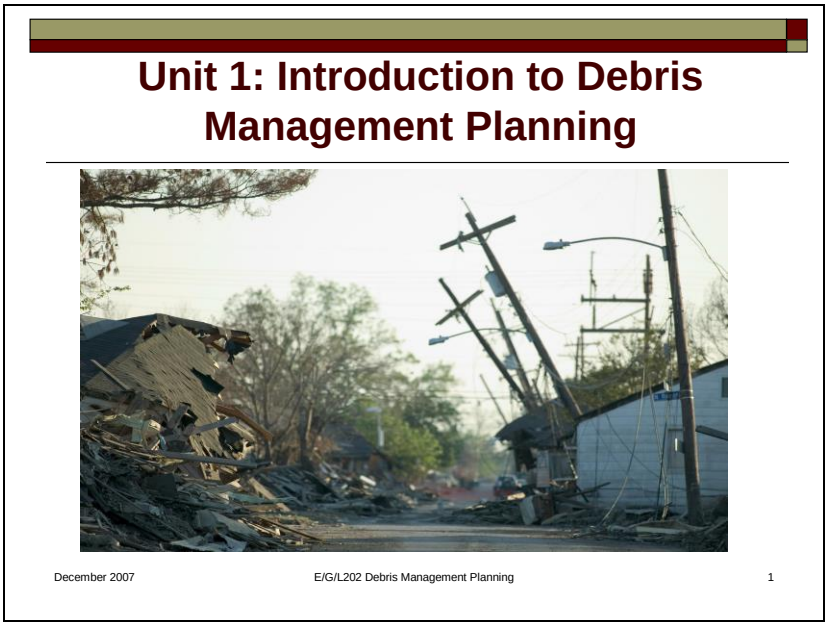
INTRODUCTION



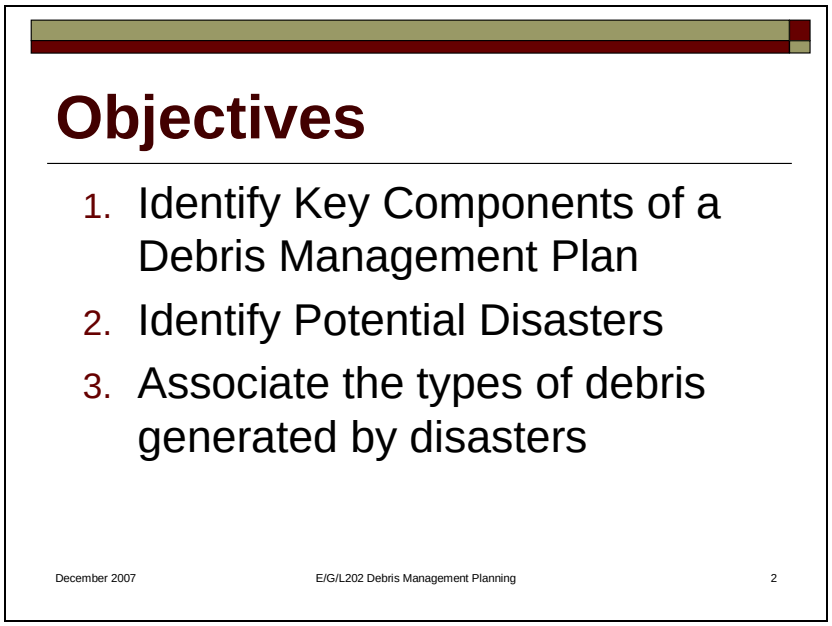
Unit Introduction

- Overview of a debris management plan
- Debris quantities in natural events are increasing:
  - Natural disasters are becoming more numerous and generating unprecedented amounts of debris.
  - More development is present in disaster-prone areas.
  - Large and more complex buildings, homes, and mobile home parks result in larger quantities of debris.
- Recent disasters:
  - Initial estimates of debris after Hurricane Andrew was 20 million cubic yards—enough to fill a football field a mile high—and took 6 months to remove.
  - In Puerto Rico, after Hurricane Georges, disaster-related debris amounted to 5 million cubic yards.
- To effectively prepare for and respond to debris-related issues, it is necessary to have an understanding of the types of debris that are generated in the various disasters.
- Therefore, this unit provides:
  - Typical types of disasters and resulting debris
  - Photo examples of typical debris situations that may be encountered in actual disasters
  - A discussion of general issues that should be considered in debris planning and issues that have arisen in recent disasters
  - An activity where you will assess potential debris issues based on the type and magnitude of the event

Terminology that will be used in this course

- Debris activities, debris-related activities:
  - The actual clearance, collection, hauling, reduction, and disposal actions being taken in the field
- Debris management:
  - The planning and coordination activities undertaken by the State/locals/Tribes to initiate and complete debris activities
- Debris operations:
  - The PA Program activities undertaken to address applicant-related debris management and activities

Notes:



Unit Objectives

At the end of this unit, you will be able to:

- Identify key components of a debris management plan
- Associate the types of debris generated by natural disasters.
- Identify critical debris management issues.

