



Resiliency in Emergency Communications and Operations Facilities

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Course Description

An architect and a Public Safety Consultant will discuss Case studies in technology, audio visual and building systems survivability in response to natural and manmade threats. Mission critical facility architectural design has unique complexities that arise with each building project. The focus of every project is to optimize the functional use of the space for operational integrity.

The session will highlight facilities around the country that responded in unique ways to unique situations. These will include hurricane, projects, tornado projects, seismic projects, snowbound projects and torrential rain projects.... as well as those designed for chemical weapons stockpiles, military installations and urban scale protection.

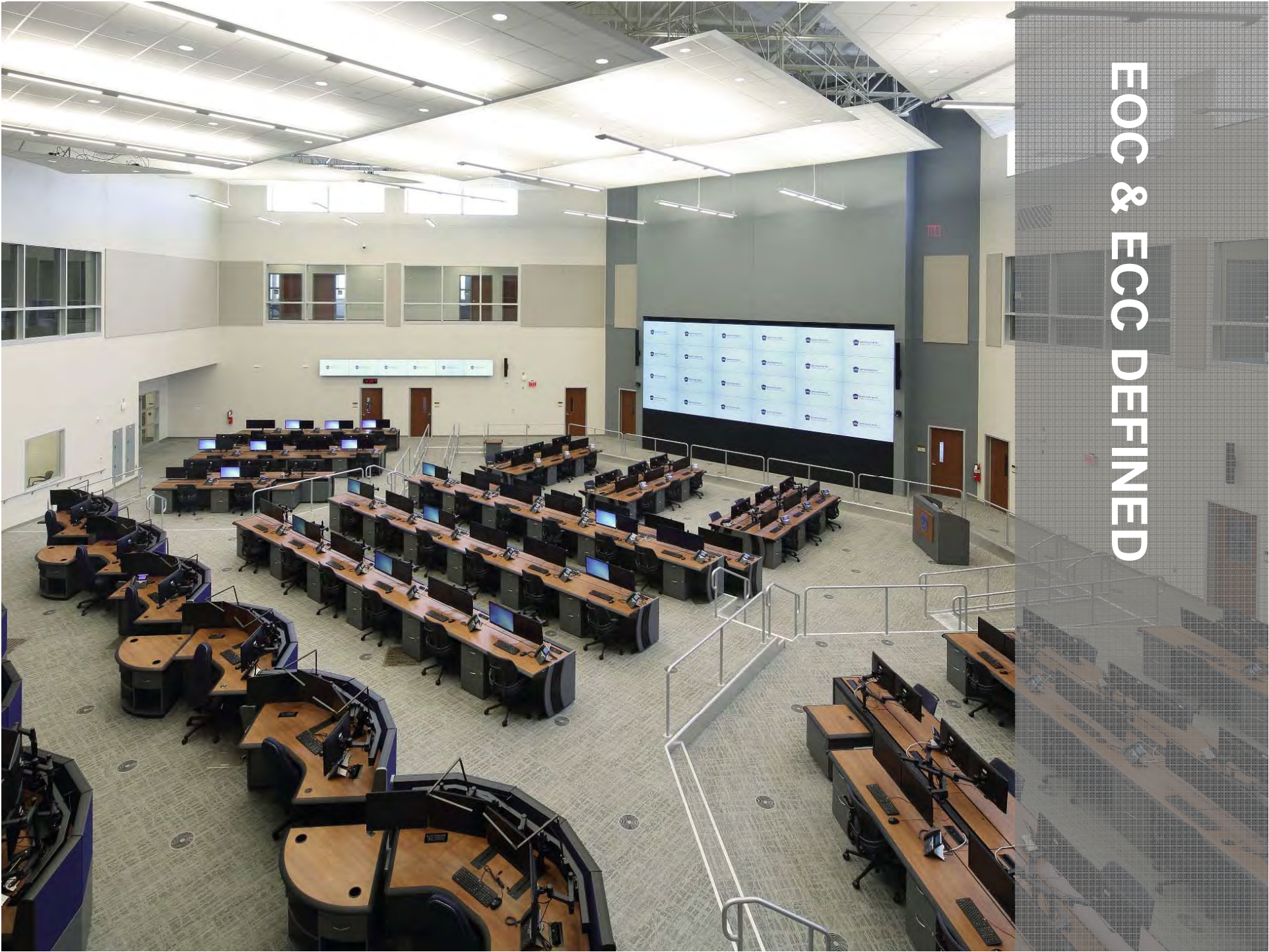
Learning Objectives

1. Participants will gain a better understanding of the applicable codes and best practices related to essential facilities.
2. Understanding of the master planning, pre-design and design methods that public safety subject matter experts and Architects utilize.
3. Participants will better understand the aspects of safety and security elements required for these specialized facilities.
4. Understanding of how the highly specialized technology requirements impact space programming, building systems, and design.

A photograph of a computer workstation. It features a curved wooden desk with several computer monitors. One monitor in the foreground shows a blue screen with a white square. A professional microphone on a boom arm is positioned over the desk. The background shows a plain wall and another monitor.

discussion

- ☐ EMERGENCY OPERATIONS AND EMERGENCY COMMUNICATION CENTERS DEFINED
- ☐ DESIGN GUIDELINES AND CRITERIA
- ☐ EXAMPLE PROJECTS



EOC & ECC DEFINED

EMERGENCY OPERATION CENTER

1. Municipal, County, State or Federal Facility developed to support activation issues related to that locale
2. Characterized by size of the locale, the quantity of agencies related to any specific incident. Facility is then sized to accommodate those agencies.
3. Organized in various formats based upon the command structure inherent to that locale
4. Supported by high level audio visual structure and mid-level communication structure.

EMERGENCY COMMUNICATION CENTER

1. Depending on the specific type of communication, can be called; PSAP (Public Safety Answering Point), Prime PSAP, Secondary PSAE, ECC or other moniker based on the agency it specifically supports
2. Municipal, County, State or Federal Facility developed to support 24/7 Emergency Communications required by that locale
3. Characterized by size of the population, the call volume, the quantity of agencies related to typical emergency communications in that locale. Facility is then sized to accommodate those agencies based on call volume.
4. Organized in various formats based upon the command structure inherent to that locale
5. Supported by high level audio communication structure and mid to high-level communication structure.

EOC/ECC OVERVIEW

Emergency Communication Centers

- Very structured environments.
- Repetition of common procedures
- Staffed 24/7/365
- Highly trained with clear chain of command.

Emergency Operations Centers

- Infrequent activations
- Staff have other 'jobs' 95% of the time.
- EM personnel spend fraction of time in EOC activations/exercises.
- No two EOC activations are the same, procedures understood by a fraction of EOC people

EOC/ECC CONTINUING TRENDS

- New hardened, secure facilities
- Multi-agency co-location
- Redundancy
- Hardening
- Stand-alone capability
- Column-free/high-ceiling
- Flexible/accessible infrastructure
- Expansion
- Shared spaces
- Displays support situational awareness
- Lockers/showers/exercise
- WC & break rooms near operations floors
- Sleeping/rest-areas/quiet-rooms
- Commercial kitchen/food storage
- Secure staff parking
- Segregated public/training/activation parking
- Multi-use of EOC



EOC/ECC EMERGING TRENDS

- Transparent "bunker-less" site security
- Stress mitigation
- Back-up Dispatch in disaster-hardened equipment room
- Standing workstations
- The "hybrid" terrace/pod EOC
- Reconciling LEED & redundancy
- Alternative energy redundancy
- Extensive charging stations
- User-control floor HVAC systems
- "Cold aisle" server room cooling
- Fusion Centers/EOC collaborations
- Text-to-911
- Real-Time Crime Fighting Center
- Taking better advantage of EOC/911 co-location
- FirstNet broadband network

DESIGN TEAM SPECIALISTS

- Can Work For Client or Architect
 - Can Act as Owner Representative for Design Requirements
 - Provide Interface with Client on Technical Requirements
 - Work with Client to:
 - Develop Concept of Operations
 - Facility Planning
 - Grant Writing
 - Life Cycle Studies
 - Provide Procurement and Systems Integration Services
-





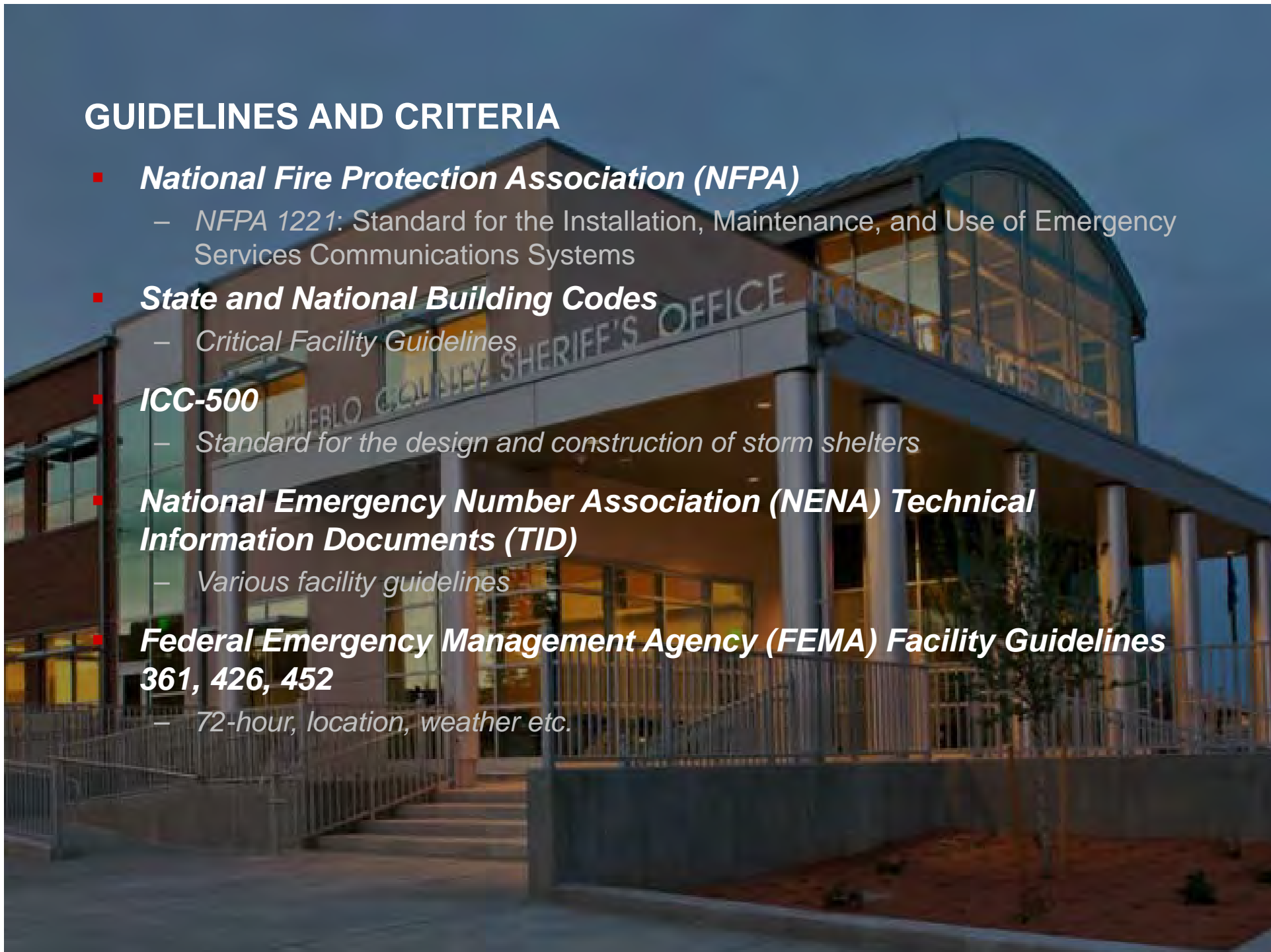
DESIGN GUIDELINES AND CRITERIA

Hardened Facility

A ***Hardened Facility*** is a secure operational space designed to protect its occupants, contents, and functional status from the worst of both natural and man-made threats and disasters.

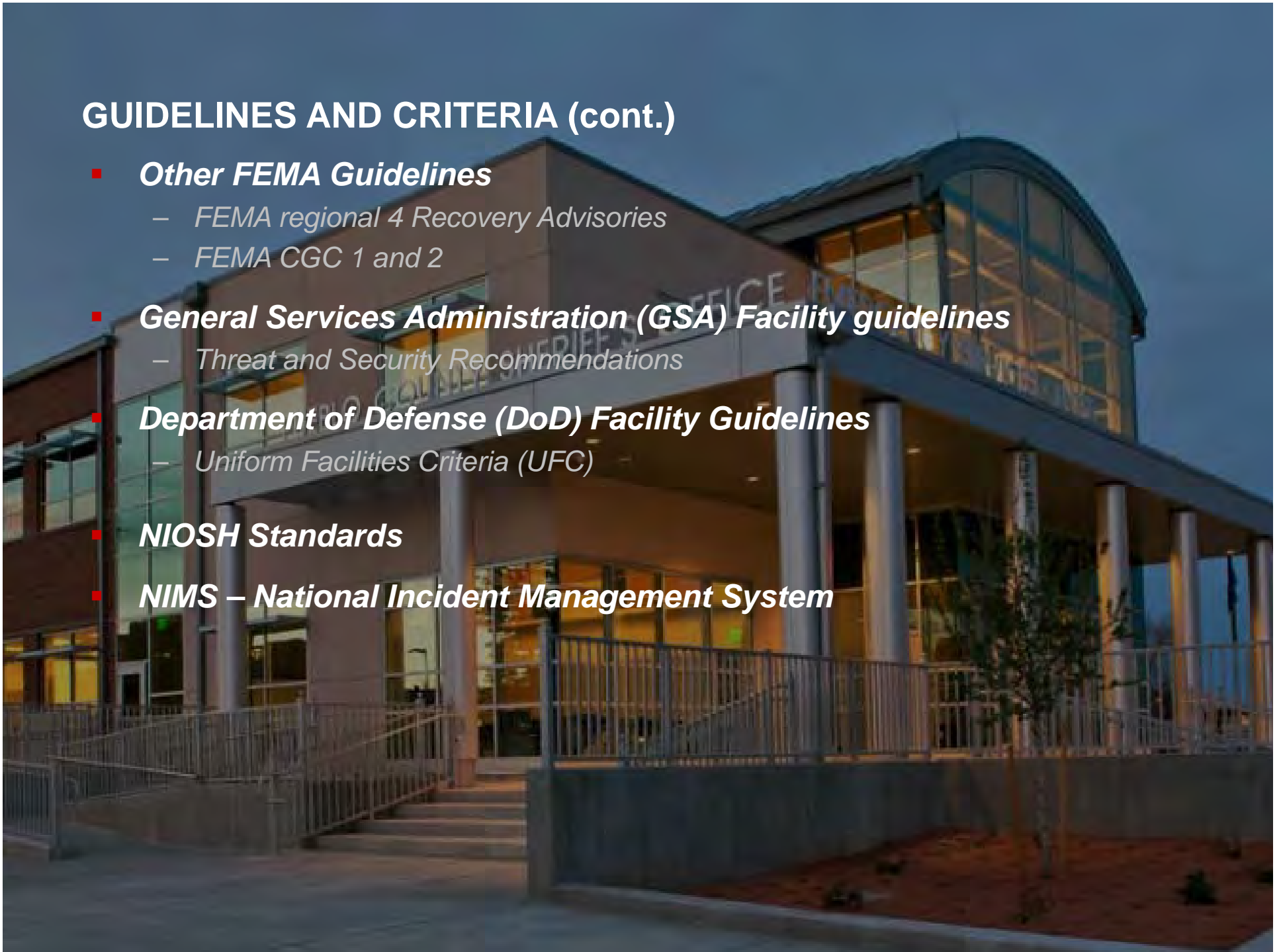
GUIDELINES AND CRITERIA

- **National Fire Protection Association (NFPA)**
 - *NFPA 1221: Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*
- **State and National Building Codes**
 - *Critical Facility Guidelines*
- **ICC-500**
 - *Standard for the design and construction of storm shelters*
- **National Emergency Number Association (NENA) Technical Information Documents (TID)**
 - *Various facility guidelines*
- **Federal Emergency Management Agency (FEMA) Facility Guidelines 361, 426, 452**
 - *72-hour, location, weather etc.*



GUIDELINES AND CRITERIA (cont.)

- ***Other FEMA Guidelines***
 - *FEMA regional 4 Recovery Advisories*
 - *FEMA CGC 1 and 2*
- ***General Services Administration (GSA) Facility guidelines***
 - *Threat and Security Recommendations*
- ***Department of Defense (DoD) Facility Guidelines***
 - *Uniform Facilities Criteria (UFC)*
- ***NIOSH Standards***
- ***NIMS – National Incident Management System***



International Building Code (IBC)

Hardened Facilities shall be designed and constructed in accordance with the International Code Council's Standard 500 (ICC 500), and designated for use during tornado or hurricane events.

Other Provisions of ICC 500

BUILDING SITING
FLOOD CRITERIA
MEANS OF EGRESS
ACCESSIBILITY
DEBRIS HAZARD
OCCUPANCY
SURVIVABILITY
FIRE SAFETY

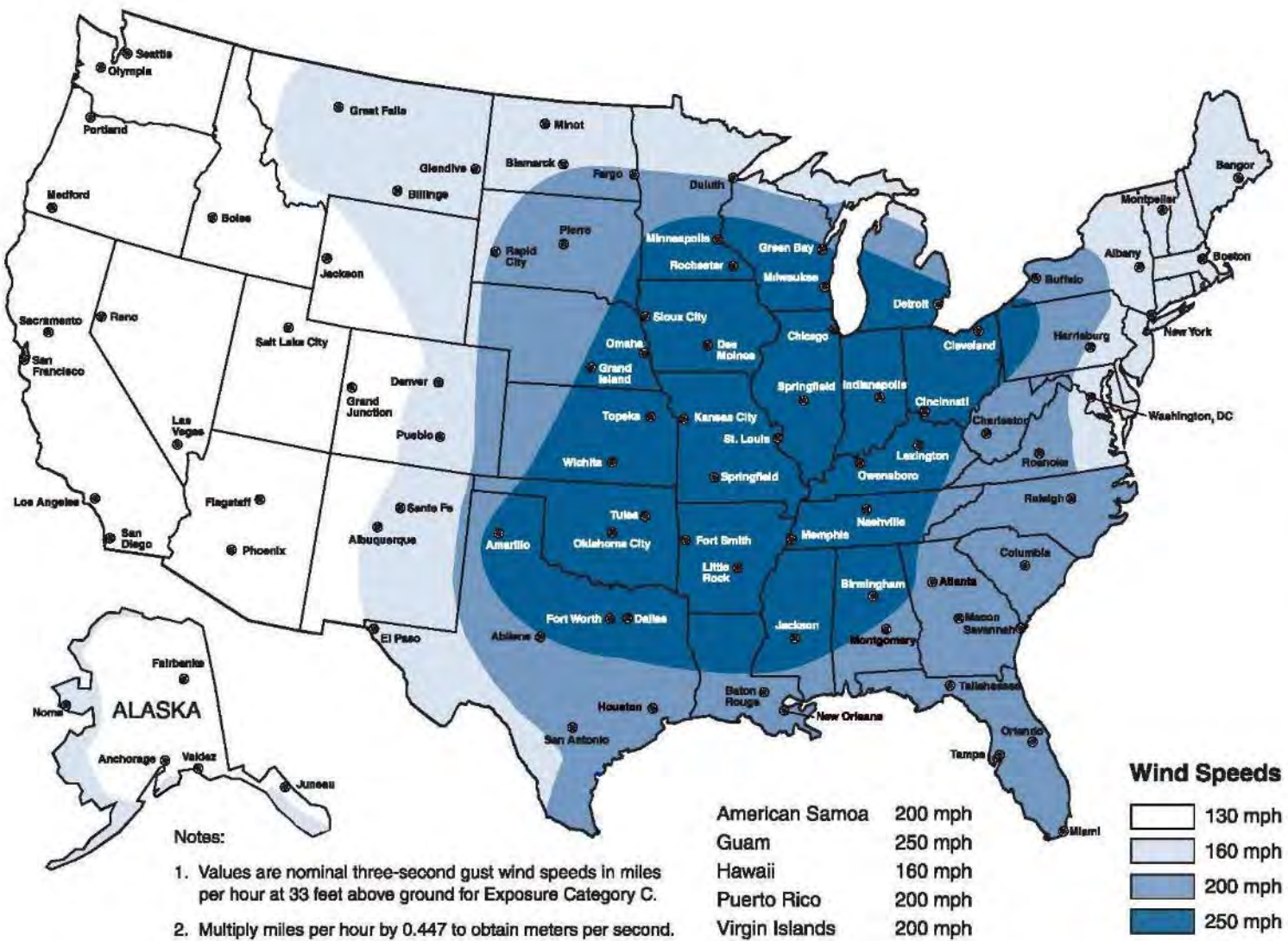
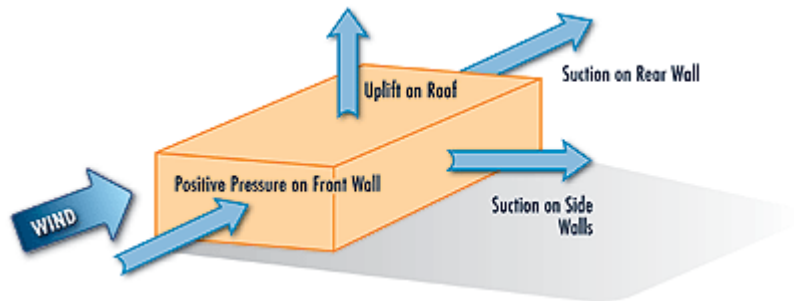
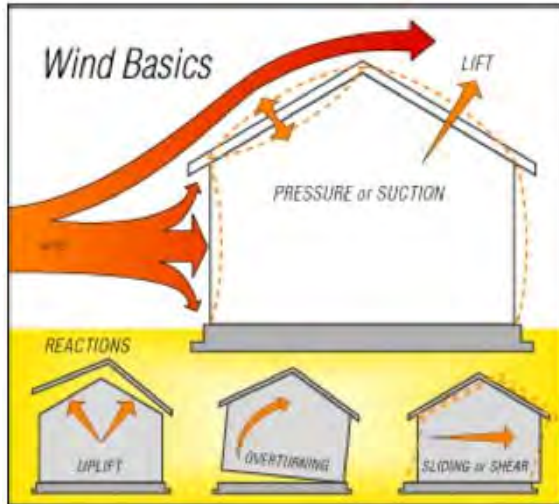
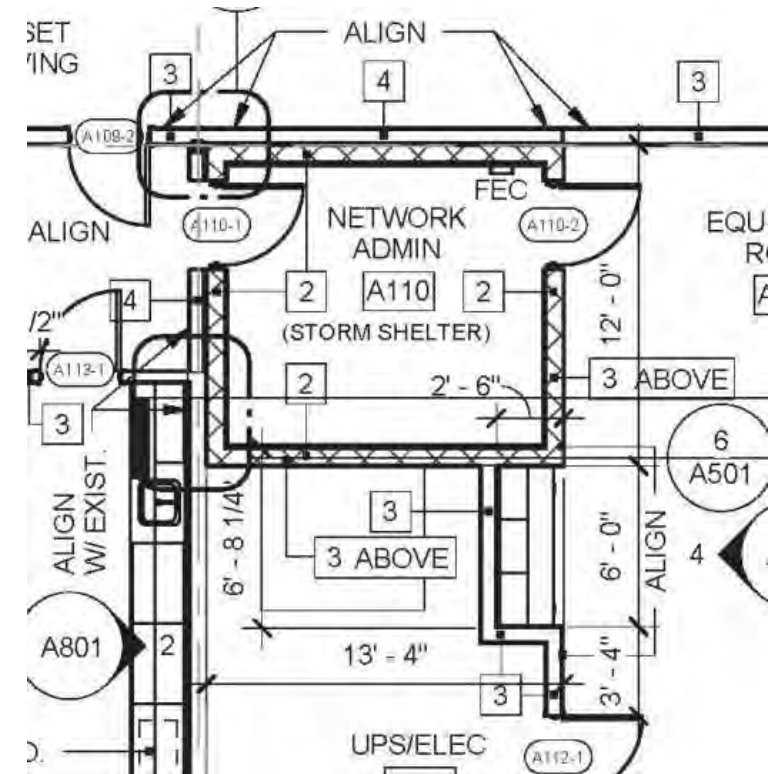
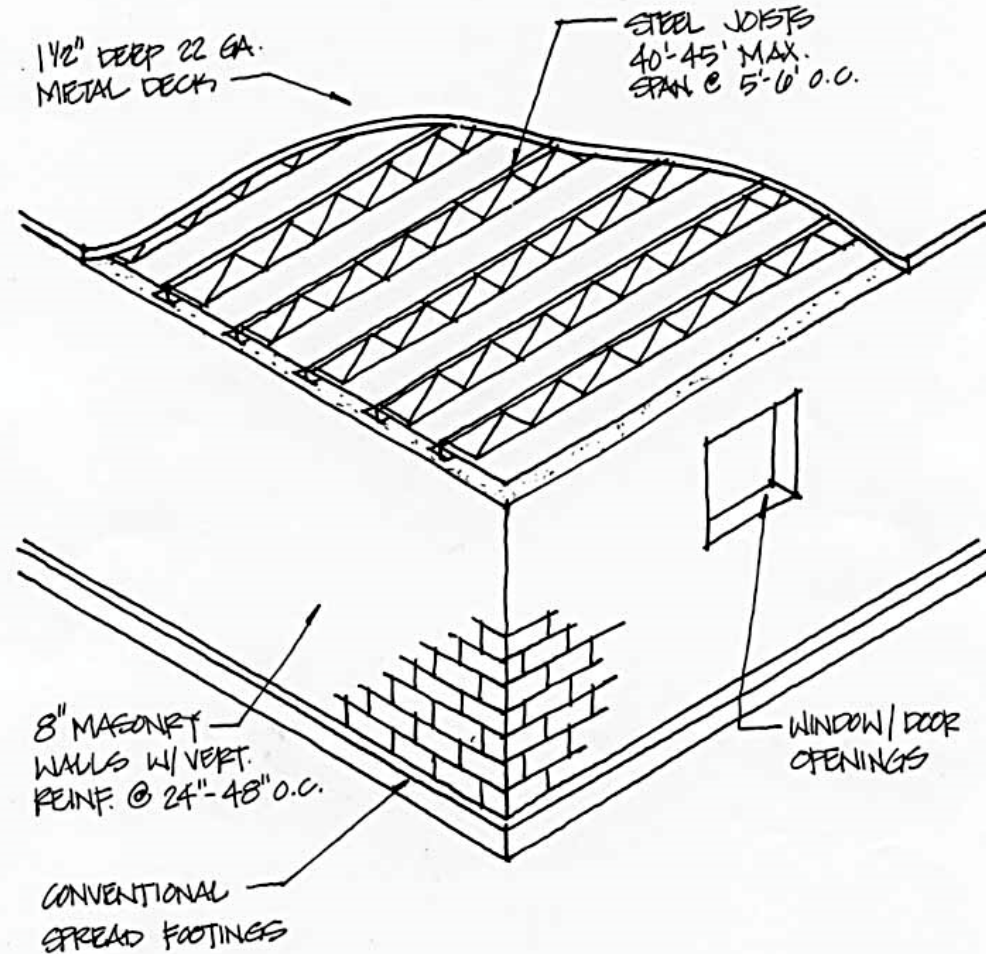


Figure 3-1. Tornado Safe Room Design Wind Speed Map (consistent with ICC-500 Tornado Hazard Map)

