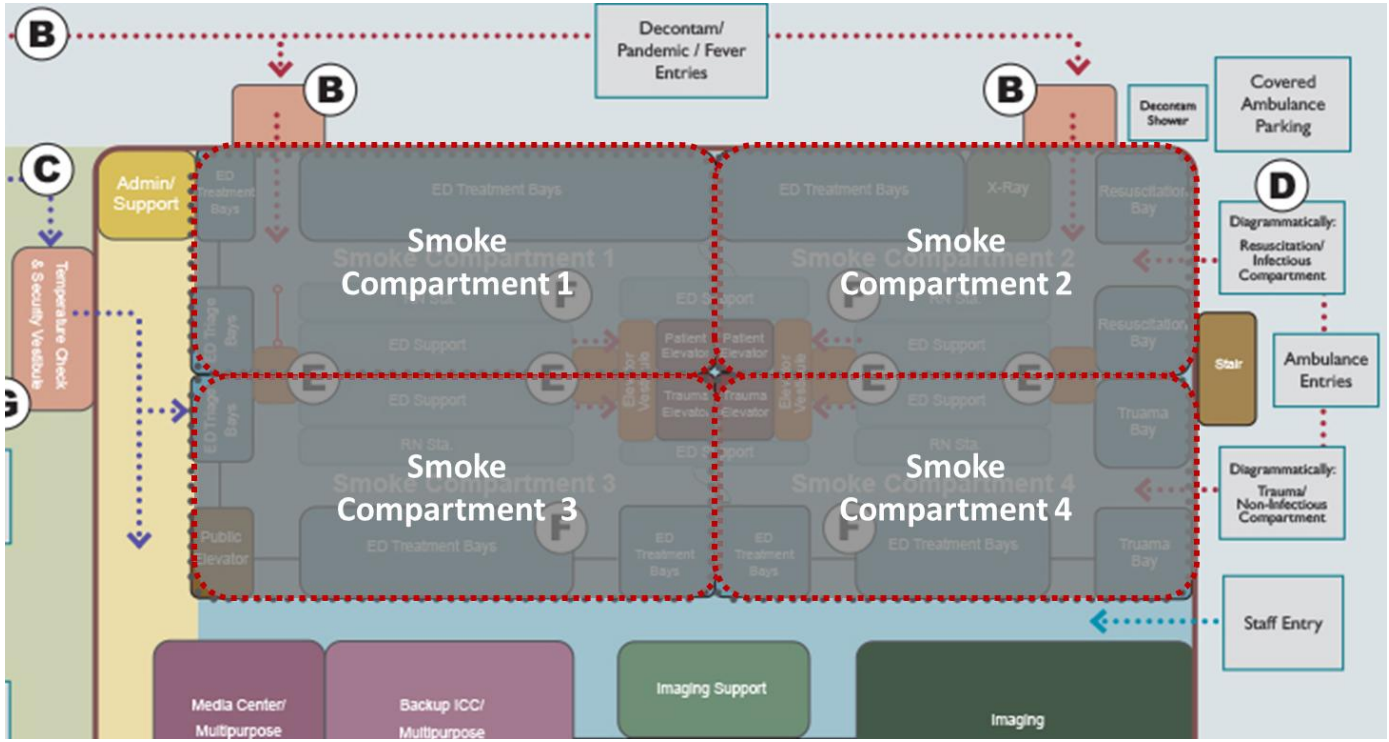
Hospitals must plan for increased patient volume while protecting internal operations.

Exterior Triage & Patient Arrival

- Separate ambulance and walk-in access
- Exterior screening capability
- Weather-protected triage areas
- Clear signage and traffic flow
- Prevent cross-contamination

Compartmentation Strategy

- Smoke compartments in ED
- Separate infectious and non-infectious zones
- Redundant HVAC per compartment
- Supports relocation without full evacuation



Shelter-in-Place vs Evacuation

Decision factors:

- Air quality levels
- Structural exposure risk
- Power stability
- Road accessibility
- Patient acuity and mobility

Evacuation planning must be pre-coordinated.

Alternate Care Sites

- Identify off-site surge locations in advance
- Evaluate utilities and ventilation capacity
- Coordinate with local jurisdictions
- Remote sites are resource-intensive — not first choice

What Can You Do Now? Immediate Next Steps

- Confirm FHSZ designation
- Conduct exterior vulnerability assessment
- Test HVAC smoke mode
- Review generator and fuel capacity
- Update Hazard Vulnerability Assessment (HVA)
- Align capital projects with WUI requirements

Aligning Design & Operations

Wildfire resilience requires integration of:

- Building envelope design
- Mechanical systems flexibility
- Emergency management planning
- Code compliance
- Long-term capital investment

Design decisions must support operational continuity.

Questions?

Thank You!

Item #6 Review slide deck for Topic 3: Wildland Urban Interface - HVAC (including ASHRAE Guideline 44)

- Discussion and public input

Facilitators: Abdel Darwich, PE, LEED AP, HFDP, Principal, Guttmann and Blaevoet Consulting Engineers; and Mikhail Fuks, PE, HFDP, DBIA (or designees)

HCAi
Department of Health Care Access and Information

HCAI Design Guide for Planning and Preparing for Disasters Wildfire-Urban Interface-HVAC

By

Abdel K Darwich, PE, ASHRAE Fellow, LEEP AP, HFDP

Mikhail Fuks, PE, HFDP, DBIA

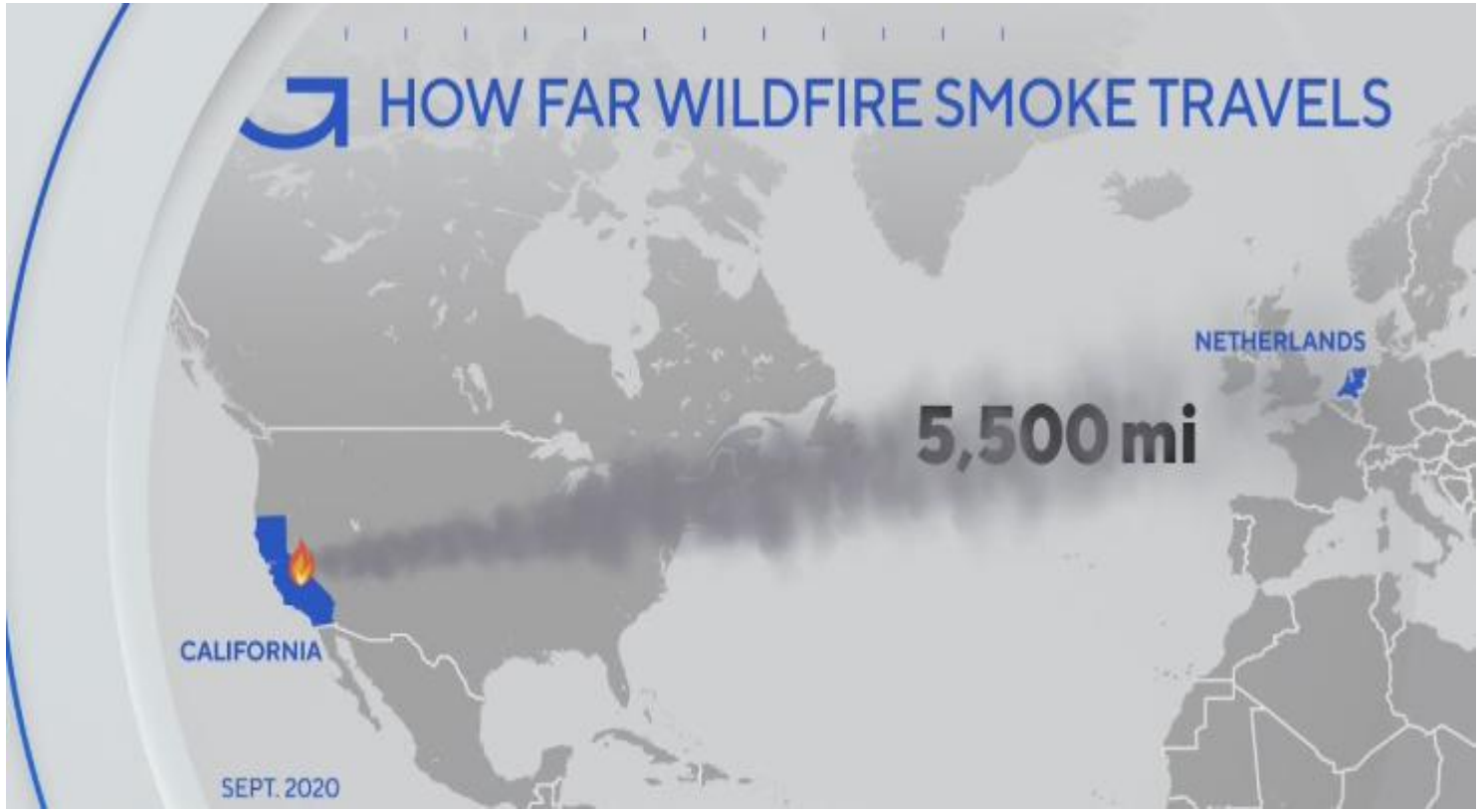
Agenda

- Background
  - Why this presentation?
  - What is wildfire smoke composed of?
  - What happens during a wildfire?
  - Types of Filters
  - Sources : HCAI DGPPD and ASHRAE Guideline 44
- Concepts to protect buildings from wildfire smoke
- Knowing first
- Planning second
- How does wildfire smoke enter a building
- Measures to mitigate wildfire smoke
- Healthcare Facilities Extra Precautions
- Triple Murphy's Law
- The future

Wildfire Smoke is a hazard !

Smoke for Wildfires is also a hazard in addition to the fire itself

It can travel hundreds and thousands of miles !



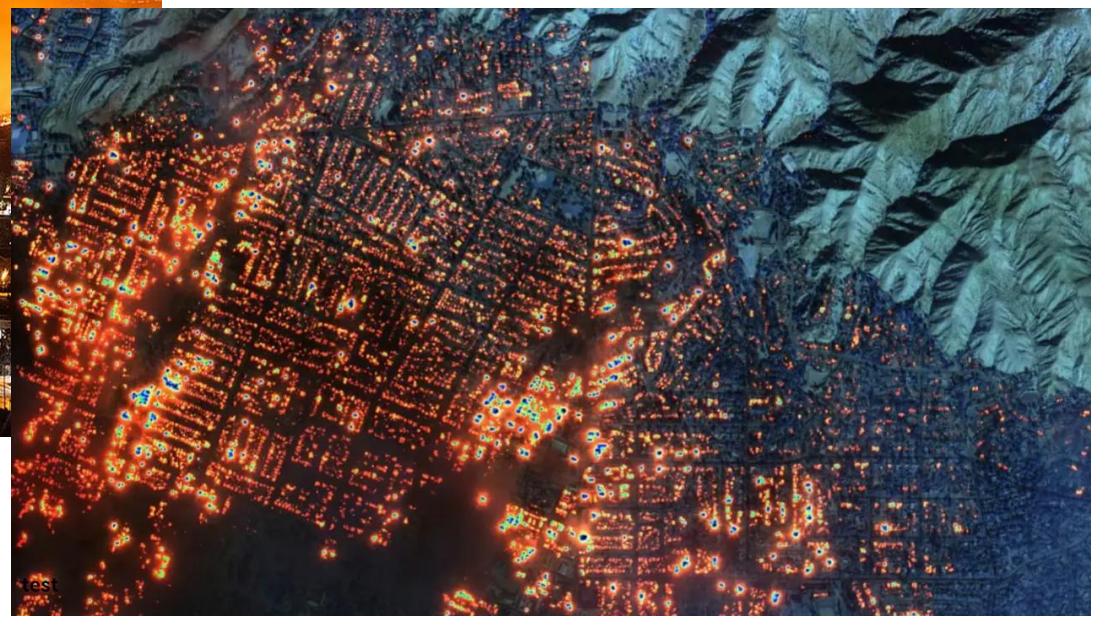
Sacramento

October 2018

Sacramento

November 2018

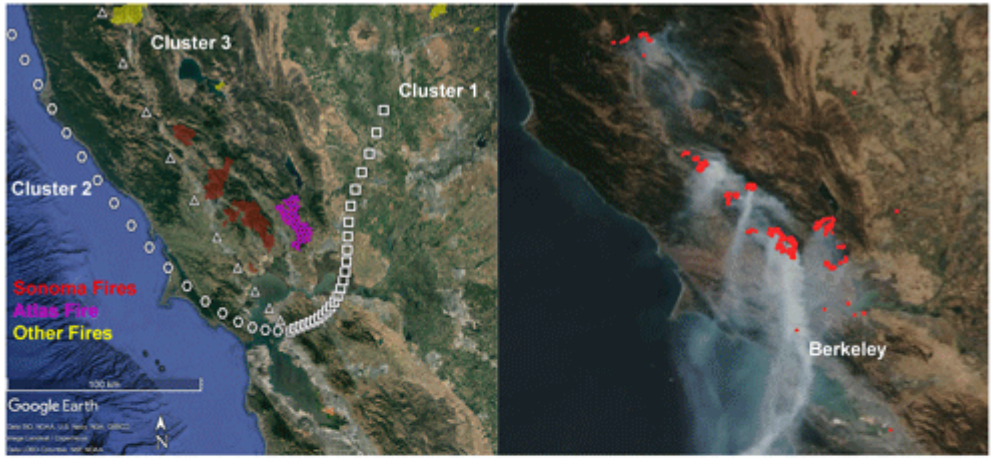
San Francisco September 2020

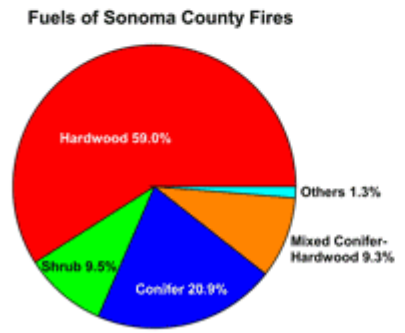


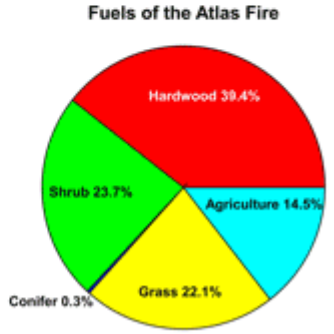
Los Angeles 2025

What is wildfire smoke composed of?

- Wildfire smoke composition depends upon multiple factors
  - the types of wood and vegetation burning
  - the moisture content
  - the fire temperature
  - wind conditions
  - other weather-related influences
- Getting more complicated with Wildfires/Urban fires





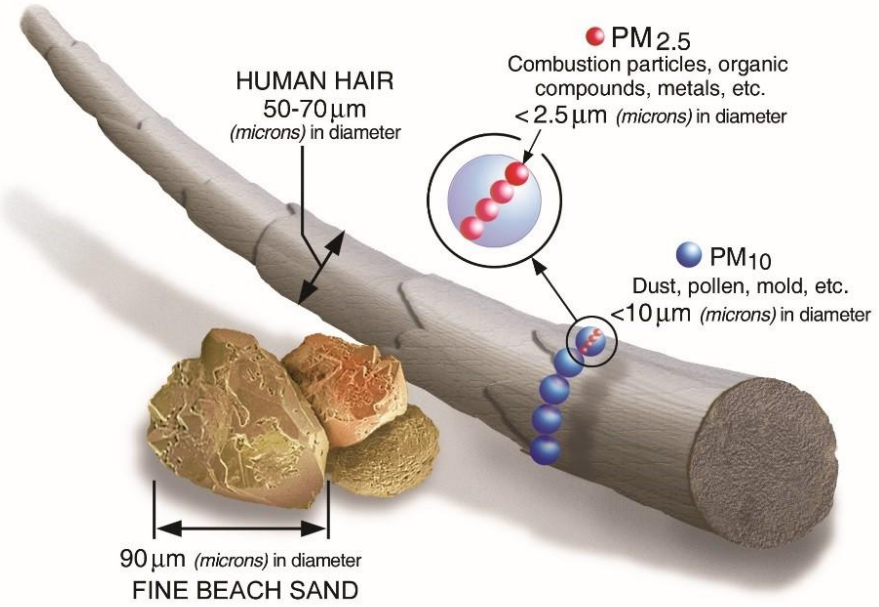


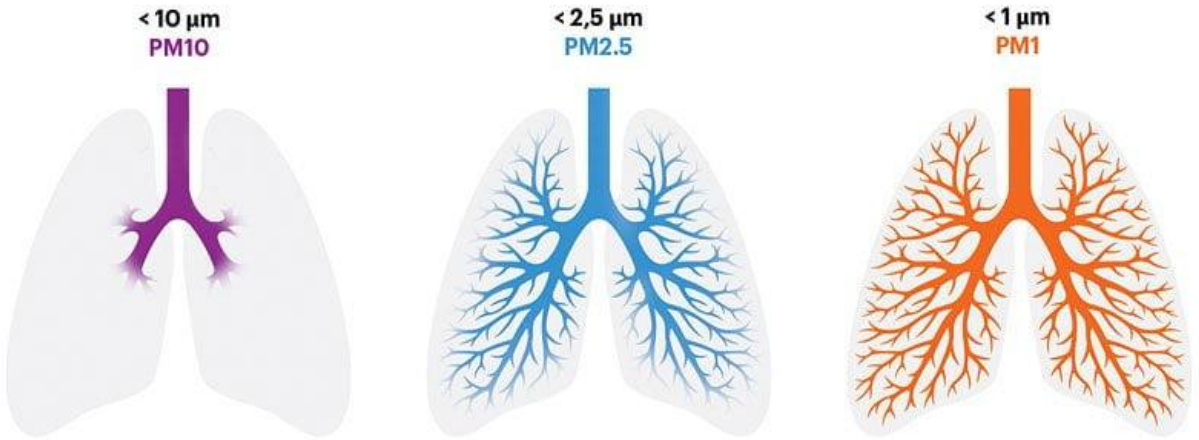
What is wildlife fire composed of ?