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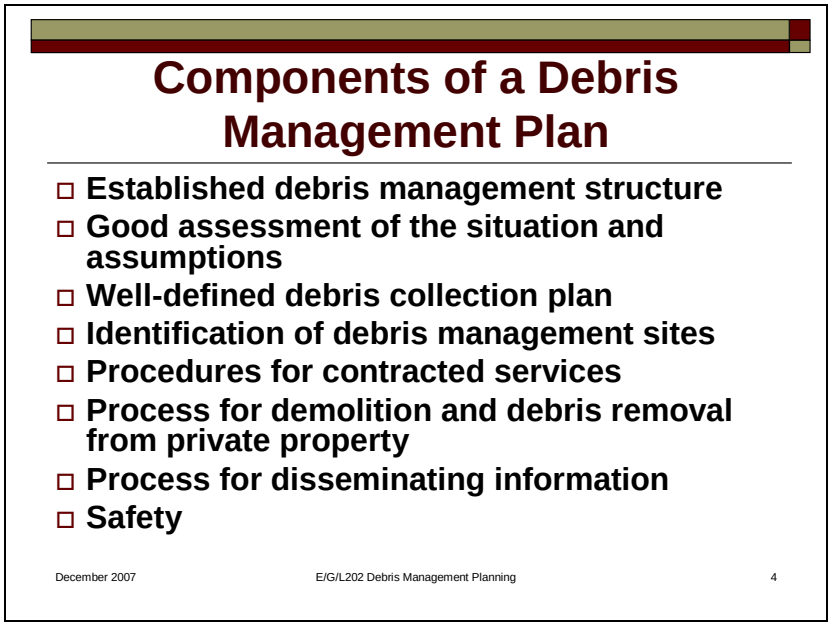
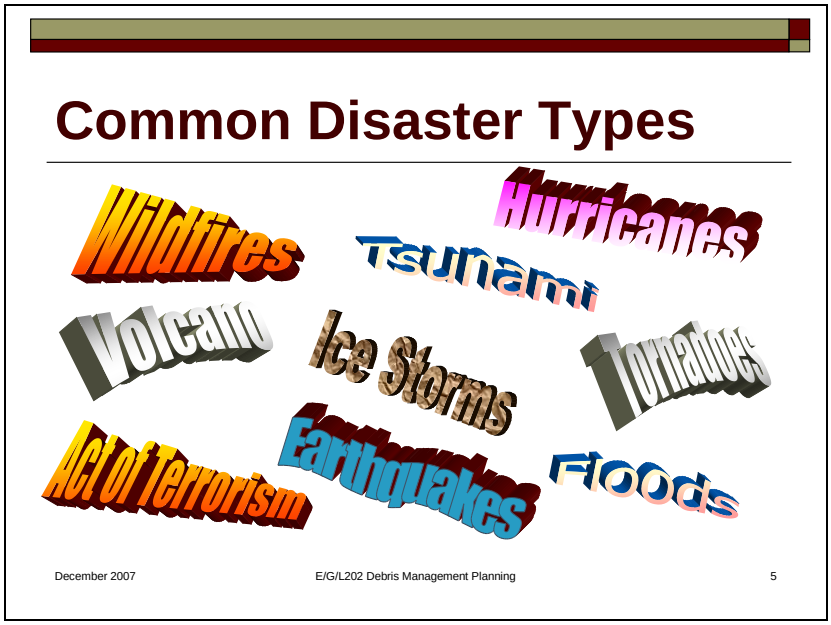


The 8 components of a debris management plan are:

- Established debris management structure
- Good assessment of the situation and assumptions
- Well-defined debris collection plan
- Identification of debris management sites
- Procedures for contracted services
- Process for demolition and debris removal from private property
- Process for disseminating information
- Safety

Characteristics of Disaster Types

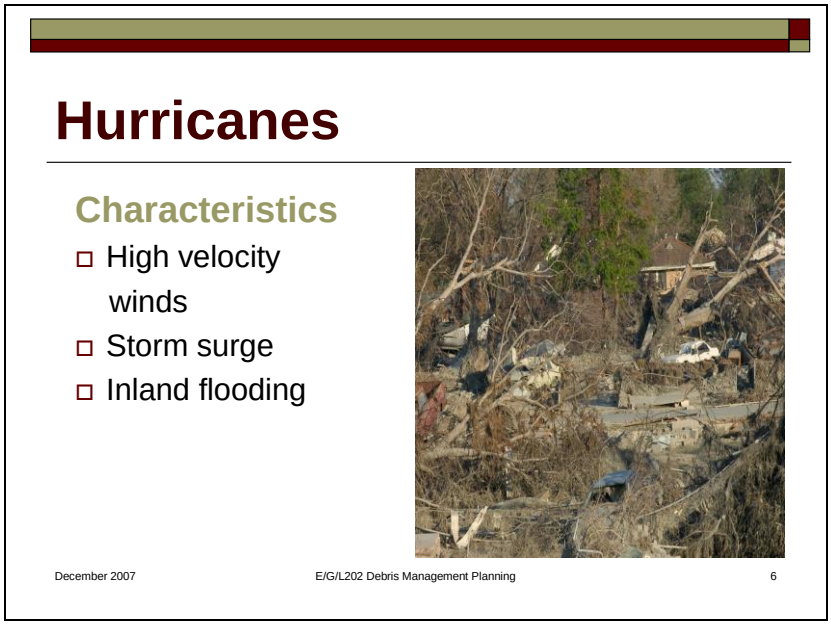


Characteristics of Disaster Types

- The following series of slides illustrates the characteristics of common disaster types.
  - These characteristics influence the type and magnitude of debris that is generated.
- Many disasters generate the same types of debris, however, the mix of debris will vary between disaster types.
  - Additional discussion of debris types will follow this section.
- Refer to the Matrix of Disasters and Their Debris Types provided as Reference A.
  - This Matrix lists the common types of debris-generating disasters and predominate types of debris generated by the identified events.
  - You may refer to this Matrix throughout this and following units.
  - Based on class discussion and personal experience within your community, you may add disaster or debris types to this Matrix.
- There are Other Disaster Types: tsunami, volcanoes, acts of terrorism.
- There are other types of disasters that occur less frequently—straight-line winds, microbursts—but their effects are similar to some of the disasters described.