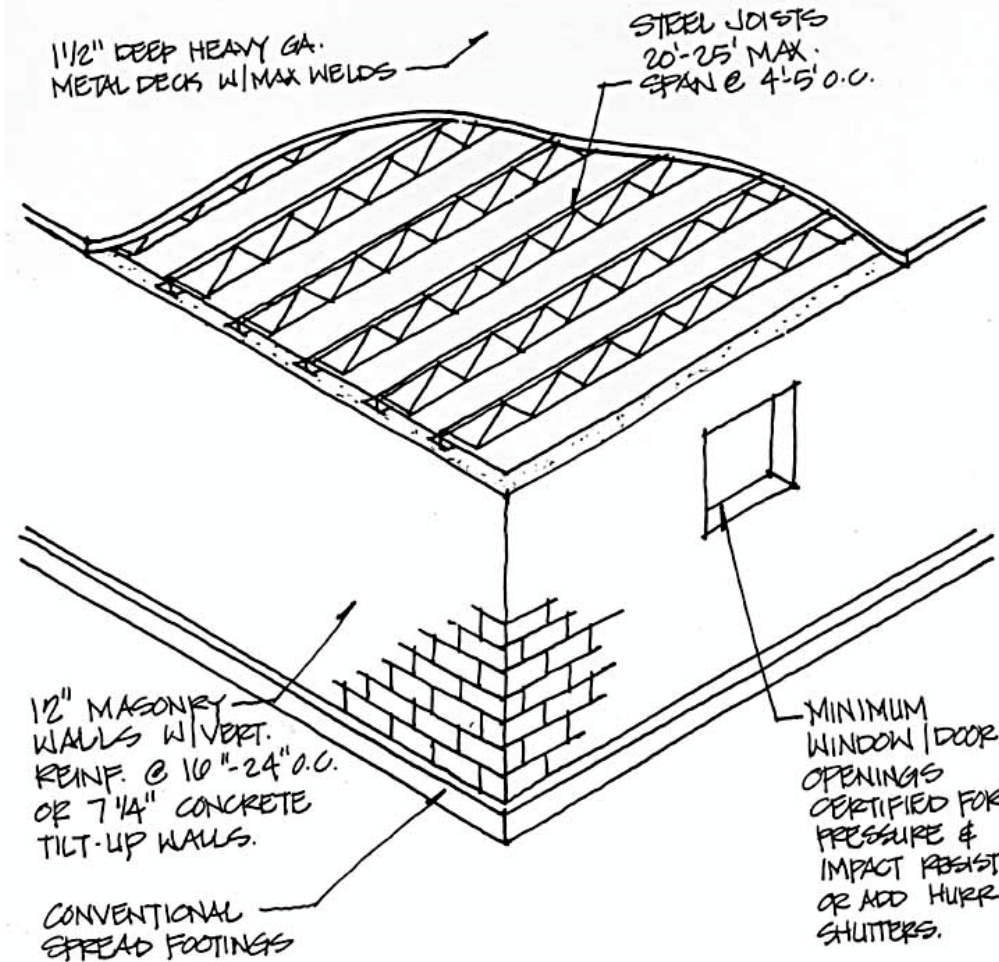




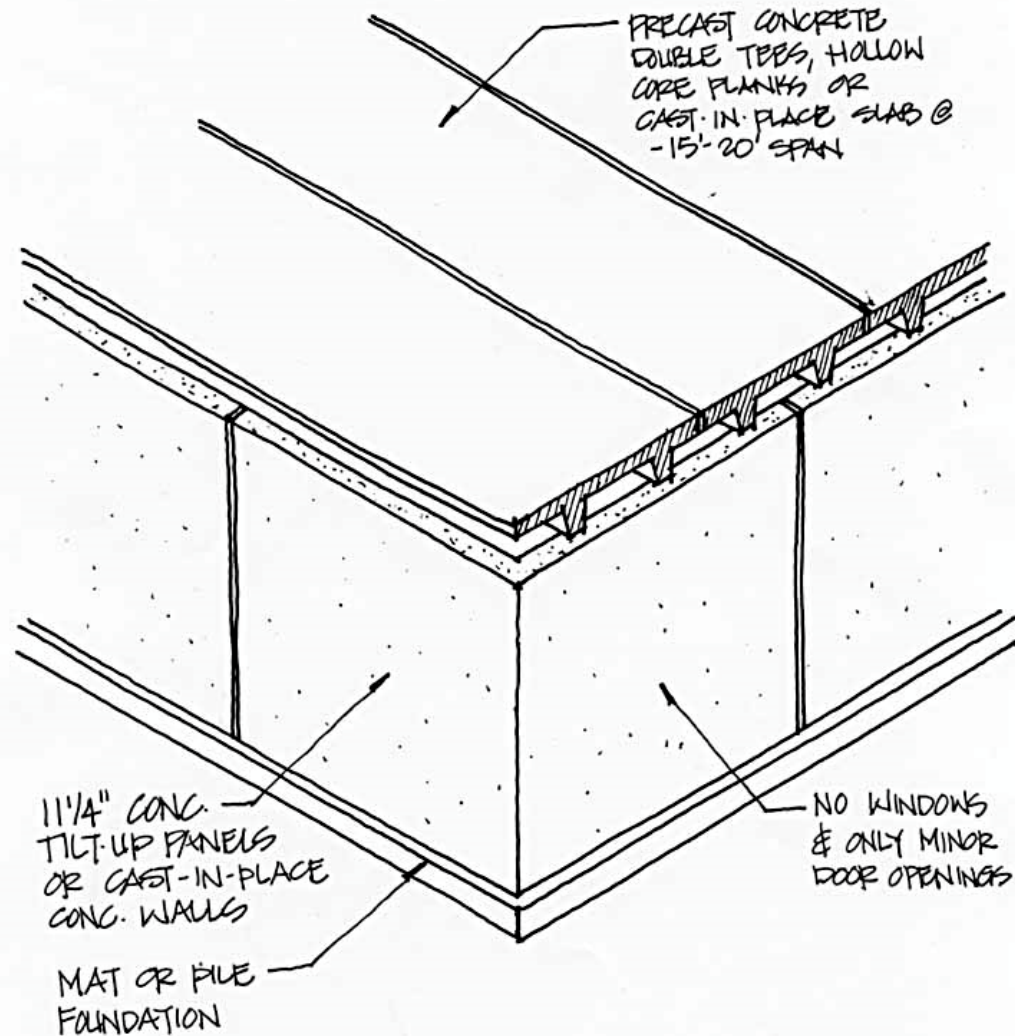
Survivability (130 MPH Wind)

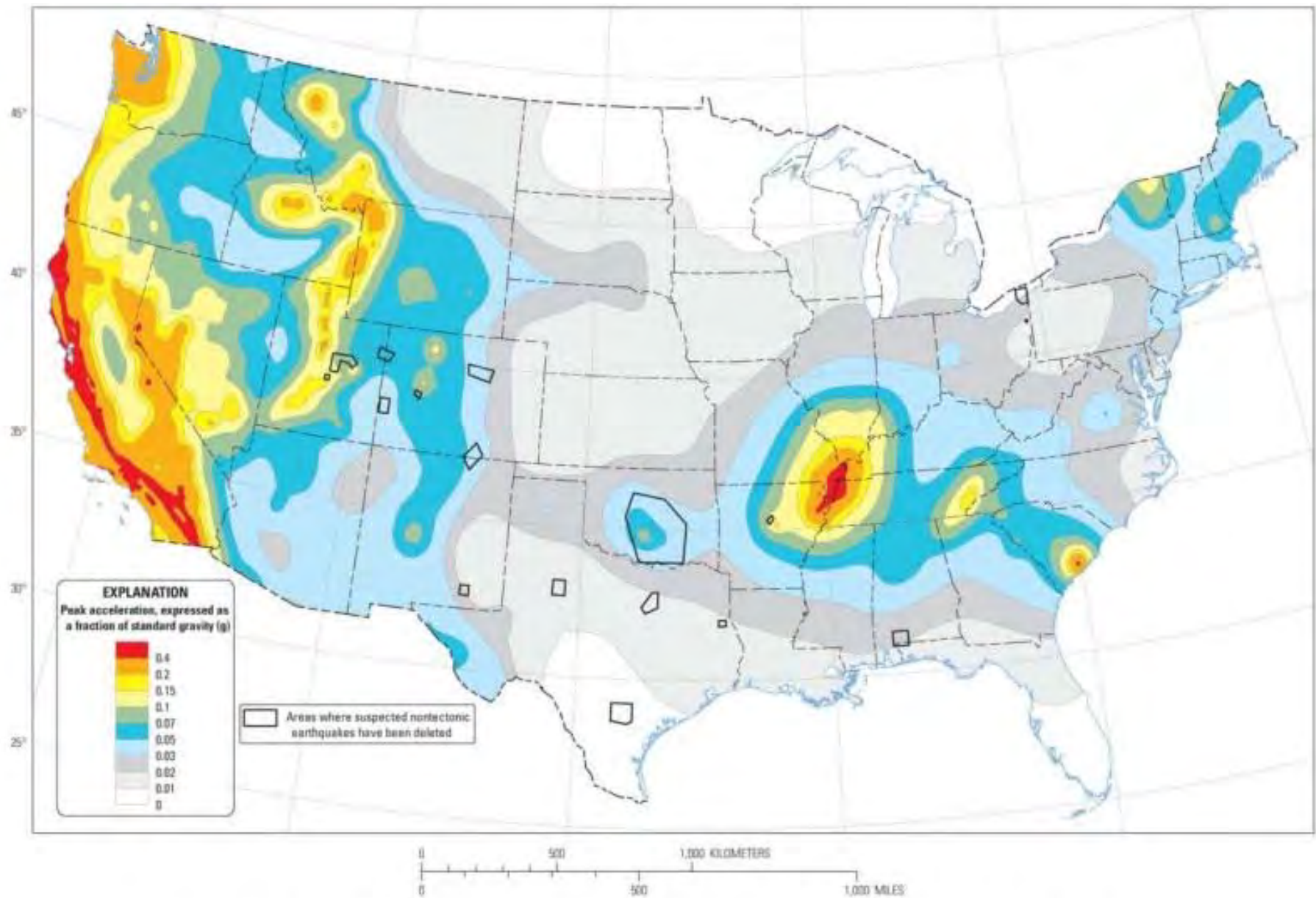


Survivability (160 MPH Wind)



Survivability (250 MPH Wind)





Ten-percent probability of exceedance in 50 years map of peak ground acceleration

FEMA THREAT/VULNERABILITY ASSESSMENT

Asset Valuation

Tangible Assets

People, Building, Equipment

Intangible Assets

Process, Reputation

Threat Determination

Natural

Tornado, Hurricane, Earthquake, Flood

Man-made

Explosive, Chemical, Arson, Cyber, Forced Entry

Vulnerability/Impact Assessment

Assessment of building functions, systems & site to identify potential weaknesses and areas that lack redundancy

RISK DETERMINATION

Determine the ***Probability of Occurrence*** and the ***Importance/Impact of Occurrence***

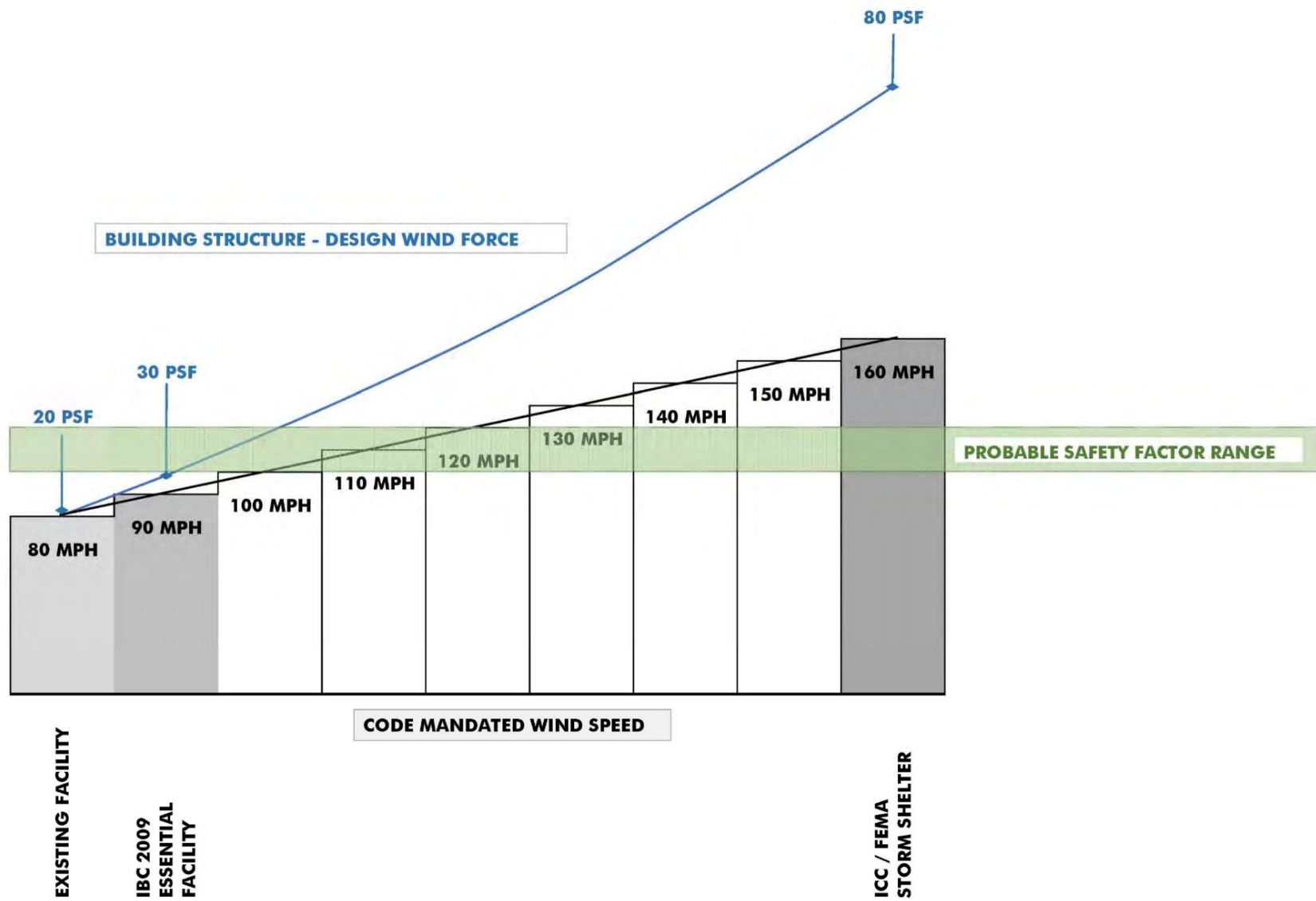
RESOLUTION

Results develop the basis for architecture and engineering considerations for the project

Threat and Vulnerability Assessment		ASSESSMENT		DESIGN PRECAUTIONS ARE NOTED FOR THE FOLLOWING BUILDING SYSTEMS						
Completion Date:	6/3/2010	Rank (high, medium, low)								
		Probability of Occurrence	Importance of Occurrence		Vulnerability Precautions	Architectural Solutions	HVAC/Plumbing/ Fire Protect Redundancy	Electrical Redundancy	Telecomm Redundancy	Other
NATURAL THREATS										
<i>Weather</i>										
Flood		High	High		In 500 year flood plain. Could be 100 year flood plain depending on location and FEMA's new maps.	Raised the grade the floor plate up out of the flood plain.	Develop floor drains throughout and damming in equipment rooms.	N/A	raise telecomm room out of flood plain	This site appears to be in the 500 year flood plain.
Snow/Ice		High	Low		If there is a tower create clearance between tower and building.	Provide clear entry canopies. Anticipate roof design to mitigate ice issues.	N/A	Provide underground power feed and power from two different grids if possible. Generators and UPS.	Highest resistance for microwave because of hail. Utilize the redundant fiber pathways. Re-establish redundant fiber pathways.	Driving blizzards with ice.
Hurricane/ Tropical Storm in this location		N/A	N/A							
Tornado/ Microburst		High	High		Less tornadoes but high sustainable and microburst winds.	minimum design is 90 mph with the ICC critical facility upgrade.		Provide underground power feed and power from two different grids if possible. Generators and UPS.	Utilize the redundant fiber pathways. Re-establish redundant fiber pathways.	
Lightning		High	High					Surge protection and lightning grounding protection.	Surge protection and lightning grounding protection.	
Wildfires		N/A	N/A							
<i>Seismic/Geological</i>										
Earthquake		Low	Low		Seismic zone 1	Typical seismic restraints specific to the region.				
Mud/ Rock Slide		N/A	N/A							
Radon		High	Low		Provide radon sealing and potential mitigation.					
Geological formation		N/A	N/A			Provides geotechnical study prior to design of structural system.				
<i>Service Interruption (Natural Occurrences)</i>										
Interruption of Primary Power Supply (natural)		Low	High		Some poor grid issues, lack of grounding in current facility and age of the building.			Provide underground power feed and power from two different grids if possible. Generators and UPS.	Utilize the redundant fiber pathways. Re-establish redundant fiber pathways.	Power quality is poor. UPS kicks in frequently.
Interruption of Secondary Power Supply (natural)		Low	High		Some poor grid issues, lack of grounding in current facility and age of the building.			Provide underground power feed and power from two different grids if possible. Generators and UPS.	Utilize the redundant fiber pathways. Re-establish redundant fiber pathways.	Power quality is poor. UPS kicks in frequently.
Interruption of Water (natural)		Low	Medium				FEMA water storage requirements. Provide two weeks supply of water. Look at potential water storage for fire protection.			
Interruption of telecomm (natural)		Medium	High					Provide underground power feed and power from two different grids if possible. Generators and UPS.	Create a secondary telecomm feed. Utilize the redundant fiber pathways. Re-establish redundant fiber pathways.	
Interruption of Food Supply (natural)		Low	Medium		Food storage capabilities.					Replenish when out. If during an activation will have Red Cross support.
Interruption of Transport (natural)		Medium	Medium					Generator fuel for 72 hours then rely on transport after that.		After three days, national guard would get fuel to the site.



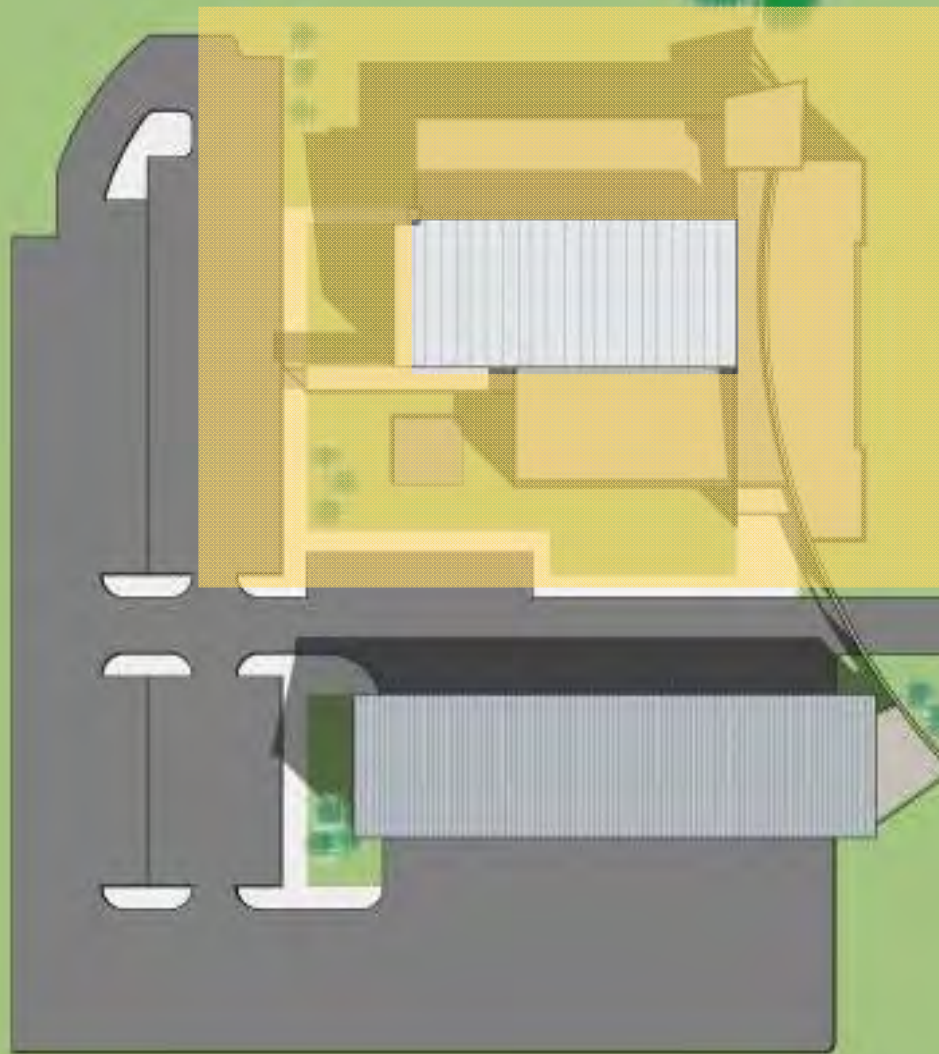
Figure 3-1. Tornado Safe Room Design Wind Speed Map (consistent with ICC-500 Tornado Hazard Map)



DESIGN ISSUES

STANDOFF

- AT/FP site protections zones
- Vehicles
 - UNCLEARED
 - 82 feet (25 Meters)
 - CLEARED
 - 31 feet (10 Meters)



DESIGN ISSUES

SITE SECURITY

- Separate secure parking area
- Separate employee entrance(s)
- Controlled entry
- Concrete planters
- Berms

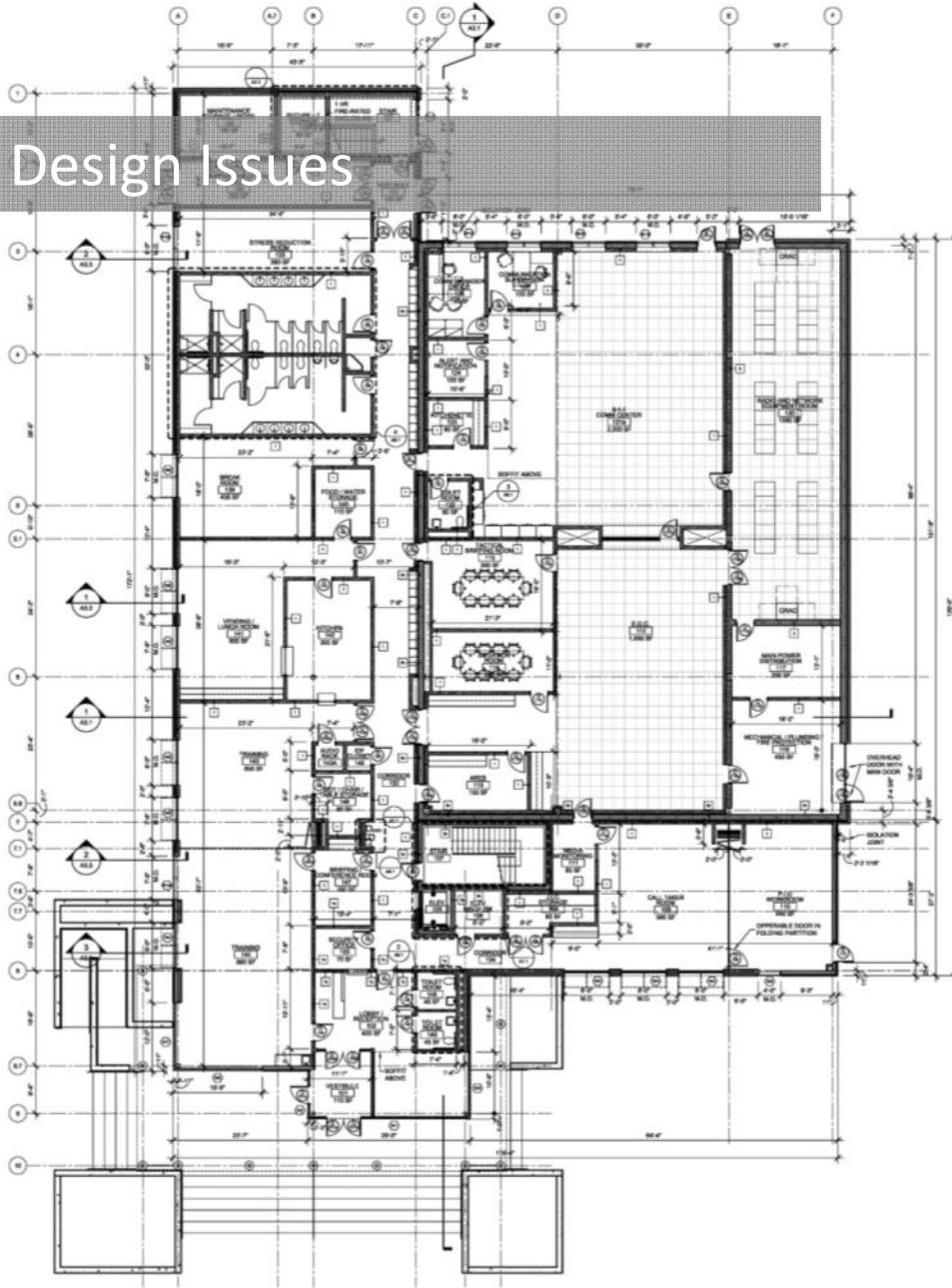




Design Issues

- Acoustics
 - Taller Spaces
 - Non-parallel walls
 - Floating Ceiling
 - Acoustic Panels
 - Carpeting
 - Quiet, but minor noise masking

Design Issues

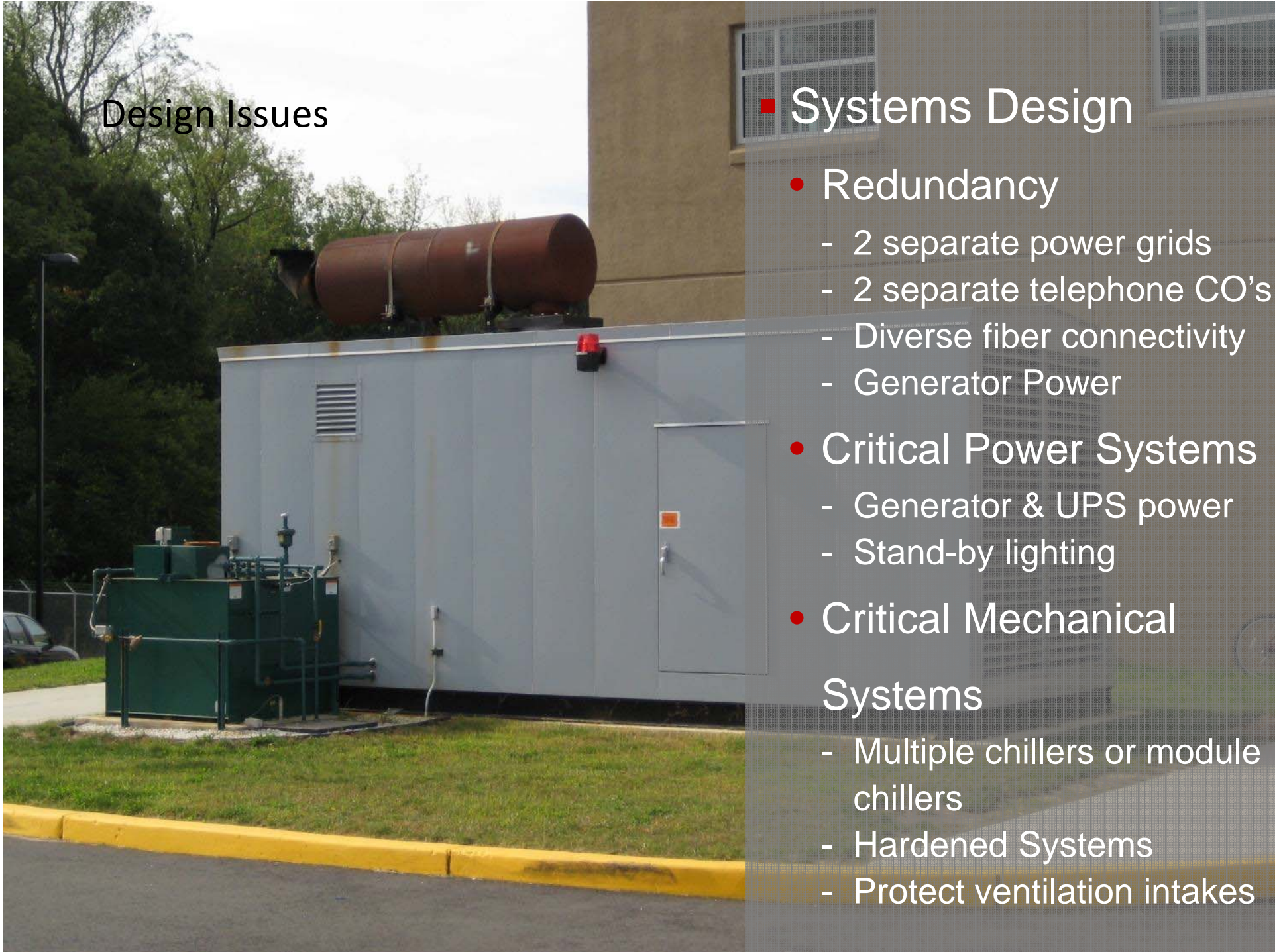


- Architectural Considerations
 - Antennae locations and connections
 - Detailed Security requirements & component integration
 - Parking
 - Adequate area & Infrastructure for systems
 - Integral central vacuum systems
 - Appropriate, comprehensive grounding system(s)
 - Layout & Detailing addressing expansion needs