- Gases
  - Oxides of nitrogen (NOX)
  - Volatile organic compounds (VOCs) *– most "smellable"*
  - Ground-level ozone (O3) formed when NOX and VOCs interact with UV in sunlight
- Particles
  - Composition : Carbon, heavy metals
  - Size : All sizes but PM2.5 *most dangerous*
  - Recent research showing ultra fine particles present

PM2.5

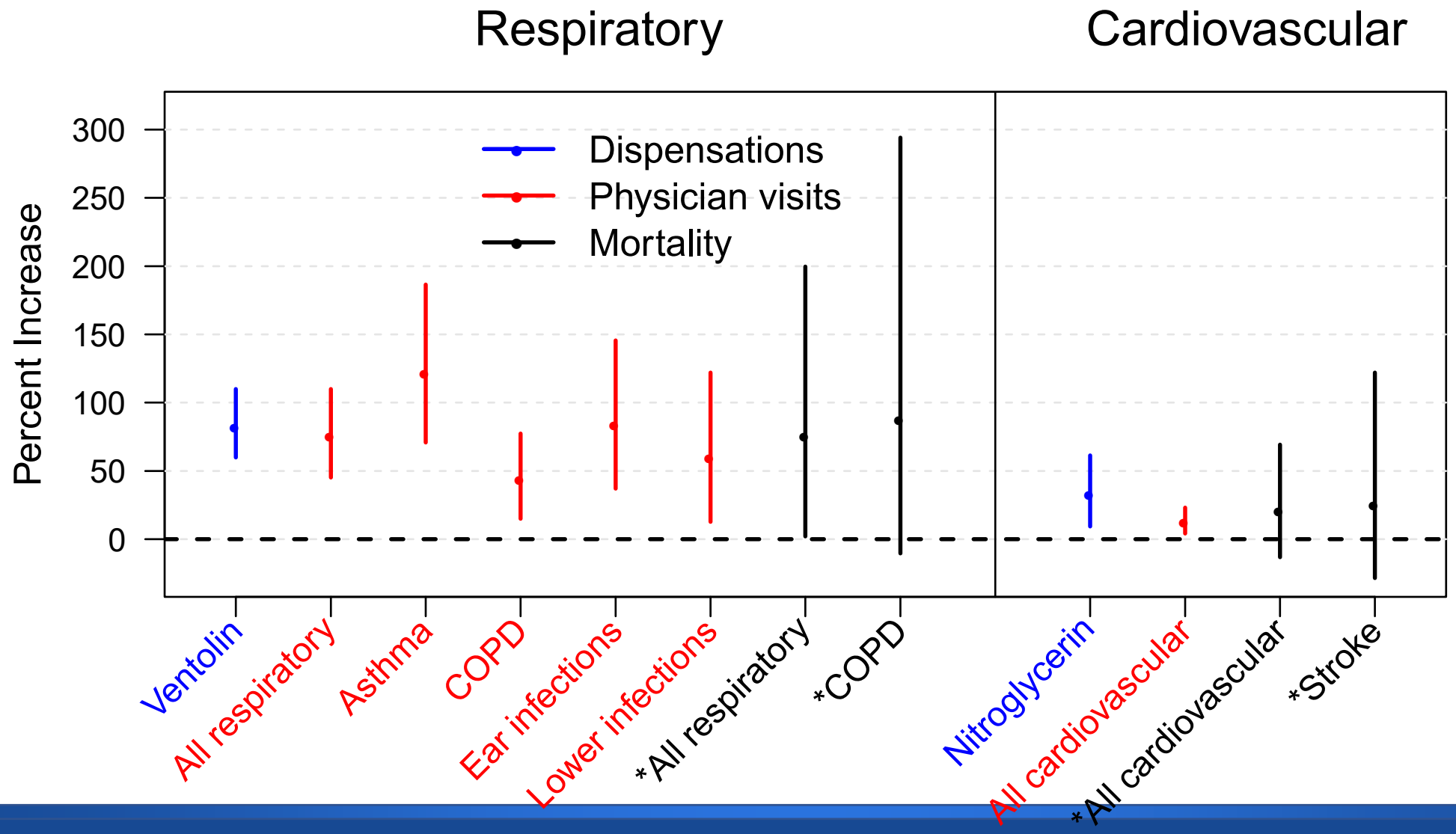
- Particulate Matter with particles that are 2.5 microns or less in diameter (PM2.5).
- Penetrates deep into the human lungs. Documented adverse heat effect.
- Most noticeable increase in wildfires





Acute Effects on a Smoky Day in British Columbia

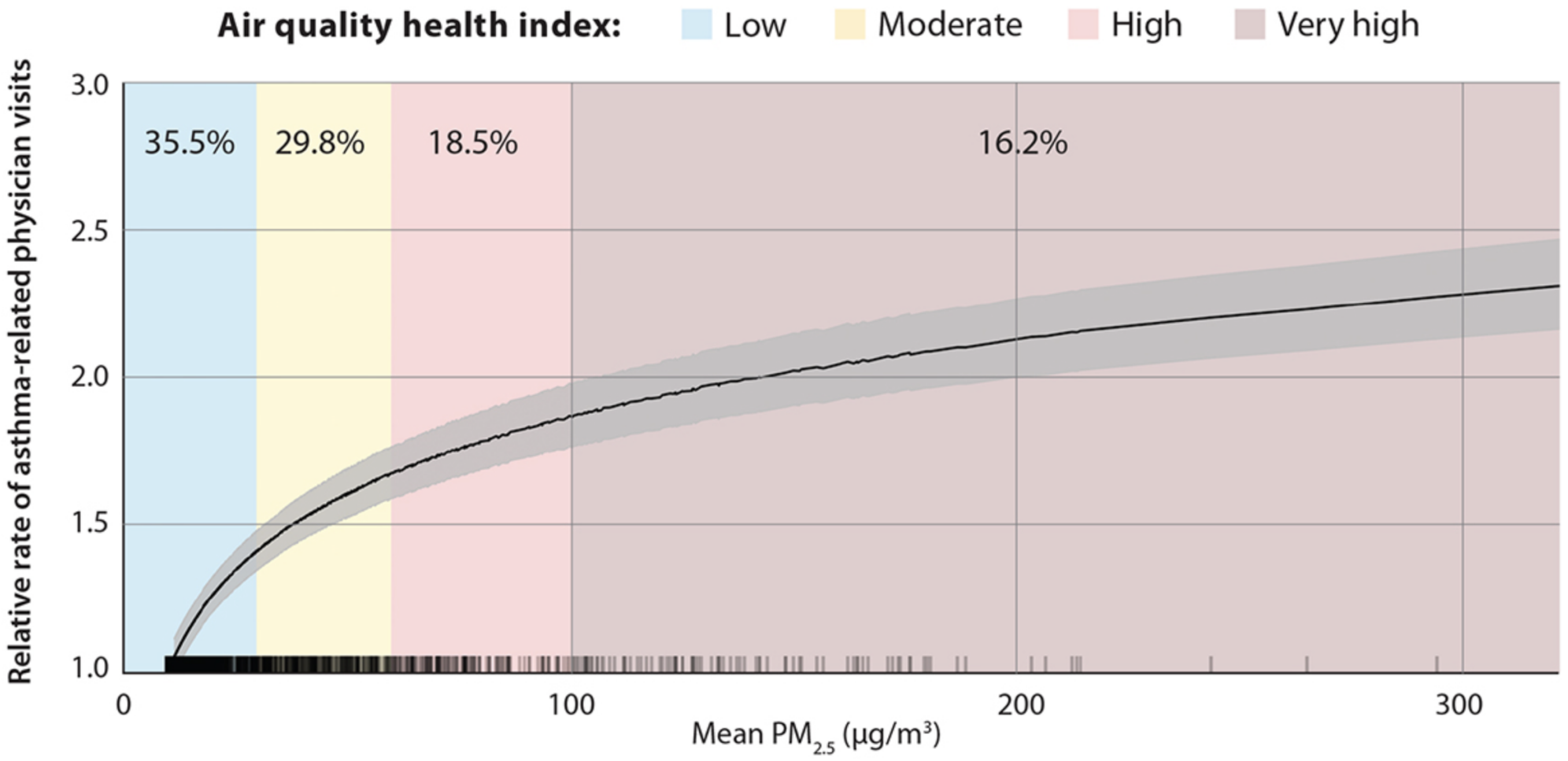
(100 μg/m^3 $PM_{2.5}$)



*Unpublished data

The Acute Effects are NOT Linear

Air Quality Health Index

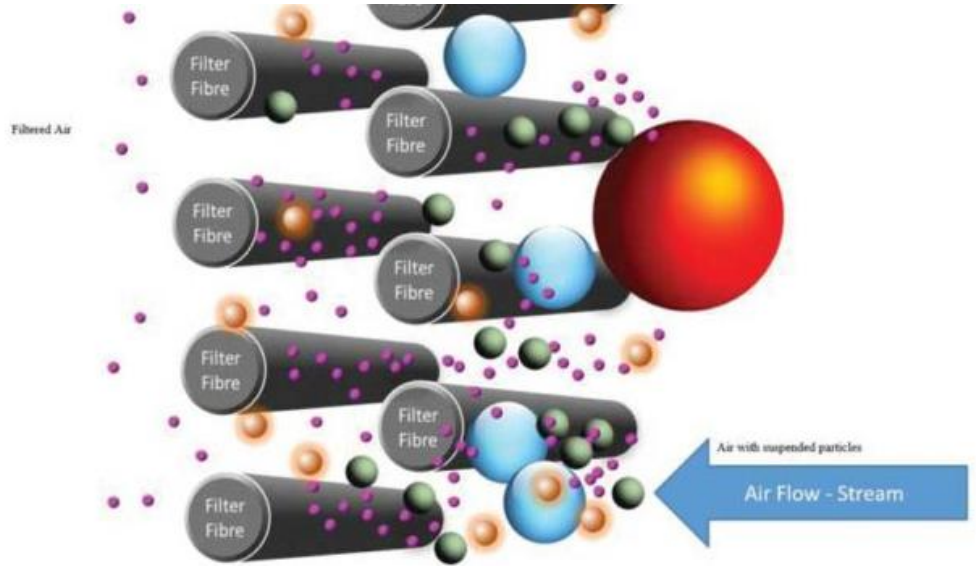


bcmj.org/bc-centre-disease-control/public-health-paradox-wildfire-smoke

Types of filters

- Particulate filters
  - Stops particulate by interception
  - Cannot stop gases
  - MERV/HEPA rated filters

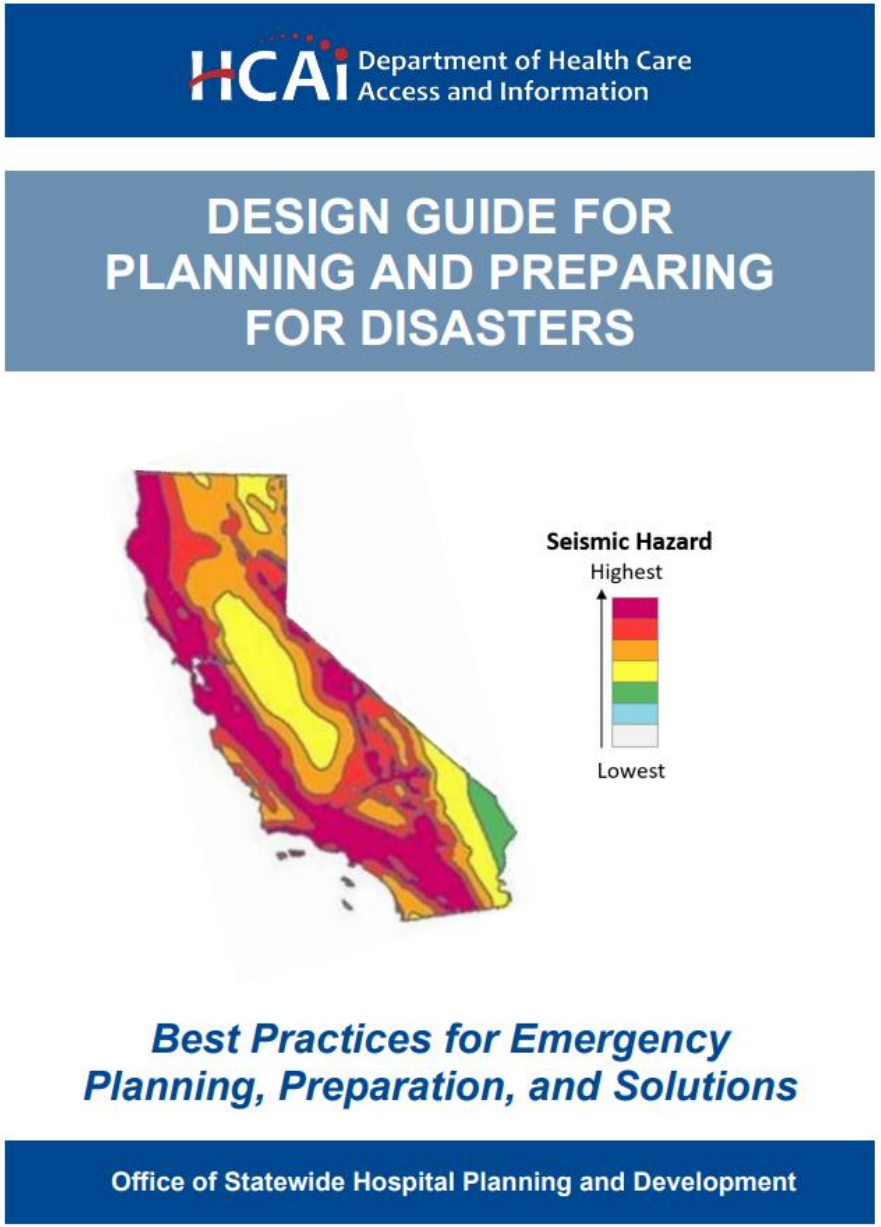
- Gas Phase filters
  - Physical
  - Chemical



Sources of Info

1. HCAI/OSHPD- Design Guide for planning and preparing for Disasters

- Worked on it 2020-2022
- Published in March 2024
- Section 7 is titled “HVAC System Considerations for Handling Smoke During Wildfires



Sources of Info

2. ASHRAE Guideline 44

- Committee started July 2021
- Detour : Published a white paper in 2022. Used as a basis for HCAI DGPPD.
- Published Guideline 44 in January 2025
- Free access after LA and Canadian fires

Protecting a building from a wildfire smoke

- Key concepts
  - Knowing
  - Planning
  - Preventing smoke from getting indoors
  - Removing smoke contaminants that get indoors

Knowing first….

- PM2.5 sensors
  - Recommendation : install permanent PM2 sensors
    - Outside (not Outside Air intake) OR data can be obtained online from an adjacent regional monitor
    - Entryways: in a hallways, ambulance bays, and loading docks near a building entrance to assess smoke ingress in the building
    - High occupancy areas, or areas occupied by at-risk populations

Knowing

Planning second…

- Extended periods of significant smoke are no longer a surprise.
- There is no longer such a thing as fire season.
- Planning is key. A plan is necessary for the next wildfire.
- **Nothing good happens at the last minute**

Planning

Planning second….

- Develop a Smoke Readiness Plan (SRP) : 4 parts. More details in DGPPD Section 7.2 And Guideline 44 Section 6.
- Questions to get started :
  - Will the building be occupied during a smoke event?
  - If so, for 1 day? Or for the duration?
  - Any specific areas of refuge?

1. Preparation section
   - The What : Specific building elements for controlling smoke
   - The Who : Roles and responsibilities of staff responsible for implementing the plan
   - The how much : Expected costs associated with implementing the plan

Planning

Planning second….

- Develop a Smoke Readiness Plan (SRP) :
  2. Testing section
     - Test all components, sensors and the overall plan
  3. Implementation section
     - When to implement the plan
  4. Return to normal operations
     - When and how to return to normal operations
- Coordinate Smoke Readiness Plan with Infection Control Group in healthcare facilities.