Notes:

Characteristics of Disaster Types (Cont'd)

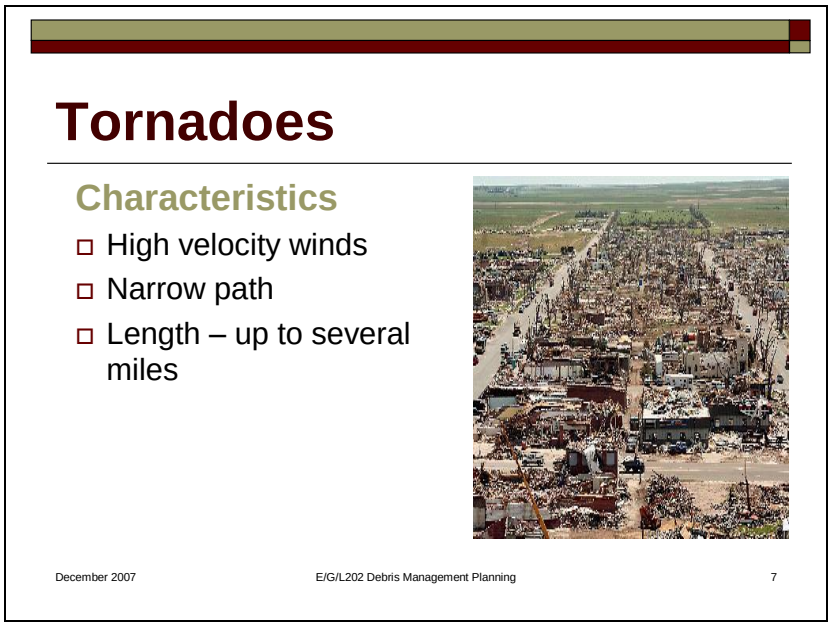


Hurricanes

- Characteristics of a hurricane:
  - High velocity winds—ranging from 74 m.p.h. to more than 155 m.p.h.
  - Storm surge – Is the most destructive effect of a hurricane
  - Wave action—usually precedes hurricane winds, causing severe damage of beaches and seaside structures and buildings
  - Inland flooding—may occur even where winds do not reach hurricane force
- The effects of a hurricane can be devastating to both coastal and inland areas as depicted in recent hurricanes.
- Hurricanes can cause large quantities of every type of debris. Heavy rainfall can cause mass flooding, and high winds can become tornadoes causing additional damage to inland areas.
- Significant damage may occur to buildings, above-grade utilities, roadways, and vegetation.

Notes:

Characteristics of Disaster Types (Cont'd)

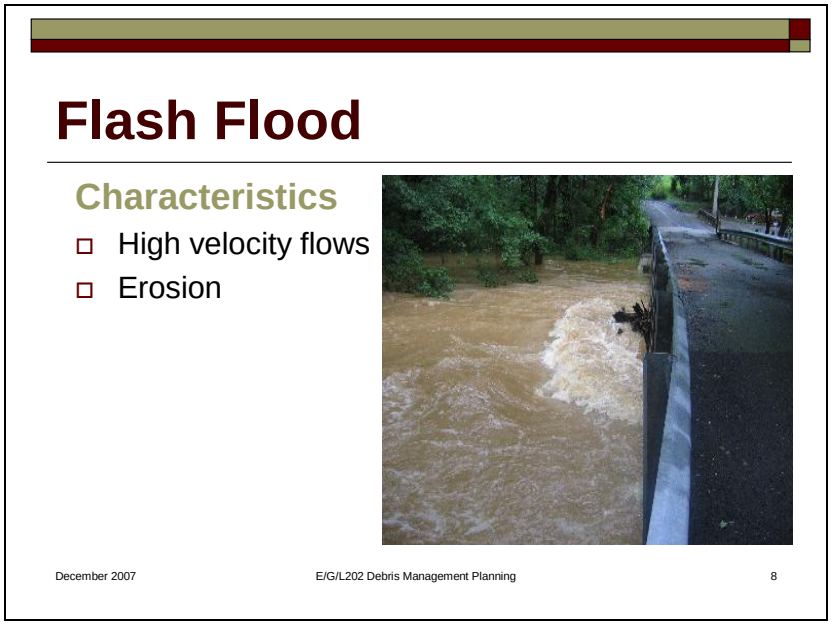


Tornadoes

- Characteristics of a tornado:
  - High velocity winds—from 40 m.p.h. to more than 300 m.p.h.
  - Narrow path of impact
  - Length of impact—up to several miles
- The high winds of a tornado can debark trees, throw vehicles several hundred feet, and severely damage structures from wood-framed to reinforced concrete.
- Significant quantities of building rubble and uprooted vegetation can result from a tornado.
- Due to the high winds and tornado effects, debris is typically mixed and widely scattered.

Notes:

Characteristics of Disaster Types (Cont'd)