Design Issues

■ Systems Design

- Redundancy
 - 2 separate power grids
 - 2 separate telephone CO's
 - Diverse fiber connectivity
 - Generator Power
- Critical Power Systems
 - Generator & UPS power
 - Stand-by lighting
- Critical Mechanical Systems
 - Multiple chillers or module chillers
 - Hardened Systems
 - Protect ventilation intakes





Design Issues

■ Mechanical / Plumbing Considerations

- Plumbing through or near the telecommunications or equipment rooms
- Double interlock preaction systems or other
- Floor drains throughout equipment spaces
- Security within HVAC pathways
- Full coordination and integration of all mechanical/plumbing within the building



Design Issues

■ HVAC Consideration

- Redundant Air Units in Data Center
- Redundant Air Units for Dispatch and EOC
- Redundant Air Units for Critical Building Systems



Design Issues

■ Electrical Considerations

- Distribution
- Backup Power
 - Three Levels
 - Normal
 - Generator
 - UPS & Generator
- Grounding
- Redundancy
- Building Surge Suppression



Design Issues

■ Data Center Distribution Electrical Considerations

- Equipment Power Requirements
- Three Phase Power
- Overhead Bus Bar Power Distribution
- Balanced Power
- Single or Multiple UPS's



Design Issues

■ Dispatch Center Distribution Electrical Considerations

- Equipment Power Requirements
- Multiple Circuits Per Position
- House Power vs. UPS/Generator Power
- Individual UPS's vs. Building UPS's



Design Issues

■ Building Grounding Electrical Considerations

- Single Point Ground System
- Use of Main and Sub Bus Bars
- Wiring Size Requirements
- Lightning Protection
- Building Ground Ring
- Structural Grounding
- Not Typical Building Grounding Systems



Design Issues

■ Data Center Grounding Electrical Considerations

- Sub Bus Bar's
- Raised Floor Pedestal Grounding
- ESD Flooring
- Data Rack Grounding
- Equipment Grounding
- Ancillary Equipment Grounding

Design Issues

■ Dispatch Center Grounding Electrical Considerations

- Sub Bus Bar's
- Raised Floor Pedestal Grounding
- ESD Flooring
- Equipment Grounding
- Ancillary Equipment Grounding
- Doors/Furniture/Drop Ceiling Grounding



Design Issues

■ Security Considerations

- Who is doing the viewing?
(central monitoring or supervisors/ watch commanders)
- PTZ cameras etc.
- Security of wireless WANs?
- What are other agencies using?
- Digital vs. Analog
- Information Systems
- Conduit requirements



Design Issues

■ Telecommunications

- Define systems being retained vs. replaced
- Design Inside Plant Infrastructure
- Diverse Paths and Redundancies
- Connectivity to other sites

Design Issues

■ Audio Visual

- Audio Visual Systems

- Large screen AVL
- Monitors
- Cable TV
- Weather/Events

- Smart Traffic Feed

- Security Systems and Monitors

- Media Feeds

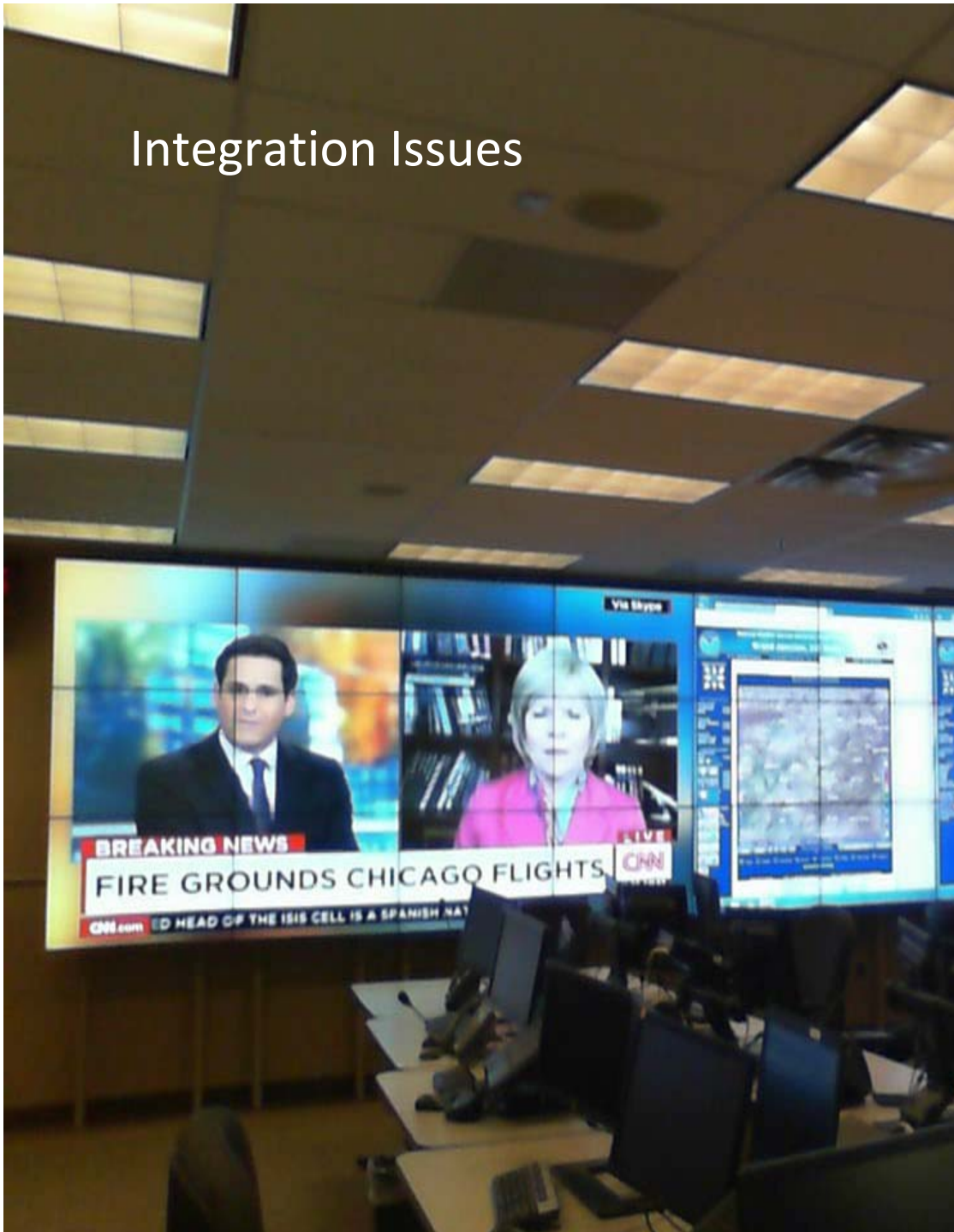
- Satellite



Design Issues

- Radio Communications Tower
 - Communications Tower
 - Roof Top Antenna's Mounts
 - Building Entry Ports
 - Fiber vs. Coax
 - Grounding Requirements
 - Power Requirements

Integration Issues



- Audio Visual Design
 - Ease of Use
 - Video Matrix's
 - Video Walls
 - Multi Wall Display Hardware/Software
 - Interactive Displays
 - Projector Systems
 - Video Teleconferencing (VTC)
 - Sounds Systems
 - Phone System Integration
 - Fiber vs. Coax
 - System Inputs
 - Viewing Angles

Integration Issues

- Audio Visual Content
 - Cable/Satellite TV
 - Weather Radar
 - Incident Management Software
 - Record Management Systems (RMS)
 - Geographic Information Systems (GIS)
 - Traffic Camera's
 - Security Camera's
 - Adhoc Connections Video and Data

Integration Issues



- Alert Notification Systems
 - Emergency Notification Systems
 - Indoor Warning System
 - Outdoor Siren Systems
 - Tone Alert Radio Systems
 - Message Board Activation Systems
 - Integrated Public Alert and Warning Systems (IPAWS)
 - Low Power AM/FM Radio Stations



Integration Issues

- Dispatch Phone Systems
 - 9-1-1 Phone System
 - Centralized Automated Message Accounting (CAMA) Trunks Lines
 - Automatic Number Identification/Automatic Location Identification (ANI/ALI) Lines
 - 9-1-1 Dispatch Consoles
 - NG9-1-1 Redundant Broadband/Fiber Requirements
 - Voice Recording Systems



Integration Issues

- Radio Communications
 - Digital Radio Systems (DTR)
 - Conventional Radio Systems
 - Amateur Radio Systems
 - Microwave/Fiber Connectivity
 - Communication Tower
 - Antenna Location
 - Coverage Design

Integration Issues

- Other Systems
 - Computer Aided Dispatch (CAD)
 - Incident Management System
 - Records Management System (RMS)
 - National Crime Information Center (NCIC)
 - Facility Security and Access Control Systems
 - IP Network (Phone and Data)
 - Building System Integration and Monitoring



Integration Issues

■ Operational Considerations

- Dispatch Console and EOC Furniture Layout
- AV Layout to Support Operational Use of Data
- Breakout Rooms for EOC
- Quiet Rooms / Destress Rooms for Dispatch Center
- Enhanced Network Requirements for NG9-1-1 and FirstNet



DESIGN THE SITE USING “CPTED” STRATEGIES

*Landscape
barriers,
topography,
sightlines all
contribute to a
subtle and
transparent site
security
approach*