Planning

Communication of the smoke readiness plan (SRP)

- Facilities O&M should know the SRP and be trained on implementing it
- For new project, include in the OPR (Owner Project Requirement) and the BOD (Basis of Design)
- Include in Sequence of Operations and make sure it is commissioned

Planning

How does wildfire smoke enter a building?

- **Intakes** - outdoor air intakes at HVAC systems.
- **Doors** - entrance and egress points into the building.
- **Envelope elements** - windows, skylights, or other penetrations in the opaque envelope.
- **Leakage** through the opaque envelope.
- **Emissions** from contaminated clothing from occupants.

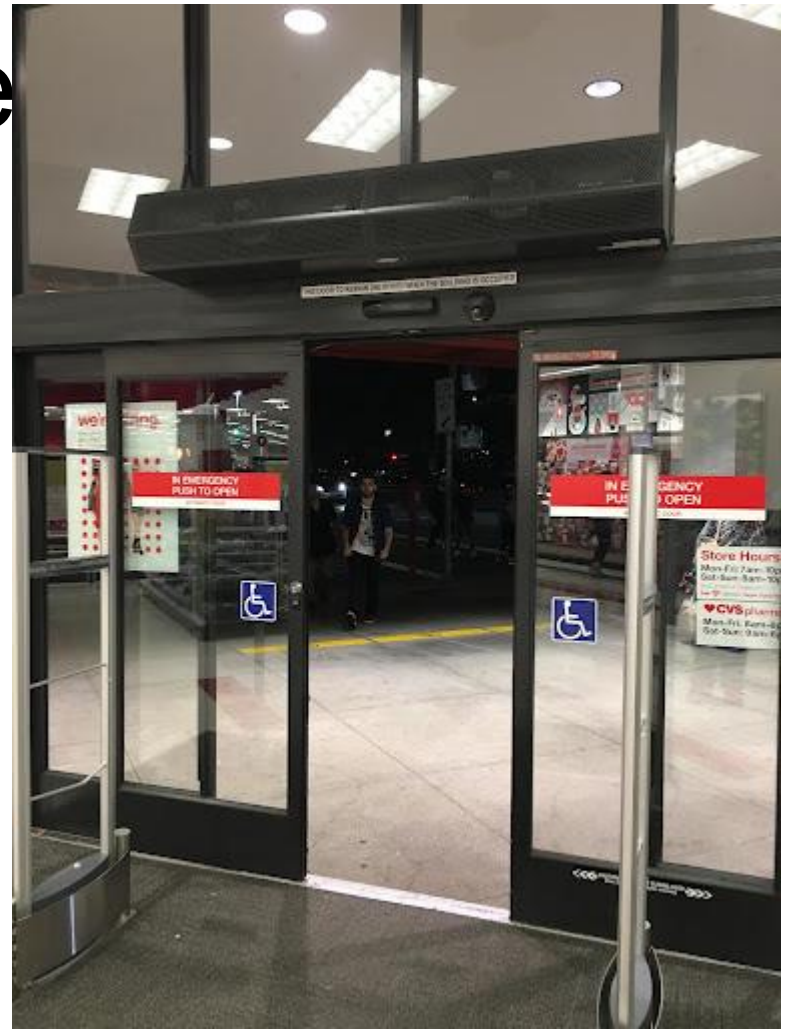
Outdoor air intakes measures

- Minimize outdoor air
- Do not completely shut down outdoor air !
- Disable economizers
- If 100%OA, consider going to recirculation
- Seal any ducts that are outdoor and under negative pressure
- Natural ventilated spaces – switch to mechanical

Preventing

Doors/Entrances measure

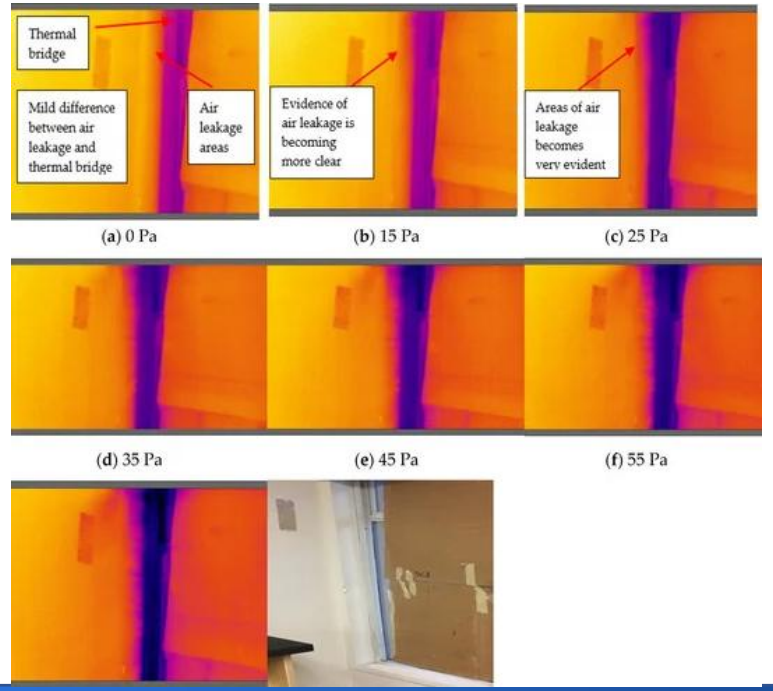
- Positively pressurized vestibules at all entrances
- Air curtains at all frequently used doors like ED, loading docks
- If new building, avoid doors facing prevailing wind direction



Preventing

Envelope measures

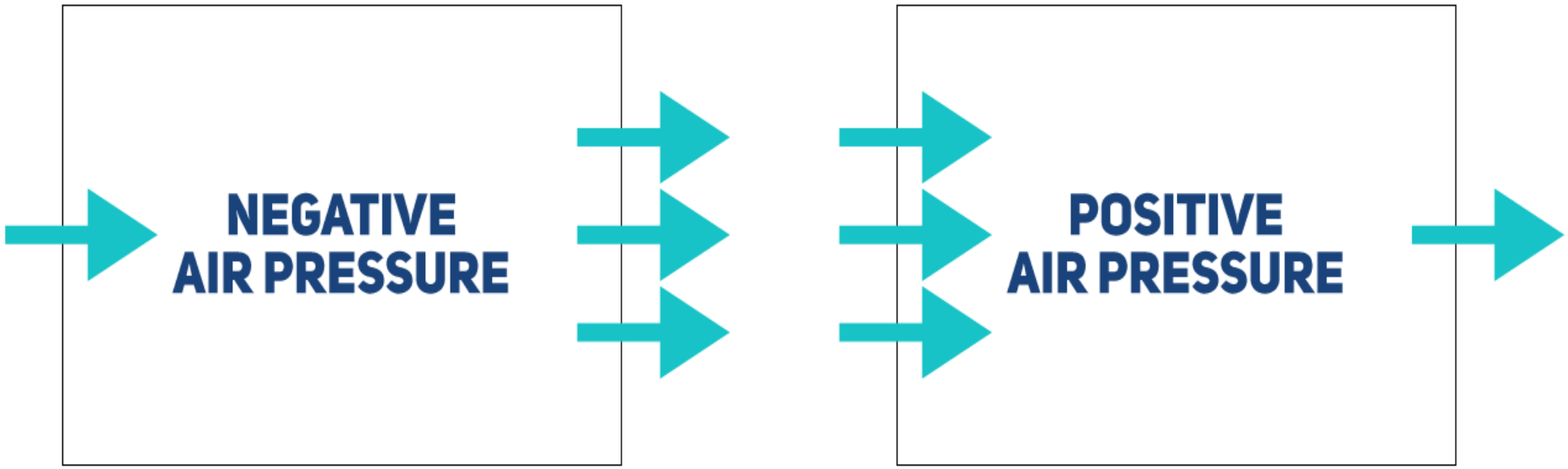
- Weatherize the building envelope, doors, and windows to reduce smoke infiltration by sealing and caulking cracks
- If existing building :
  - Visual inspection
  - Professional inspection
- If new building :
  - Commission the envelop
  - Set air leakage goals



Preventing

KEEP your building positive

- Always keep outside air more than exhaust air
- Use your BMS ! Building Management System
- Install airflow measuring stations if needed



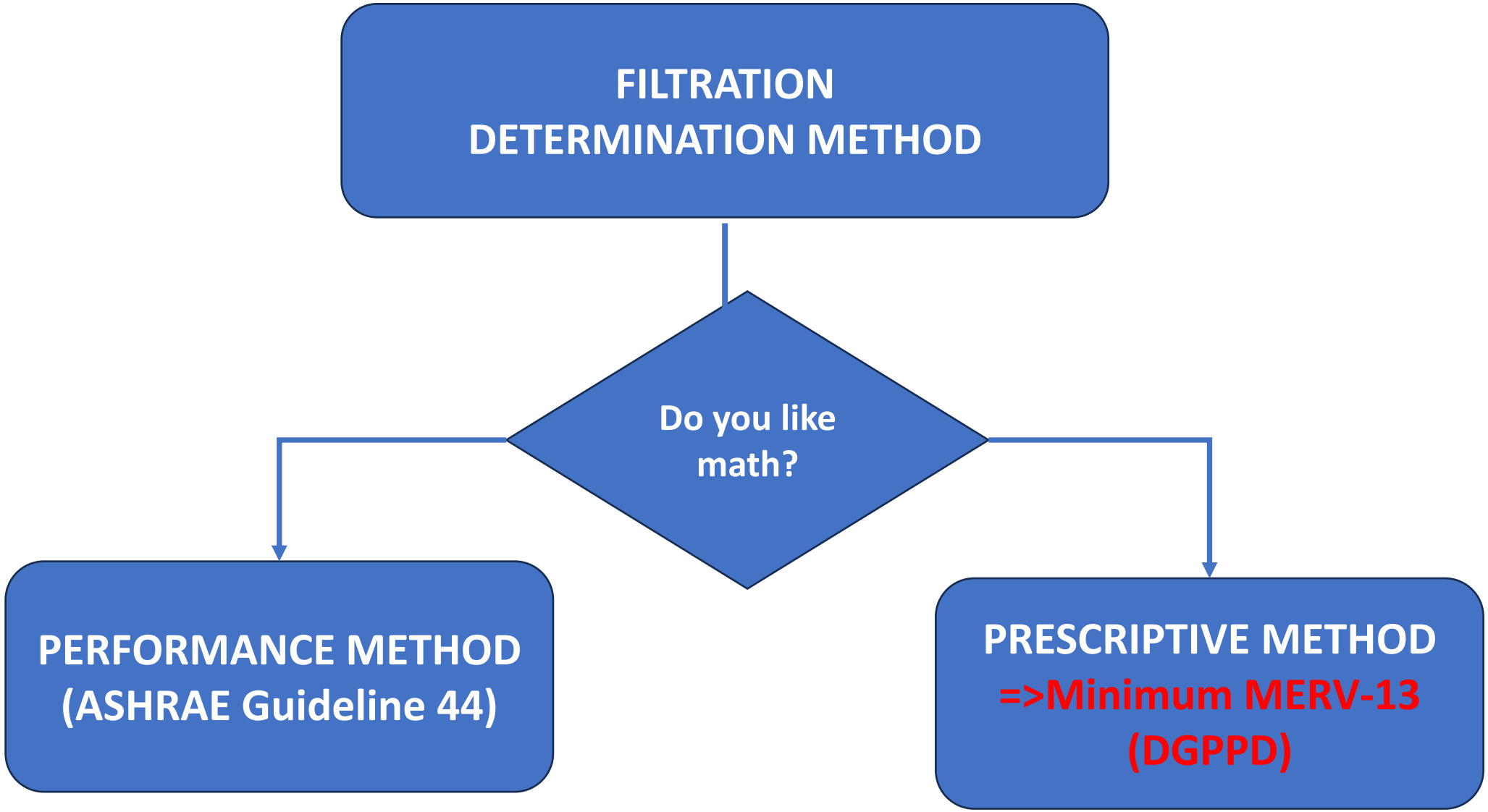
Preventing

Filtering wildfire smoke

- Most important goal : filter PM2.5 → Particulate Filters
- Optional : Filter gases
- What filter efficiency is needed ?

Figure 7.3 – Filter Before and After Load From Wildfire

Removing


FILTRATION
DETERMINATION METHOD
Do you like
math?
PERFORMANCE METHOD
(ASHRAE Guideline 44)
PRESCRIPTIVE METHOD
=>Minimum MERV-13
(DGPPD)

Removing

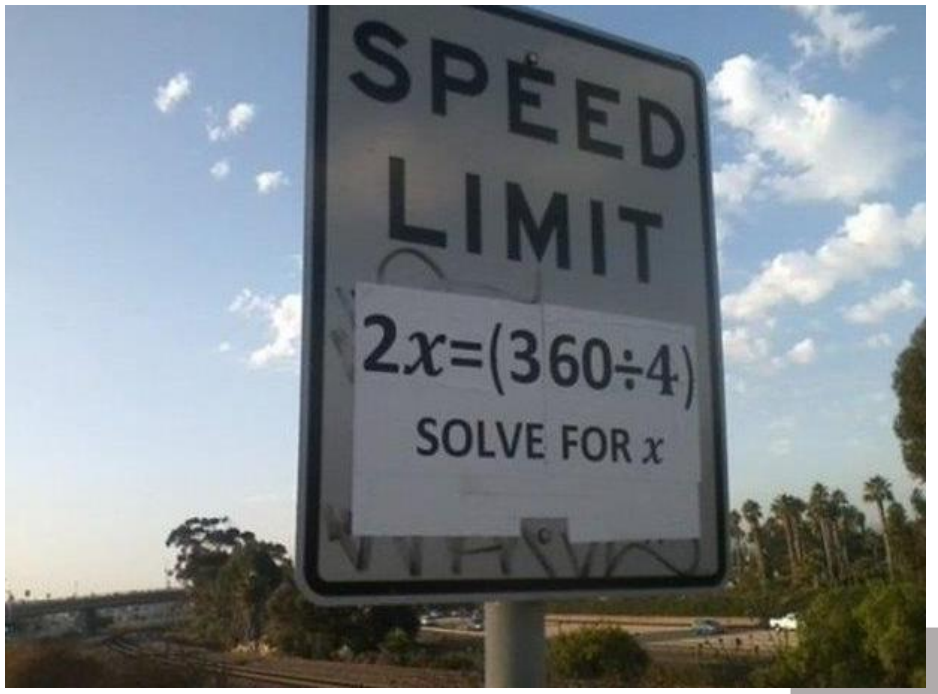
Prescriptive Method
Filter minimum MERV method

- MERV = Minimum Efficiency Reporting Value
- DGPPD and ASHRAE Guideline 44 → Minimum MERV-13
- MERV-13 will stop 85% of PM2.5 passing through

Removing

Filter efficiency Performance method

- ASHRAE Guideline 44 equation with the following variables:
  - Outdoor PM2.5 concentration
  - Airflow
  - Indoor PM2.5 concentration
  - Filter efficiency



Removing

Other filter considerations

- Frequency of filter change during a wildfire event
  - ASHRAE Guideline 44 gives a method and example
  - Filter loads. When does it fail?
  - Anticipate to change filters very frequently and have them in stock
- Inspect existing filter frames for any leakage !

Removing

Filters-going beyond the minimum

- Have empty racks in AHUs for HEPA and gas phase filters (e.g. carbon filters)
- Need to size the fan and the VFD to account for extra pressure drop
- Extra filtration -> extra energy usage

Removing

Portable air cleaners

- Additional localized filtration
- Purchase in advance and store
- Make sure they do not generate ozone
- Rating is still residential by AHAM. CADR = Clear Air Delivery Rate.
- For wildfire fire smoke, AHAM recommends CADR equal to the size of the room in square feet, e.g., for a room of 120 sq.ft , the CADR should be 120.
- For new projects, plan for more power outlets and storage space
- The deployment of PACs in health care facilities should be reviewed with the facility infection control team. Given the large areas in hospitals, the airflow from PACs may become large enough to compromise infection control.

