Environmental Health Training in Emergency Response (EHTER) - Awareness Level

Mission, Kansas-September 17-20, 2012

Sponsored By
U.S. Department of Health and Human Services
Centers for Disease Control and Prevention
National Center for Environmental Health
Division of Emergency and Environmental Health Services
Environmental Health Services Branch

and

Mid-America Regional Council

Produced in Cooperation with the Regional Homeland Security Coordinating Committee, with funding from the U.S. Department of Homeland Security’s Urban Area Security Initiative

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Conducting Building Assessments

Objectives

- Describe the Environmental Health role in building assessments
- Discuss how disasters can impact buildings
- Identify exterior and interior building components
- Explain assessment preparation and process for buildings
- Identify building-related health hazards
- Exercise recovery and reoccupancy evaluations
- Identify preventative actions to improve building resiliency

Disaster Management
**Role of Environmental Health**

- Ensure buildings provide the occupants a healthful environment
- Prevent disease caused by impaired or contaminated buildings
- Provide information on building needs to protect occupants
- Conduct interventions needed to protect the public from impaired buildings
- Assist building officials identifying damaged structures that may cause physical injury

**Role of Environmental Health - Building Environments**

- On average, people spend 50% of the day in their homes
- On average, Americans spend about 90 percent or more of their time indoors
- Evolution of building codes in the United States
- Buildings have purpose and are designed to facilitate a specific function

Disaster Management
Role of Environmental Health- Healthy Homes Principles
Seven principles, keep it:
- Dry
- Clean
- Ventilated
- Contaminant-Free
- Safe
- Pest-free
- Maintained

- Understand the connection between building damage and health impacts
- Training and credentialing available through National Center for Healthy Housing (NCHH), CDC and HUD Healthy Homes

Role of Environmental Health – Safety
- Safety of team
- Situational awareness
- Knowledge of building contents and hazards
- Right of entry and legal authority
- Scope of Assessment – typically a limited, visual inspection
- What PPE is needed
- Demeanor and mindset of building owners
- Communication/contact needs

Disaster Management
Role of Environmental Health – Safety (continued)

Urban Search and Rescue (US&R) Markings
- Structure triage, assessment and marking system to communicate structure/building hazards
- For safety, Practitioners need to know what markings mean
- Practitioners need to research what unique markings may be used in their community

Role of Environmental Health – After Major Disasters

Assessment Response
- FEMA Incident Management Assistance Teams (IMATs) conduct rapid overview of damage
- Individual response groups such as Urban Search and Rescue (USAR) teams, Army Corps of Engineers and National Guard respond and further triage needs
- Specialized teams, e.g. Strike, Task force
- Consider teams that might be involved with Catastrophic events
- Consider teams that might be involved with non national events (state and local teams)
Role of Environmental Health – Community Recovery
Where do Building Assessments fit in?

- Broad damage assessment occurs (EH working in multi discipline teams)
- Sheltering
- More detailed assessment begins
- Interim Housing provided (permitting needed)
- Structures repaired and rebuilt
- Monitoring (follow up inspections)

Note: Building assessments are NOT a replacement for insurance adjustors

Pictures courtesy FEMA

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Role of Environmental Health – Community Recovery
Where does Environmental Health fit in?

- Building, emergency management and safety officials are the normal building assessment team leads
- Environmental Practitioners utilized in a cross discipline team
- Practitioners can integrate into building assessment teams
- Integration may lead to additional funding for Environmental Health

Pictures courtesy FEMA

Disaster Management
### Role of Environmental Health – Key Partners

- Emergency Management
- Emergency Operation Command (EOC)
- Public works and wastewater utilities
- Emergency Support Functions (ESF)
- Building owners and building support services (maintenance)
- Local code enforcement/building dept.
- Builders and the Construction Industry
- CDC, Healthy Homes, HUD, EPA and Small Business Administration
- Insurance Companies
- Land grant Colleges and Universities
- Home Inspection Industry and Realtors

![Partners compare assessment reports, Illinois]( Courtesy FEMA)

### Role of Environmental Health – Activity

**What can you bring to the table for building assessments?**

- Environmental Practitioners have broad knowledge backgrounds and working experience
- Practitioners may work in multiple programmatic areas; onsite systems, group care facility inspections, drinking water etc.