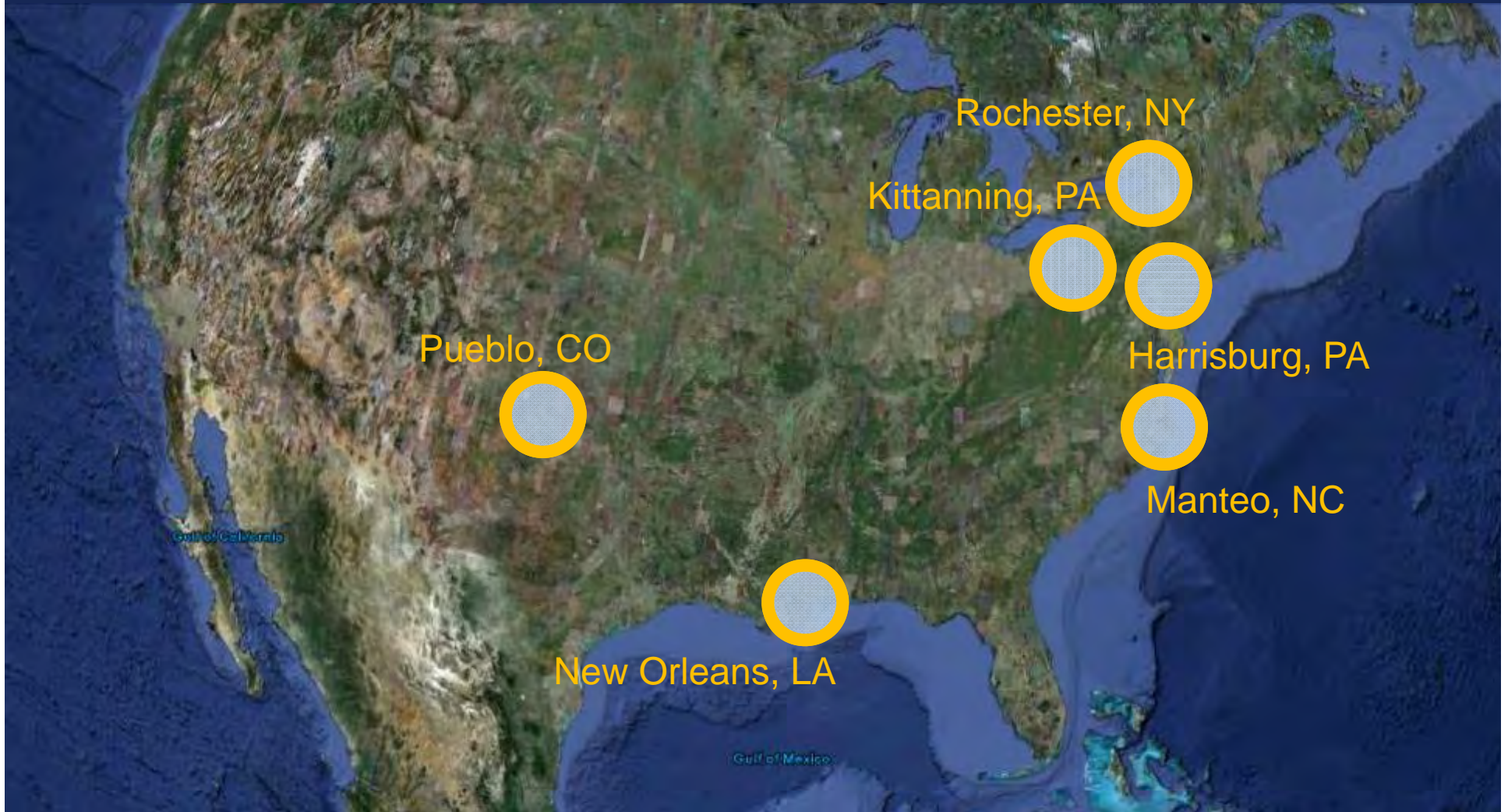
BUILD FOR CHANGE

Inspire confidence by planning for expansion from the beginning

EXAMPLE PROJECTS

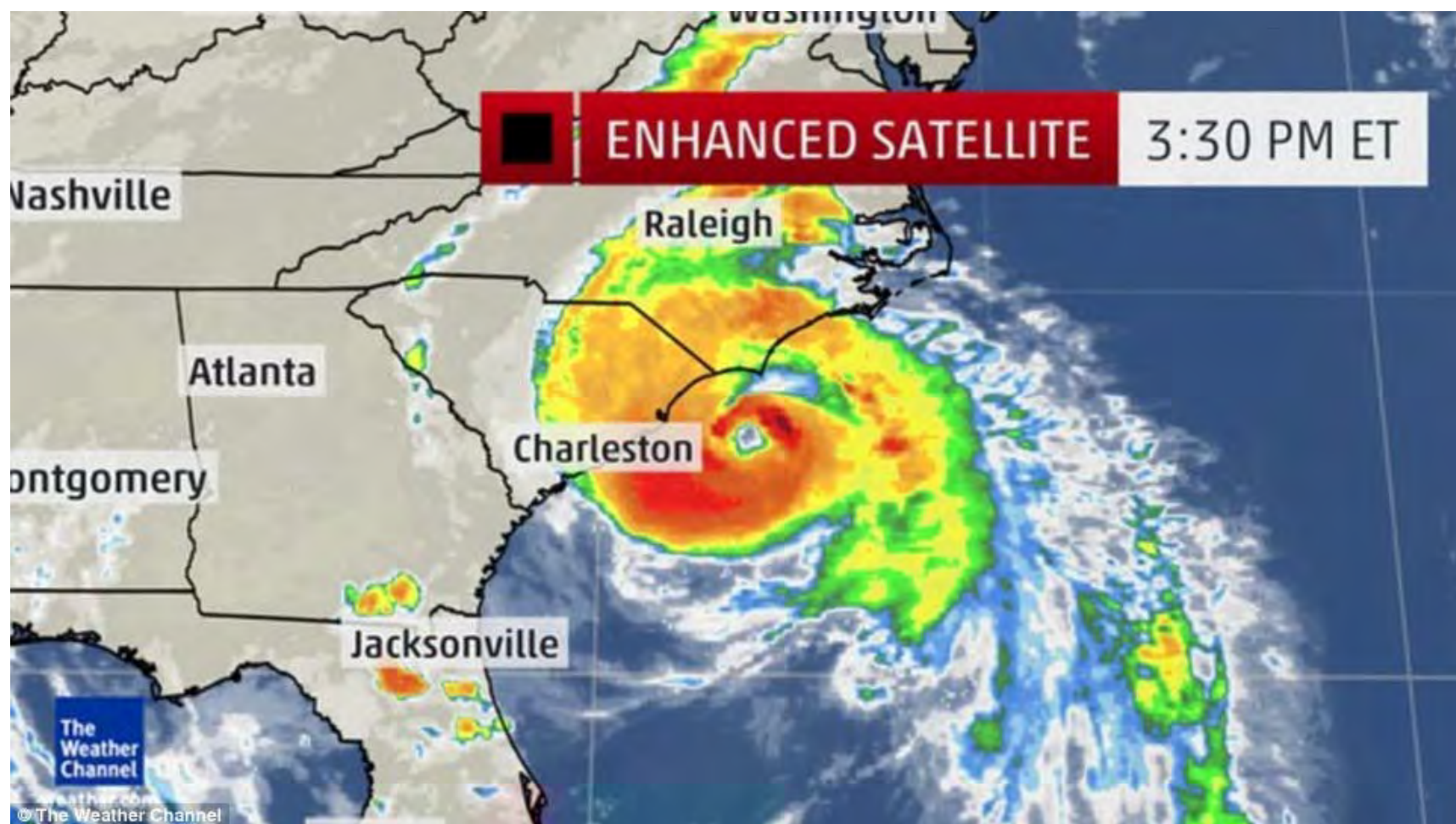


LOCATION MAP

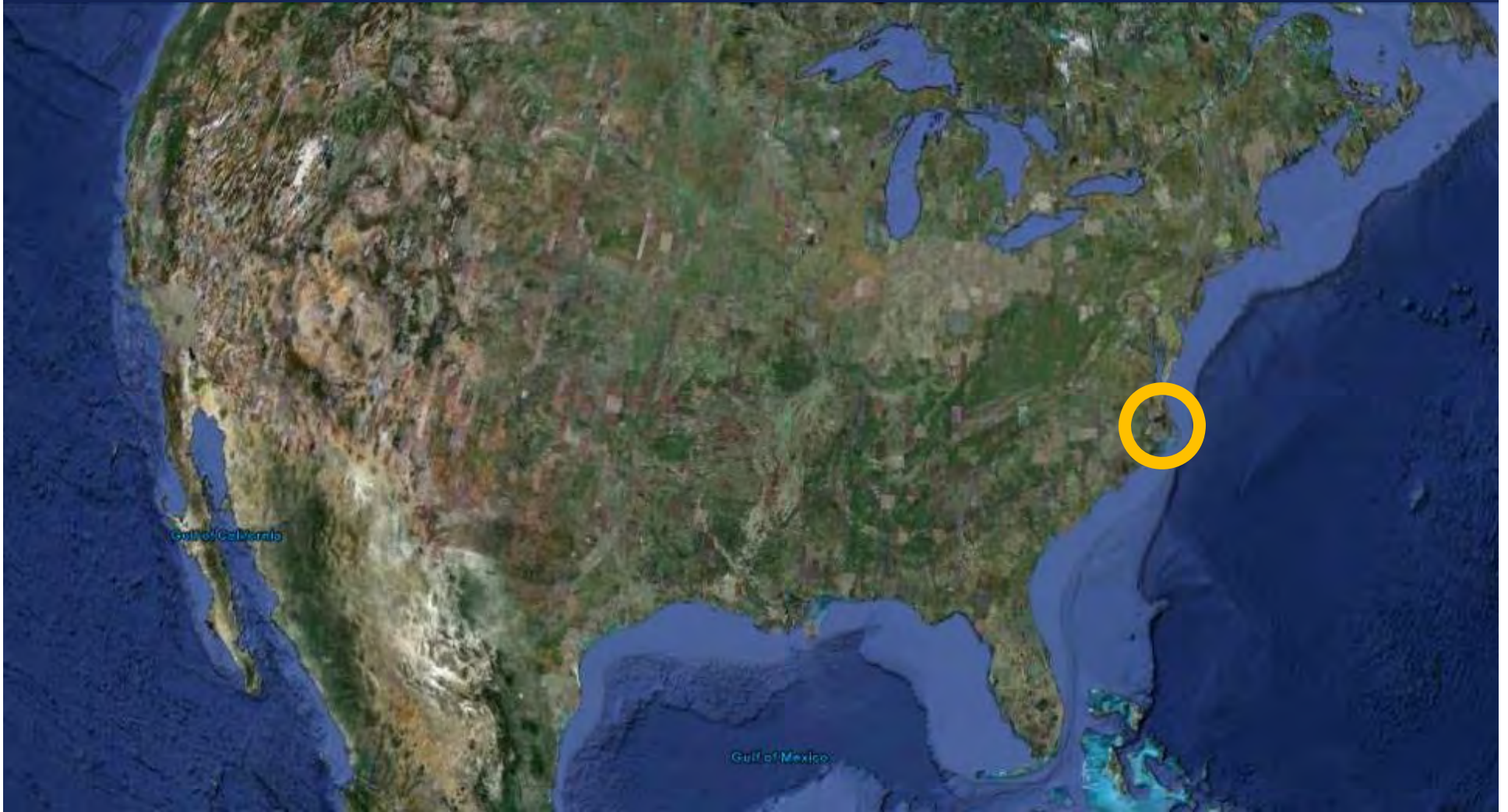


DARE COUNTY REGIONAL EMERGENCY SERVICES CENTER

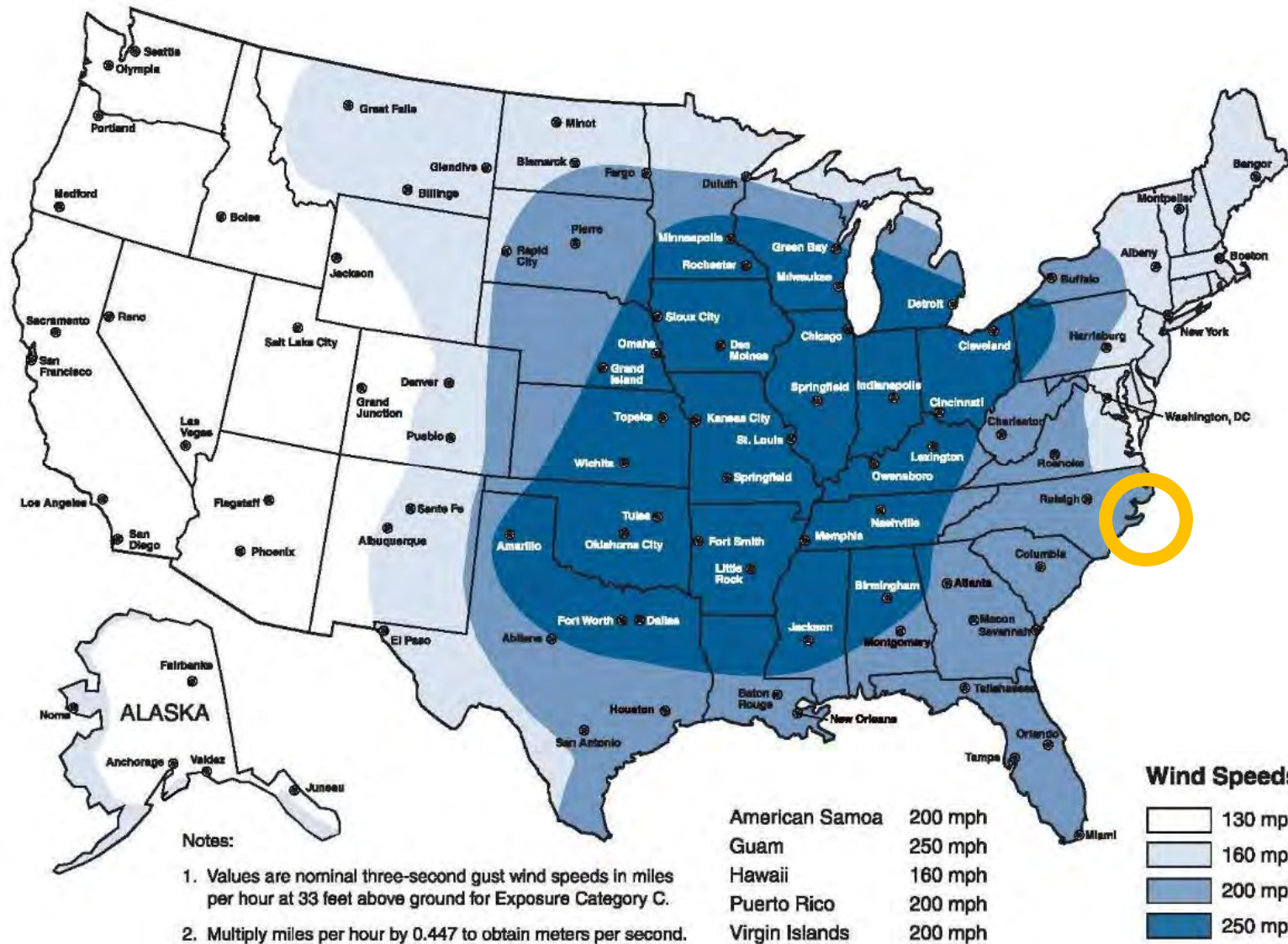




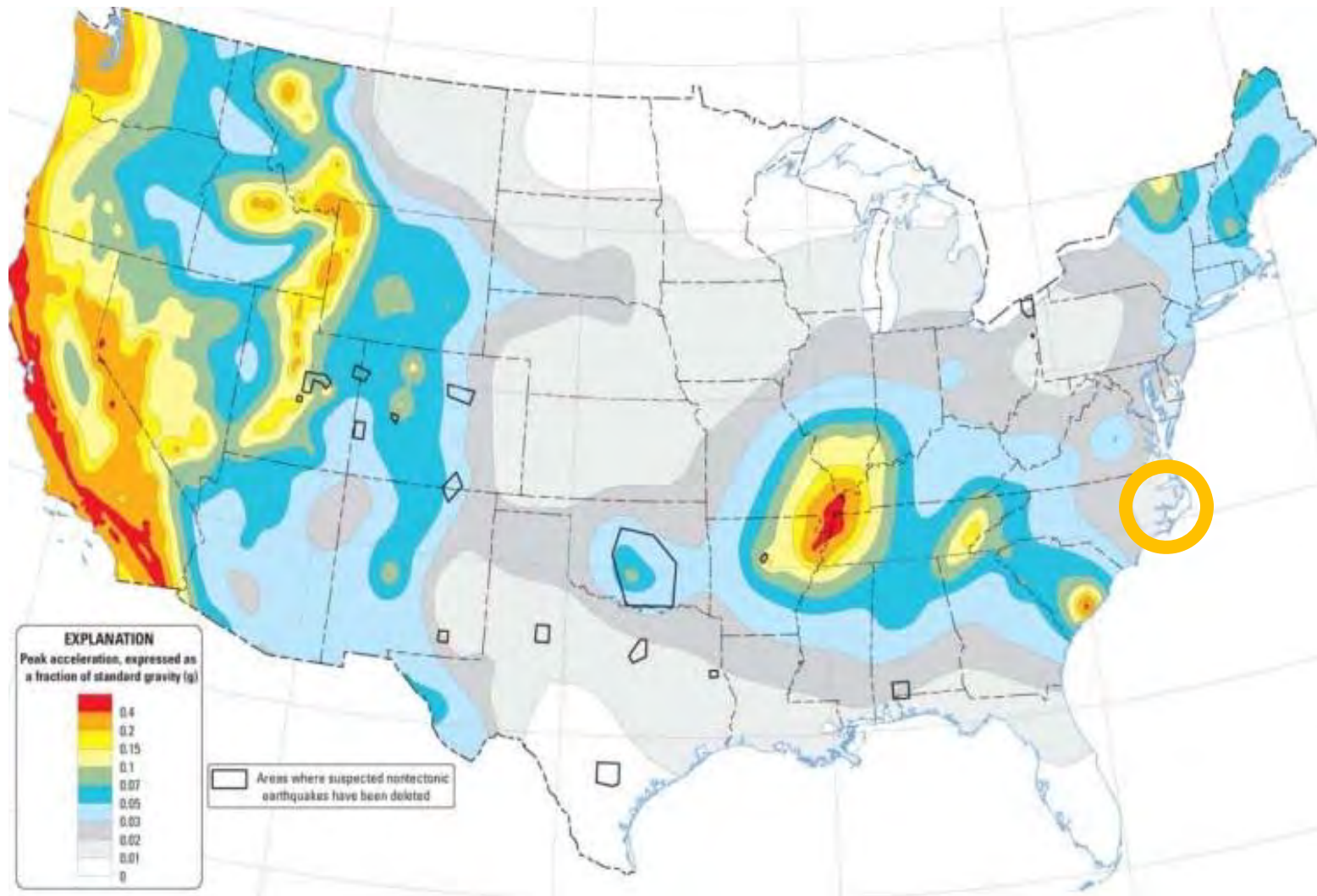
LOCATION MAP

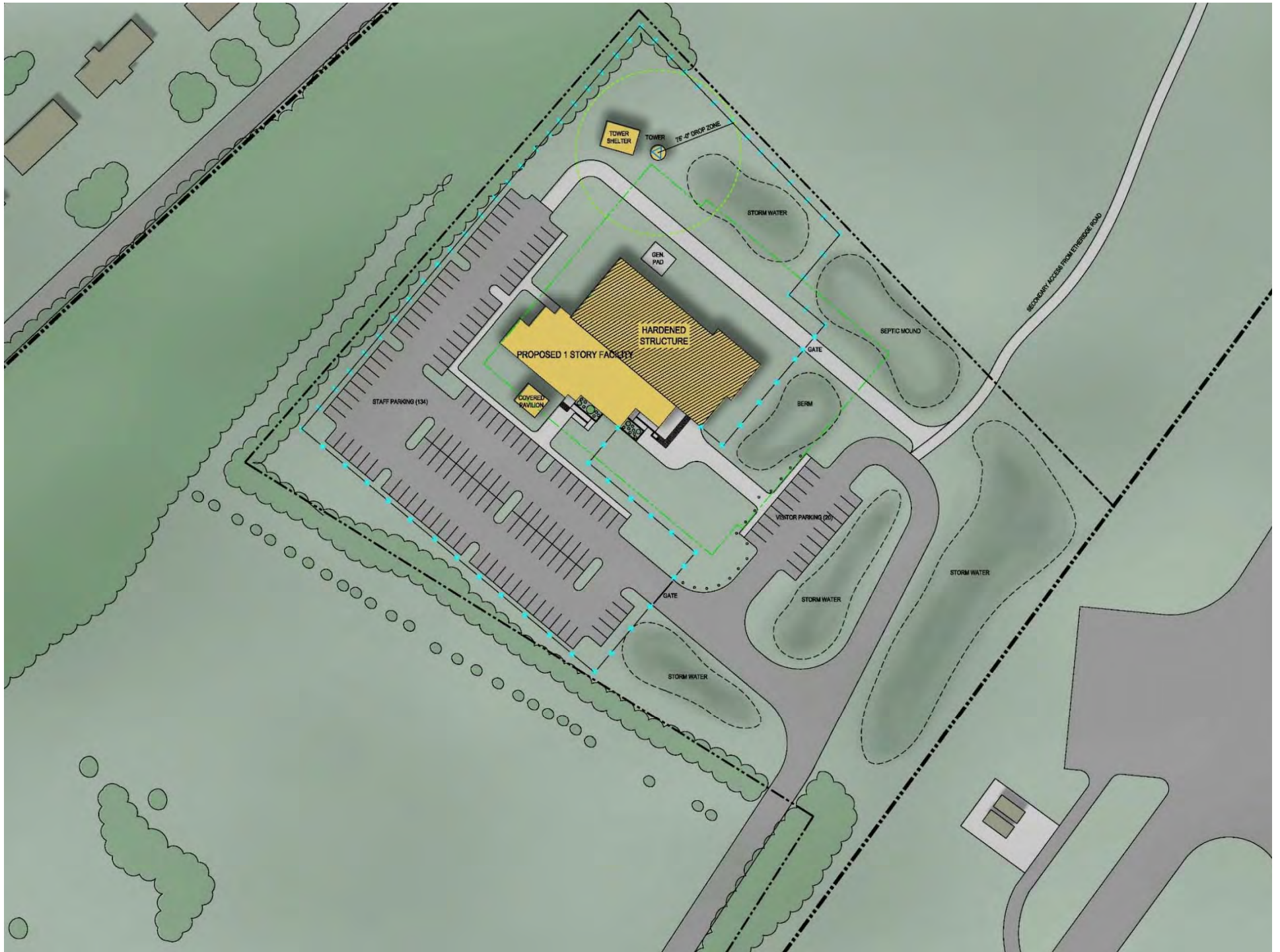


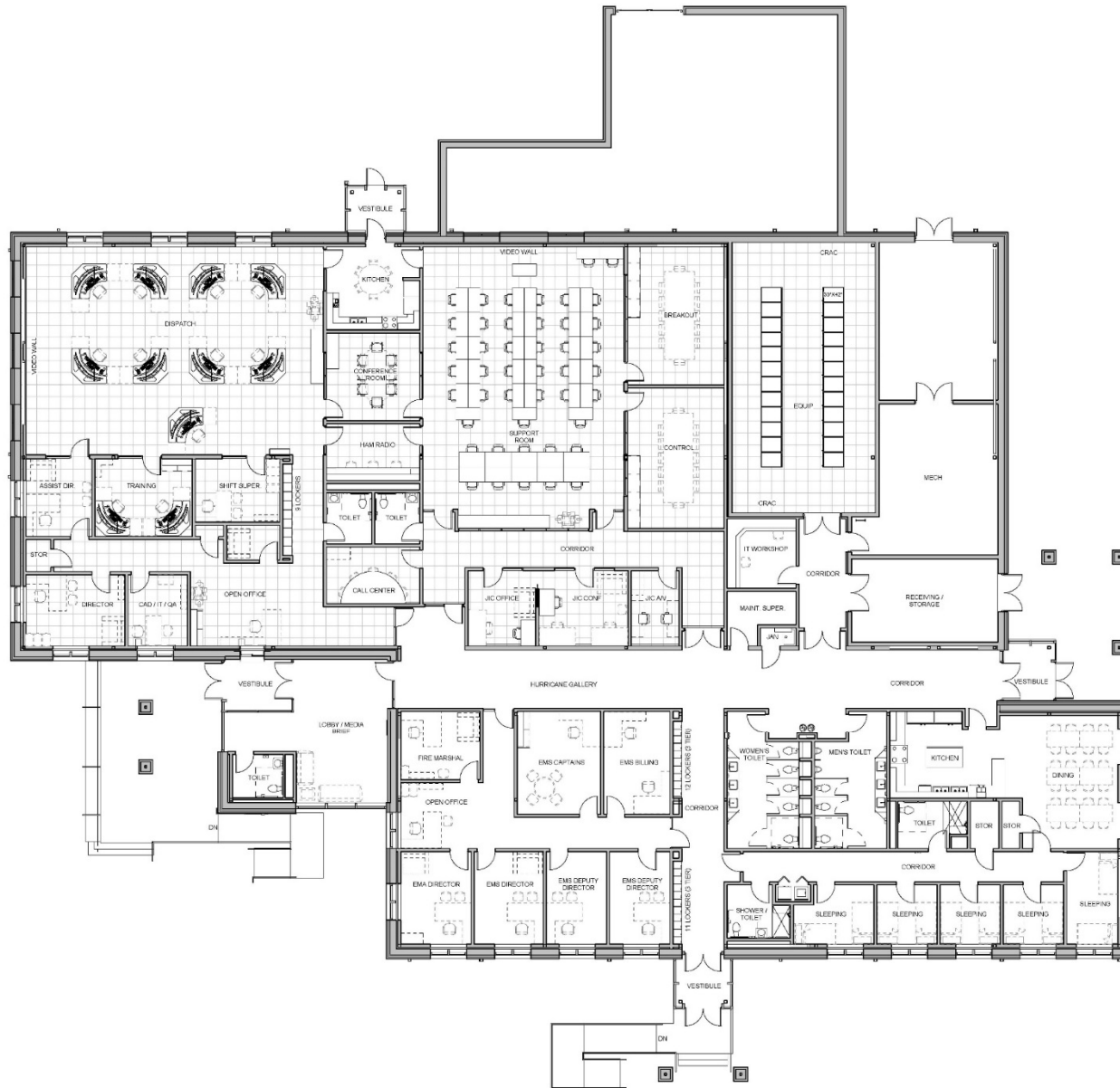
MAXIMUM WIND GUST MAP



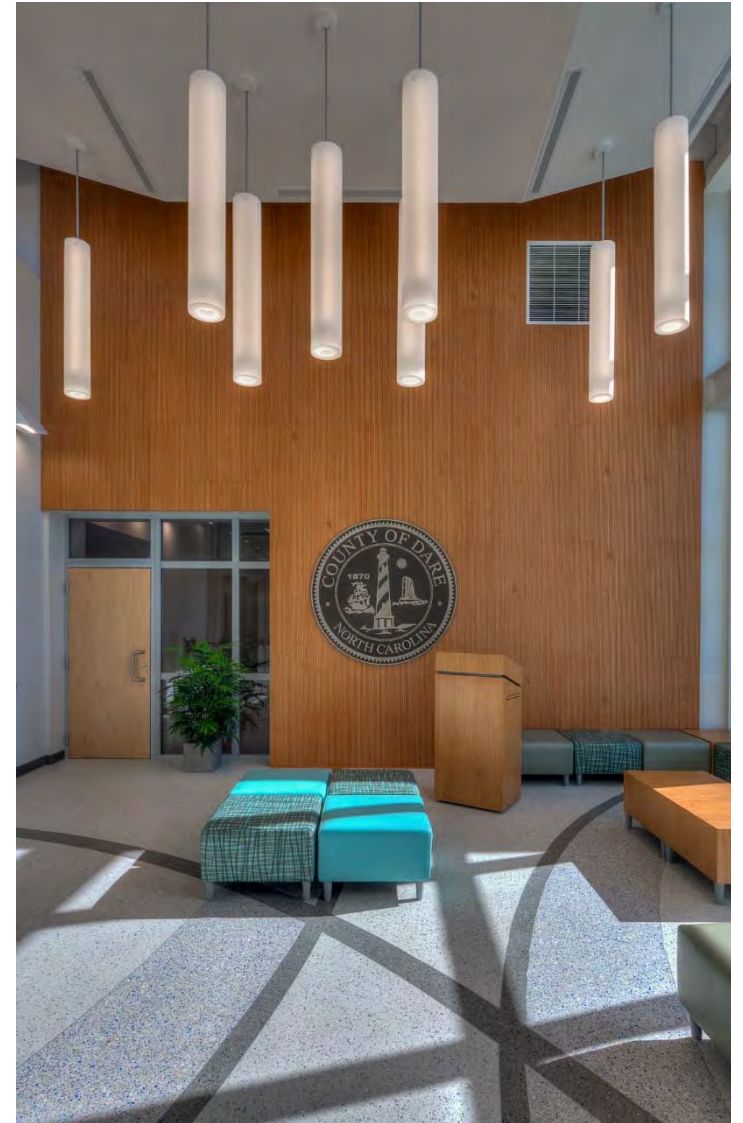
SEISMIC MAP









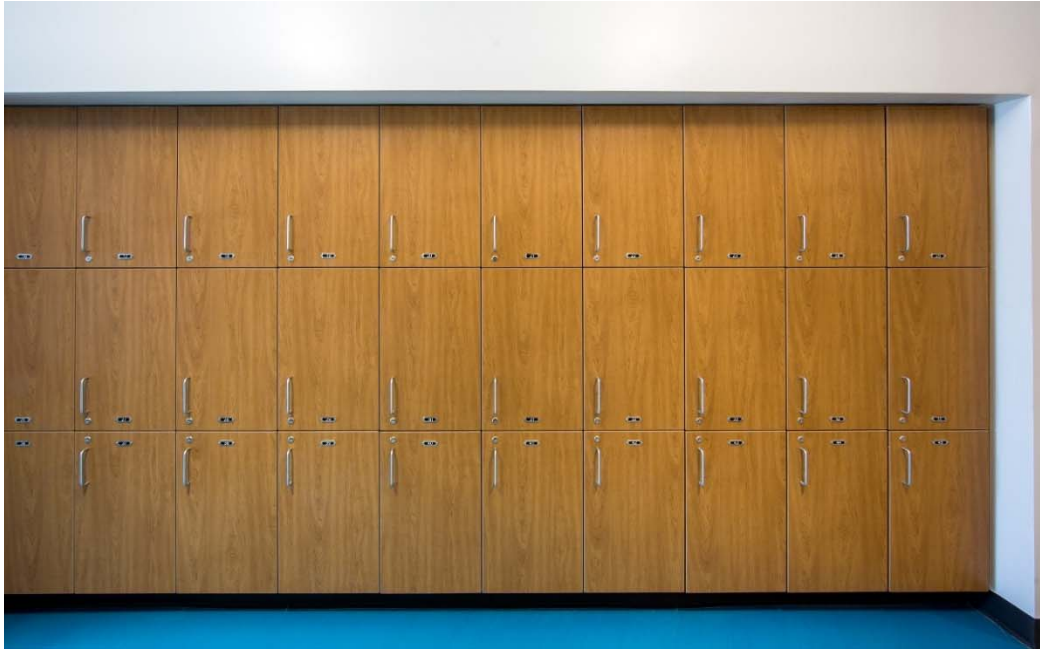








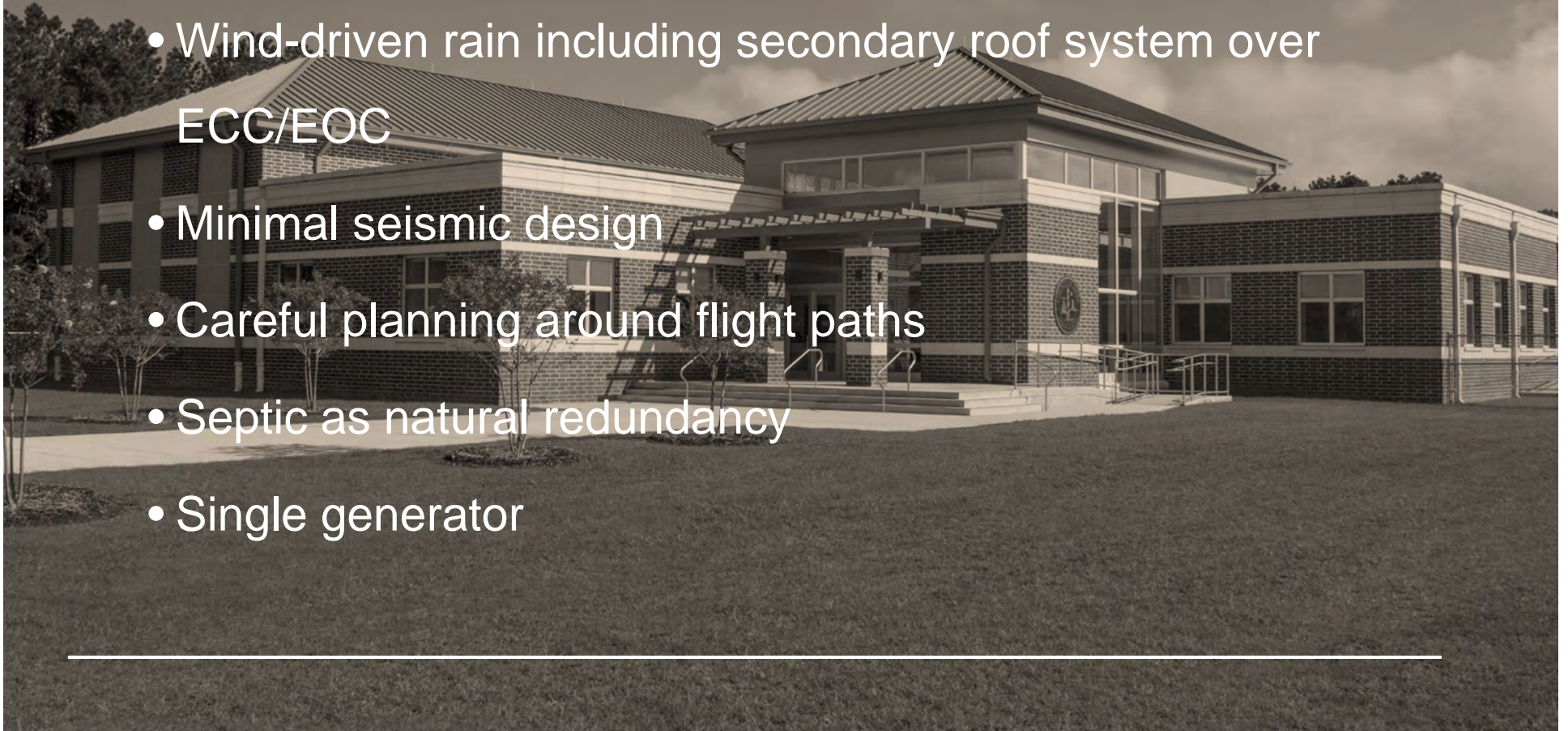




DARE COUNTY REGIONAL EMERGENCY SERVICES CENTER

System Highlights

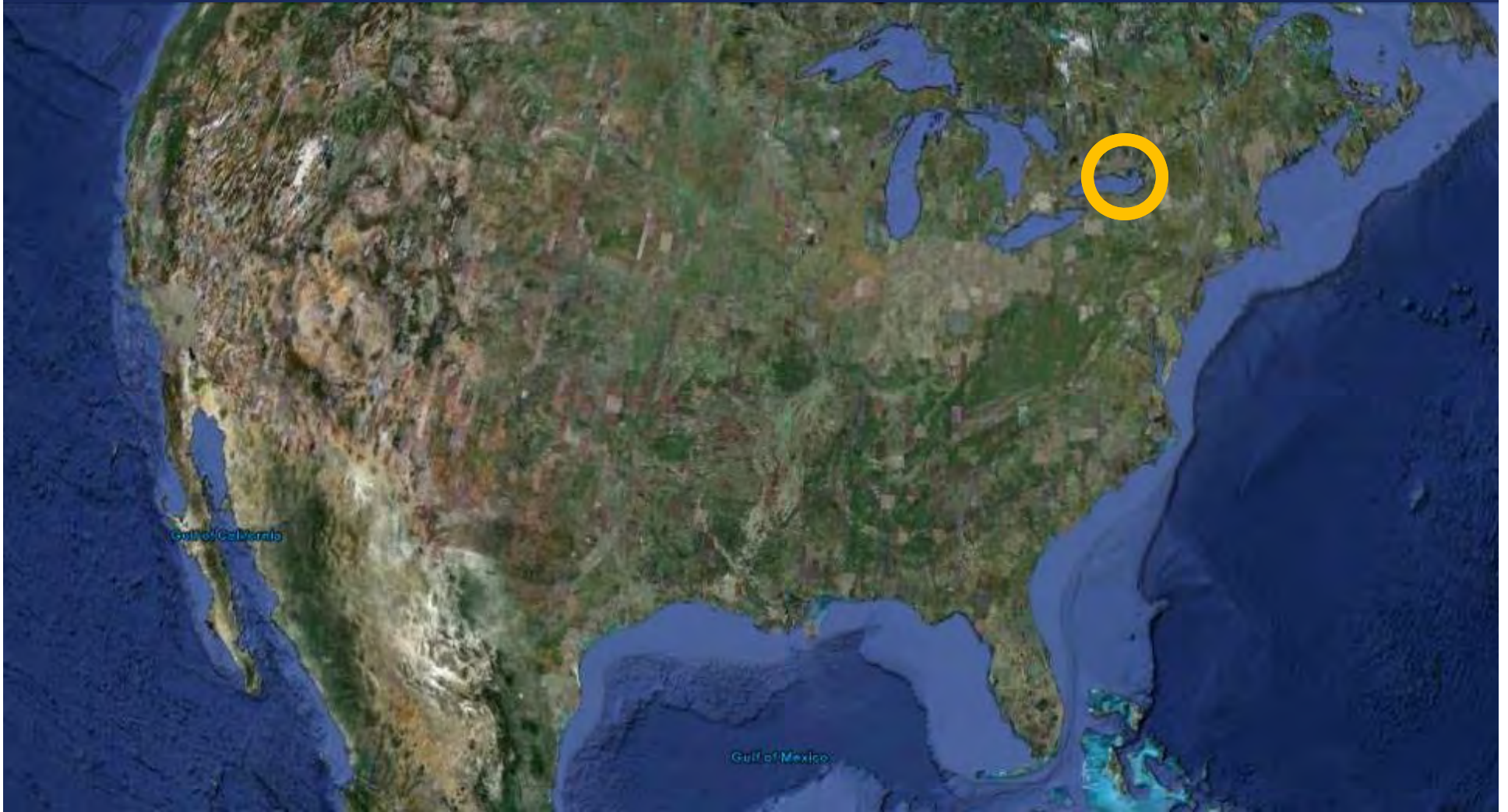
- 200 mph wind speed
- Wind-driven rain including secondary roof system over ECC/EOC
- Minimal seismic design
- Careful planning around flight paths
- Septic as natural redundancy
- Single generator



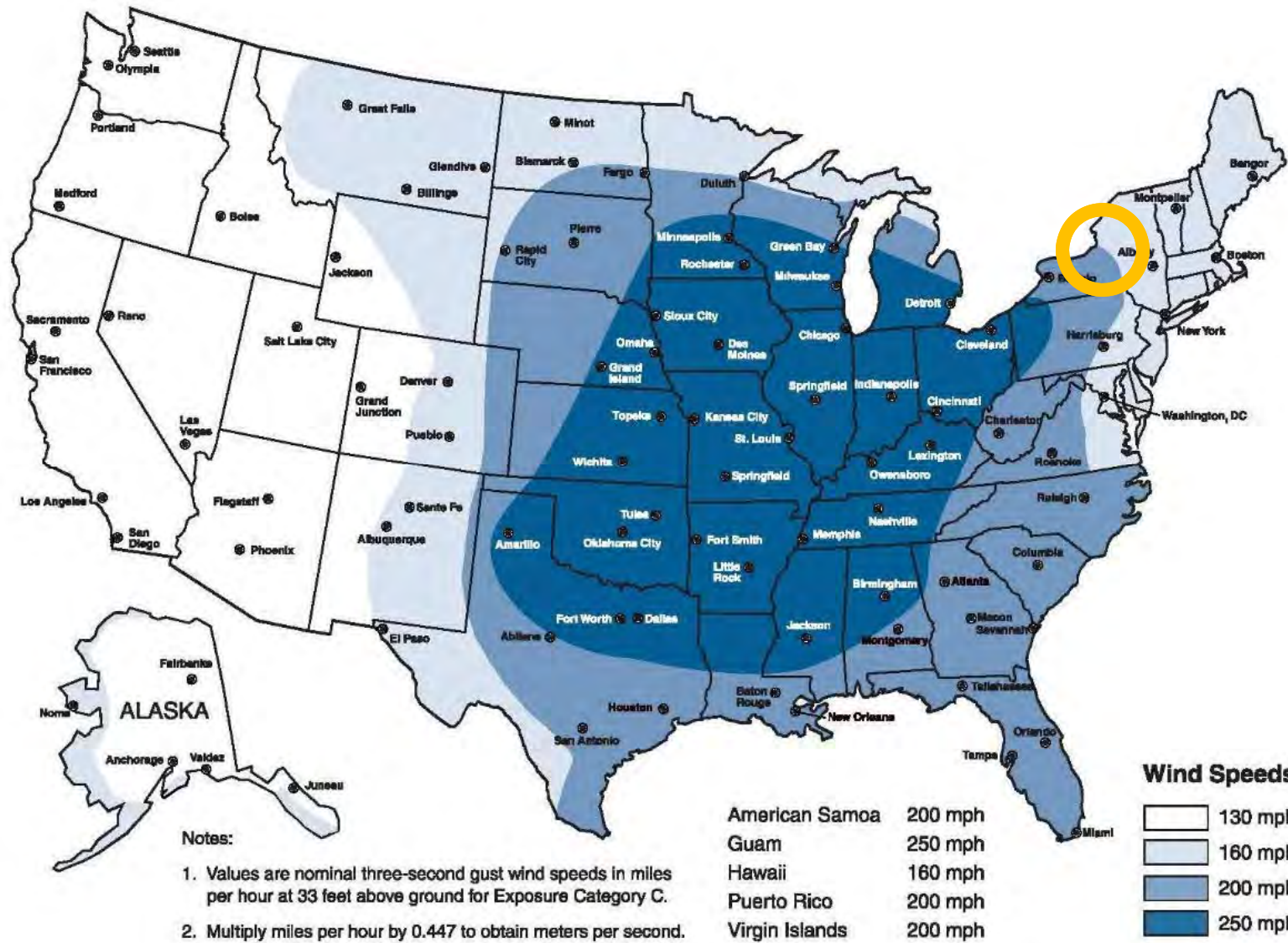


WAYNE COUNTY, NY
PSAP

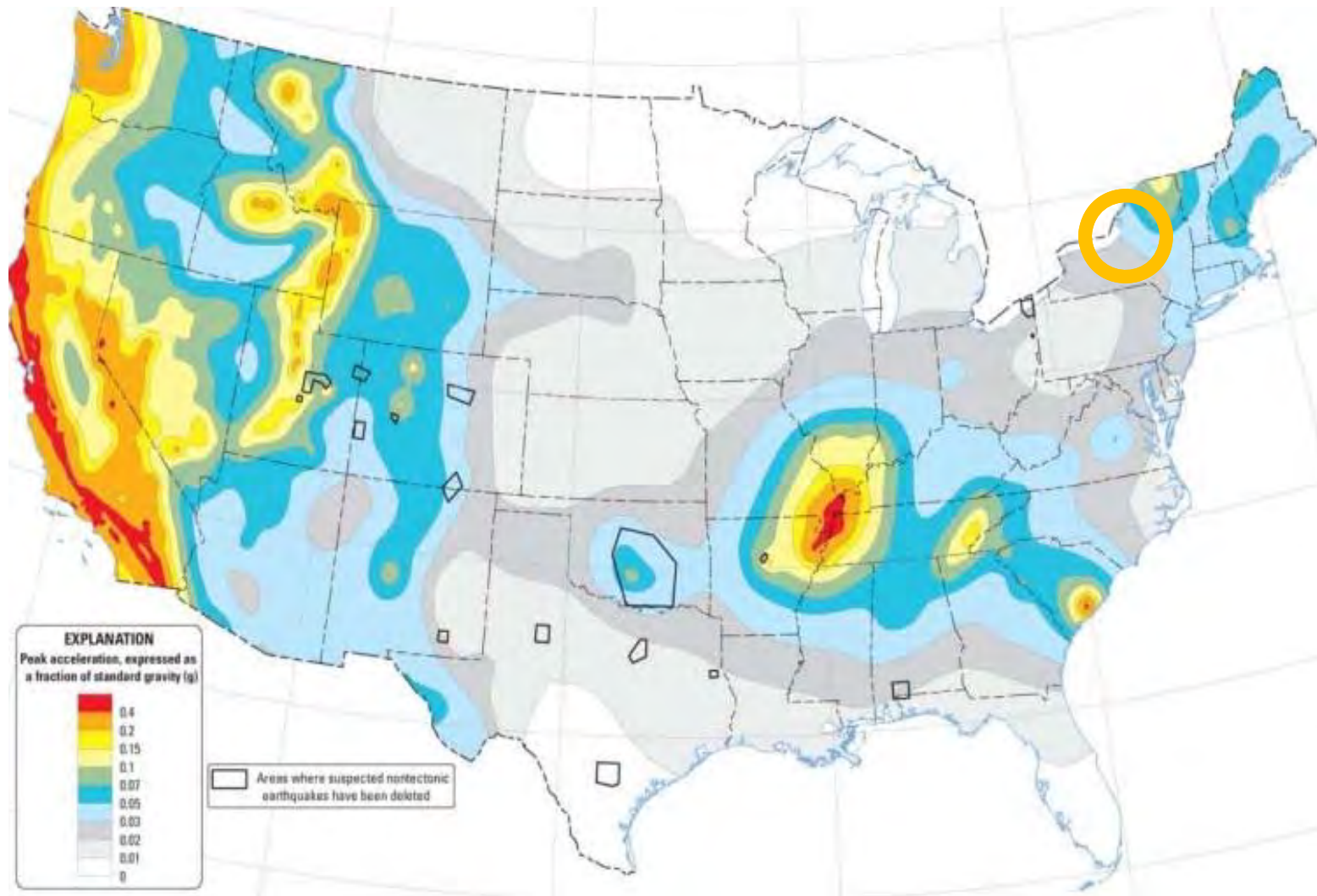
LOCATION MAP



MAXIMUM WIND GUST MAP



SEISMIC MAP













WAYNE COUNTY, NY
PSAP

System Highlights

- 200 mph wind speed – replaced all windows w/ ballistic and blast
 - High snow load design including replacement increase of structure over ECC
 - Seismic restraints of equipment
 - Serviced by the data center from below
 - Replaced HVAC units above to service this space only
-

A black and white photograph of a modern, multi-story brick building with large windows. The building features a prominent entrance with a covered walkway supported by brick pillars. The text "1910 ELBERTON AVENUE" is visible on the building's facade. The sky is clear and bright.