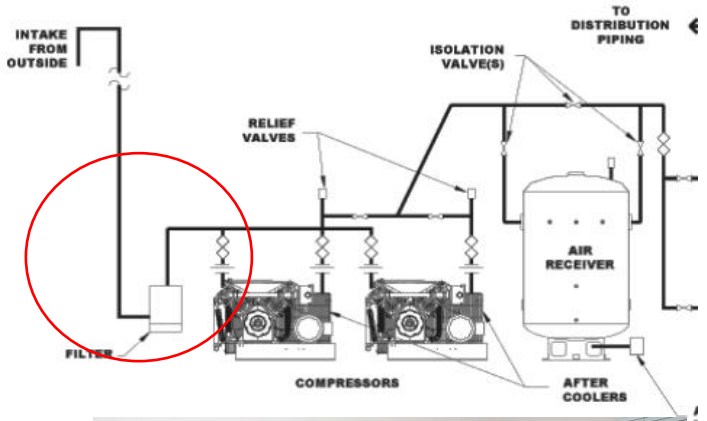
Removing

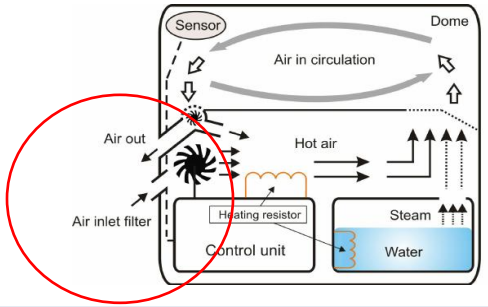
Healthcare facilities

- Continuous operation under even severe wildland fire smoke. Hospital emergency departments near the fire must remain operational to treat firefighters and affected community residents.
- Hospitals may contain clean rooms (e.g., compounding pharmacies). Smoke could rapidly load the filters in these areas.
- Spaces in health care facilities have to maintain a certain pressure (positive or negative). Consult with Infection control before changing OA or changing pressure especially in :
  - Operating room suites
  - Nurseries and pediatric care
  - Patient waiting and outpatient care areas
  - Patients in hematology/oncology units who may have compromised immune systems.

Non-HVAC filters in hospitals

- Non-HVAC filters will also load up from wildfire smoke
- Medical Air Compressor – Filter on air intake
- Filter in medical equipment like NICU incubators
- Have a full inventory and lots of spare



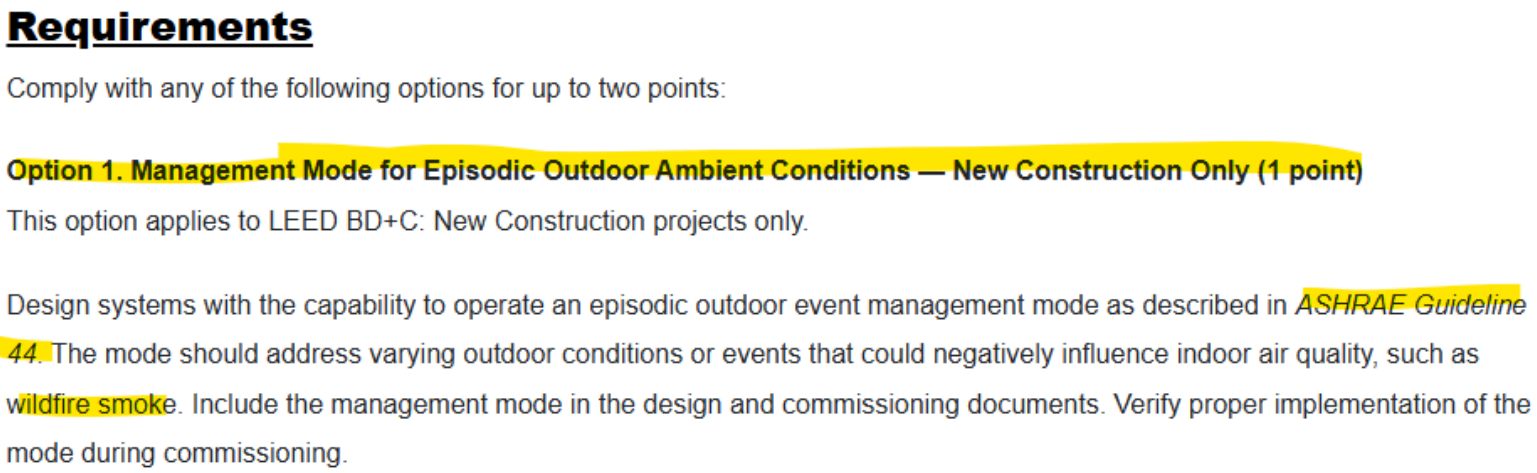


Triple murphy’s law

- EARTHQUAKE + PANDEMIC +WILDFIRE ?
- YES in August to November to 2020 in Northen California
- Wildfire = Minimize Outside Air
- Pandemic = 100%OA (maybe not after ASHRAE 241)
- What to do ?

The future

- Wildfires will be a continuous threat
- Buildings MUST be designed for this disaster
- LEED v5 will have one credit point for applying Guideline 44 to mitigate wildfire smoke.



Requirements

Comply with any of the following options for up to two points:

Option 1. Management Mode for Episodic Outdoor Ambient Conditions — New Construction Only (1 point)

This option applies to LEED BD+C: New Construction projects only.

Design systems with the capability to operate an episodic outdoor event management mode as described in *ASHRAE Guideline 44*. The mode should address varying outdoor conditions or events that could negatively influence indoor air quality, such as wildfire smoke. Include the management mode in the design and commissioning documents. Verify proper implementation of the mode during commissioning.

Thank You

Questions

Item #7 Review slide deck for Topic 4: Infection Control – HVAC

- Discussion and public input

Facilitators: Abdel Darwich and Mikhail Fuks (or designees)

Item #8 Review slide deck for Topic 5: Infection Control – Operations

- Discussion and public input

Facilitators: Jennifer Cox, MHA, BSN, RN, PHN, CIC, System Director, Epidemiology and Infection Prevention, University of California Irvine Health; and Kelly Martinez, RN, MBA, FACHE, EDAC, Co-founder, Hallsta, Inc. (or designees)

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Infection Prevention Operations

Topics and Objectives

Foundational Principles

Designing for Preparedness:

- Role in Infection Prevention and Hospital Epidemiology in Design

Infection Control Risk Assessment (ICRA)

- Clear workflows for design decisions impacting infection prevention
- Early identification of pandemic/emergency operational modes
- Preparedenss-driven room standardization for flexibility

Regulatory & Guideline Framework

- FGI Guidelines
- ASHRAE 170/188
- California Mechanical Code
- California Plumbing Code
- Cal/OSHA Aerosol Transmissible Disease Standard (ATD)
- ASHE 241
- CDC, OSHA, CMS, state regulations
- Local building & plumbing codes
- Relevant HCAI Documents
- PINs related to HVAC emergency modes, AIIR, anterooms, pandemic design considerations
- CANs for plumbing, water safety, medical gas, and finishes
- HCAI requirements for commissioning, functional testing, and post-occupancy validation

Built Environment Factors That Influence Infection Prevention

- **Airflow, Pressurization & Ventilation Principles**
  - Normal operations vs. emergency modes
  - Airborne isolation strategies
  - Convertible rooms (med/surg → AIIR)
  - Convert space into isolation ward (ward level, not room level)
  - Webinar guide idea about two exhausts for versatility

Built Environment Factors That Influence Infection Prevention

- **Materials & Finishes for Cleanability and Durability**
- **HCAI-compliant product selection**
  - Cleanable, durable materials compatible with hospital-grade disinfectants
- **Seams, joints, and transitions designed for easy disinfection**
- **Resilience during surge cleaning or enhanced environmental disinfection protocols**

Built Environment Factors That Influence Infection Prevention

- **Hand Hygiene Infrastructure**
  - Placement strategy
  - Supply redundancy
  - Water outages / alternative stations

Built Environment Factors That Influence Infection Prevention

- **Environmental Services Workflow Integration**
  - Storage, staging, waste collection points
  - Access to utility rooms, cleaning equipment, and dilution systems

Planning for Flexibility & Surge Capacity

Planning for Flexibility & Surge Capacity

- **Design of Units to Convert to Higher Acuity**
  (e.g., standard rooms → AIIR; PACU → critical care)
- **Universal/Standardized Room Designs**

Planning for Flexibility & Surge Capacity

- **Space for Temporary Isolation Areas**
  - Donning/doffing zones
  - Ante/transition spaces secured during outbreaks
- **Traffic Flow Flexibility**
  - Segregation of clean/dirty pathways during outbreaks
  - Ability to reconfigure entrances/exits
  - Controlled access points
- Morgue space/planned outdoor space for refrigerator trailers as needed

Emergency-Mode Ventilation & Pressurization

Emergency-Mode Ventilation & Pressurization

- **Convertible Air Pressure Modes (positive ↔ negative) – can't do?**
- **Safeguards for Maintaining Pressurization During Power Loss**
- **Monitoring Systems**
  - Real-time room pressure and ACH monitoring
  - Alerts and integration with BMS
  - Remote dashboards for IP/FMS visibility

Preparedness in Water Systems

Preparedness in Water Systems

- **Designing for Low-Use Zones & Stagnation Prevention**
- **Design Requirements Under the California Plumbing Code**
  - Recirculation design
  - Prevention of stagnation/dead legs
  - Fixture selection (aerosolizing / non-aerosolizing)

Preparedness in Water Systems

- **Integration with Water Management Plan**
  - ASHRAE 188 alignment
  - California Legionella prevention guidance (CDPH + HCAI expectations)
- **Emergency/Low-use Conditions**
  - Design features that support flushing
  - Automated flow or temperature monitoring
  - Access points for sampling required by IPC and water safety programs

Preparedness in Water Systems

- **Sampling Ports & Sensor Infrastructure**
  - Temperature, chlorine residual, flow monitoring
  - Automation for flow
- **Backup Disinfection Approaches Readiness**
  - Hyperchlorination access points
  - Compatibility with secondary disinfection
  - Ensure secondary disinfection is able to continue injecting during loss of power

Preparedness in Water Systems

- **Emergency Response Scenarios**
  - Main breaks, contamination events, construction shutdowns

Clinical Operations & Workflow During Outbreaks

Patient Flow During High-Consequence Outbreaks

- Waiting room segregation
- Dedicated paths for infectious vs. non-infectious patients

Staff Workflow & Decontamination Areas

- PPE storage and surge stock readiness
- Reusable PPE processing infrastructure

Additional Populations

- **Visitor Management Infrastructure**
  - Screening stations
  - Holding zones
- Exterior spaces capability to accommodate separated populations
  - Electricity
  - Space for tents, buses

Sterile Processing & Perioperative Preparedness

- Scalable Sterile Processing Capacity
- Scalable OR/procedural capacity
- Support for Contingency/Deferred Sterilization Needs
- Redundancy in HVAC for Procedure Rooms & ORs
- Decentralized and centralized reprocessing options (pros and cons)

Waste, Hazmat, and Biohazard Readiness

- **Redundant Waste Routing**
- **Space for Temporary Biohazard Surge**
- **Decontamination Stations and Dedicated Storage**

Technology & Digital Infrastructure

- **Real-Time Environmental Monitoring**
  - Air pressures, temp/RH, water quality, ACH
  - Automated dashboards
- **Automation & Controls That Support Preparedness**
  - Rapid mode switching (AIIR mode, pandemic surge mode)

Supply Chain & Storage Preparedness

- **Strategic Supply Storage Capacity**
  - PPE
  - Disinfectants
  - High-consequence pathogen kits
- **Decentralized Storage for Critical Supplies**
- **Design for Supply Decontamination / Distribution Flow**

Facilities Management & Emergency Response Coordination

- **Designing for Maintainability During Outbreaks**
  - Safe zones for staff to work in mechanical rooms
  - Remote inspections
- **Cross-Training & Access Needs for Building Systems**
- **Documentation & System Maps That Support Preparedness**
  - Airflow schematics
  - Water system zones
  - Pressurization grids

Commissioning, Recommissioning & Validation

- **Infection Prevention Role in Commissioning**
- **Pre-Occupancy Verification for Preparedness**
  - Pressurization tests
  - Airflow patterns
  - Water system flushing verification
- **Scenario-Based Testing**
  - Simulated surge
  - Outage drills
  - Water disruption exercises

Construction & Renovation Preparedness

- **ICRA (Infection Control Risk Assessment) Integration**
- **Phased Construction & Temporary Controls**
  - Maintaining safe airflow during renovations
  - Water stagnation mitigation during partial closures
- **Turnover & Reopening Plans**
  - Water system recommissioning
  - Air balance verification

Governance & Decision-Making Framework

- **Including IP Early and Throughout All Phases**
  - Predesign → Schematic → DD → Construction → Activation
- **Preparedness-based Design Review Checklists**
- **Escalation Pathways for Design Decisions That Impact Safety**

Item #9 Review slide deck for Topic 6: Infection Control – Design

- Discussion and public input

Facilitators: Teresa Endres and Kelly Martinez (or designees)

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Beyond Minimums: Crafting Resilient Healthcare Facilities

Building codes set the baseline; true resilience demands more for critical infrastructure and patient safety.

Planning Diagrams History

Background context: SARS, MERS, and pandemic readiness planning

Emergency Design Task Force
Looked to countries with previous SARS/MERS pandemics

SARS Pandemic 2003
Asia (China, Hong Kong, Taiwan, Singapore, Vietnam, Philippines & Thailand), and Canada

MERS Pandemic 2012

Singapore MOH 2014
Pandemic Readiness and Response Plan for Influenza and Other Acute Respiratory Diseases + DORSCON Matrix

Resources

- Factors Influencing the Response to Infectious Diseases: SARS and MERS in South Korea (PubMed/NIH)
- SARS: Lessons from Toronto (NCBI Bookshelf/NIH)
- European Center for Disease Prevention and Control

Emergency Operations Planning to Accommodate Surge Capacity

Planning Diagrams History

Singapore Ministry of Health Pandemic Readiness and Response Plan

Summary tables for response measures under the DORSCON matrix

Possible scenarios	Applicable response phases	Border Control	Public health measures						
			Temperature screening in institutions / buildings	Social distancing	School closures	Contact tracing	Phone surveillance or quarantine	Antivirals for influenza	Vaccination
GREEN - Negligible to low public health impact									
• **High virulence** • **No or limited H-H transmission** • **Disease mainly overseas**	Alert (with containment of imported cases)	Health Advisory Notices (HANs) (Posters, Cards)	No	No	No	Yes, if cases are imported	Consider to implement depending on risk	Treatment of case where necessary	No
• **Similar or lower virulence and transmissibility as seasonal flu**	Mitigation	No	Consider to implement if necessary			No	No		Vaccination for high risk groups, if available
YELLOW									
• **High virulence but low transmissibility** • **Disease mainly overseas**	Alert (with containment of imported cases)	HANs Health Declaration Cards (HDCs) and temperature screening of inbound passengers, if necessary	No	No	No	Yes, if cases are imported	Consider to implement depending on risk	Treatment of cases where necessary	Procure and offer vaccine when available
• **Local epidemic with low virulence but high transmissibility**	Mitigation	HANs	Consider to implement if necessary			No	No		
• **High virulence and transmissibility, but vaccine available**	Mitigation		No						Distribute vaccine to mitigate impact
ORANGE									
• **High virulence and transmissibility** • **Disease mainly overseas**	Alert	HANs HDCs and temperature screening of inbound passengers, if necessary	No	No	No	Yes, if cases are imported	Quarantine	Treatment of cases, consider limited prophylaxis of personnel providing	Procure and offer vaccine when available
• **High virulence and transmissibility** • **Disease in Singapore**	Containment				Yes, selective closures if cases	Yes, as far as operationally feasible	Quarantine, as far as operationally feasible		

Singapore Ministry of Health Pandemic Readiness and Response Plan for Influenza and Other Respiratory Diseases design & operations guide
Disease Outbreak Response System Condition (DORSCON) Matrix

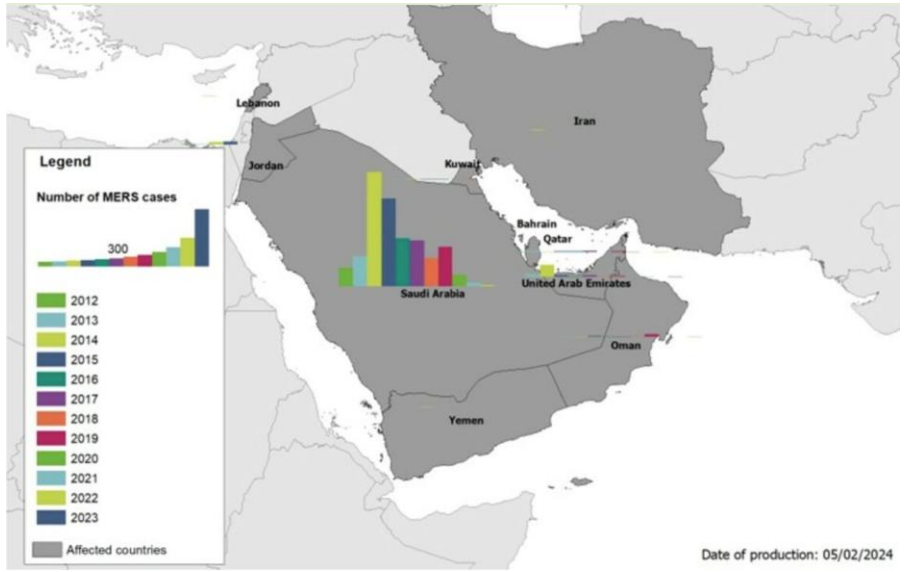
Planning Diagrams History

- The Emergency Design Task Force looked to countries with previous SARS/MERS pandemics
- **SARS pandemic 2003:** Asia (China, Hong Kong, Taiwan, Singapore, Vietnam, Philippines & Thailand), and Canada
- **MERS pandemic 2012**
- Singapore Ministry of Health 2014 Pandemic Readiness and Response Plan for Influenza and Other Acute Respiratory Diseases + DORSCON Matrix
- Pandemic patient units developed in Canada & Asia in response to 2003 SARS pandemic

Resources:

Factors Influencing the Response to Infectious Diseases: Focusing on the Case of SARS and MERS in South Korea - PubMed (nih.gov)

SARS: LESSONS FROM TORONTO - Learning from SARS - NCBI Bookshelf (nih.gov)



Planning for Surge

- Provide adequate medical evaluation and care
- The ability to survive a hazard impact and maintain or rapidly recover operations that were compromised
- Plan for large-scale events that affect many people, **which may include** chemical, biological, radiological, earthquakes, other natural or human-caused disasters
- Large hospitals typically operate at or near capacity
- Smaller hospitals faced with limited availability of resources and outside support
- When designing for resiliency, **consider designing beyond the code minimums**

The Importance of Resilience in Healthcare

Designing Beyond Code Minimums

Seismic Events

Threats posed by earthquakes and ground movement.