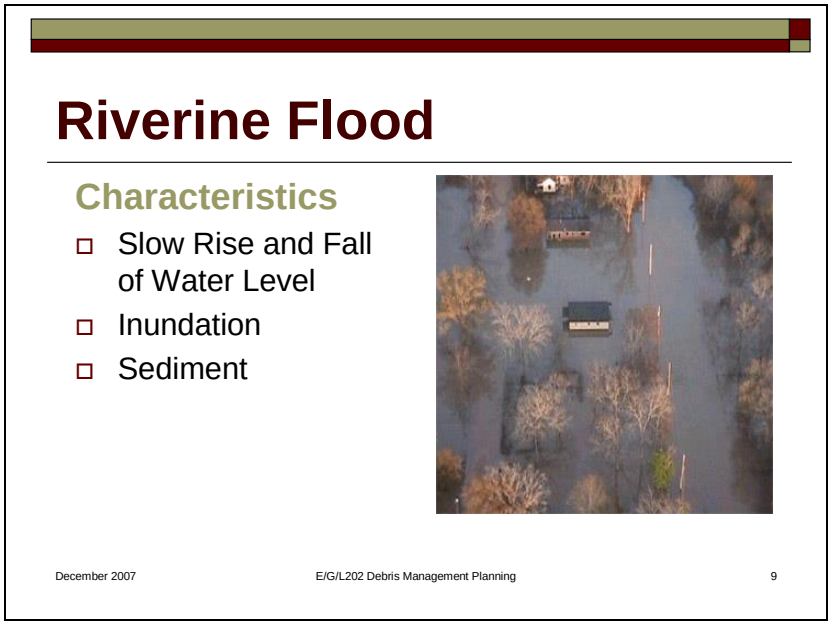


Flash Floods

- Characteristics of flash floods:
  - High velocity flows—destroying structures, vegetation, and infrastructure
  - Erosion
- Most areas of the country have experienced natural disasters in flooding.
  - Structural damage may occur from high velocity flow and forces from sediment transport.

Notes:

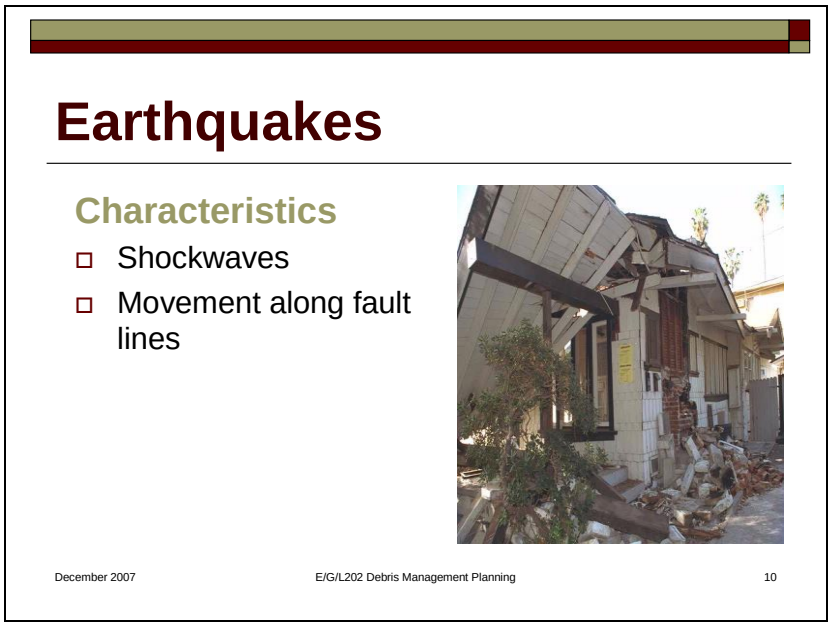
Characteristics of Disaster Types (Cont'd)



Riverine Floods

- Characteristics of a riverine flood:
  - Slow rise and fall of water elevation over a period of time
  - Inundation
  - Sediment
- Most areas of the country have experienced natural disasters in flooding.
- Structural damage may occur from flood saturation and sediment accumulation.
- Floods are often the most difficult disaster events relative to debris.
  - Often, all possessions are destroyed.
    - Clothes, furniture, personal effects
    - Carpet, sheetrock, wood
  - Debris is put out for collection in waves for long periods of time.
    - As water levels recede
    - Emotionally difficult to part with items
    - Some (particularly the elderly) may need assistance in moving objects

Characteristics of Disaster Types (Cont'd)



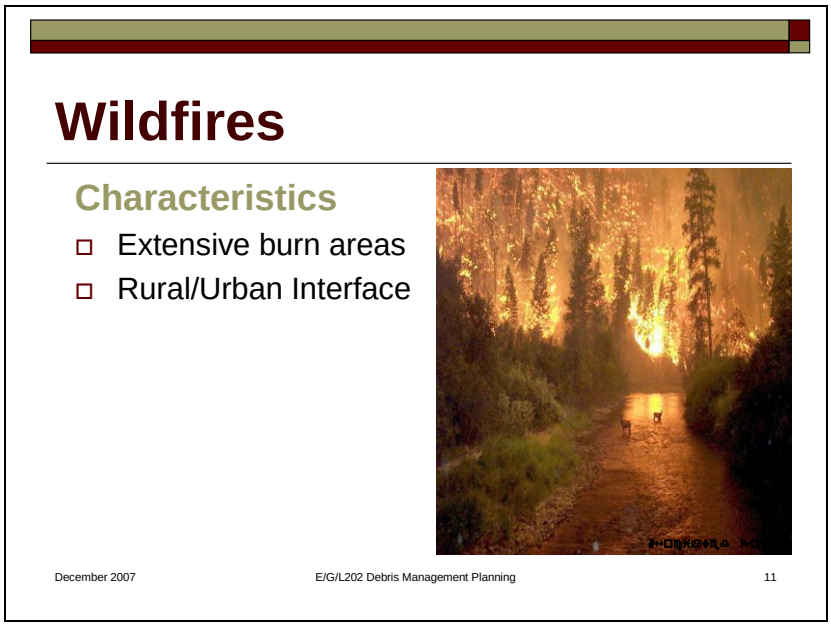
Earthquakes

- Characteristics of earthquakes:
  - Shockwaves—a series of long rolling actions or rapid vibration
  - Movement along fault lines—both vertical and horizontal can cause ground displacement up to several feet
  - Aftershocks for several days or even weeks
- Although relatively infrequent compared to the other disaster types, the effects are usually devastating
- Most large earthquakes occur on the west coast, but other areas of the country are also prone to earthquakes, perhaps to a lesser degree
  - New Madrid earthquake in the Missouri-Tennessee-Arkansas-Kentucky area
  - Major earthquakes have occurred in South Carolina and New England
  - Puerto Rico and the Virgin Islands are in earthquake-prone zones
  - San Andreas fault on the West Coast
- Damages include
  - Building and infrastructure damage
  - Damage to equipment and personal property from collapsed walls and roofs
  - Sediment from earthquake-induced landslides

Notes:

- Photograph is a house following the Northridge, California, earthquake of January 1995.