COMMONWEALTH OF PENNSYLVANIA PENNSYLVANIA EMERGENCY MANAGEMENT AGENCY

Harrisburg, Pennsylvania

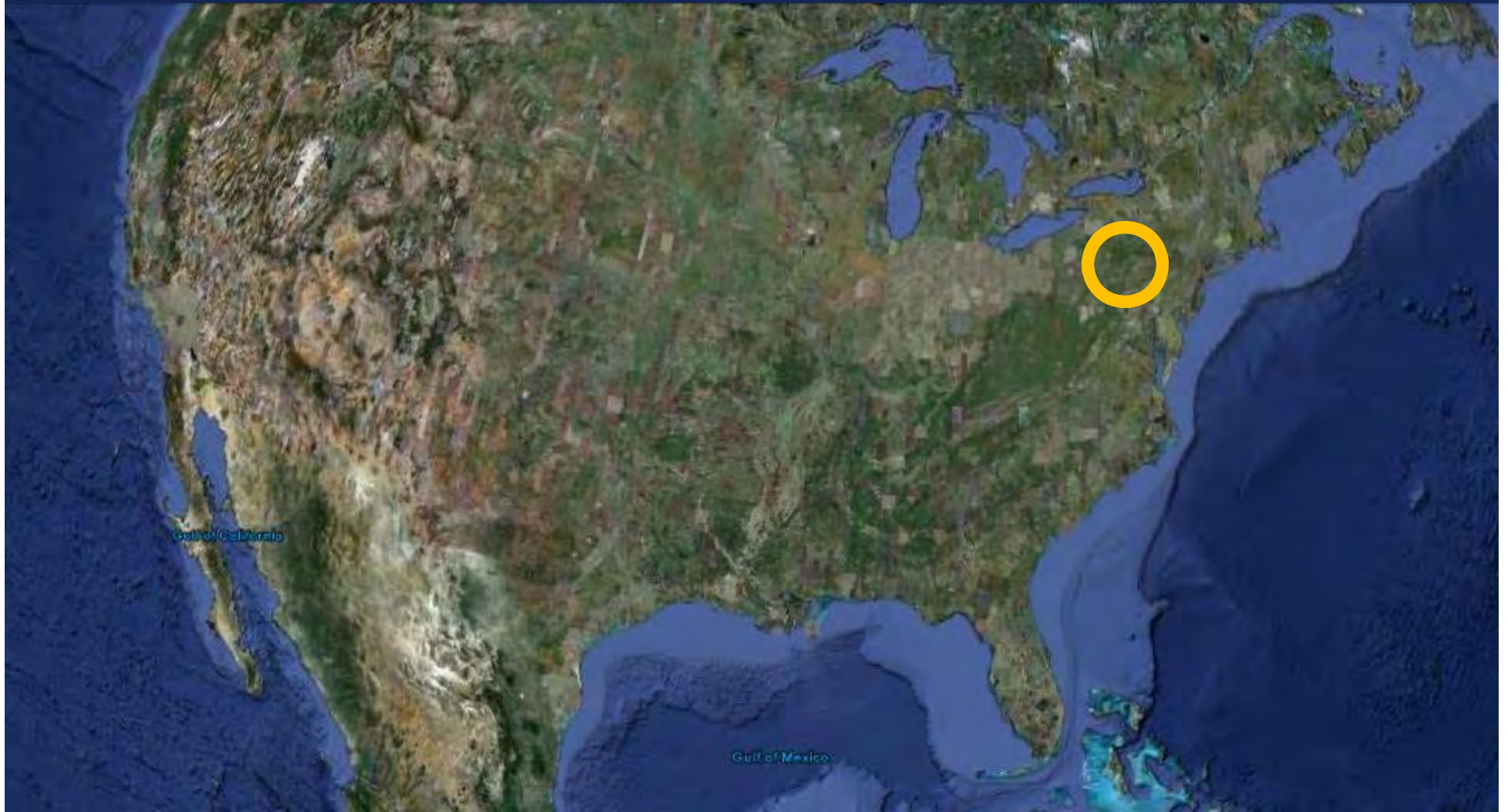
The New York Times

NEW YORK, WEDNESDAY, SEPTEMBER 11, 1991

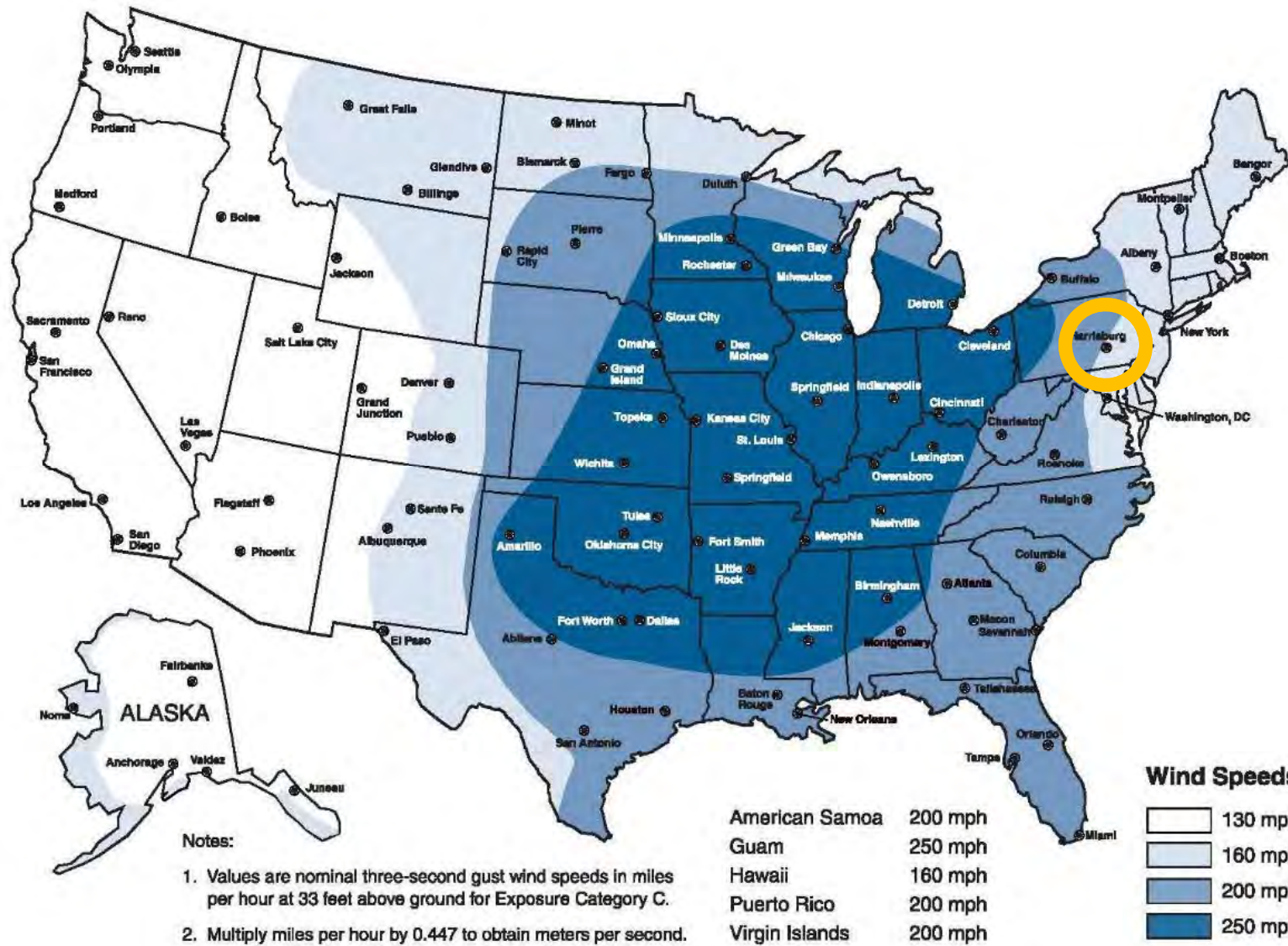
8 CENTS

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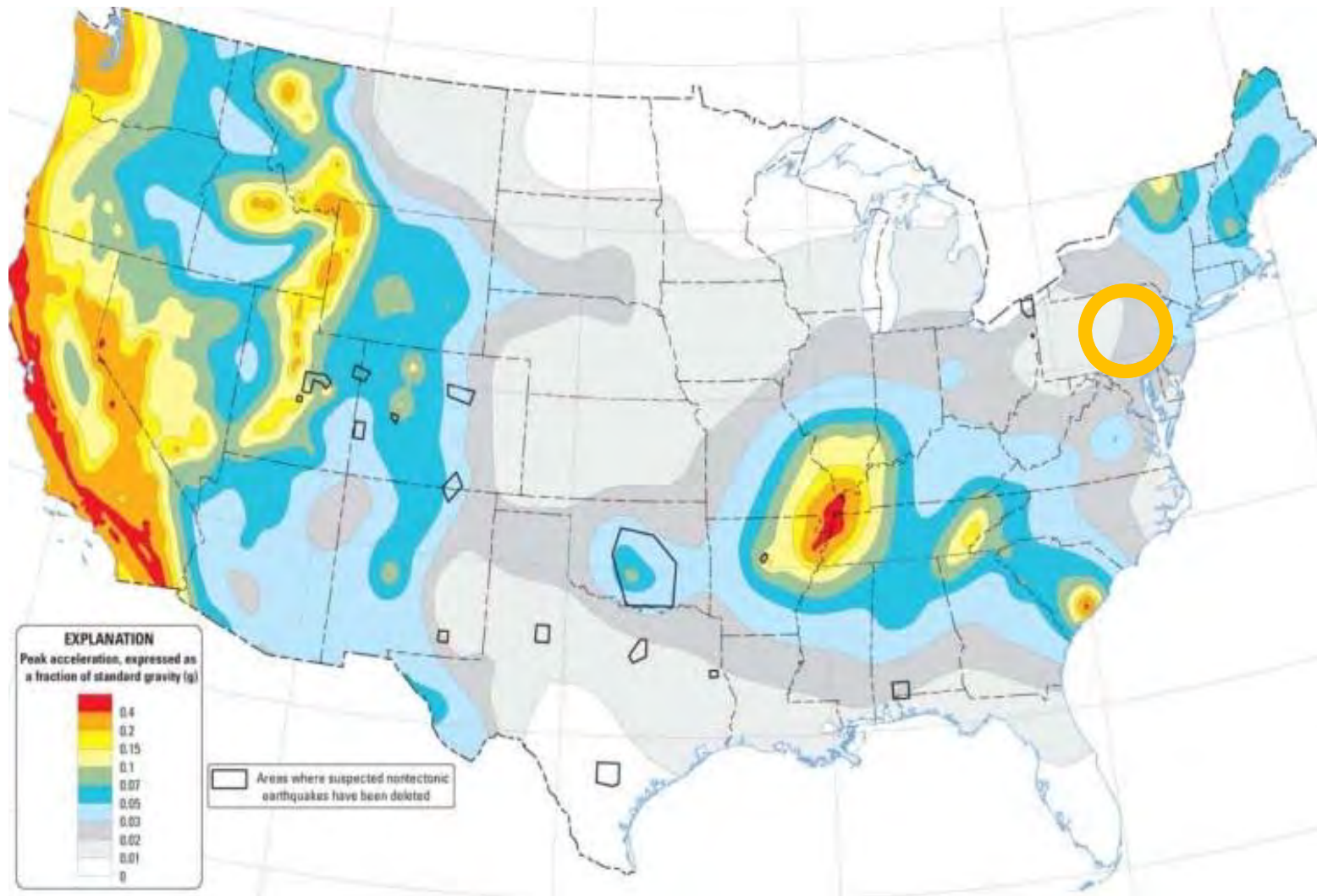
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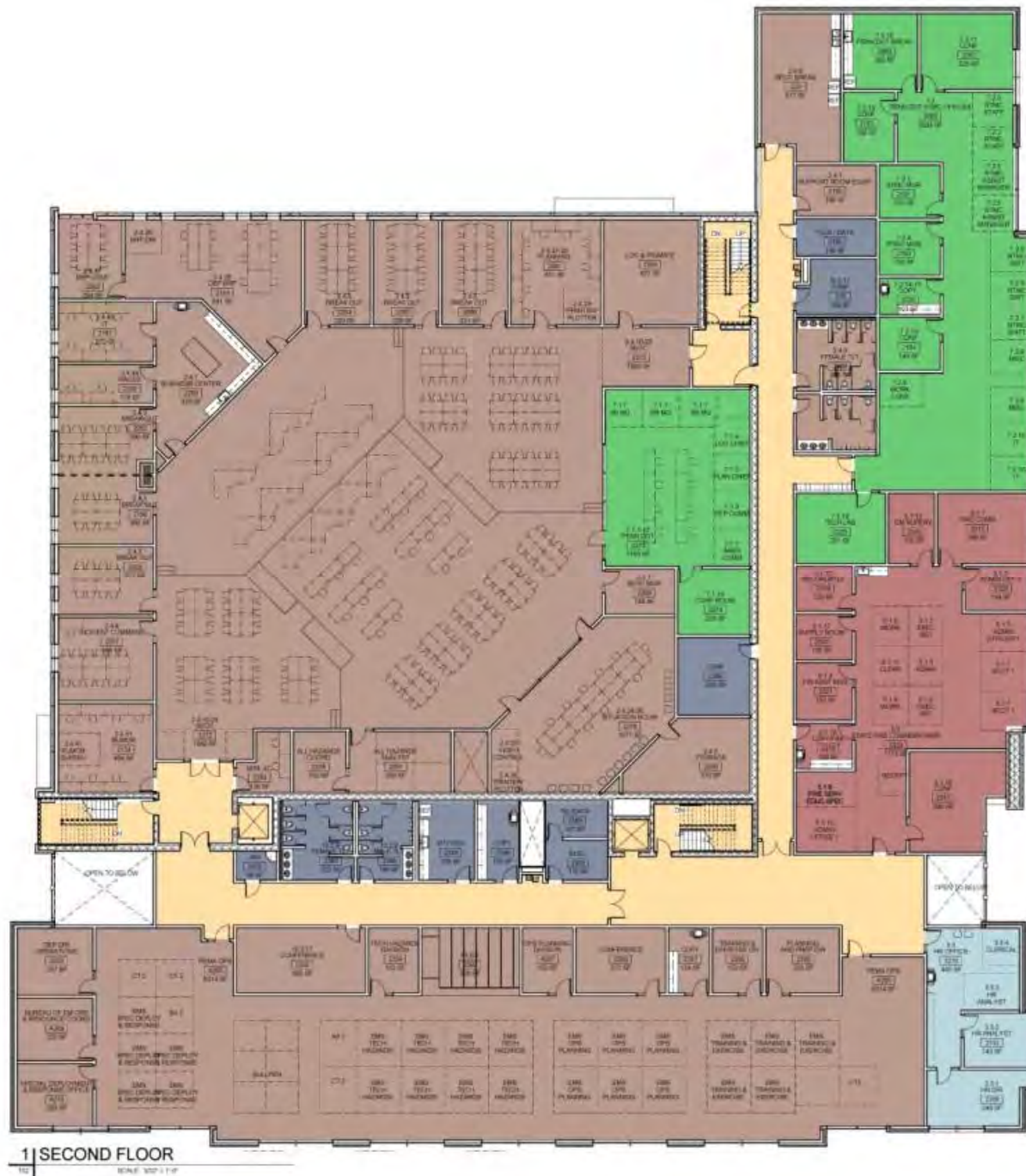
MAXIMUM WIND GUST MAP



SEISMIC MAP

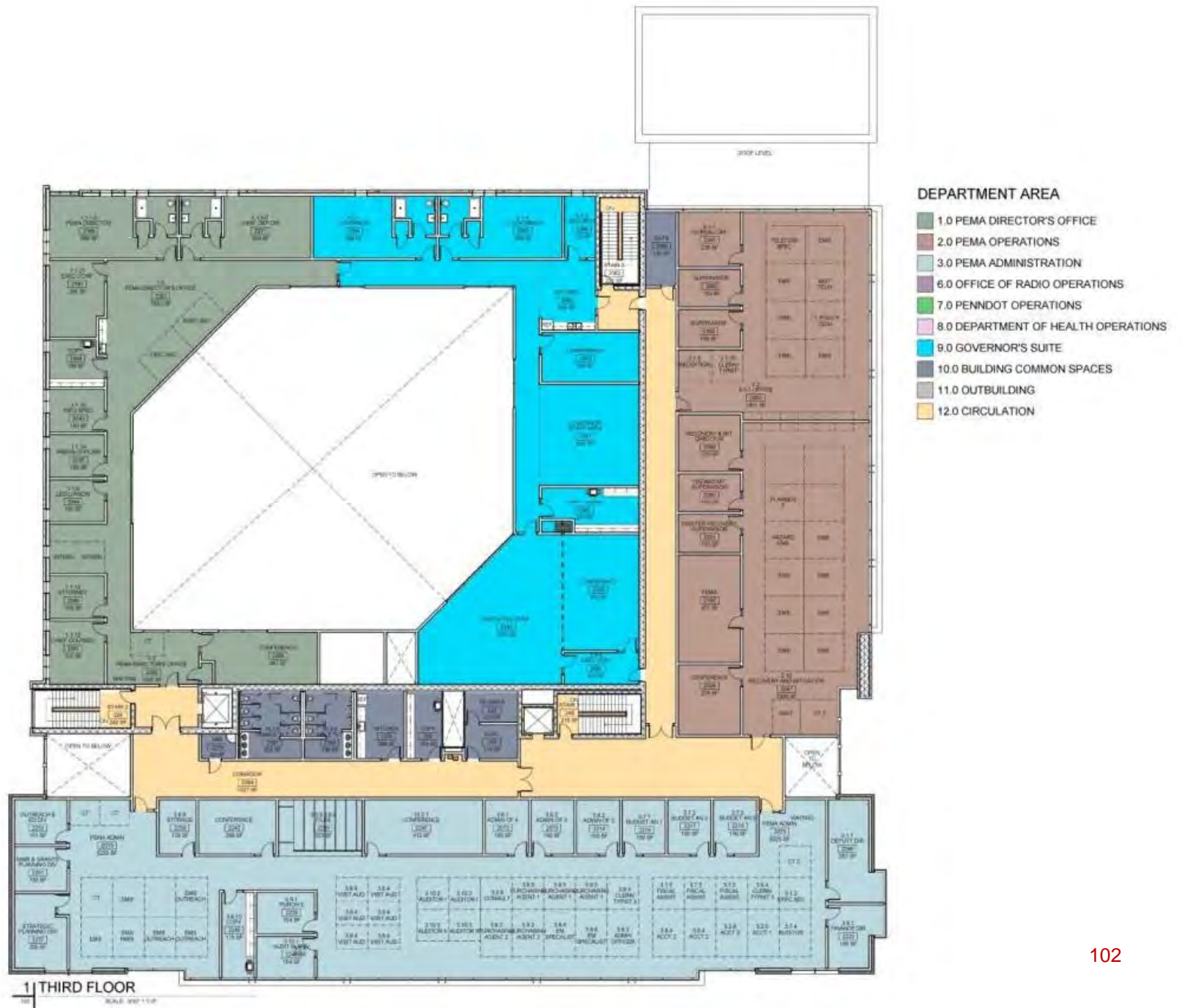






DEPARTMENT AREA

- 1.0 PEMA DIRECTOR'S OFFICE
- 2.0 PEMA OPERATIONS
- 3.0 PEMA ADMINISTRATION
- 4.0 HOMELAND SECURITY
- 5.0 OFFICE OF THE STATE FIRE COMMISSIONER
- 6.0 OFFICE OF RADIO OPERATIONS
- 7.0 PENNDOT OPERATIONS
- 8.0 DEPARTMENT OF HEALTH OPERATIONS
- 9.0 GOVERNOR'S SUITE
- 10.0 BUILDING COMMON SPACES
- 11.0 OUTBUILDING
- 12.0 CIRCULATION

















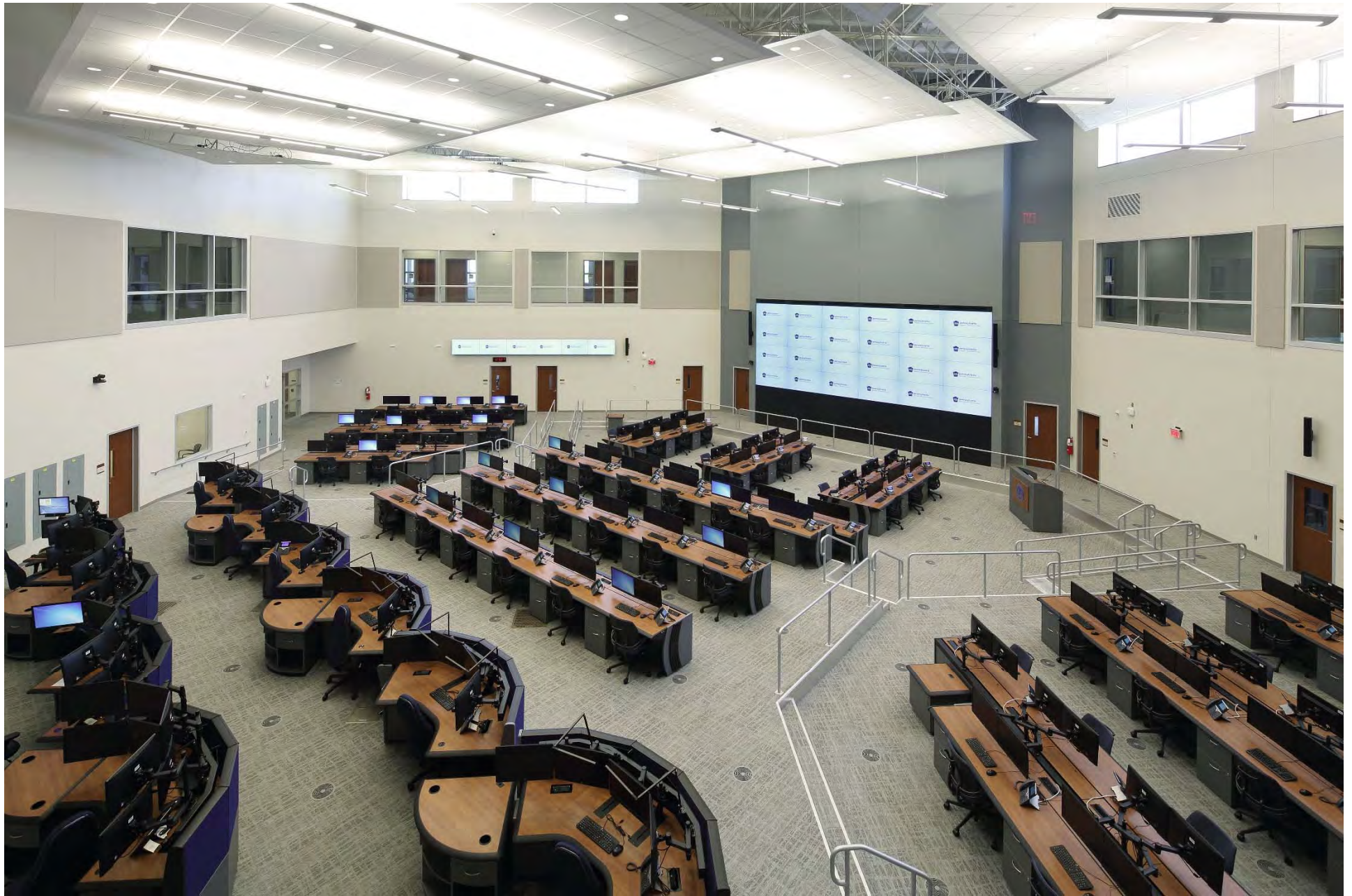




















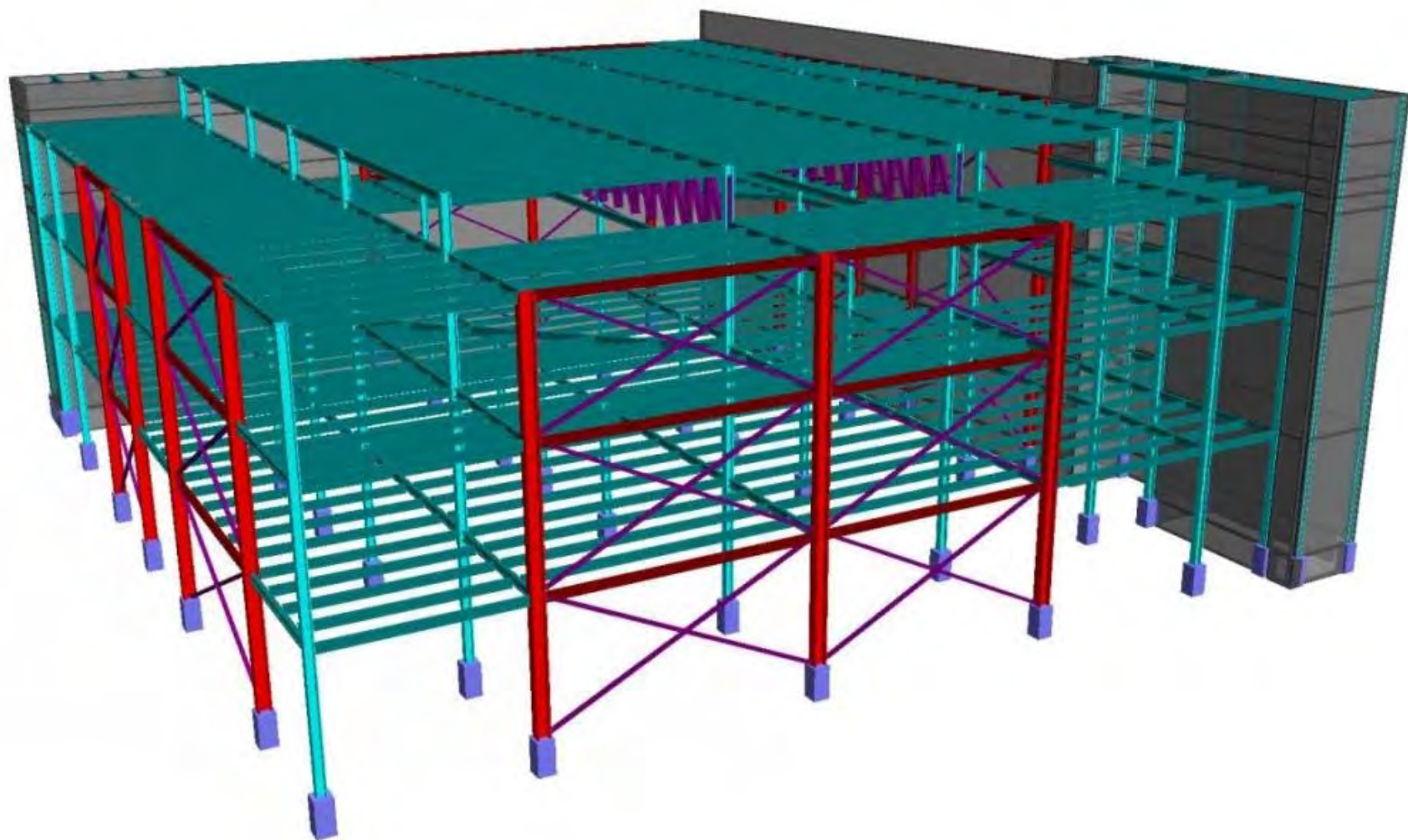


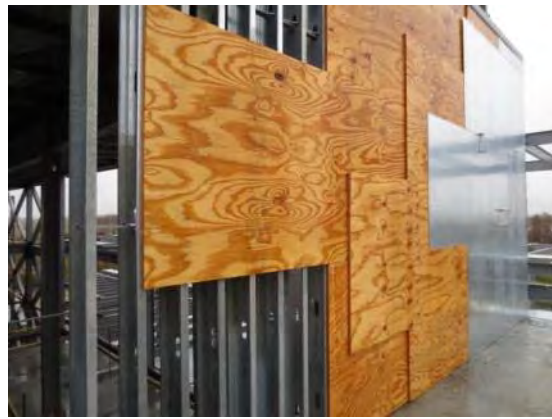






SCHBADERGROUP architecture







COMMONWEALTH OF PENNSYLVANIA – PEMA

Harrisburg, Pennsylvania

System Highlights

- 200 mph wind speed – two levels of window system design
- Hardened building within a hardened building
- Seismic restraints of equipment
- Serviced by the data center from below
- Dual Generators