Pandemics

Widespread infectious disease outbreaks.

Mass Casualty Events

Incidents resulting in a large number of casualties.

Hazardous Materials

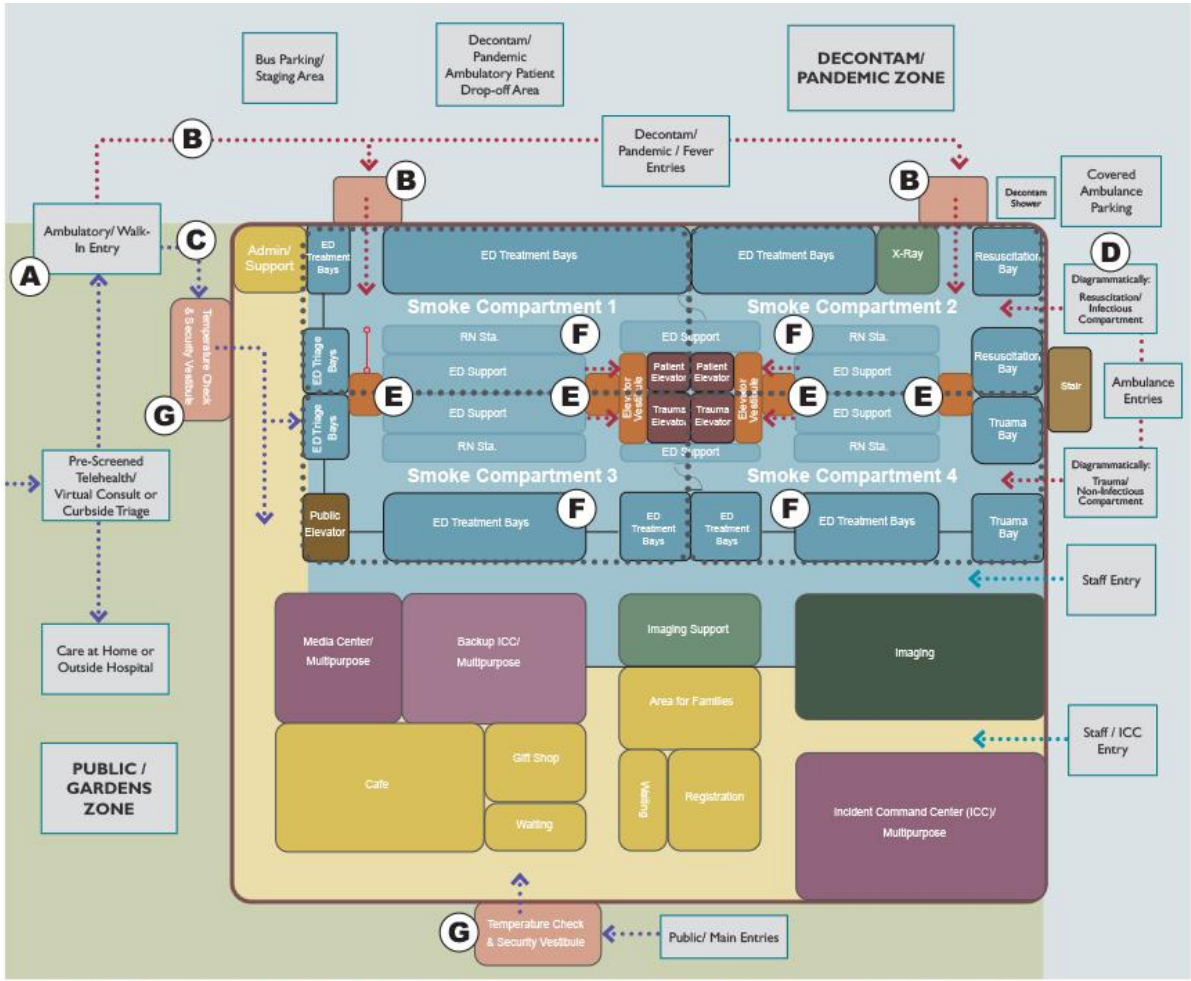
Risks associated with chemical, biological, or radiological substances.

Other Disasters

Includes both man-made and natural disasters not explicitly listed.

Designing beyond code minimums is a proactive choice for enhanced preparedness and continuity of operations.

Emergency Department Floor Plan Reference



EMERGENCY RESPONSE DIAGRAM | **NEW** EMERGENCY DEPARTMENT & ENTRY LEVEL

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LEGEND:

- Emergency Department
- Imaging Department
- Public Space
- Multipurpose Space
- Patient Elevators
- Public Elevators
- Service Elevators
- Public Flow
- Patient Flow
- Staff Flow
- Material Flow
- Do Not Exceed 20', Typical of Vestibules/ Rooms

The intent of the planning diagrams is to provide options for individual features / concepts

KEYNOTES:

A Patients triaged via telehealth/virtual care or curbside/outside the hospital & directed to most appropriate entry. "Emergency Event" triage include temperature check & questionaire regarding travel, exposure, etc.

B Symptomatic patients are directed to Emergency Department fever entry/entries

C Non-symptomatic ambulatory patients enter for additional/typical triage through Ambulatory Entry

D Ambulance patients are triaged off-site/en route with option to enter the "Decontam/Pandemic" compartment

E Anteroom or vestibule (created with two sets of corridor doors) to each Emergency Department compartment, which allows each compartment to be locked and isolated with one-way flow (donning & doffing through separate vestibules)

F Emergency Department contains two or more compartments that have separate, dedicated & redundant building systems which allows each unit to be locked & become a "Decontam/Pandemic" compartment. One-way flow in & out of each compartment through donning & doffing anteroom/corridor vestibule (anteroom vs. corridor vestibule is based on facility operational model).

G Fever check at the front door. No one with a fever would be allowed to enter the facility.

The diagrams assume new facilities are designed based on a modular approach. The planning/layout concepts apply to any layout for a new facility

EMERGENCY RESPONSE SPACES:

Support spaces that can flex into Emergency Response spaces. Typically these spaces are conference (separatable), classrooms, workrooms, etc. that are multi-purpose rooms which flex to Emergency Response uses during an emergency event.

Incident Command Center (ICC) - ideal to have dedicated kitchenette and separate entry/exit directly to outdoors

Backup ICC - for secondary ICC overflow

Media Center - a location for media to gather and receive updates from emergency response, hospital & public health staff

Areas for Families - this space serves as a location for families to gather away from the media and public view, typically used for mass casualty events

Emergency Department: Enhanced Preparedness

Optimizing for Surge Capacity and Infection Control

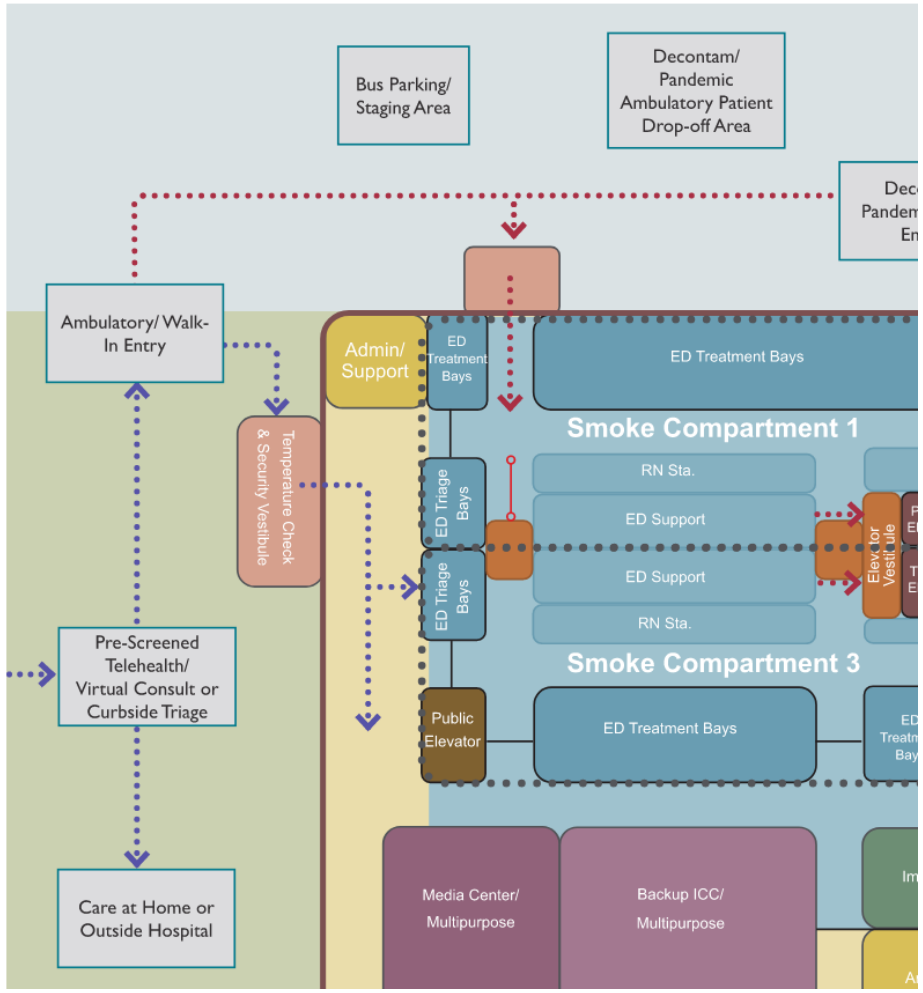
Infrastructure for Isolation & Flow

Implementing separate compartments with redundant HVAC systems, strict separation of clean and soiled flows, and dedicated elevators for different patient types to manage patient movement effectively during surges.

Integrated Patient Care

Integrating X-ray services within resuscitation and pandemic compartments to minimize patient transfers and reduce the risk of cross-contamination.

Patient Arrival



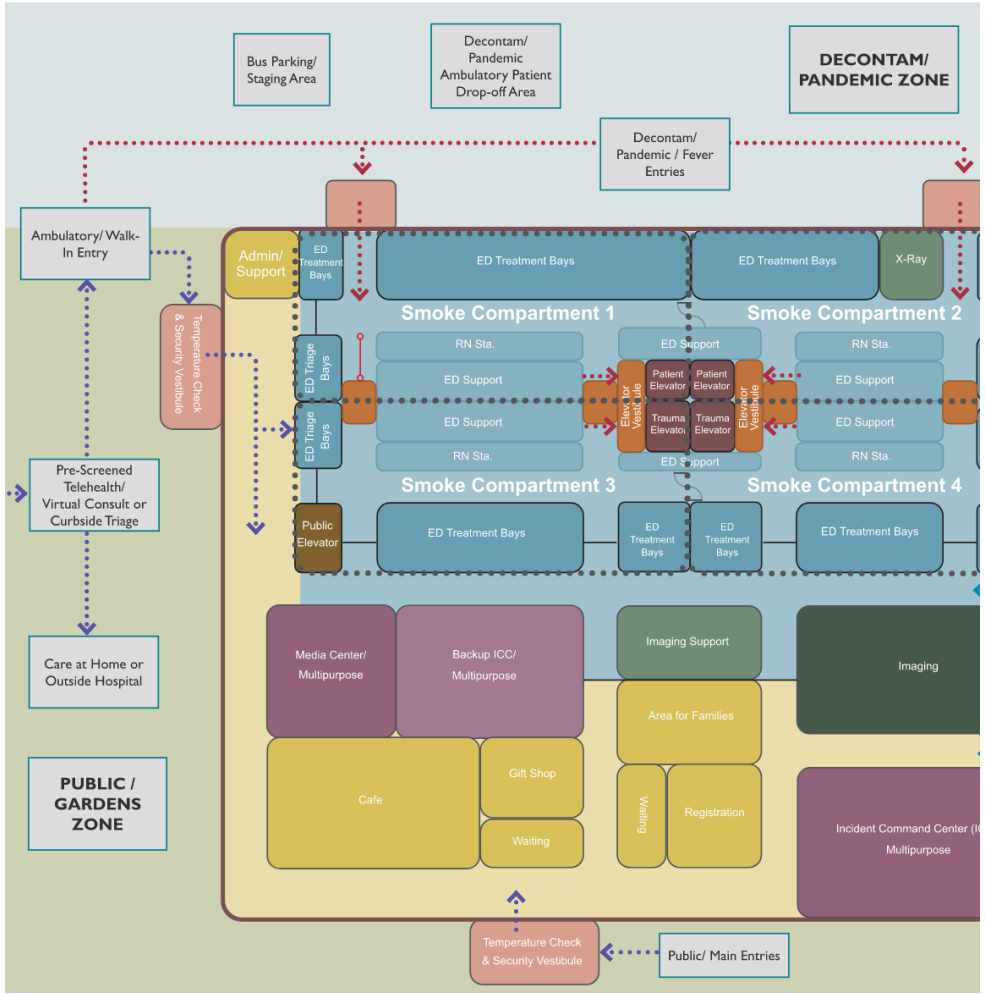
Parking & patient triage

- Ability to accommodate emergency conditions
- Virtual & curb-side patient triage

Patient waiting

- Exterior triage, waiting, and queuing areas are necessary during surge events
- Provide exterior safe & comfortable triage & waiting
- Differentiate between confirmed exposed patients, possibly exposed patients, and non-pandemic related emergencies
- Consider covered parking structures, tents, quick deployment trailers or modular
- **Consider designing beyond the code minimums**

Patient Arrival



Decontamination

- Drop-off in a location separate from designated parking areas
- Provide dedicated entry vestibules designated for decontamination that can be used as an air lock
- Beyond code minimums: decontamination showers
- Provide PPE donning/doffing areas/supplies immediately available
- Can be used for secondary screening or security screening
- Decontamination entry vestibules immediately outside of each pandemic/infection compartment in the Emergency Department
- [OSHPD PIN 35 Healthcare Decontamination Facilities]
- **Consider designing beyond the code minimums**

ED Entry and Triage Innovations

Improving Patient Flow Management

Enhanced Entry Security

Security and temperature checks at all entry points.

Flexible Entry Configurations

Optional isolation entry vestibules for pandemic or non-pandemic scenarios.