Characteristics of Disaster Types (Cont'd)

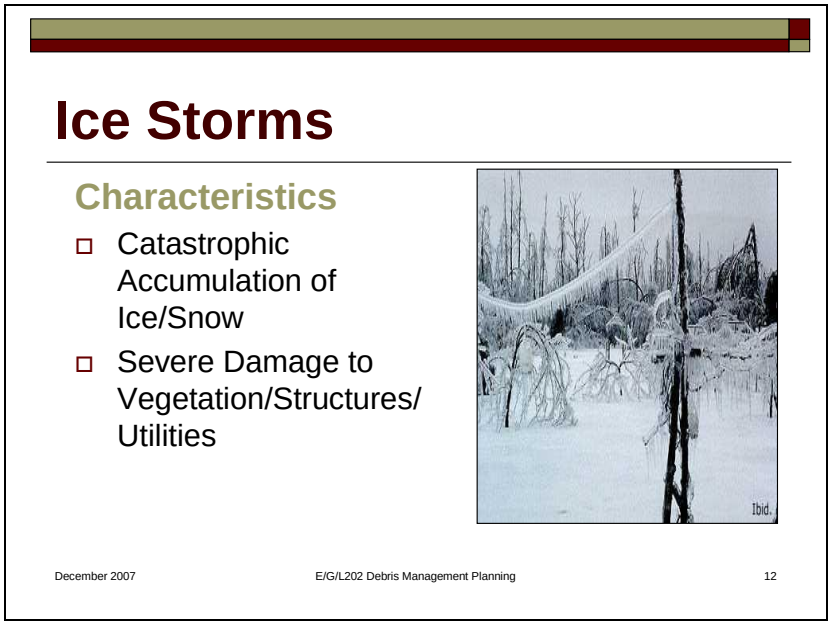


Wildfires

- Characteristics of wildfires:
  - Extensive burn areas
  - Possible flooding and mudslides
- Damages resulting from wildfires include
  - Loss of vegetation
  - Damaged homes and buildings
  - Landslides and mudslides on burnt slopes when rains follow the fire
- Wildfires can produce a significant amount of debris with the increase of houses in woodlands.

Notes:

Characteristics of Disaster Types (Cont'd)

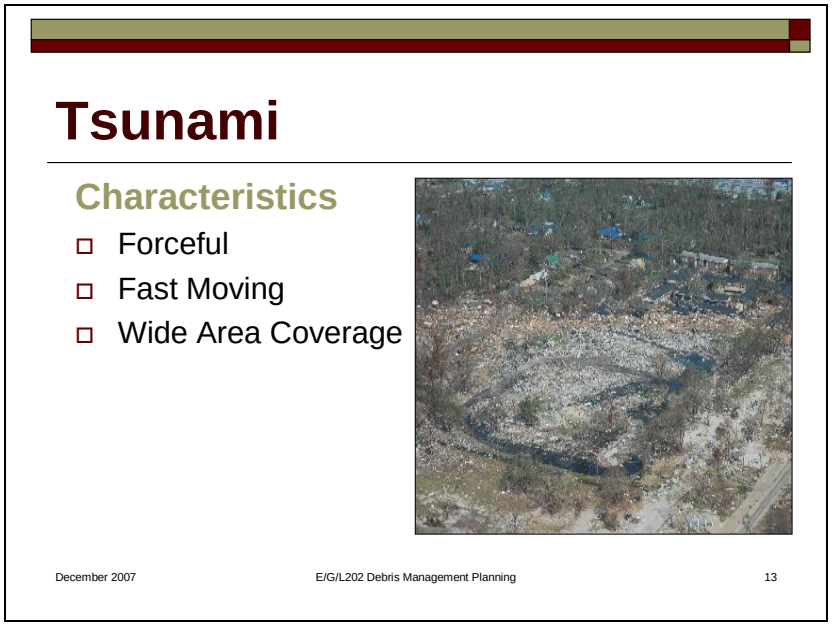


Ice Storms

- Characteristics of ice storms:
  - Catastrophic accumulation of ice and snow
  - Significant damage to vegetation
  - Travel is difficult—roads may be closed as a result of fallen trees and limbs
  - Power is disrupted and not easily repairable—utility poles and wires may be severely damaged and become debris
  - Continued cold weather may impede restoration of utilities
  - Combined with snow accumulation and rapid warming, flooding may occur
- Communities susceptible to ice storms must plan for extensive vegetative debris removal and reduction

Notes:

Characteristics of Disaster Types (Cont'd)



Tsunamis can occur anywhere where you have coastal exposure.