**Take 5 minutes and write down your own individual knowledge and working experience that you feel could contribute to a disaster building assessment team in your community. Share any disaster building assessment response experience you may have. Be prepared to share with the group.**

![CDC]( )  
![FEMA]( )
Disaster Impacts on Buildings – Numerous Causes

**Natural Disasters**
Hurricanes, blizzards, landslides, tornadoes, earthquakes, volcanic eruptions, heat waves, floods, lighting strikes, hail storms, wild fires, sinkholes, snow melt, avalanches and severe storms

Pictures courtesy FEMA

**Technological/Manmade Disasters**
Terrorist attacks, fires, explosions, biological or chemical contamination, cyber attacks, nuclear attacks and critical infrastructure disruption

Pictures courtesy NOAA
Building Components - Exterior

Building envelope
- Roof covering
- Exterior walls
- Windows
- Doors

Envelope protects us from:
- Hot or cold air
- Moisture
- Precipitation (snow and rain)
- Insects and rodents
- Wind
- Sun
- Dust

Utility Infrastructure
- Electrical service connection
- Potable water supply
- Liquid waste disposal
- Gas service connection
- Heating, Ventilation and Air Conditioning (HVAC)

Disaster Management
Building Components - Interior

Furnishing
- Mattresses
- Couches
- Office desks
- Tables

Finishing
- Carpet
- Laminate flooring
- Sheetrock
- Paint
- Wood panels

Building Components – Interior (continued)

Appliances
- Refrigerators
- Stoves/ovens
- Hot water heaters
- Dish washers
- Clothes washer
- Clothes dryers
- Microwaves
- Kitchen exhaust fan

Function Specific
- Autoclaves
- Commercial kitchen equipment
- Network servers
- Medical support machinery

Disaster Management
### Disaster Impacts on Buildings - Affects

**Function affected**
- Compromised structural integrity
- No protection from the open environment

**Unsafe access/egress to structure**
- Access eroded away
- Blocked access
- Overhanging structural concern (trees)

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**Possible acute and chronic exposure health risks**
- Indoor air concerns – mold
- Sewage flooding or backup
- Chemical contamination
- Nuclear contamination
- Biological terrorist attacks

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Disaster Impacts on Buildings – Affects (continued)

Visible mold after flood, Tennessee  Courtesy FEMA
Checking mailboxes for anthrax, Courtesy CDC

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Disaster Impacts on Buildings – Affects (continued)

Critical utility services reduced or eliminated

- No potable water supply
  - Private well
  - Public water
- Gas supply interruption
- Power loss

Disaster Impacts on Buildings – Affects (continued)

Damaged or destroyed

- Long-term utility costs
  - No area to repair the onsite wastewater system, nearest sewer system located miles away
  - Building repair may exceed the value of the building
  - Property may be eroded away or now unsuitable for building foundation

Destroyed house due to flooding, Wisconsin
Courtesy FEMA

Potable water supply disruption, Louisiana
Courtesy FEMA

Storm surge removes onsite wastewater system
Courtesy CDC

Lack of liquid waste disposal
- Onsite system
- Public sewer
- Heating Ventilation and Air Conditioning (HVAC)
Building Assessment – Preparation

Equipment needed

- Standard EH survey tools
  - Flashlight
  - Camera
  - Binoculars
  - PPE
- Specialized tools
  - Multi gas meter
  - Moisture meter
  - GPS for GIS mapping
  - Lead and asbestos test kits
  - Water pressure gauge
  - Voltage tic meter (non contact)
- Critical tools
  - Practitioner senses
  - Practitioner training

Access, permission and authority

Before we conduct our assessment
- ICS forms, form 202
  - Mission/task number
  - Operational period
  - Assessment/task scope
  - Health and safety Plan (HASP)
- Right of entry and enforcement capacity
- Building owner awareness of assessment
- Permitting agencies that need to be advised
Building Assessments Preparation
Documentation preparation
Before going into the field determine what information is available
- Impact areas (earthquake, flood, chemical release, tornado)
- Means of liquid waste disposal in the area
- Means of drinking water supply
- Street maps (signs removed)
- Aerial pre and post disaster
- Pre-disaster risk assessment
- Geo-coded data

Street map, New Jersey. Courtesy FEMA
Path of EF-2 tornado. Courtesy NOAA

Building Assessments Preparation
Documentation preparation (continued)
Many Property Appraiser websites can provide:
- Current owner
- Age of structure(s)
- Floor plans (great for documentation)
- Parcel boundaries
- Exterior and interior wall material
Building Assessment Preparation

Documentation forms

- Forms should be adapted to meet mission needs
- Forms should document the type and use of building
- Broad estimations of damage (≤50% or >50%)(functional or nonfunctional)

- Routine inspection forms not needed for initial disaster building assessment
- Photographs need accurate tracking and labeling

Building assessment, California

- Photographs need accurate tracking and labeling

Tracking building assessment pictures, New York

 Pictures courtesy FEMA

Building Assessment Preparation

Documentation forms (continued)

- Form flow needs to facilitate an effective, comprehensive and efficient assessment
- Liquid waste disposal - sewer or an onsite system
- Potable water – onsite well or public water supply
- Use floor plan sketches
- Property site plans for quick documentation

Fire damaged well water pump at child care center, Texas

Courtesy FEMA
Building Assessment Preparation

Documentation forms (continued)

- Tablets and laptops
- Can quickly fill out assessment forms
- Quick integration of photographs into assessment reports
- Real-time updates from and to the field
- Several Home Inspector programs as guides and possible tools

Inspector receiving real-time data in the field, New Orleans
Courtesy FEMA

Building Assessment Preparation - Activity

Documentation forms

Review the example building assessment forms in your student manual. Pick one form to critique based off your assigned disaster event.