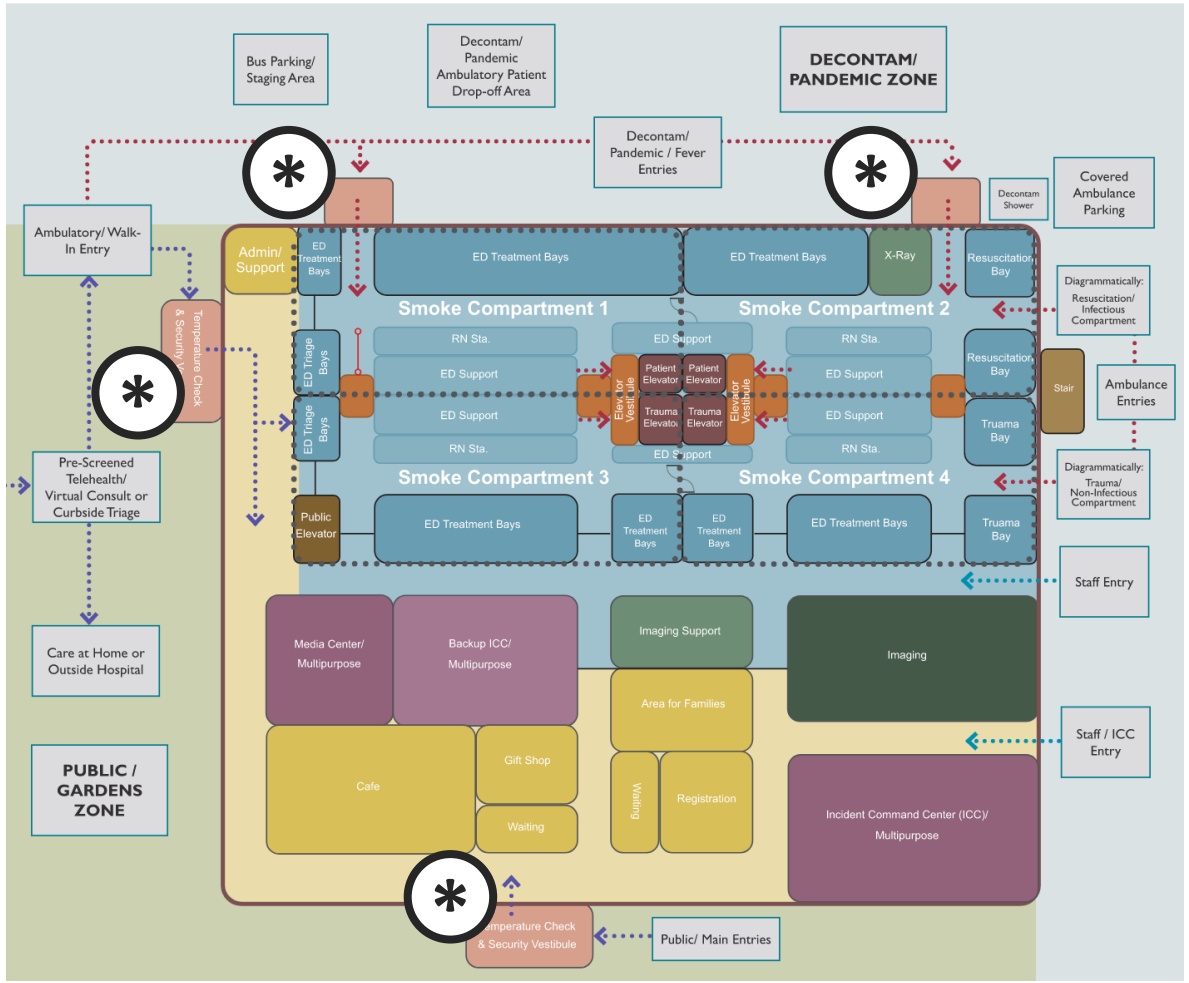
Streamlined Ambulance Access

Separate entry points for routine trauma and critical cases.

Remote Triage Solutions

Virtual and curbside triage options to manage patient influx.

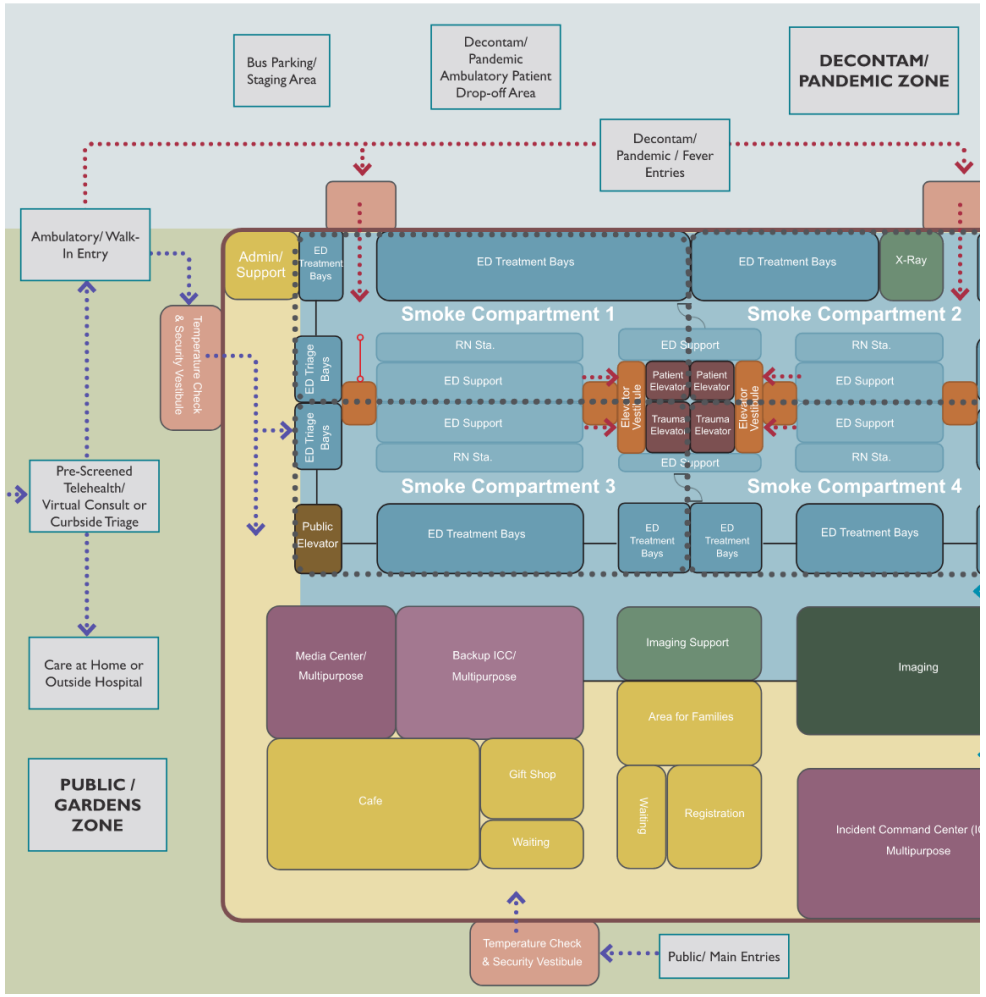
Entry in Hospital



Recommendations for the Entry Level

- Evaluate each entry for appropriateness
- Entries should be clearly identified with instructions
- Entries for staff only should be identified & locked to prevent unauthorized access
- All public entries should be provided with symptom checkpoints and security
- Vestibules provide secondary opportunity to screen patients and public
- Screening prevents exposing staff & other patients
- Size public entry vestibules to accommodate secondary screening & security checks
- **Consider designing beyond the code minimums**

Emergency Department: Ambulatory Pre-Screening



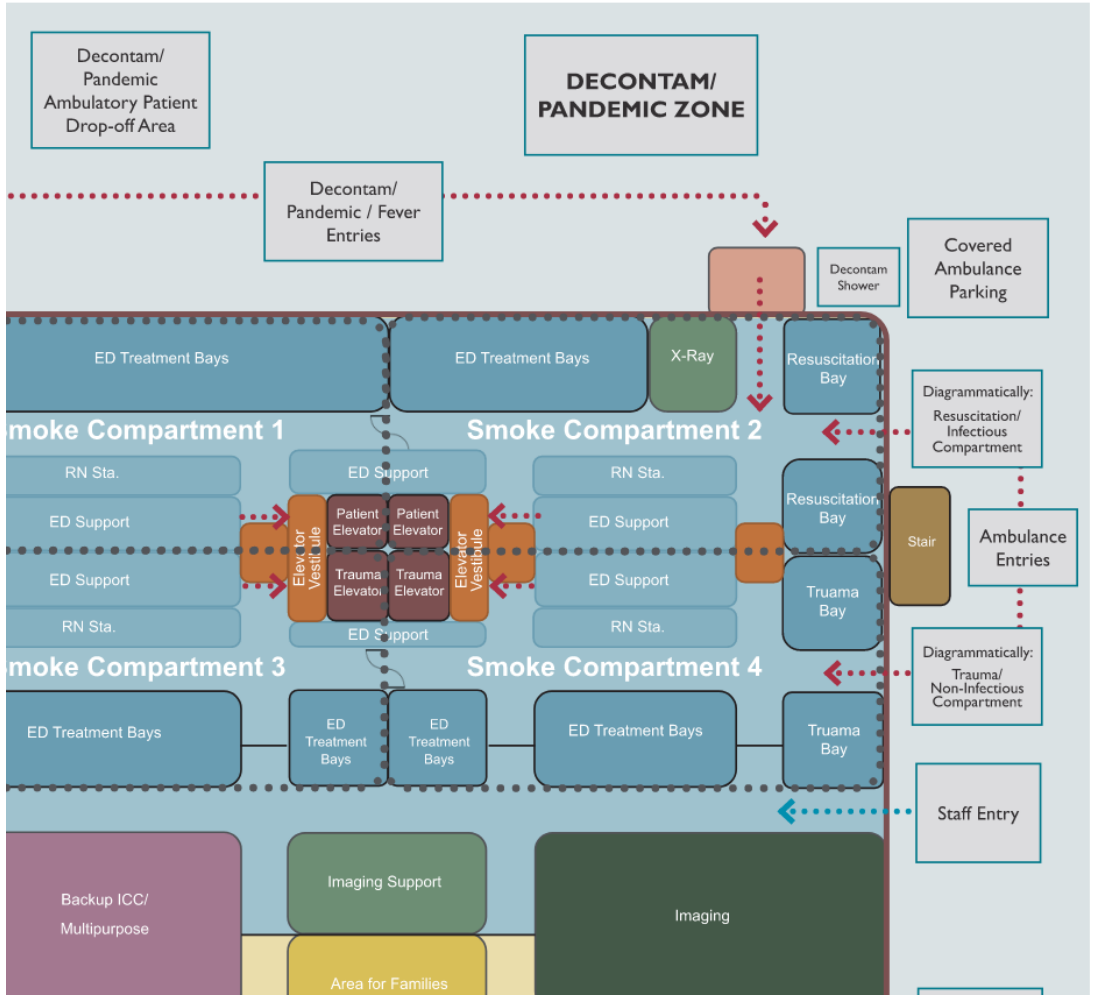
Entering the ED

- Prior to arrival leverage telehealth or virtual care
- In the parking lot utilize curbside/outside screening
- Provide predetermined walk-up screening locations outside of the ED

After screening is completed

- Direct patients to the appropriate entrance based on their symptoms
- Provide separate pandemic/infectious or non-pandemic/non-infectious entrances
- **Consider designing beyond the code minimums**

Emergency Department: Ambulance Entries

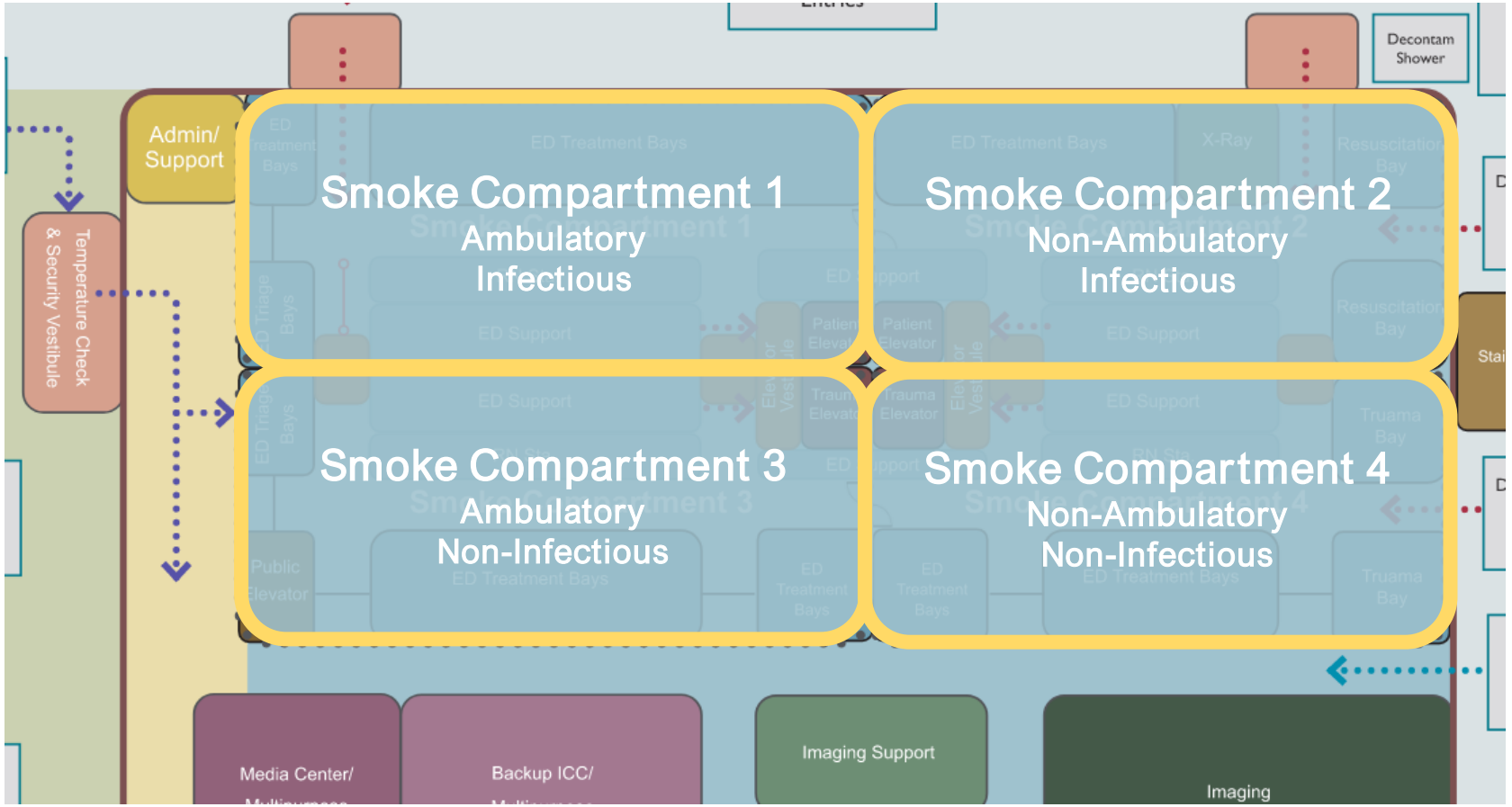


Separate ambulance entry

- Separate ambulance traffic from other patient areas
- Consider additional safeguards for pandemic, or hazardous materials exposure
- Consider separate dedicated ambulance entries into:
- **Infectious disease/resuscitation** compartment
- **Non-infectious/trauma** compartment
- **Consider designing beyond the code minimums**

ED Compartmentation

Dedicated **infectious disease/resuscitation** and **non-infectious/trauma** compartments.



Pandemic-Ready Patient Units

Designing for Integrated Infection Control and Flexibility

Flexible Entry Points

Option for separate entries into patient units to manage patient and staff flow.

Streamlined Material Flow

Maintaining separate clean and soiled pathways throughout the unit to prevent cross-contamination.

Patient Room Entry

Ante-room vestibules at each patient room create critical buffer zones for infection control.

Key Strategies

Flexible Patient Unit Entry Solutions

Multipurpose Rooms

Designate rooms to serve as either clean or soiled areas, providing flexibility during pandemics.

Ante-Room Vestibules

Implement entry vestibules for each patient room to create critical buffer zones.

Separation of Flows

Maintain distinct pathways for clean and soiled materials throughout the unit.

Acuity-Adaptable Units: Design Flexibility & Resilience

Maximizing adaptability for evolving healthcare needs.

Surge Capacity

Enable patient rooms to adapt to higher care needs during surges, crucial for pandemics and emergencies.

Design Flexibility

Incorporate varied configurations for patient toilet and shower rooms to maximize adaptability and optimize space.

Future-Proofing

Enhance facility resilience by allowing for evolving patient care demands.

STRATEGIC DESIGN FOR ADAPTABLE HEALTHCARE ENVIRONMENTS.

AAUs provide essential flexibility to meet unpredictable healthcare demands.

Decontamination and Entry Vestibules

Dedicated Entry Vestibules

Designed as airlocks for decontamination.

Strategic Location

Situated immediately outside pandemic/infection compartments in the Emergency Department (ED).

Dual Functionality

Can be used for secondary screening or security screening; includes decontamination showers beyond code minimums.

Strategic Entry Management

Optimizing all facility entrances for safety and control

Evaluate & Identify Entry Points

Clearly mark all entry points with appropriate instructions.

Secure Staff Access

Implement robust measures to prevent unauthorized entry into staff-only areas.

Public Entry Screening

All public entries should be provided with symptom checkpoints and security.

Vestibule Design

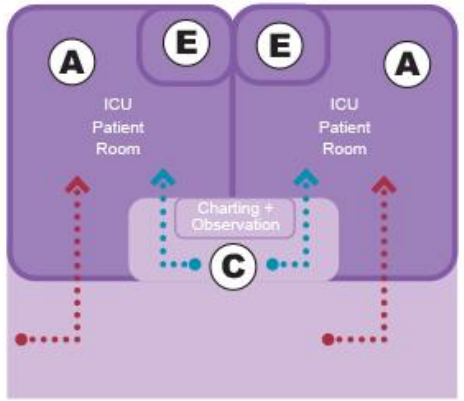
Size public entry vestibules to accommodate secondary screening and security checks.