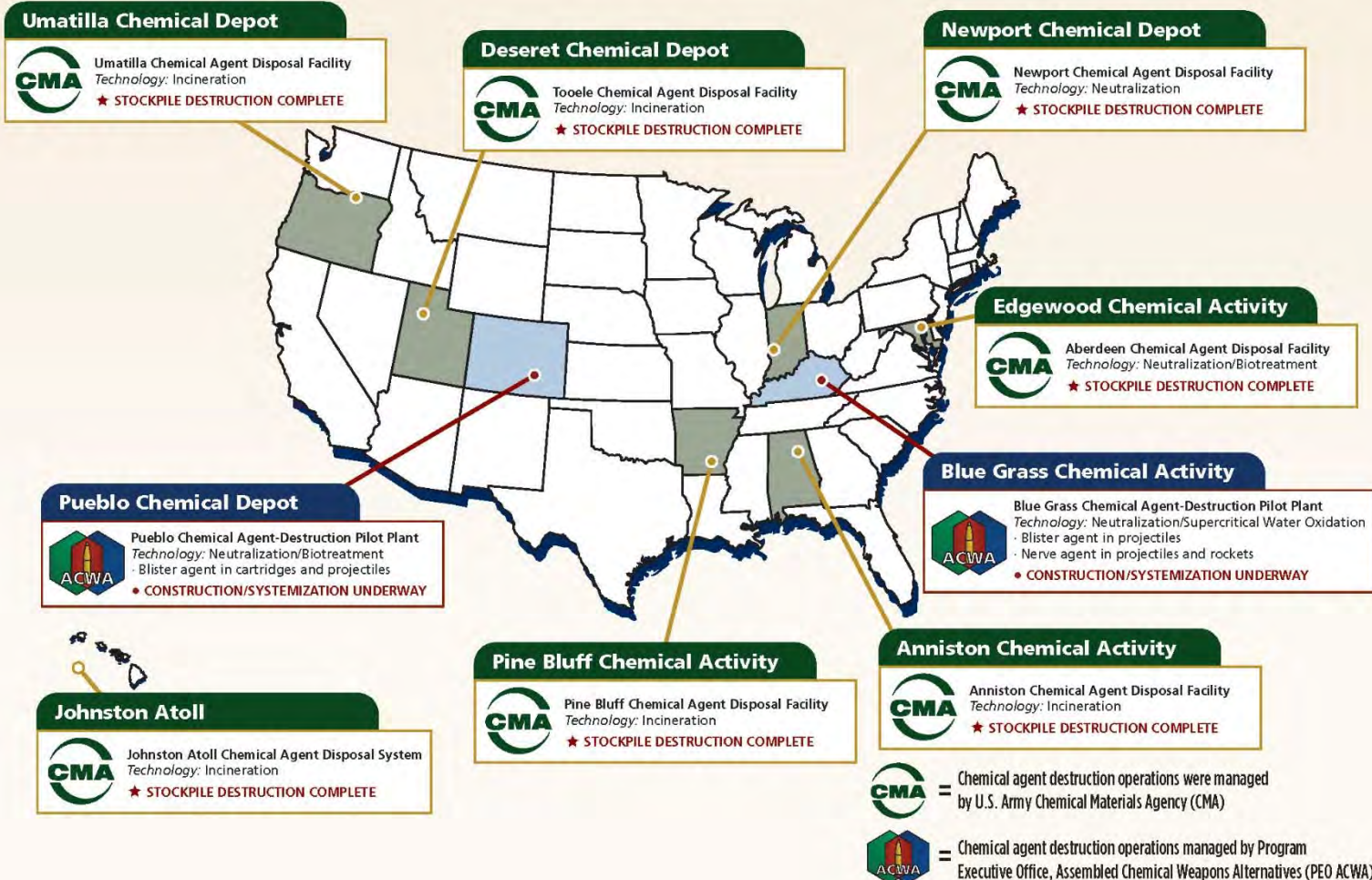


PUEBLO COUNTY EMERGENCY SERVICES CENTER

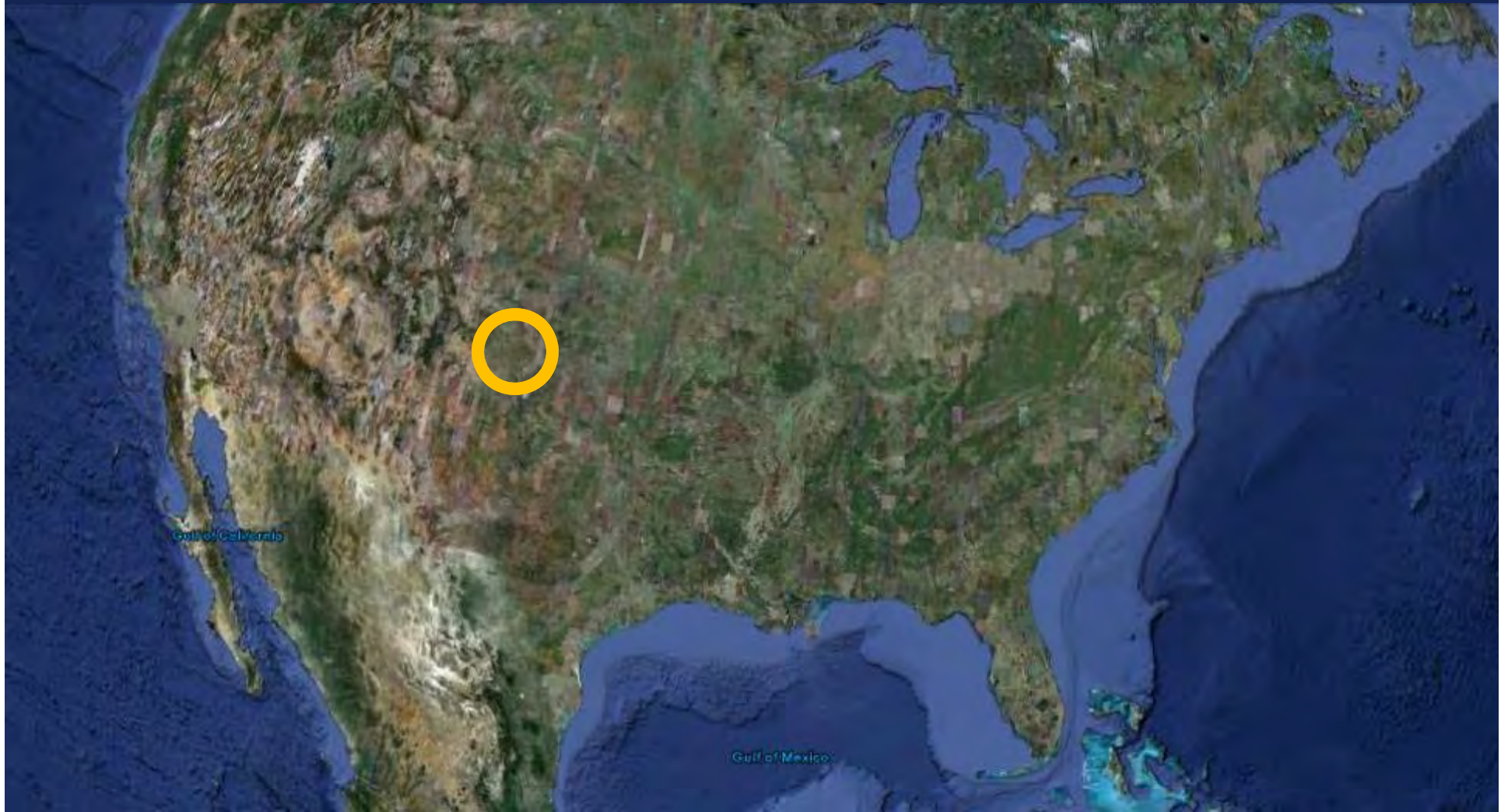
Pueblo, Colorado



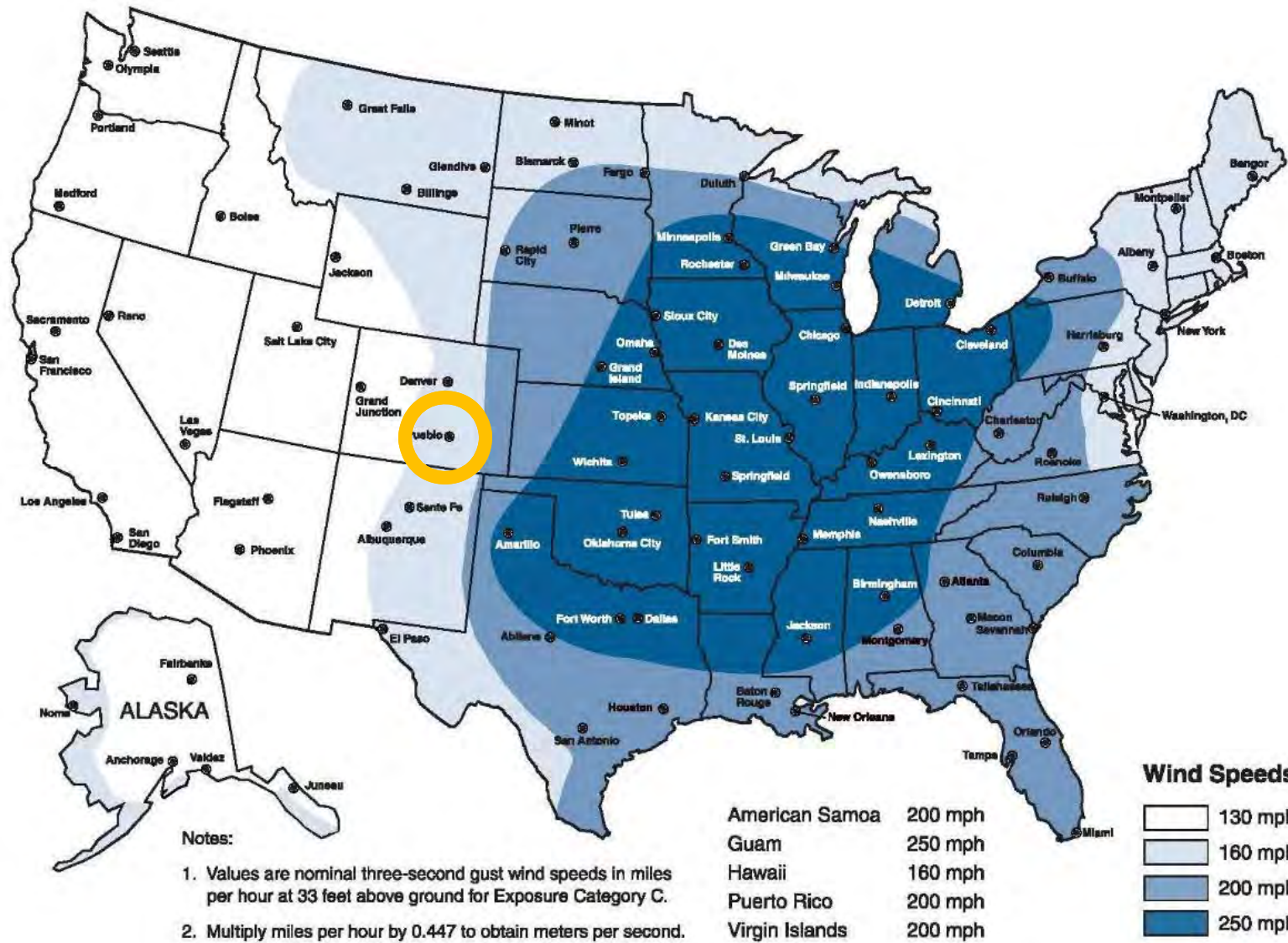
U.S. Chemical Stockpile Demilitarization Map



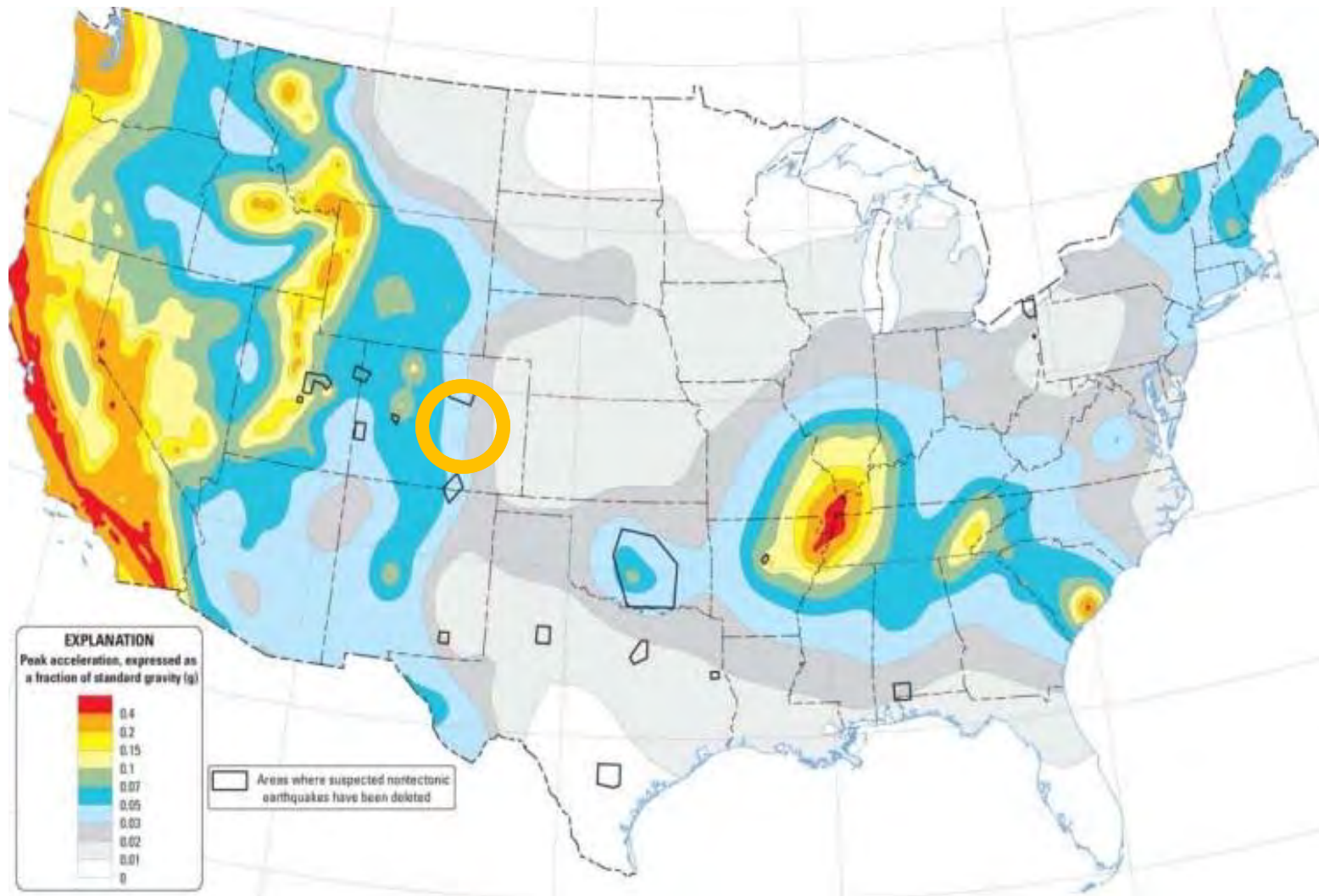
LOCATION MAP



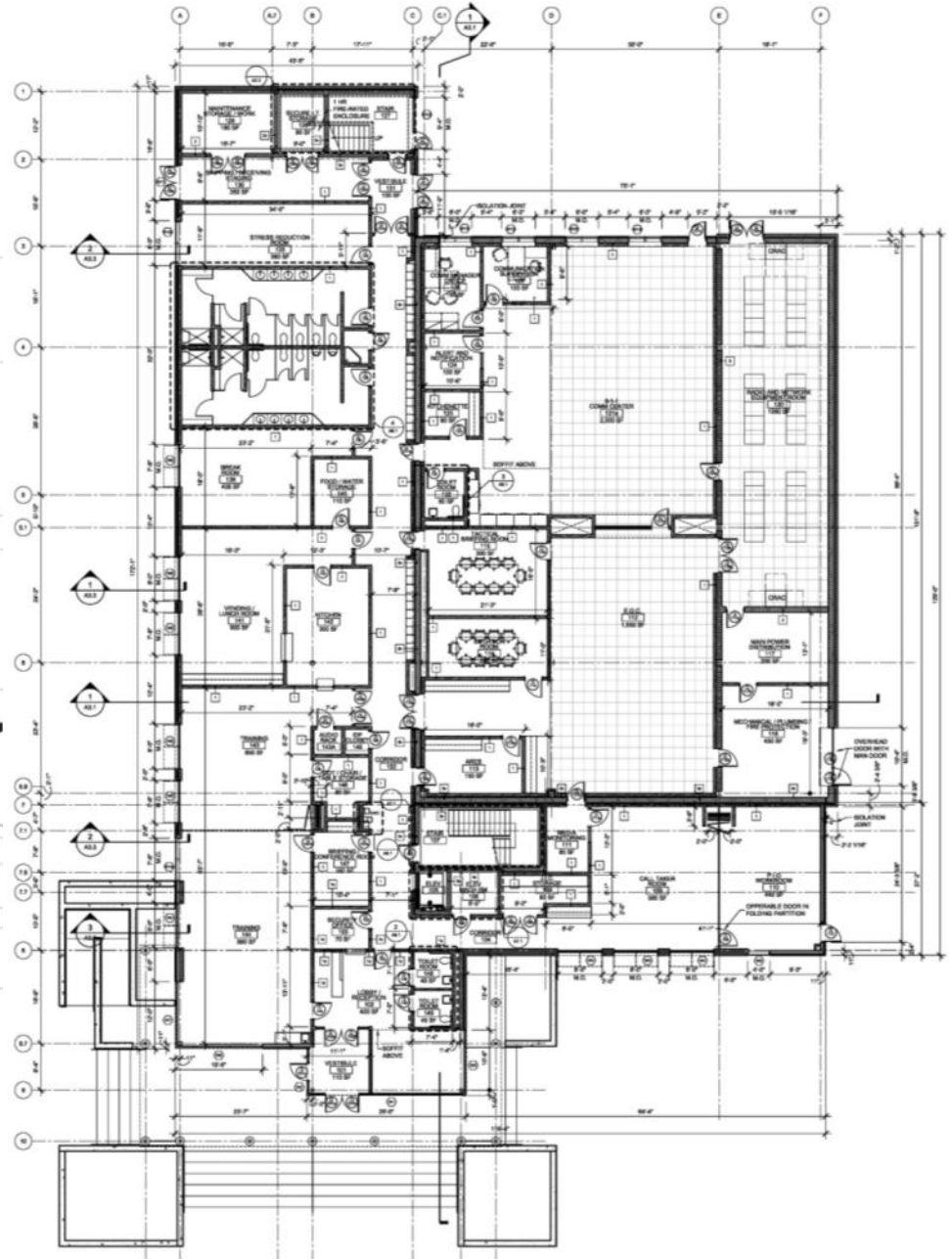
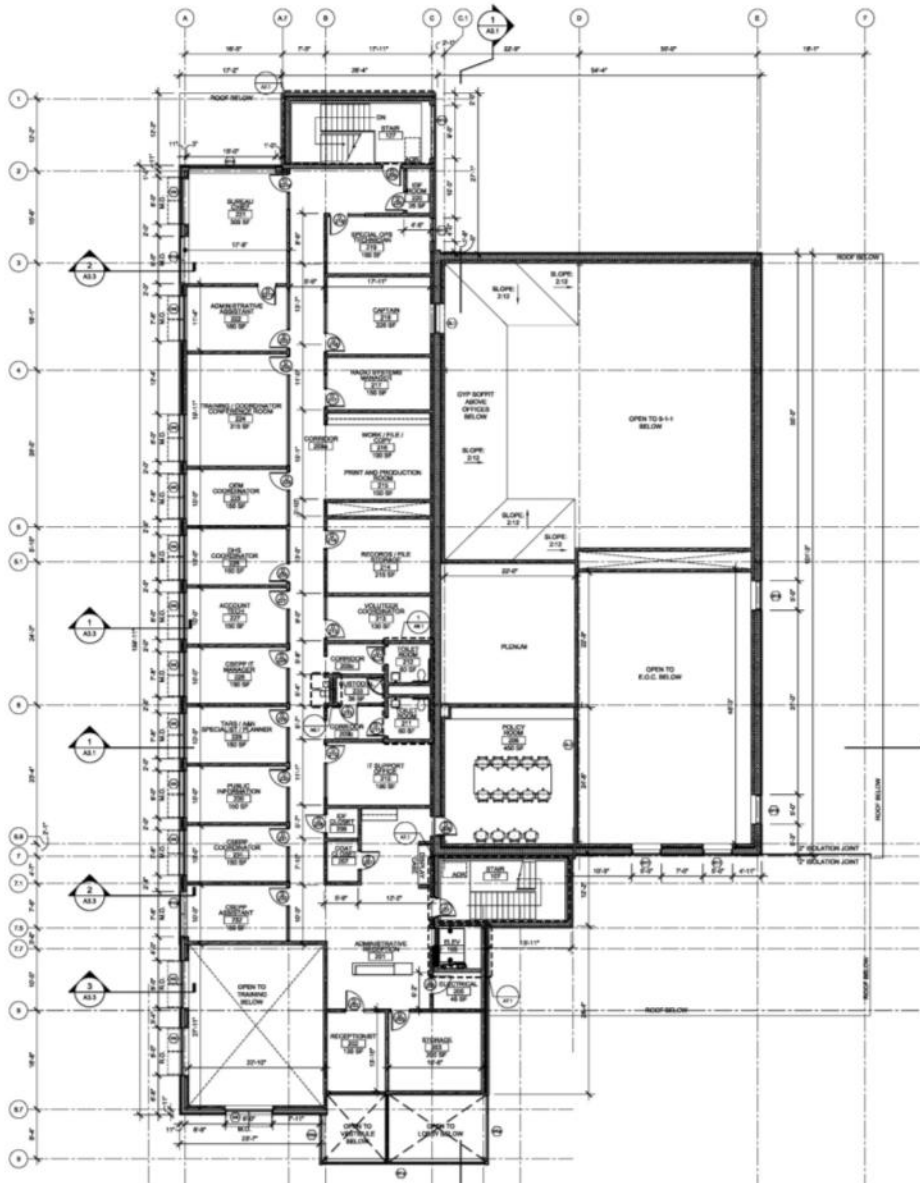
MAXIMUM WIND GUST MAP