The characteristics of a tsunami include:

- Forceful
- Fast Moving
- Wide Area Coverage

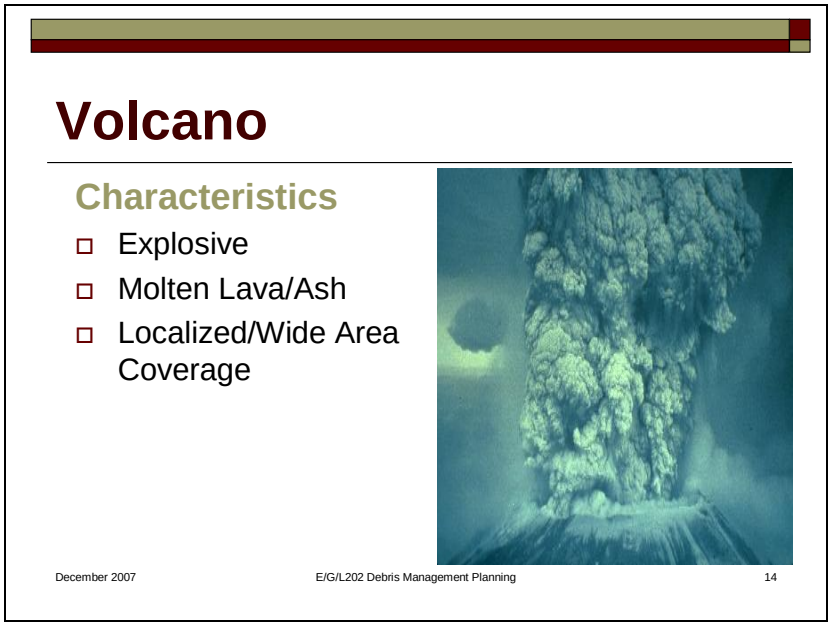
A tsunami is very similar to storm surge damage as caused by a hurricane.

It can be more devastating, faster moving and can flow inland farther.

The receding waters pull debris back which can result in more marine debris problems.

Notes:

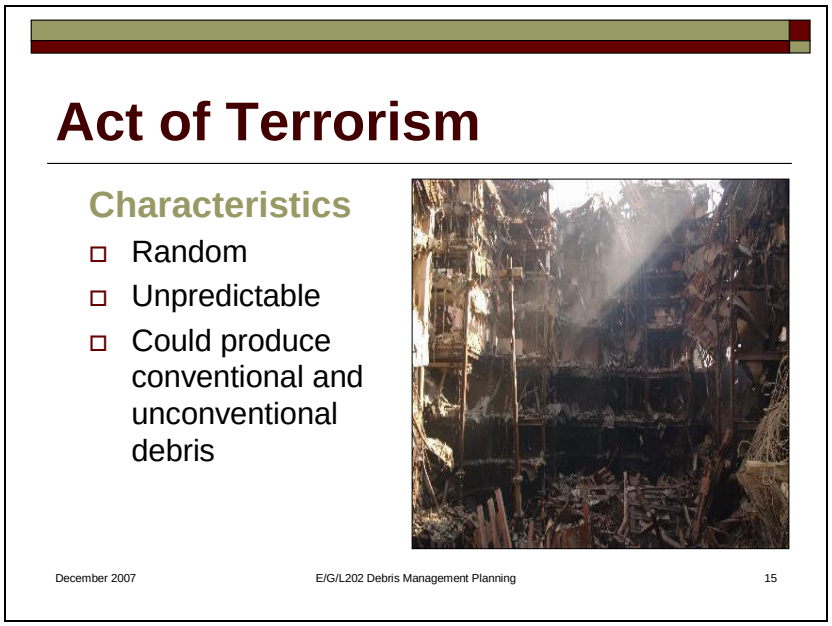
Characteristics of Disaster Types (Cont'd)



Characteristics include:

- Explosive
- Molten Lava/Ash
- Localized/Wide Area Coverage

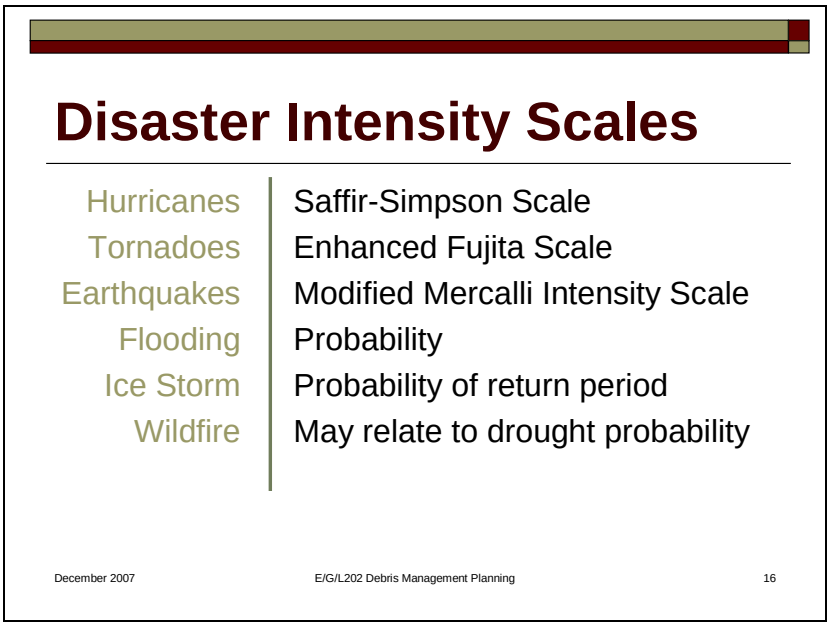
Notes:



Characteristics include:

- Random
- Unpredictable
- Could produce conventional and unconventional debris

Notes:

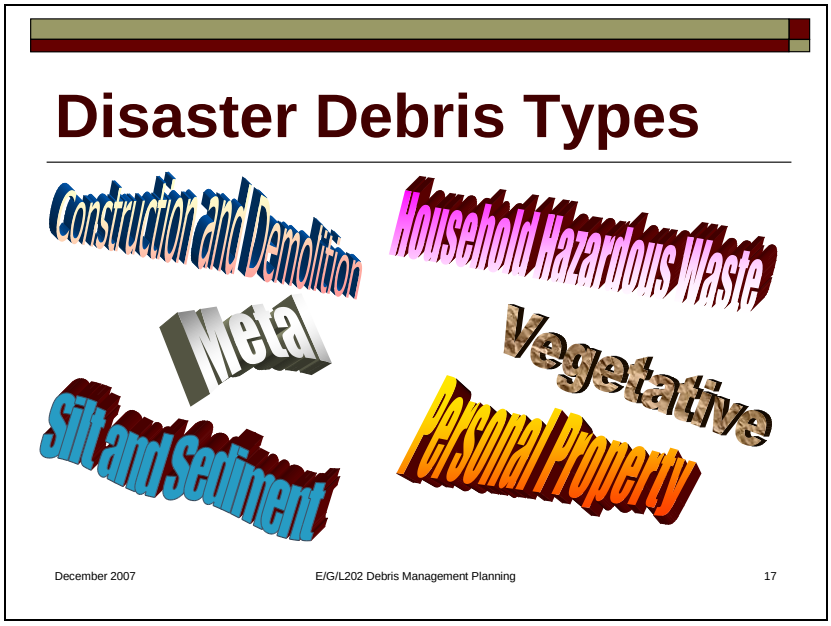


Disaster Intensity Scales

- Disaster Intensity Scales have been developed for hurricanes, tornadoes, and earthquakes that relate the intensity of an event to the anticipated type and magnitude of damage.
  - Disaster Intensity Scales for Hurricanes, Tornadoes, and Earthquakes.
- Other disaster types also have some measure of intensity:
  - Flooding: Normally identified by probability. For example, reference to a 100-year flood represents a 1% probability of occurring in any 1 year.
  - Ice Storms: Less defined but some areas do maintain records on return periods.
  - Wildfires: Difficult to affix a scale but some relate wildfire potential to drought probability.

Notes:

Debris Types and Issues



- The following slides identify the characteristics of debris generated by the various disaster types.
- As indicated earlier, many of the debris types will be generated by more than one disaster type, however, the magnitude and mix of the debris will vary between disasters.
- As these slides are shown, you should begin to consider how these types of debris will be handled in your community.

Notes:

Debris Types and Issues (Cont'd)

- Vegetative debris includes:
  - Trees
  - Brush
  - Limbs
- Vegetative debris will be generated from most disaster types:
  - Hurricanes and Tornadoes—significant quantities
  - Floods
  - Wildfires
  - Ice Storms—some of the largest amounts of vegetative debris come from ice storms
- Vegetative debris will be found both on public and private property, and will be found within streets, often blocking vehicle traffic.

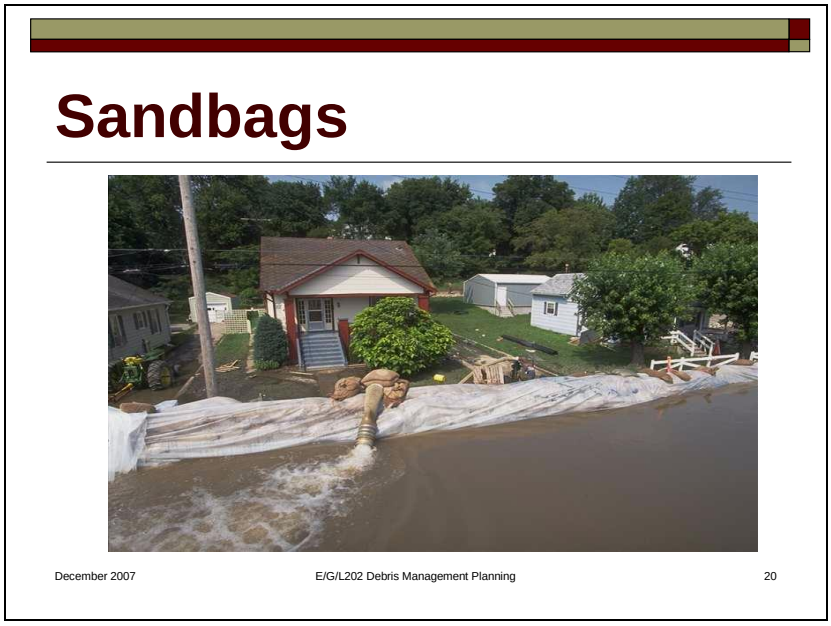
Notes:

Debris Types and Issues (Cont'd)

- Sediment and sand will result primarily from flooding events (floods and hurricanes).
  - Areas with unconsolidated or loose soil material may become almost a river of sediment during flood conditions.
  - Sediment flow conditions can be highly destructive and dangerous.
- Wildfires and earthquakes may also generate landslides and mudslides, resulting in the deposition of sand and rocks.
- Sediment flow combined with high velocity floodwater may cause extensive structural damage—both the sediment and structural debris will require disposal.

Notes:

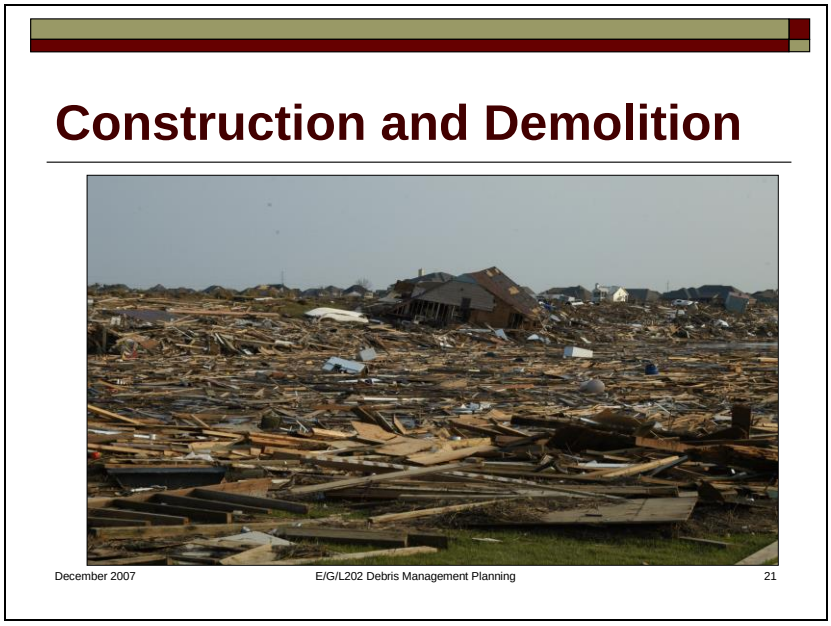
Debris Types and Issues (Cont'd)