Pandemic Patient Unit (PPU) Design

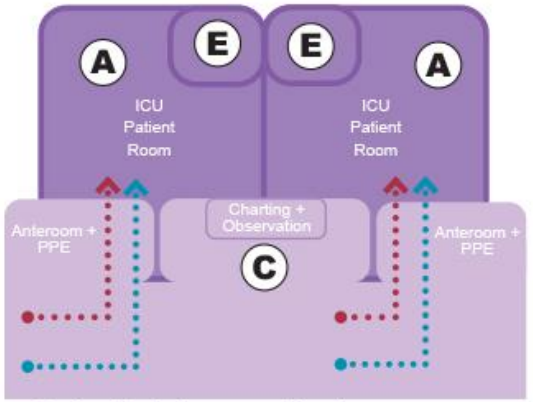
- Explore optimal locations and workflows for PPE management at unit entry points.
- Dedicated donning alcoves.
- Separate doffing alcoves equipped with waste receptacles and handwashing stations.
- Ensure compliance with California Department of Public Health (CDPH) requirements for donning and doffing at patient room entry.
- Consider design beyond the code minimums.

California Acuity-Adjustable Patient Units

- California's Title 22 does not provide for acuity-adaptable patient rooms where a patient steps down in the same room
- California Department of Public Health will allow an entire unit to flex
- New facilities consider using the "Acuity-Adjustable" model to provide future flexibility during patient surges
- Existing units can be adapted to surge as needed
- Acuity-adjustable patient units (AAU) allow care to flex to a higher level as needed in the same room/unit
- AAUs are well-suited for pandemics and other large-scale emergencies
- **Consider design beyond the code minimums**



Option A: Flexible Anteroom



Option B: Anteroom + Charting

Options: Flexible Anteroom or Anteroom + Charting

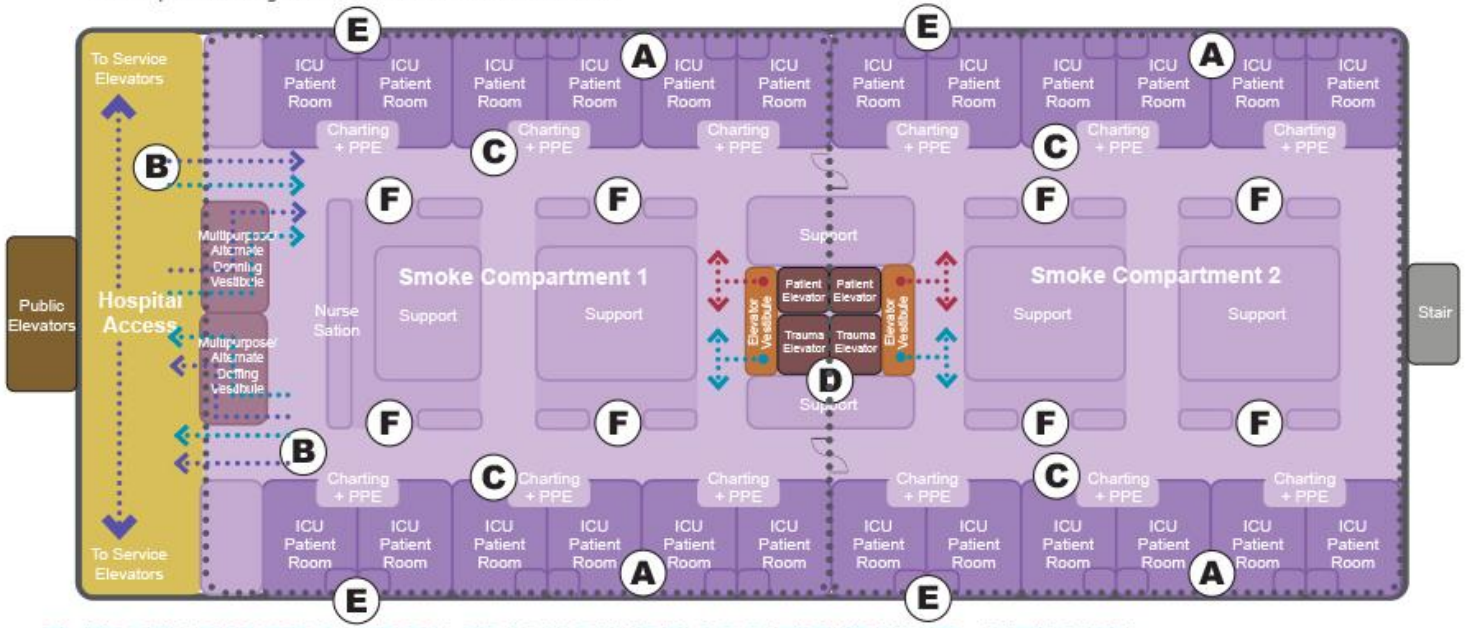
Provides an alcove for PPE and medical equipment that supports the patient room during **pandemic mode**. The intent is to ensure corridors remain uncluttered during **pandemic mode** and ease of donning/doffing PPE.

The intent of the alcove options is to provide health facilities with options to quickly respond to pandemic and other emergency conditions.

Alcove for patient's medical equipment outside of the patient room. Staff can continue to frequently monitor the patient vitals while reducing exposure to possible unknown within the patient room.

Assumptions:

Pandemic Patient Unit (PPU): ICU Patient Unit with "Pandemic Mode" capabilities designed as Care Suite with non-rated corridors



EMERGENCY RESPONSE DIAGRAM | PANDEMIC PATIENT UNIT - **NEW** ICU

LEGEND:

- MED / SURG Department
- ICU Department
- Public Space
- Multipurpose Space
- Patient Elevators
- Public Elevators
- Service Elevators
- Public Flow
- Patient Flow
- Staff Flow
- Material Flow
- Do Not Exceed 20', Typical of Vestibules/ Rooms

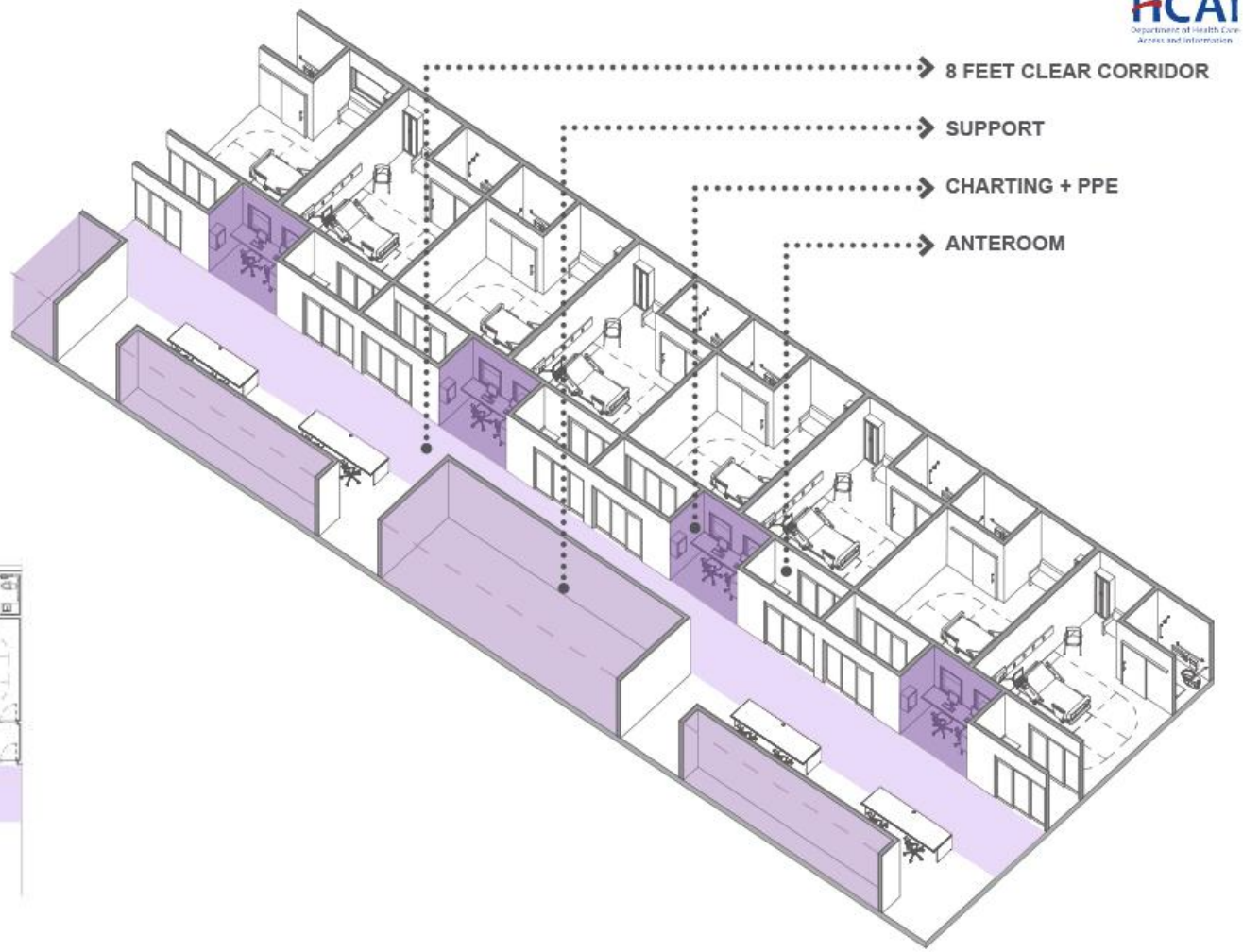
The intent of the planning diagrams is to provide options for individual features / concepts

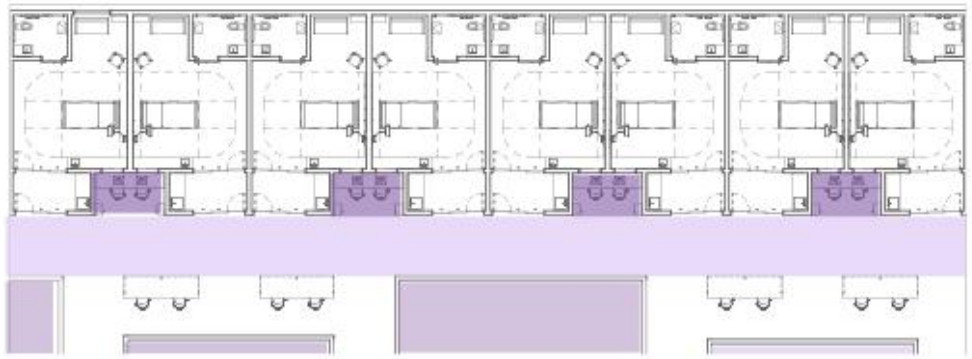
KEYNOTES:

- **A** Patient rooms are neutral or negative - refer to Chapter 2
- **B** One-way flow of patients, staff, and materials are recommended, where possible
- **C** Charting + PPE/Equipment Alcove: hand washing station recommended - anterooms shall comply with code requirements
- **D** During "Pandemic Mode" implement operational model to limit access to the Pandemic Patient Unit from the patient and trauma elevators
- **E** Patient Toilet Room - health facilities to determine in-board vs. out-board toilet rooms vs. side-by-side
- **F** Health facilities to determine centralized vs. decentralized nurse stations

Intent is to recommend that health facilities identify and design specific units that can flex into "Pandmeic Mode" when needed. These Pandmeic Patient Units would operate as typical ICU during "Non-Pandemic Mode".

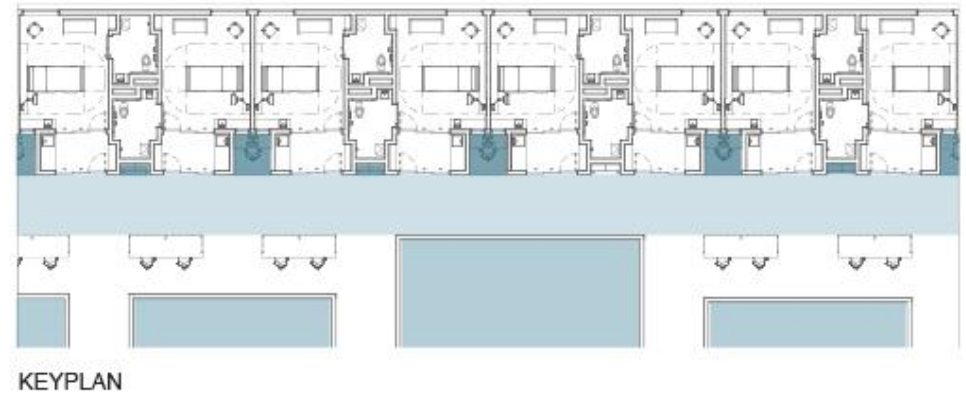
Pandemic/Isolation Patient Unit Floor Plan Reference



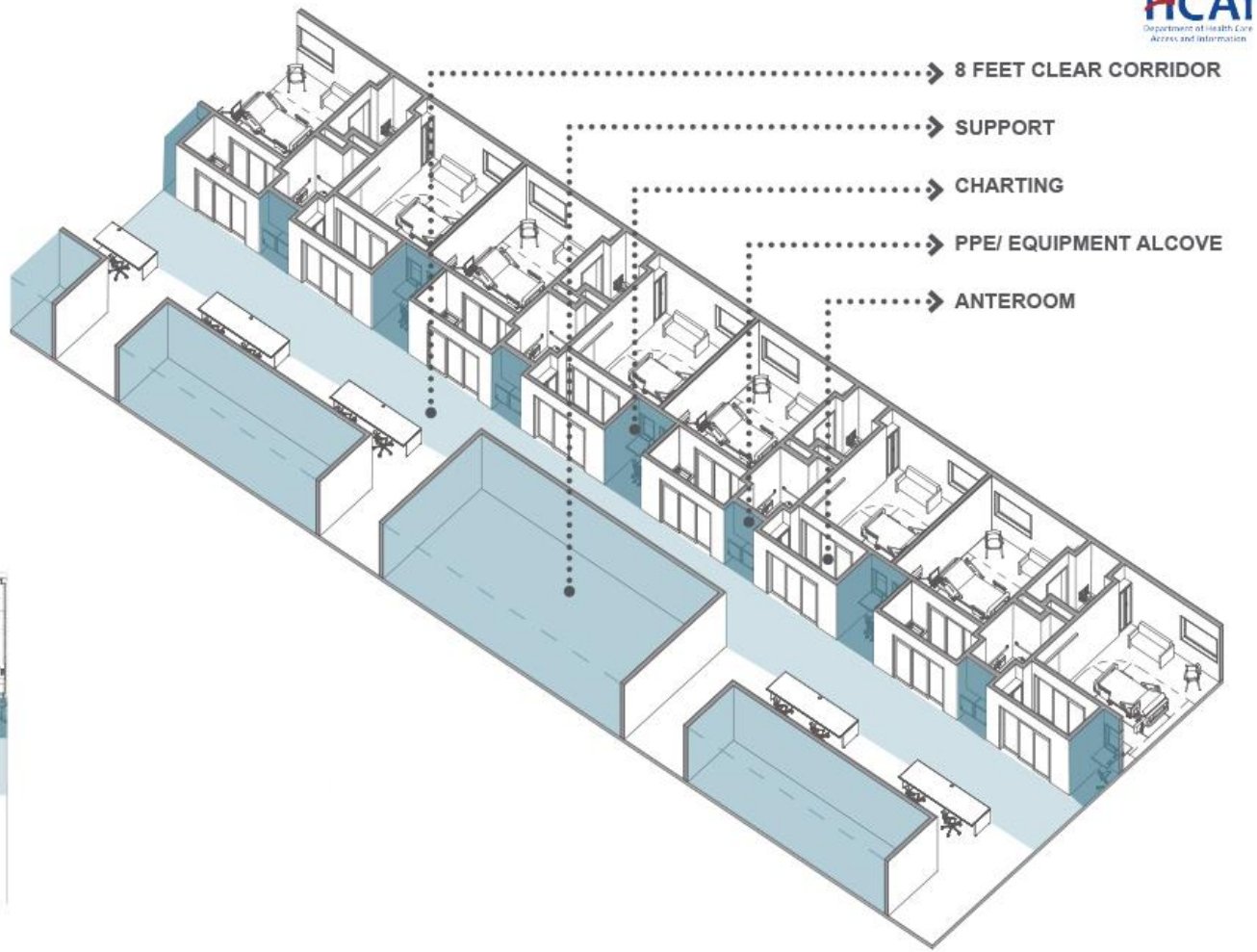


KEYPLAN

Pandemic/Isolation Patient Unit Floor Plan Reference



KEYPLAN



Flexible Donning/Doffing Solutions in PPUs

Adapting donning and doffing areas within patient units.

Multipurpose Room Considerations

Explore spaces that can be adapted for donning and doffing activities.