SEISMIC MAP























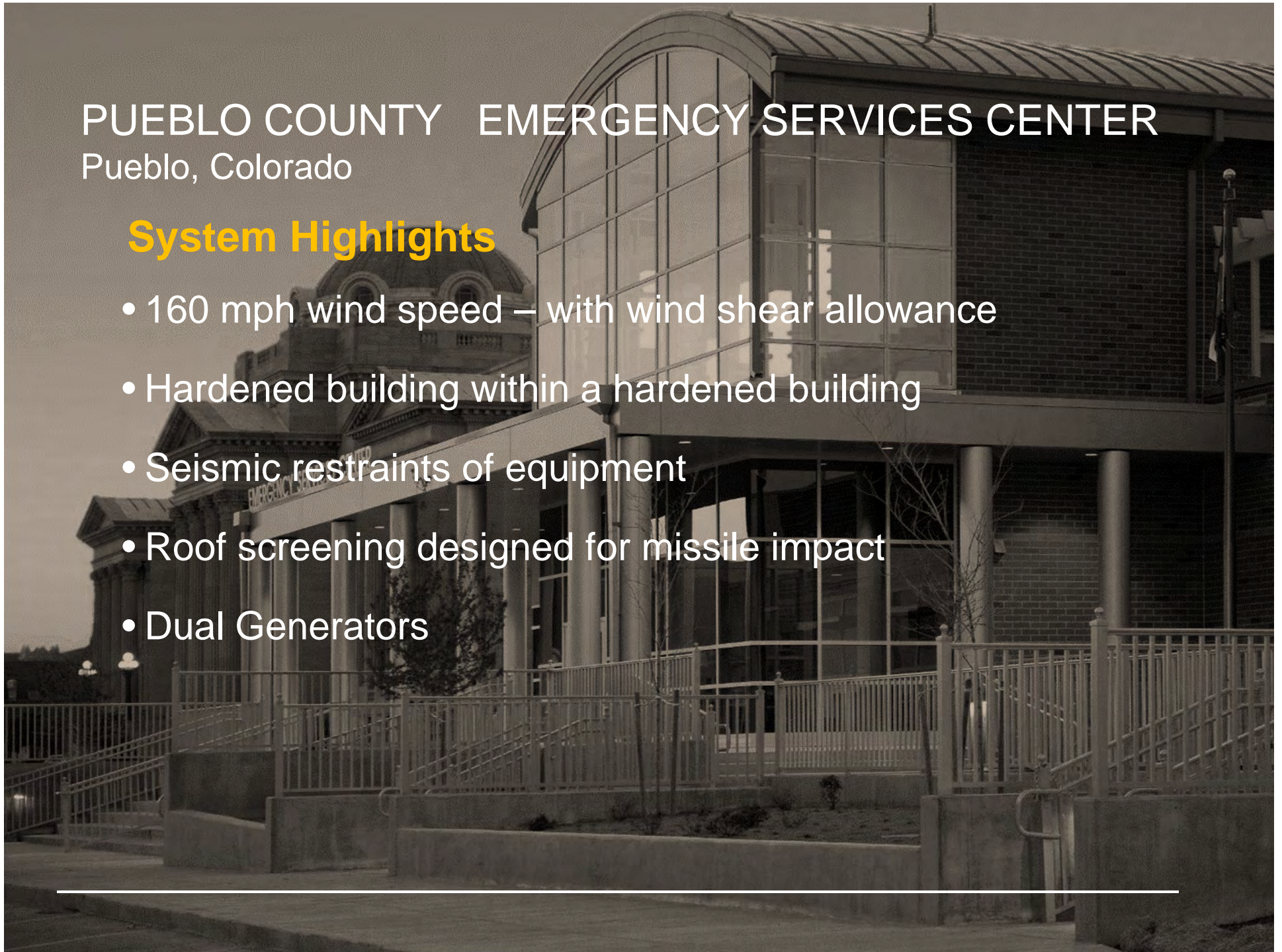


PUEBLO COUNTY EMERGENCY SERVICES CENTER

Pueblo, Colorado

System Highlights

- 160 mph wind speed – with wind shear allowance
- Hardened building within a hardened building
- Seismic restraints of equipment
- Roof screening designed for missile impact
- Dual Generators

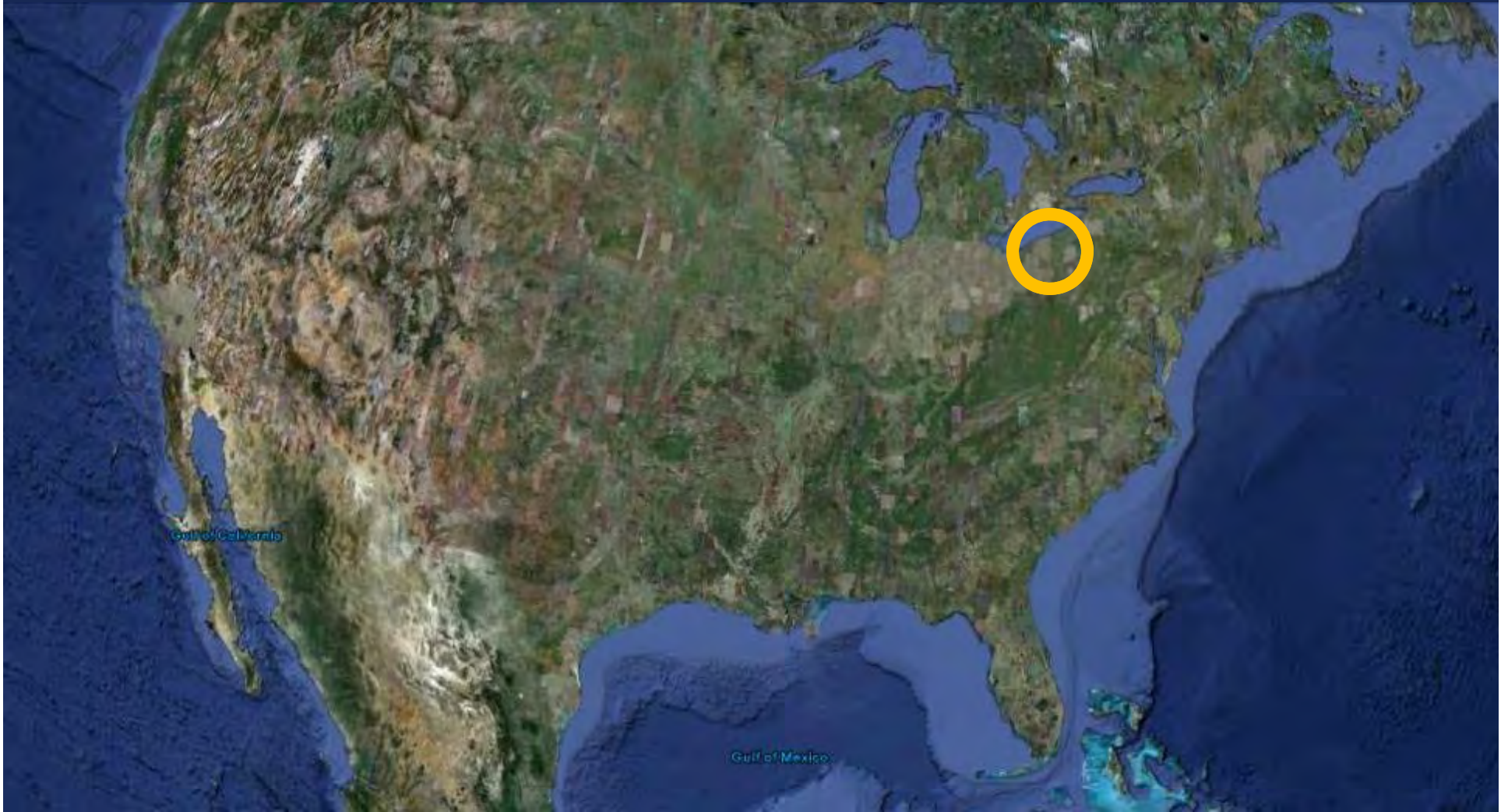


ARMSTRONG COUNTY EMERGENCY SERVICES CENTER

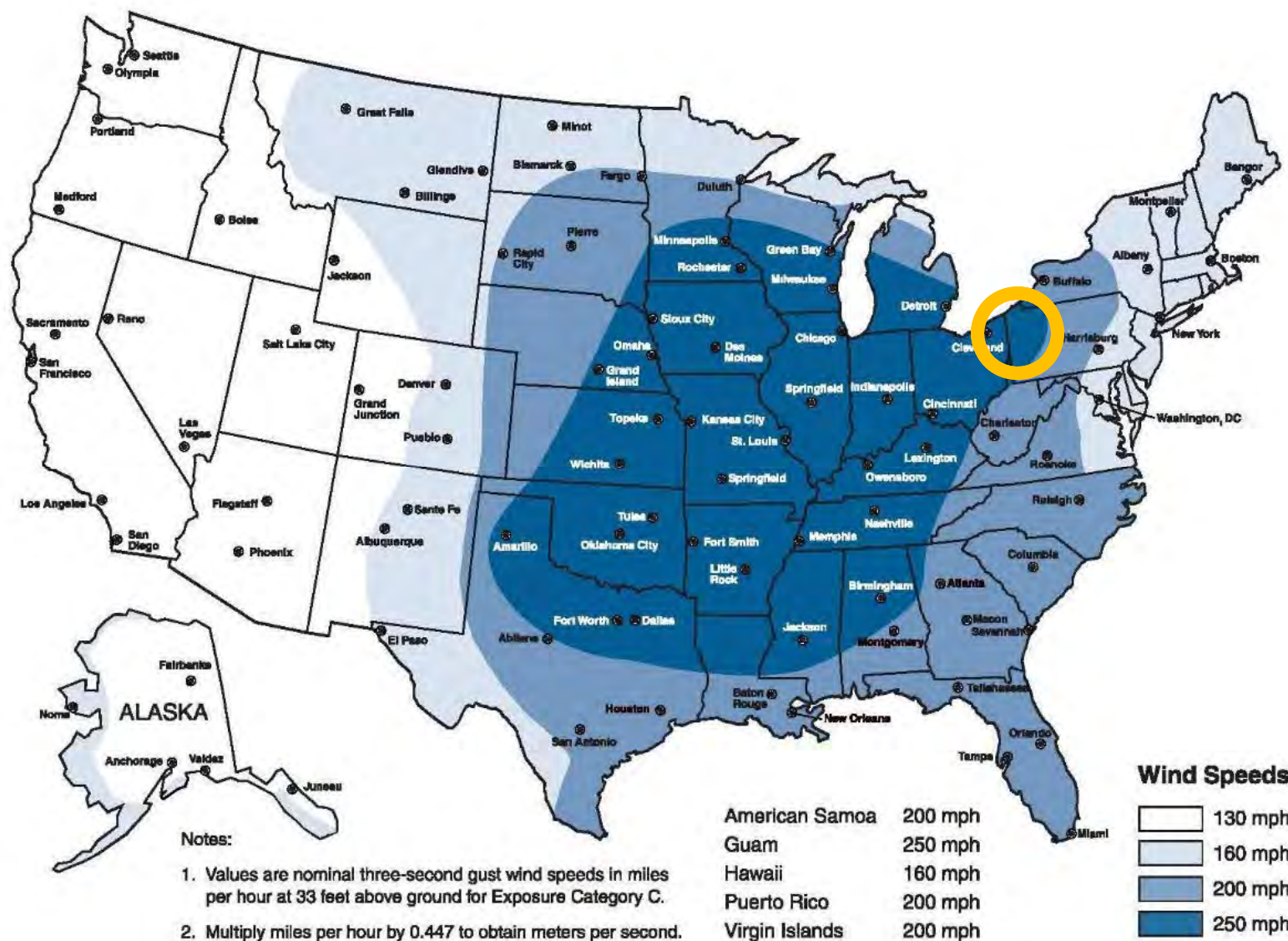
Kittanning, Pennsylvania



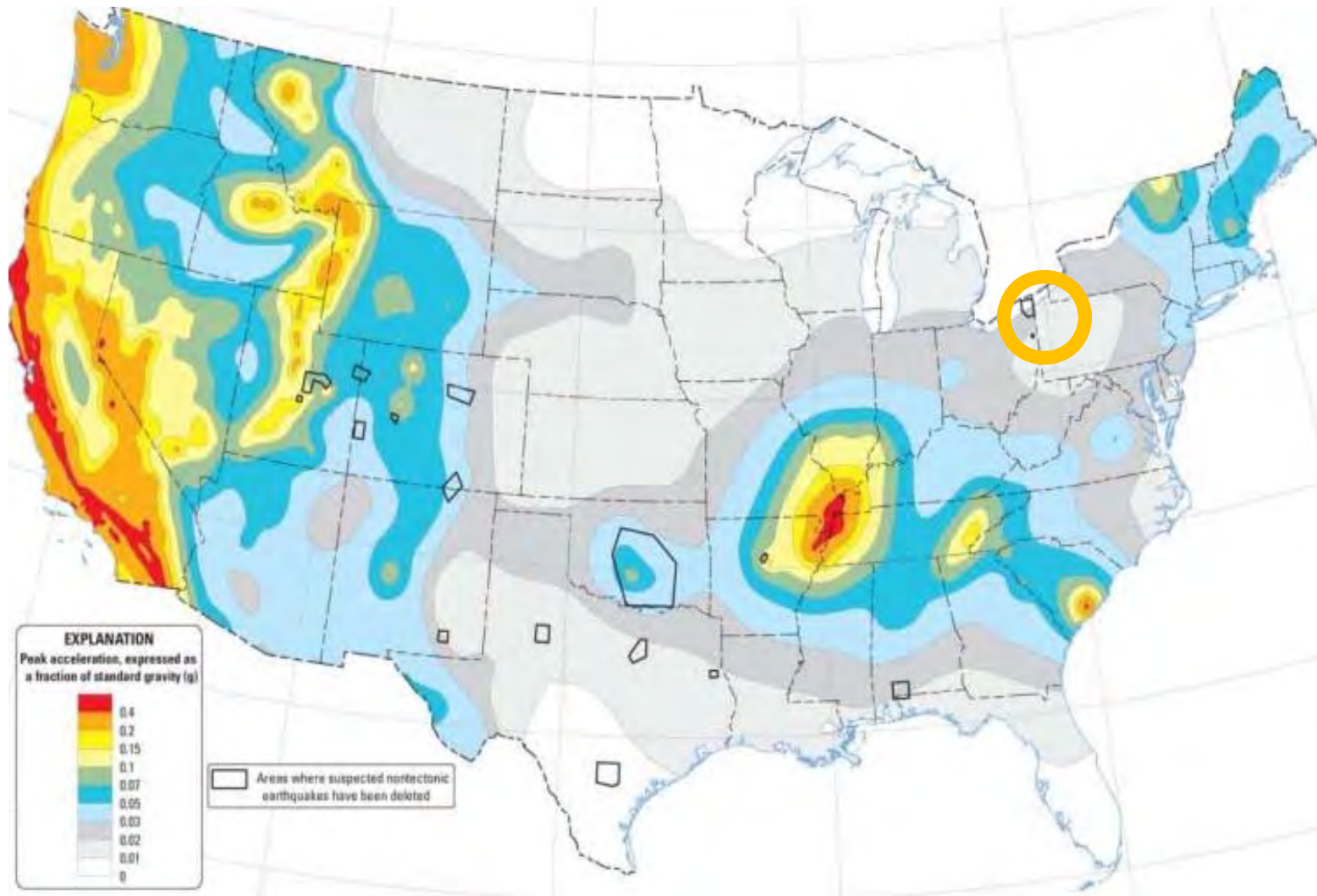
LOCATION MAP

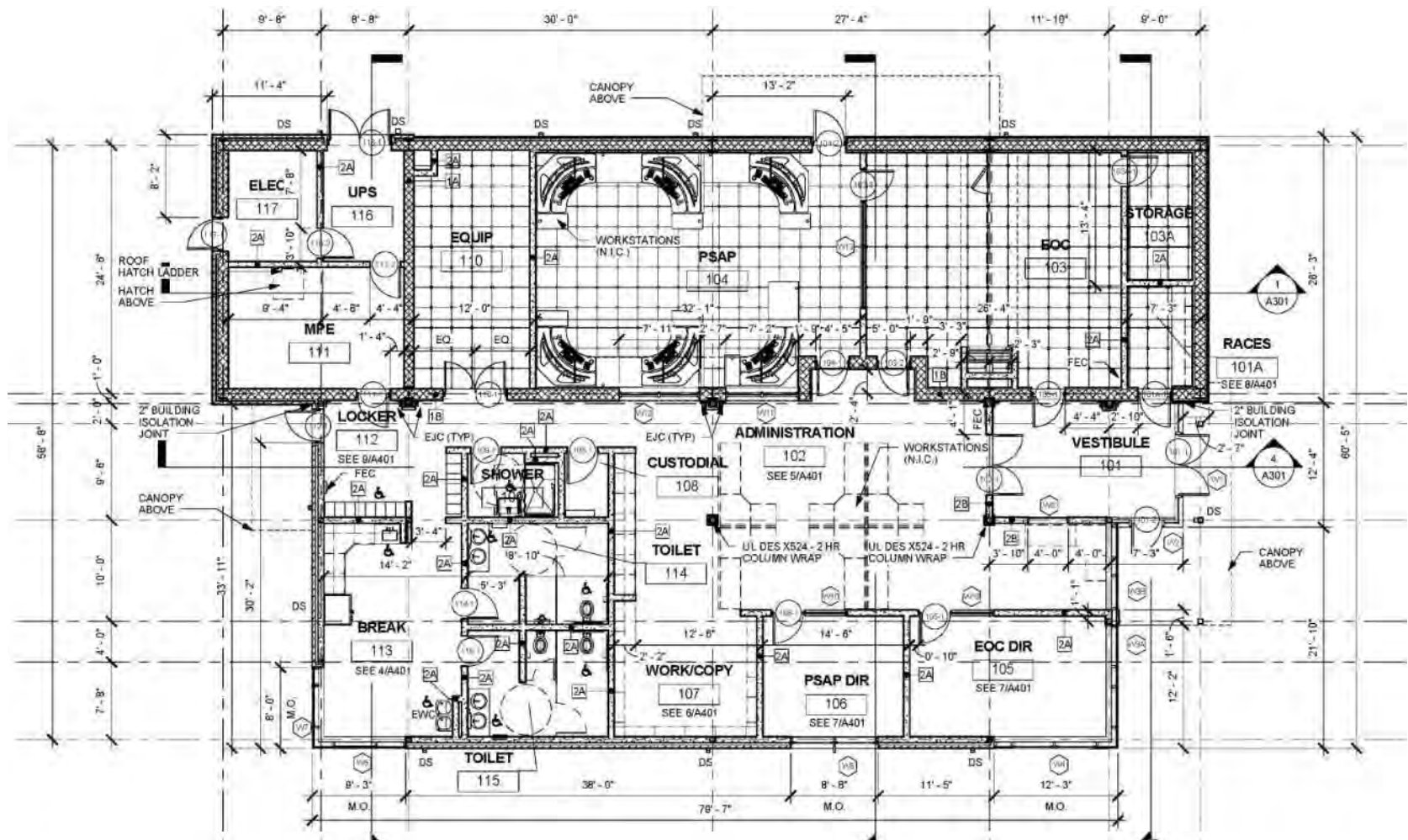


MAXIMUM WIND GUST MAP



SEISMIC MAP



















ARMSTRONG COUNTY EMERGENCY SERVICES CENTER

Kittanning, Pennsylvania

System Highlights

- 200 mph wind speed – tornado – missile impact glazing
- No significant seismic design
- High snow load roof design
- Masonry hardened shell
- Single generator