Group A - Snow storm event
Group B - Earthquake
Group C - Wildfire
Group D - Tornado

What would you change or add to the form? Consider potential component damage and associated hazards created by the type event.

Working in small groups, take 10 minutes and write down your ideas for building assessment forms. Be prepared to share your ideas with the group.
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**Building Assessment Process (exterior)**

**Exterior Assessment Pattern**
- Building assessments should start with the exterior
- Note exterior damage that will be symptomatic of interior damage
- Evaluate what can be seen at a distance
- Circle the structure in one direction then circle in the opposite direction

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**Utility infrastructure**
- Limited, visual inspection of utility infrastructure components
  - Electrical – shock hazard?
  - Gas – any apparent leaks?

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**Disaster Management**
Building Assessment Process (exterior)
Utility infrastructure - Potable water supply

Private well
- Damage to casing
- Loss of pressure

Municipal supply
- Under a boil water notice
- Service line damage

Building Assessment Process (exterior)
Utility infrastructure - Wastewater

Is there sewage on the ground?
Onsite system (septic)
- Displaced tank or drainfield
- Saturated soil conditions
- Drainfield treatment area erosion
Sanitary sewer
- Connection component damage
- Backflow into building

Disaster Management
Building Assessment Process (exterior)
Foundation
- Foundation damage, a safety concern for responders and occupants
- Are exterior walls vertical and straight?
- Check for cracks in masonry slabs
- Look at individual piers for elevated structures
- Take photographs of damage and use an item for scale
- May need further onsite evaluation by an engineer

Building Assessment Process (exterior)
Foundation types
- Continuous wall with slab
- Basement
- Crawlspace
- Slab on grade

Disaster Management
Building Assessment Process (exterior)
Foundation types (Continued)

- Is the structure safe for an interior assessment?
- Do visual cracks appear in foundations that indicate a need for evaluation by an engineer?
- Describe the damage, type of foundation and take photographs of your concerns
- Safety first, avoid dangerous areas

Building Assessment Process (exterior)
Roof Covering and Sheathing

- Safety, roof damage can be an exterior symptom of interior structural concerns
- Roof damage leads to water intrusion
- Water intrusion leads to indoor air issues
- Indoor air issues are a public health concern

Note: Quick mitigation of damaged roofs
- How can we prevent further damage with compromised roofs? – FEMA’s BLUE ROOF
- Immediate steps to limit indoor air issues – Increase air movement with fans and dehumidifiers
Building Assessment Process (exterior)

Windows and doors

- Damaged windows and screen coverings cause loss of vector control
- Compromised vector control can lead to entrance of rodent and insects that can transmit disease
- Window and frames can give signs of possible structural damage
- Will doors open and shut easily?

Building Assessment Process (interior)

Interior Assessment Patterns

- Go right, stay right (AKA hug a wall)
- Line walk through
- Looking high to low then low to high

Disaster Management
Building Assessment Process (interior)

Flooring
- Flooring conditions
  - Flooring buckled, shifted or cracked
  - Flooring absorbent or non absorbent
  - Subflooring saturation
  - Indication of foundation issues

Public Health Concerns
- Potentially hazardous materials, i.e. asbestos flooring tiles
- Slip, trip and fall hazards
- Saturated, absorbent materials lead to indoor air issues

Walls and Ceilings
- Wall cracks normally occur around door and window frames
- Water stain may be visible on ceiling or wall materials
- Ceiling building material may contain asbestos
- Wall paint may contain lead, damage creates flakes
- Physical damage can expose asbestos and other hazardous building materials

Disaster Management
Building related Health Hazards
A 3-step evaluation process
1. Chemical, physical or biological hazard present in the building?
2. Does a pathway exist to transport the hazard to the occupant?
3. If so, can the exposure be quantified (time/dose)?