Usage Options

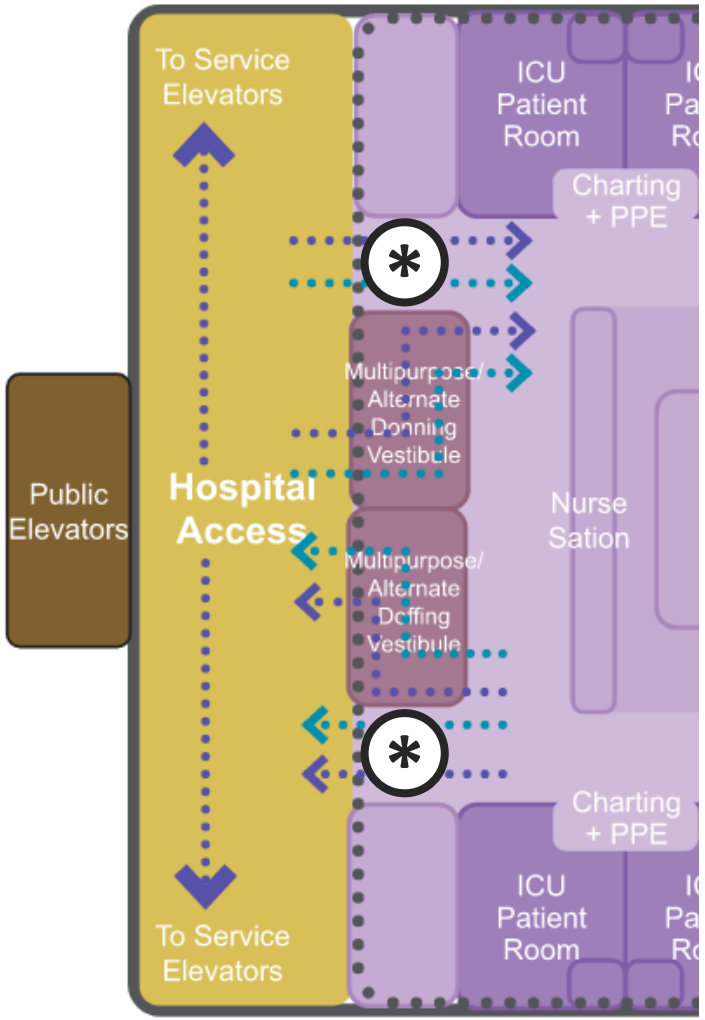
Consider dedicated spaces, combined spaces, or flexible use of existing areas.

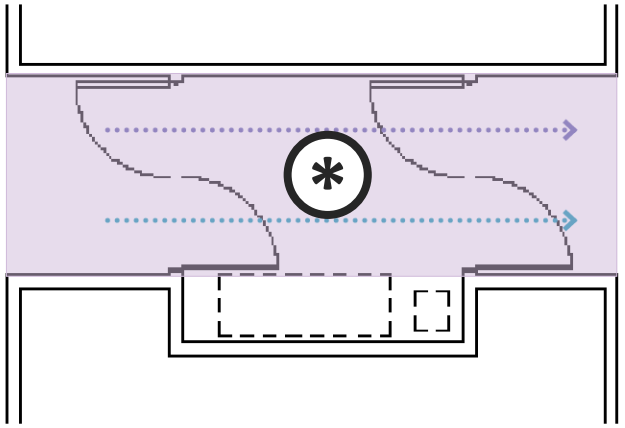
Objectives

Ensure compliance with health department requirements and maintain operational efficiency.

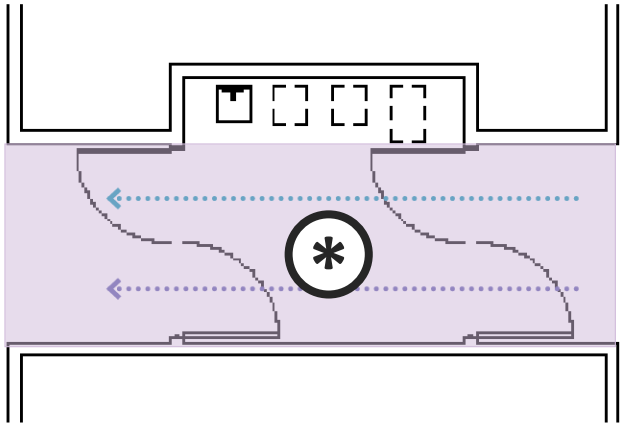
Ensure compliance and operational efficiency through adaptable donning and doffing areas.

PPU Donning/Doffing Options





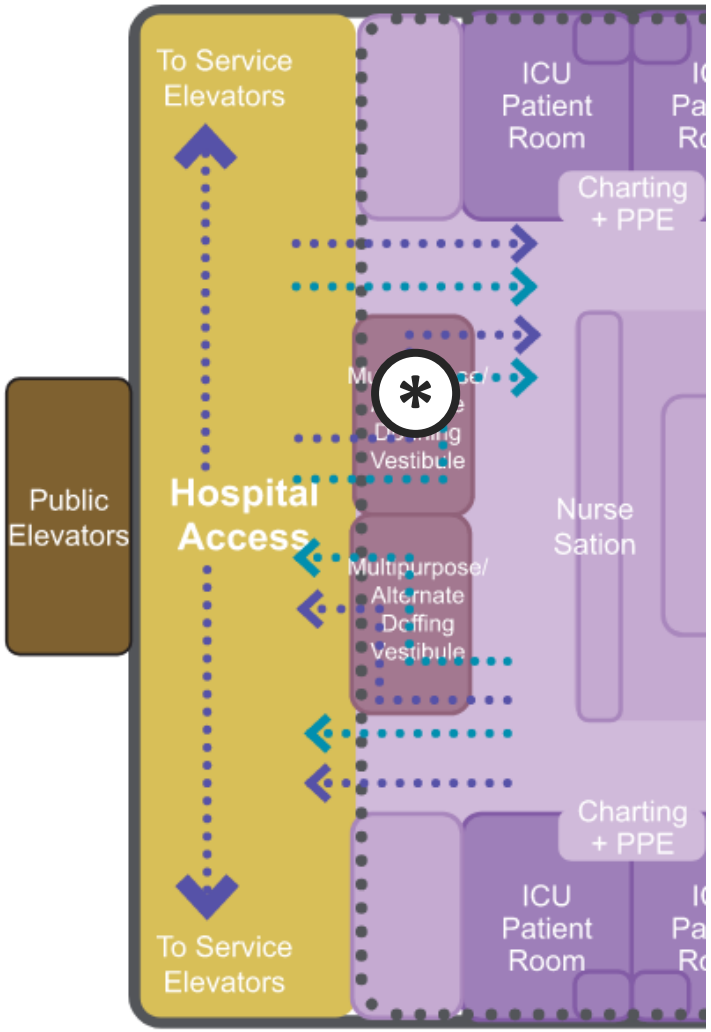
DONNING - DEPARTMENTAL ENTRY

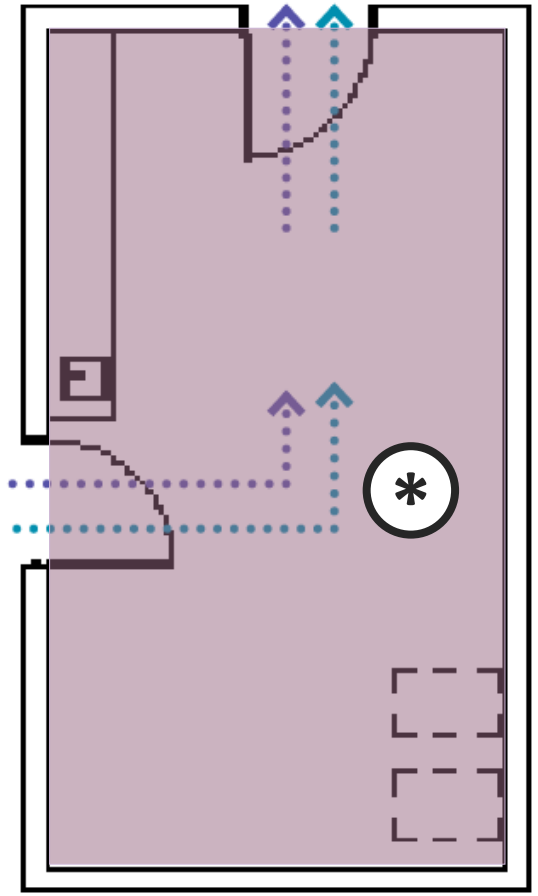


DOFFING - DEPARTMENTAL EXIT

- Donning & doffing at patient unit entry was explored with California Department of Public Health (CDPH)
- Internation PPU:
  - PPE donning alcove at PPU entry to unit
  - PPE doffing alcove w/ trash receptacle + hand washing station at exit of unit
- **Consider design beyond the code minimums**

PPU Donning/Doffing Options





- CDPH requires donning & doffing at **patient room entry**, as opposed to unit entry
- The Guide includes donning & doffing at patient unit entry as an option
- Donning/doffing multipurpose room(s):
  - Dedicated donning & doffing
  - Combined donning/doffing
- **Consider design beyond the code minimums**

Key Considerations

Staff Support and Well-being

Respite and Recharge Rooms

Offer quiet, contemplative spaces away from patient areas.

Natural Elements

Prioritize access to natural daylight and views where possible.

Flexible Spaces

Utilize flex space to accommodate staff respite during emergency conditions where dedicated spaces cannot be provided.

Use of Interior Spaces

Staff Spaces

- Provide in or adjacent to departments most utilized during emergency conditions
- During emergency conditions
  - Staff may not be able to leave the facility
  - Will be working significantly extended hours
- **Lesson learned + beyond code minimum**
- Staff lounge is not an appropriate area for staff in need of a quiet contemplative space to decompress or grieve
- Consider respite & recharge rooms
- Provide access to natural daylight and views
- Where dedicated respite spaces cannot be provided
  - Provide flex space to accommodate staff respite during emergency conditions

Conclusion

Investing in Resilience

Recap of Key Strategies

- Incorporating robust structural integrity.
- Ensuring redundant critical systems (power, water, HVAC).
- Designing for flexible space utilization.
- Implementing advanced security measures.
- Planning for pandemic and emergency readiness.

Beyond Code Minimums

- A strategic investment, not just an expense.
- Enhances patient safety and well-being.
- Protects invaluable healthcare staff.
- Guarantees enduring operational capacity during crises.

Resilience ensures the facility remains a safe haven and a vital operational asset, even in the face of unforeseen challenges.

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Hazard Vulnerability Analysis (HVA)

A systematic approach to risk identification and resilience planning

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Building Resilience Through Risk Identification

A systematic process to identify threats, assess vulnerabilities, and ensure operational continuity for healthcare facilities.

Department of Health Care Access and Information

What Is a Hazard Vulnerability Analysis (HVA)?

A Hazard Vulnerability Analysis (HVA) is a systematic and structured risk assessment process designed to identify potential threats and hazards that could impact an organization, particularly healthcare facilities. It involves evaluating the likelihood of each hazard occurring and the potential severity of its impact on operations, patient care, and staff safety.

Based on this evaluation, risks are prioritized to focus resources and efforts where they are most needed.

The ultimate goal of an HVA is to inform and guide the development of effective emergency preparedness and mitigation strategies, thereby enhancing overall organizational resilience against a wide range of potential disruptions.

Focuses on preparedness and resilience.

Why HVA Matters in a Resilient Hospital Model

The HVA is foundational to building a resilient healthcare system by transforming reactive crisis response into proactive risk mitigation. It empowers hospitals to:

Enhance Strategic Preparedness: Move beyond ad-hoc responses to structured, data-informed readiness plans.
Strengthen Infrastructure Resilience: Identify and address physical and technological vulnerabilities to ensure operational continuity during disruptions.
Ensure Business Continuity: Develop robust plans to maintain essential services and patient care even under extreme stress.
Prioritize Capital Investments: Make informed decisions on where to allocate resources for the greatest impact on resilience and safety.
Ensure Regulatory Compliance: Meet and exceed requirements for emergency preparedness and disaster management.

The HVA ensures that preparedness efforts are directly aligned with identified risks, creating a more effective and efficient approach to safeguarding hospital operations and patient well-being.

Categories of Hazards Evaluated: Natural Hazards

Focus on natural threats and their impact on hospital operations, access, utilities, and staffing.

Geological Hazards

Includes earthquakes as a key natural threat.

Meteorological/Climatological Hazards

Covers wildfires, severe storms, extreme heat, and drought.

Hydrological Hazards

Focuses on flooding as a potential impact.

Impact Areas

Evaluates the effects on hospital operations, access, utilities, and staffing.

Categories of Hazards Evaluated:

Technological & Infrastructure Hazards

Power Outages

Uninterrupted power is essential for life support, diagnostics, and operations.

IT System Failures

Critical IT systems like EHR and PACS must remain operational.

Cybersecurity Breaches

Protecting sensitive patient data and preventing malicious attacks.

Medical Gas Failures

Reliable systems for oxygen and other gases are necessary.

HVAC Failures

Maintaining temperature, humidity, and air quality is critical.

Communication Outages

Reliable communication systems are essential for coordinating care.

Categories of Hazards Evaluated

Human-Caused & Operational Hazards

Human-Caused Hazards

Threats originating from intentional or unintentional human actions.

Operational Hazards

Internal or systemic risks that can disrupt normal functioning.

HVA Methodology: How Risk Is Scored

Probability

Human Impact

Property Damage

Business Continuity Impact

Operational Disruption

Recovery Time

Preparedness Level

Internal Response Capability

This comprehensive scoring creates a ranked list of risks, enabling prioritized mitigation and preparedness efforts.

Risk Scoring Matrix

Prioritizing Mitigation Efforts

	Low Impact	Medium Impact	High Impact
Low Probability	**Low**	**Low-Medium**	**Medium**
Medium Probability	**Low-Medium**	**Medium**	**Medium-High**
High Probability	**Medium**	**Medium-High**	**High**

Risk Score = Probability x Impact x Preparedness Gap. High-risk items require immediate focus.

HVA's Role in Infrastructure & Capital Planning

Informing Critical Decisions

HVA findings serve as the foundation for strategic infrastructure investments.

Risk Mitigation Priorities

Guiding implementation of seismic reinforcement, redundant power systems, flood barriers, fire-resistant materials.

Optimizing Capital Investments

Aligning financial resources with identified risks and vulnerabilities for maximum impact.

Infrastructure Renewal Cycles

Establishing proactive plans for maintenance, upgrades, and replacements based on assessed needs.

Operational Preparedness & Response Planning

Key Components of Operational Plans

Surge Capacity

Strategies to rapidly expand resources and services during high-demand periods.

Emergency Staffing

Protocols for activating and managing personnel during crises.

Interagency Coordination

Mechanisms for seamless collaboration with external partners.

Equipment Staging

Plans for timely positioning of essential equipment and alternative care sites.

Incident Command

Frameworks for establishing and operating an incident command system.

Regulatory & Accreditation Alignment

Demonstrating Compliance: A documented HVA is a cornerstone for meeting stringent regulatory and accreditation requirements.

Key Regulatory Bodies: CMS, The Joint Commission (TJC), State Health Departments.

Meeting Emergency Preparedness Mandates: The HVA provides the systematic risk assessment required to develop robust emergency preparedness plans.

Evidence of Due Diligence: A thorough HVA serves as concrete evidence that the organization proactively identifies potential threats.

Facilitating Accreditation: By aligning with emergency management standards, the HVA simplifies the survey process.

Integration into Continuous Improvement

Annual Review

Ensures ongoing relevance of the HVA process.

Post-Event Updates

Incorporates lessons learned from major events.

Capital Planning Integration

Allocates strategic resources effectively.

Training Program Incorporation

Enhances preparedness through integrated training.

The HVA is a dynamic process that must be reviewed annually, updated after major events, integrated into capital planning, and incorporated into training programs.

Conclusion: The Cornerstone of Hospital Resilience

Transforming Preparedness into Robust Resilience

Anticipation of Risk

Proactively identify potential threats and vulnerabilities specific to the healthcare environment.

Prioritization of Mitigation

Focus resources on addressing the most critical risks to maximize impact and efficiency.

Protection of Life Safety

Ensure comprehensive measures are in place to safeguard patients, staff, and visitors.

Maintenance of Continuous Care

Develop strategies to sustain essential healthcare services during and after disruptions.

Strengthening of Infrastructure

Systematically enhance the physical plant, utilities, systems, and operational capabilities.

The HVA is the foundational element for building a healthcare system that is not only prepared but truly resilient.

Item #10 Review slide deck for Topic 7: Hazard Vulnerability Assessment

Facilitators: Jennifer Cox and Kelly Martinez (or designees)

- Discussion and public input

Item #11 Discuss schedule for the series of HCAI Design Guide for Planning and Preparing for Disasters webinars in 2026

- April 2026: Power Independence
- May 2026: WUI
- June 2026: Infection Control – HVAC
- July 2026: Infection Control – Design
- August 2026
- September 2026
- Discussion and public input

Facilitator: Teresa Endres (or designee)

Item #12 Comments from the Public/Subcommittee Members on Issues not on this Agenda

The Subcommittee will receive comments from the Public/Subcommittee Members. Matters raised at this time may be taken under consideration for placement on a subsequent agenda.

Facilitator: Teresa Endres (or designee)

Item #13 Adjournment