ORLEANS PARISH EMERGENCY SERVICES CENTER

New Orleans, Louisiana

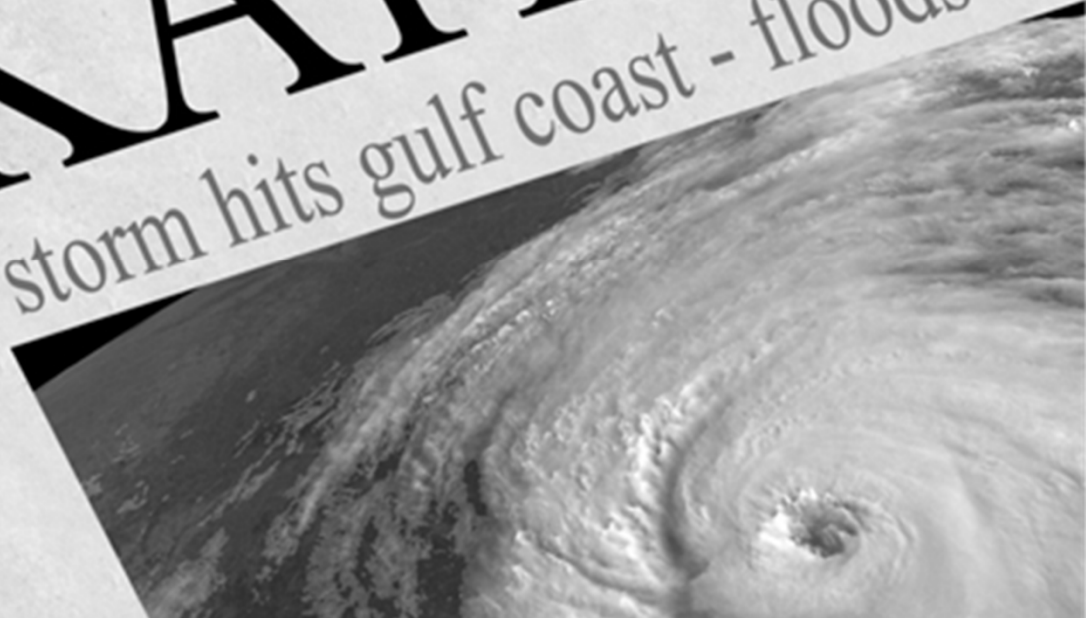


WEATHER

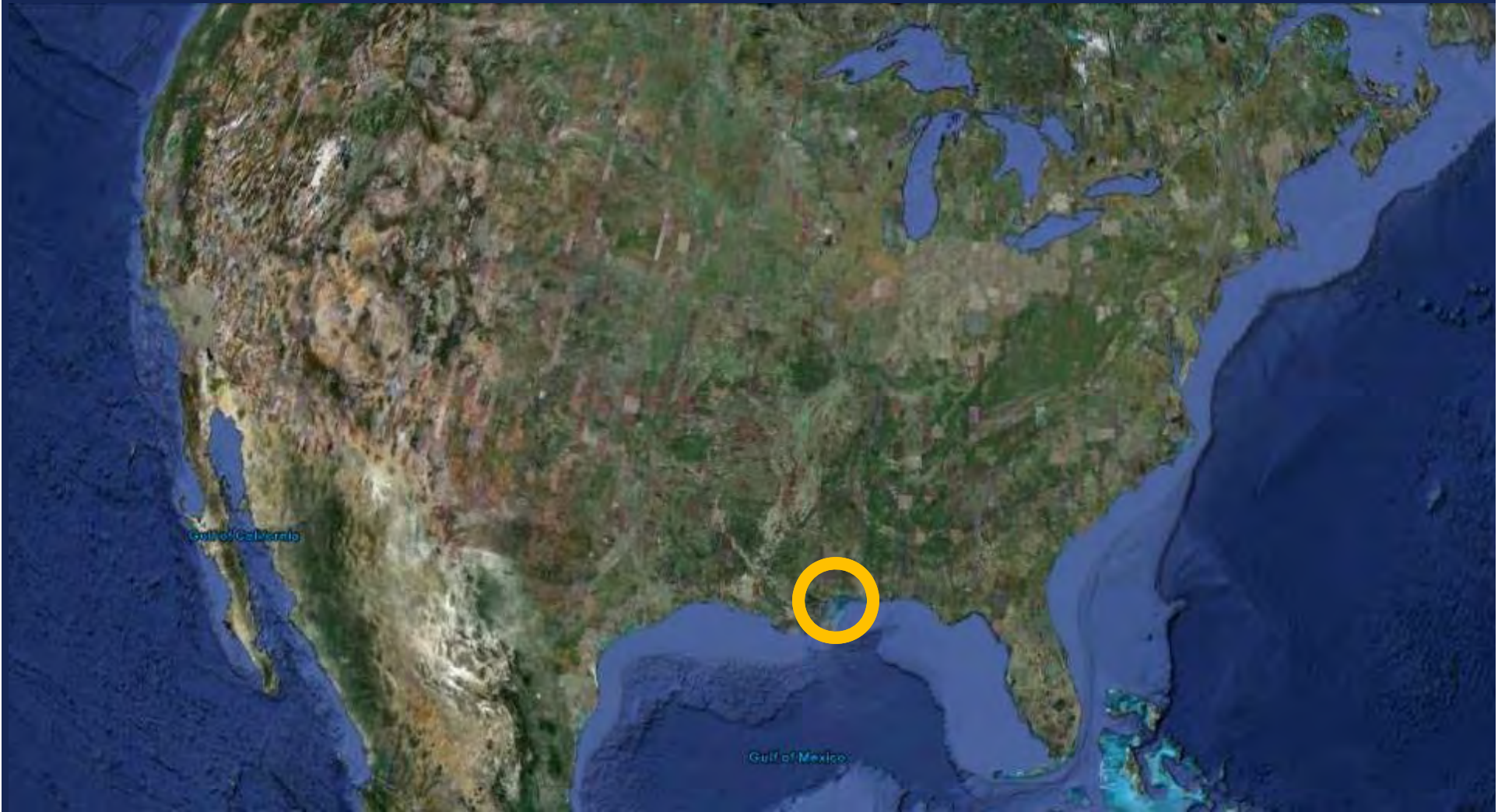
Monday August 29th, 2005 - Late Edition

HURRICANE KATRINA

Perfect storm hits gulf coast - floods New



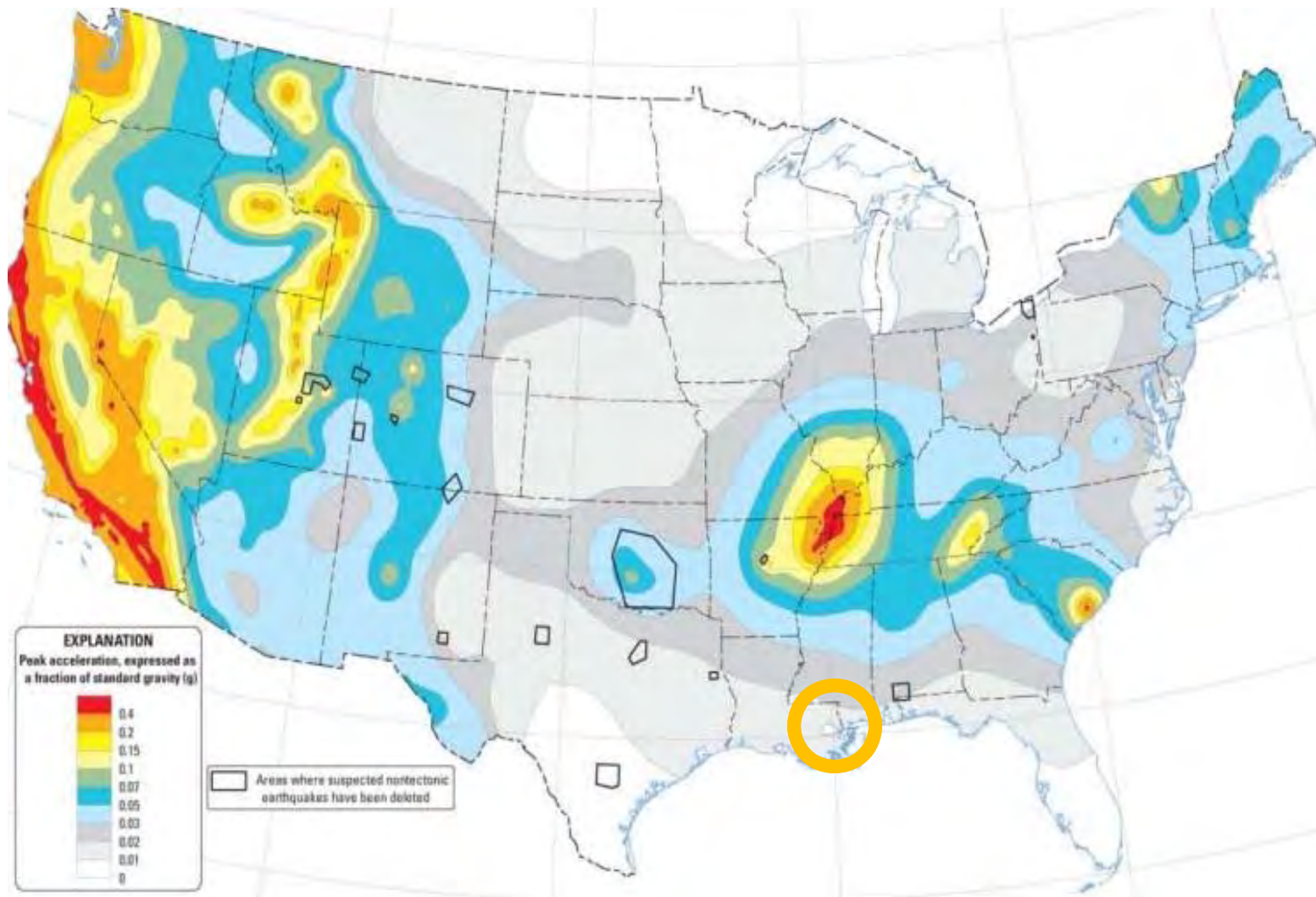
LOCATION MAP



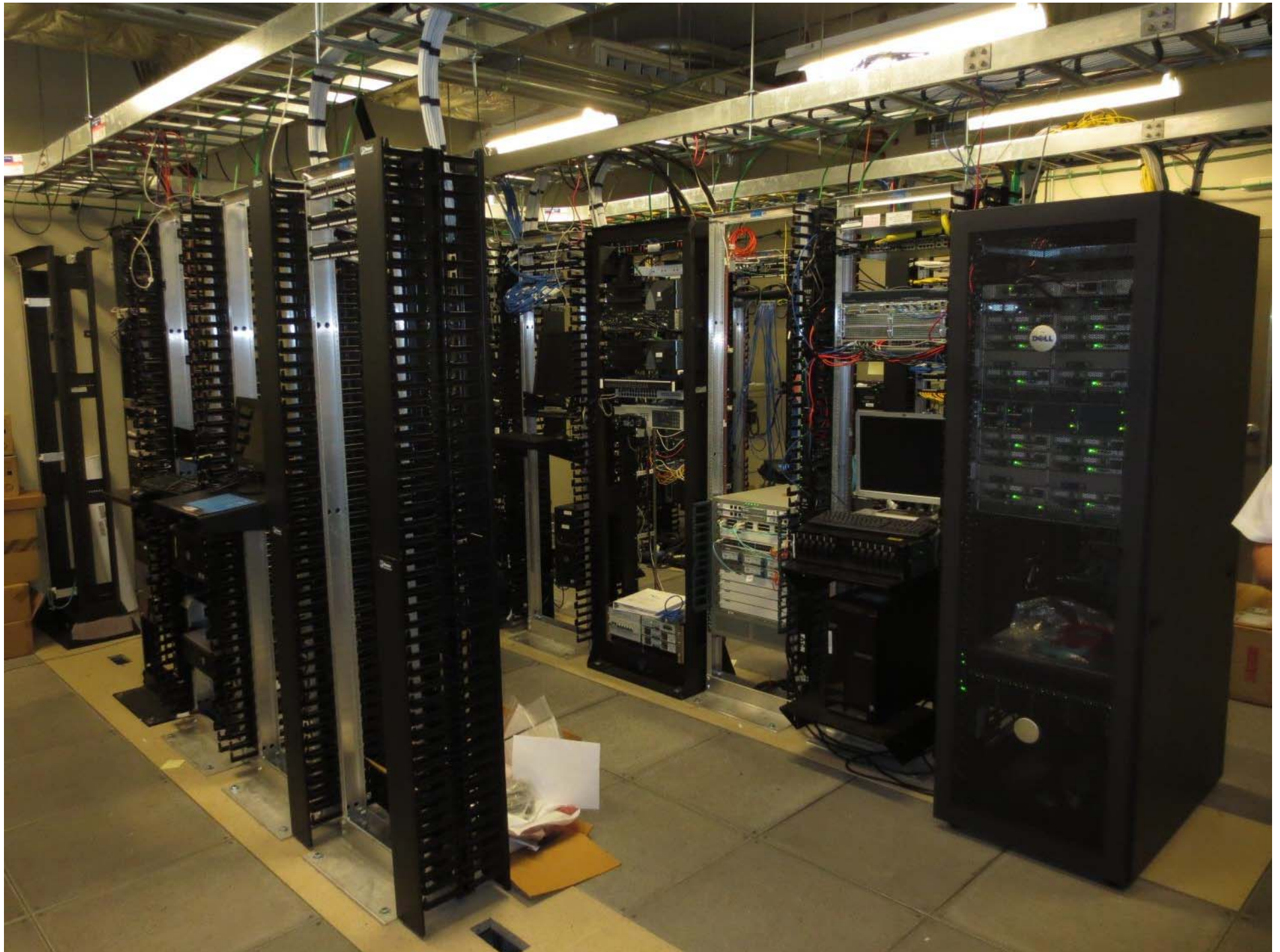
MAXIMUM WIND GUST MAP



SEISMIC MAP







ORLEANS PARISH EMERGENCY SERVICES CENTER

New Orleans, Louisiana

System Highlights

- 200 mph wind speed – tornado – missile impact glazing
- No significant seismic design
- SLOSH Model Design – raised FFE
- Roof with multiple rain drainage redundancies
- Masonry hardened shell
- Single generator



A photograph of a computer workstation. It features a curved wooden desk with several computer monitors. One monitor in the foreground shows a blue screen with a white square. A flexible boom microphone is positioned over the desk. The background shows a plain wall and another monitor.

discussion

QUESTION AND ANSWER

THANK YOU!

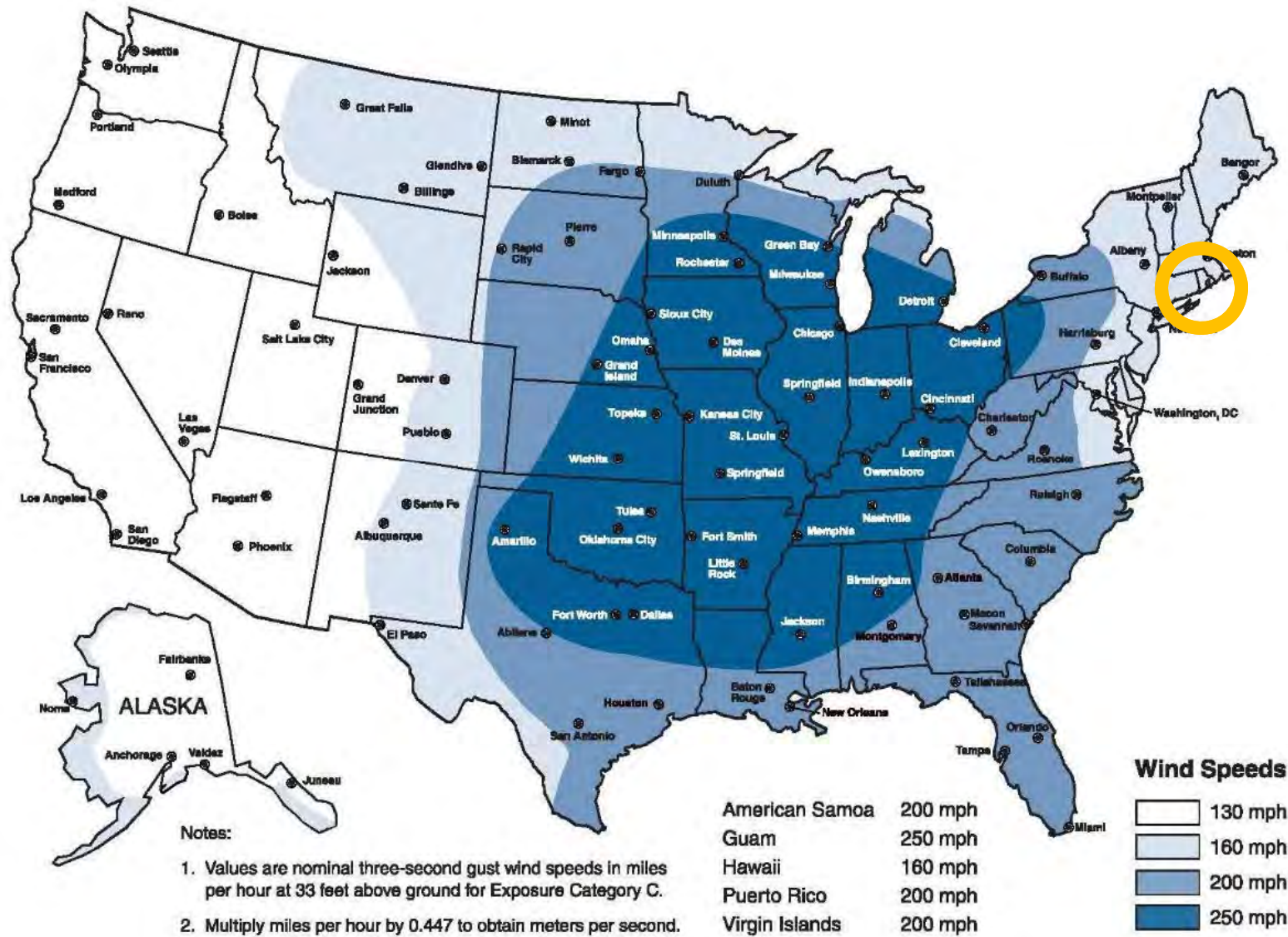
RHODE ISLAND STATE POLICE
HEADQUARTERS
Rhode Island



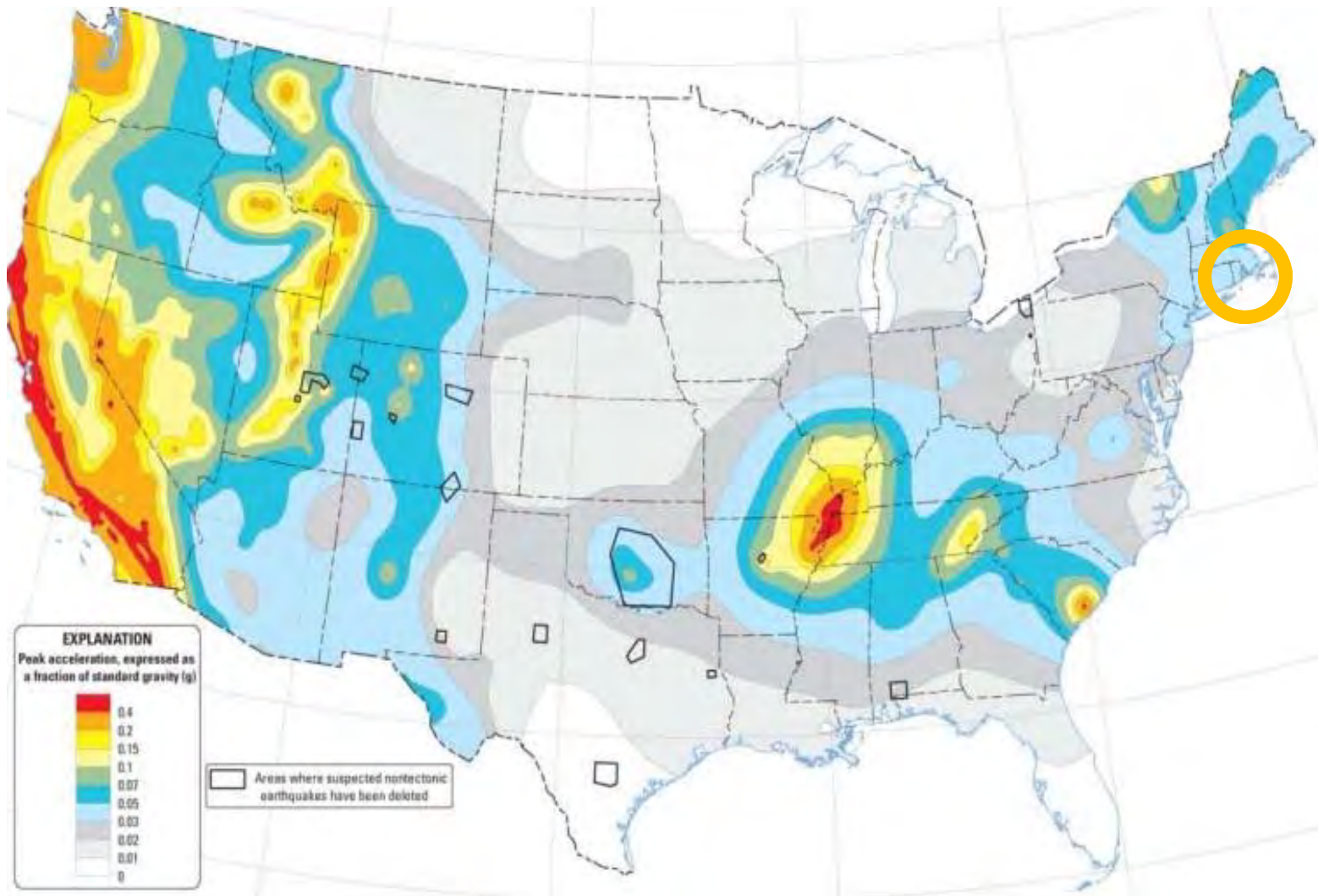
LOCATION MAP



MAXIMUM WIND GUST MAP



SEISMIC MAP









WELCOME
TO THE NEW
RHODE ISLAND E 9-1-1
CALL CENTER

STATE OF KENTUCKY Emergency
Operations Center
Frankfurt, KY



Ky. weapons depot confirms mustard gas leak

By Jeffrey McMurray
The Associated Press

Jul. 29, 2008 - 04:32PM | Last Updated: Jul. 29, 2008 - 04:32PM | 0 Comments

LEXINGTON, Ky. — The first mustard gas leak in three years was confirmed Tuesday at a chemical weapons stockpile in Kentucky, less than a month after workers there found a leak inside a separate storage igloo housing a deadly nerve agent.

But officials said the latest leak poses no danger to the community nor the surrounding atmosphere.

Richard Sloan, public affairs officer for the [chemical storage site at Blue Grass Army Depot in Richmond](#), said trace amounts of mustard gas vapor were detected during a routine inspection of a storage area this week. Army workers won't know whether there is also a liquid leak until a closer inspection inside the igloo.

Because the igloo is full of artillery weapons containing [mustard agent](#), the biggest chore in cleanup efforts is to pinpoint which one is leaking, he said.

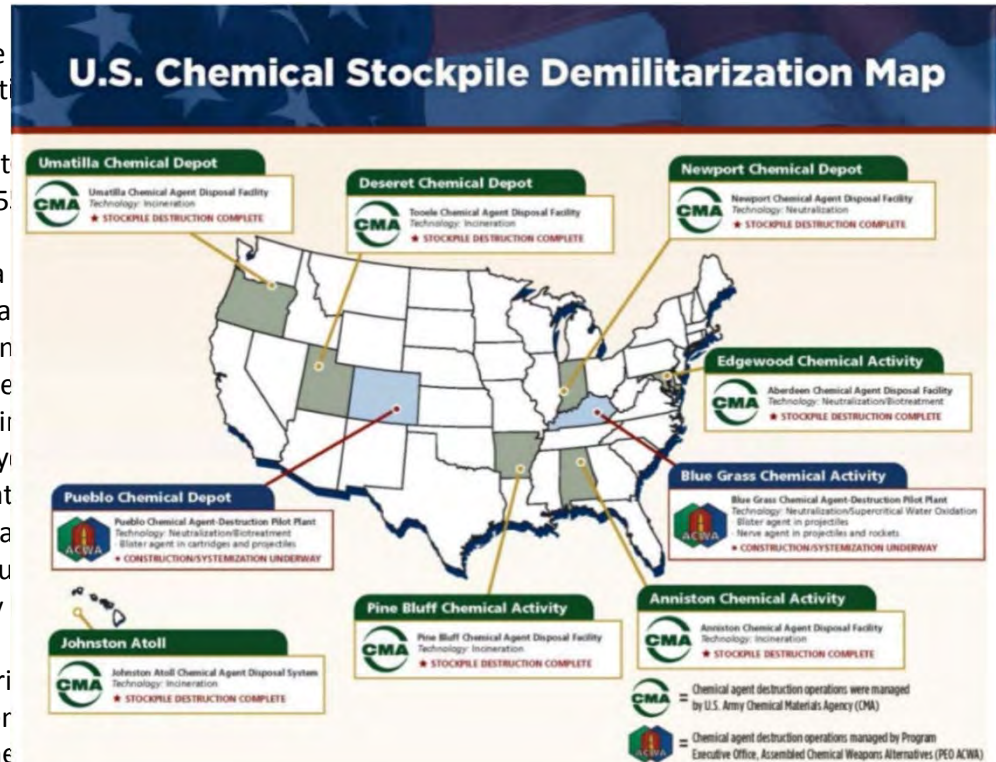
"If they could walk in there and find a puddle, that would be they're probably going to do is find several thousand project through."

Another concern is the summer heat, which could raise the temperature and cause additional leaks. Once the leak or leaks are identified, the 15,000 containers to limit the risk of future leakage.

Mustard agent is among the least lethal of the Cold War-era chemicals. The agent can kill by 2017 to comply with an international treaty. The agent can be absorbed by anyone coming in contact with the chemical. It often causes blistering. Earlier this month, the depot announced it had detected a small leak in the storage igloos. While the sarin leaks were contained, it sent a mobile destruction unit to dispose of the sarin canisters by year-end. Craig Williams, executive director of the Kentucky-based waste management company for its handling of the first [sarin leak](#), particularly what he called Tuesday that proper procedures have been followed after such a leak. "The diligence shown out there in finding these things really has serious consequences," Williams said.

He added, "In the bigger picture, the only way to eliminate risk is to destroy the chemical weapons. The timetable for destroying the chemical weapons has been set. It will be if the Pentagon provides sufficient funding for the effort. The

[523 tons of agent, including mustard gas and the nerve agents GB and VX](#)



Deadly March Tornadoes Were First Billion-Dollar Disaster of 2012

The swarms of March caused more than \$1.5 billion in damage and killed 40. The drama is difficult to qualify, however, because tornadoes are "atypical events" by nature

By Andrea Mustain and OurAmazingPlanet | April 10, 2012

A swarm of tornadoes that tore through the Midwest and Southeast in early March has earned the grim title of the nation's first billion-dollar weather disaster of 2012.

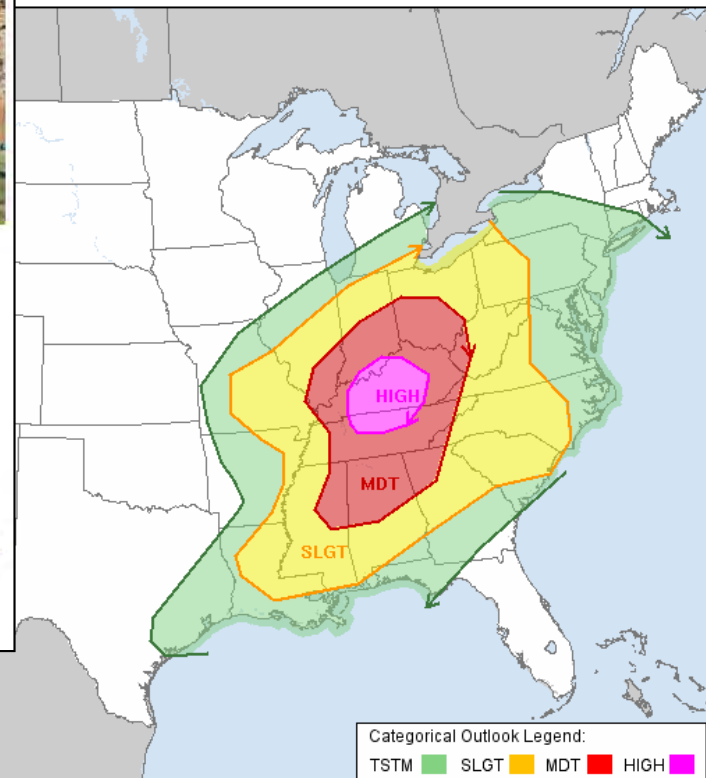
From March 2 through the early hours of March 3, 132 tornadoes were reported across nine states. Although those numbers are preliminary, and will undoubtedly decrease once overlapping reports are eliminated, their aftermath was devastating, causing more than \$1.5 billion in damage and killing 40 people.

The storms killed four people in Ohio, but they took the greatest toll in Indiana, killing 13, and Kentucky, where 23 people died.

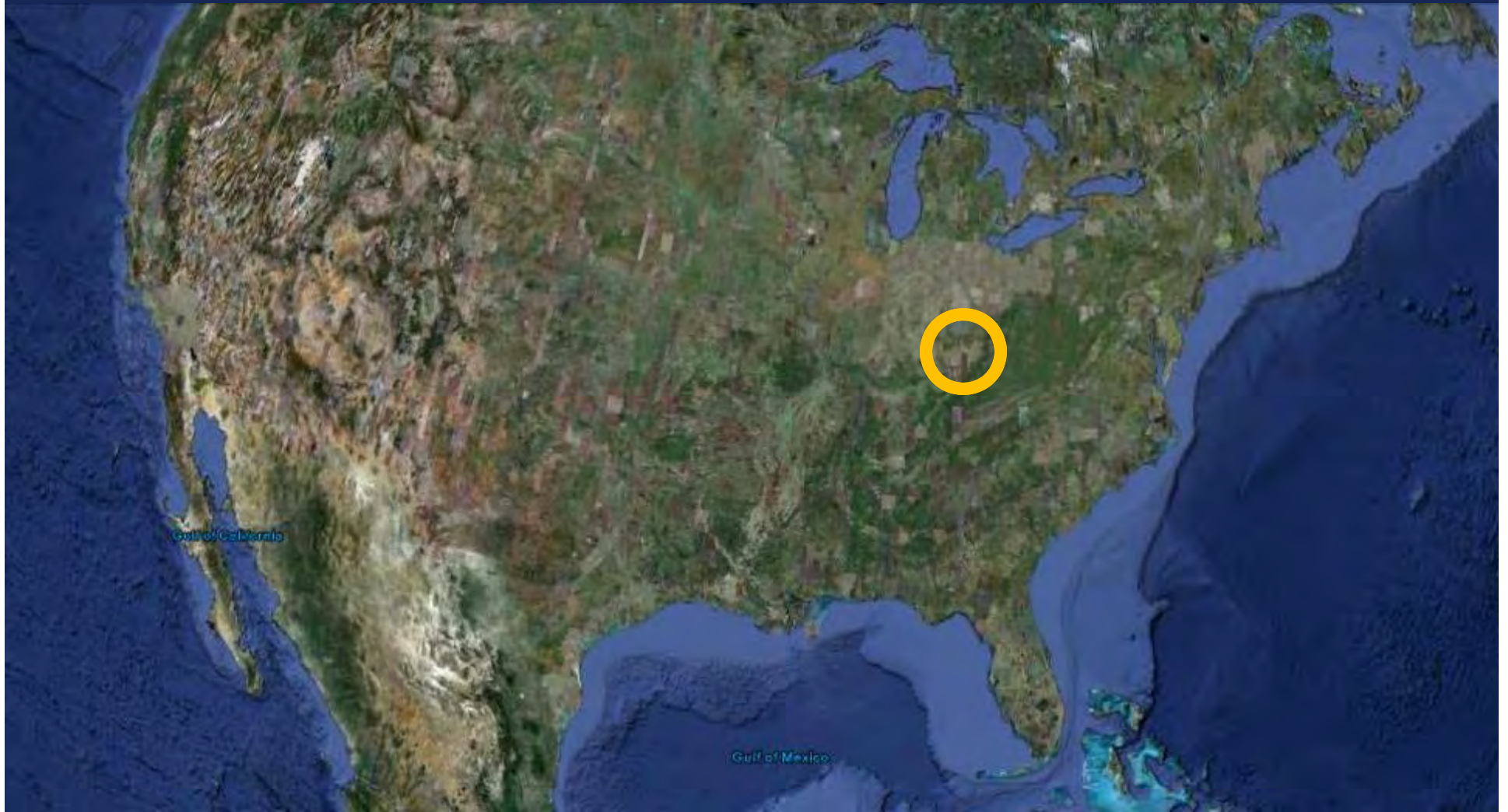
The costly disaster follows on the heels of a record-breaking year for devastation wrought by the vagaries of the weather and longer-term climate conditions. Last year, the United States experienced 14 separate events that caused \$1 billion or more in damage. Five of those events were tornado outbreaks.



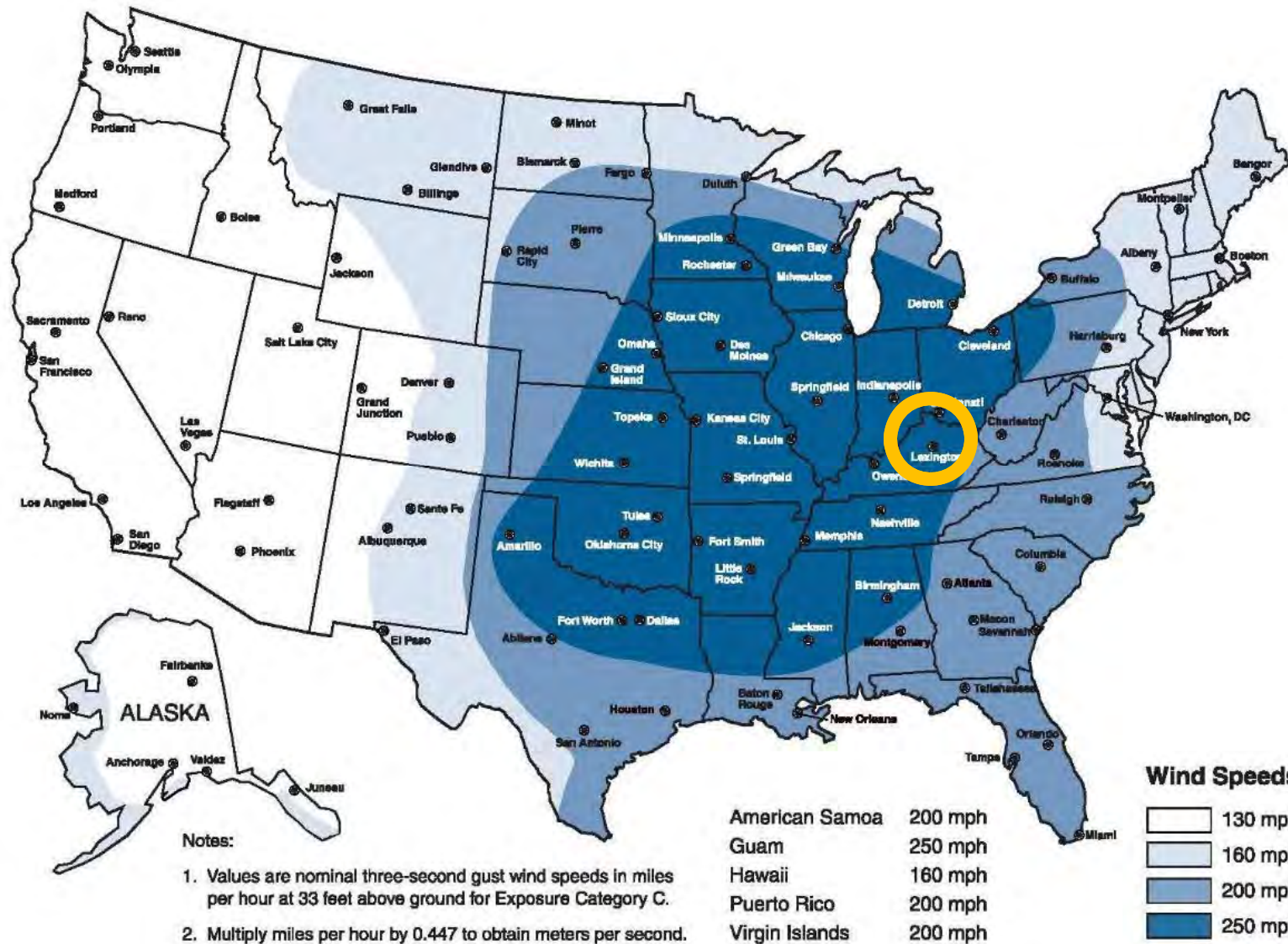
Michael Raphael/FEMA



LOCATION MAP



MAXIMUM WIND GUST MAP



SEISMIC MAP