Building related Health Hazards (continued)
Indoor Air Concerns (mold)
- Most common biological concern after disaster events
- A visual walkthrough will give you all the information you need
- Look for mold growth and water damage
- Find moisture source(s) and eliminate them

Disaster Management
Building related Health Hazards (continued)

Structural concerns
Apparent structural damage that could endanger occupants
- Foundation shifting or settling – break in waste disposal lines
- Roof truss or support damage - possible water intrusion (mold)
- Load bearing walls damaged or cracked – cracks in potable waterlines

Disaster introduced contaminants in buildings
There are a variety of hazards that could negatively affect health
- Wastewater, fire ash, soot and smoke; anaerobic muck, river silt and mud; heating oil and other substances can enter structures
Some situations may be actual hazards and some may be falsely perceived by the public - Practitioners will need to find answers
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Building related Health Hazards (continued)
Contaminants in buildings
- Consider chemicals and hazardous materials stored in buildings
- What do people keep under their kitchen sink or in the garage
- What type waste is stored in buildings such as hospitals – need applicable MSDS sheets before entry into the structure
- Unique chemical contamination concerns – NIOSH pocket guide

Building related Health Hazards (continued)
When buildings are repaired or demolished
What hazards can be created from disturbed building material
- Asbestos shingles, siding and insulation
- Lead paint on interior and exterior of building
- Need for evaluations before building repair or demolition
  - Most jurisdictions require special permits for asbestos and lead

Disaster Management
Building related Health Hazards (continued)
Communication and legal considerations

- Posting placards on assessed buildings can clearly communicate identified hazards
- Identify legal right of entry in your jurisdiction
- Consider legal liability and immunity of classifying conditions
- Identify legal authority to post assessed buildings

Recovery and Reoccupancy – Considerations
After we identify potential building hazards
How do we recover and when can we reoccupy the building?
What balance needs to be made considering:
- Disaster needs
- Building function impact
- Occupant specific risk assessment

Disaster Management
Recovery and Reoccupancy – 4 Step Evaluation Process
Measured response process to potential hazards

1. Public health hazard exists now or in future?
2. Does hazard or remediation impact building use?
3. Disaster need considerations
4. Use Recommendations

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Recovery and Reoccupancy – Activity

Working in small groups over 15 minutes, evaluate assigned disaster scenarios. Utilizing your combined Environmental Health knowledge and experience, make recovery and reoccupancy recommendations. Use the 4 step evaluation process and base your recommendations considering disaster needs, building function impact and occupant specific risk assessment.

Pick a person in your group to brief out your scenario and recommendations.
Recovery and Reoccupancy – 4 Step Evaluation Process

**Group 1 – Heavy snow melt floods a residential home**

1. Public health hazard exists *now* or *in future*?
2. Does hazard or remediation impact building use?
3. Disaster need considerations
4. Use Recommendations

![Image of a person cleaning a flooded house](image1)

Carpet and padding removal, North Dakota
Courtesy FEMA

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Recovery and Reoccupancy – 4 step evaluation activity

**Group 2 – Earthquake damaged elementary school**

1. Public health hazard exists *now* or *in future*?
2. Does hazard or remediation impact building use?
3. Disaster need considerations
4. Use Recommendations

![Image of asbestos in an elementary school](image2)

Asbestos dust in an Elementary School, California
Courtesy FEMA

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Disaster Management
Recovery and Reoccupancy – 4 step evaluation activity

**Group 3- Regional wide blackout and a Nursing home**

1. Public health hazard exists *now or in future*?
2. Does hazard or remediation impact building use?
3. Disaster need considerations
4. Use Recommendations

![Hospital on generator power, Guam](image)

**Group 4- Compromised river levee floods residential homes**

1. Public health hazard exists *now or in future*?
2. Does hazard or remediation impact building use?
3. Disaster need considerations
4. Use Recommendations

![Resident salvaging items, New Orleans](image)

![Resident staying near their homes, New Orleans](image)

Disaster Management
Recovery and Reoccupancy - When we cannot reoccupy

- Determine who can legally condemn a structure
- How are building owners notified
- Who can clear a structure for use
- Consider single causes and combination of possible health hazards
- Need to find alternate shelters for occupants

Unsafe structure posted, North Carolina
Courtesy FEMA

Recovery and Reoccupancy – Mold Remediation

- Remove mold growth
  - Porous surfaces? Dispose and replace
  - Impervious surfaces? Clean and disinfect
- Should you sample for mold?
  - Typically not indicated for emergency response

Moldy drywall removal, Montana
Wallboard replacement, Montana

Pictures courtesy FEMA
Recovery and Reoccupancy – Mold Remediation PSAs

Example topics to be covered on mold remediation PSAs
- Mold basics
- Mold cleanup and guidelines
- What to wear when cleaning moldy areas
- Moisture and mold prevention and control tips
- Hidden mold

Improving Building Resiliency – Strengthening Buildings

Keeping structures intact prevents further damage
- Prevents flying or collapsing debris
- Protects interior from water and wind damage
- Easy installation at time of construction or normal repair
- Protects interior appliances
- Possible savings in building insurance

Disaster Management
Improving Building Resiliency – Readiness
Some disaster events may give us warning

Improving Building Resiliency – Preventative Construction
Building structures that can better withstand future events

Disaster Management
Disaster Management