- Sandbags used to protect against flooding remain after floods recede.
- Removal of sandbags must be handled cautiously—they can be contaminated with pollutants from flooded sewage treatment plants, pesticides, herbicides, chemicals, and hydrocarbons. The sandbags must be tested and disposed of properly.

Notes:

Debris Types and Issues (Cont'd)



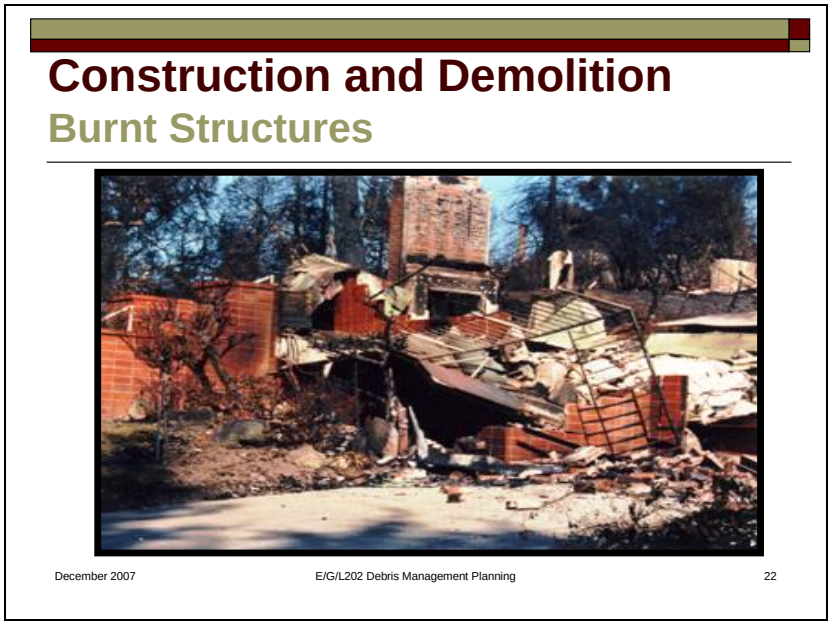
- Construction and Demolition (C&D) material is generated by damaged structures and can be present in most types of disasters to varying degrees (hurricanes, tornadoes, floods, and earthquakes).
- C&D materials may include disaster-damaged building materials and damaged contents.
- Some C&D materials can be recycled.
- The structure use and building materials must be evaluated to consider the potential presence of asbestos and other potentially hazardous materials.

Utility Systems

- In addition to building damage, construction debris may include utility systems such as utility poles, wiring, conduits and other items from power, telephone, cable TV, and other utilities.
  - These damages should be expected in all types of disasters, with a significant concentration from ice storms.
  - It is necessary to coordinate closely with appropriate utility companies to define jurisdictional responsibilities and to encourage cooperation to expedite recovery.

Notes:

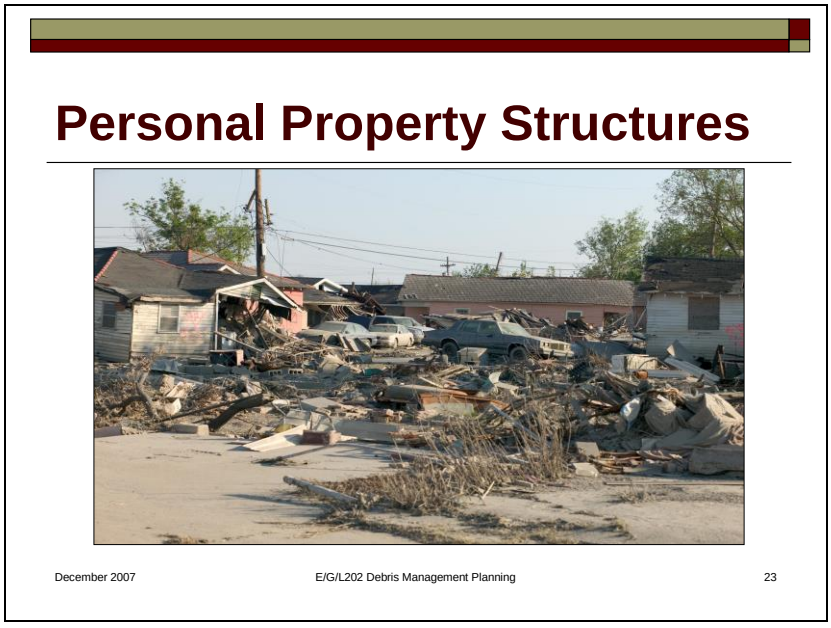
Debris Types and Issues (Cont'd)



- Charred wood and construction materials are a significant portion of wildfire debris, and may also result from earthquake or other disaster-induced fires.
- Charred materials may require different handling and disposal:
  - Resulting materials are often a mix of the building construction materials and contents, including asbestos and other hazardous material, but their presence may not be readily identifiable.
  - Burned asphalt often is included in this mix.
  - Must look at the method of disposal to determine how various possible components of this mix may be accounted for and paid for.
- Even if removal is the responsibility of the private landowner, the local community must consider its disposal.

Notes:

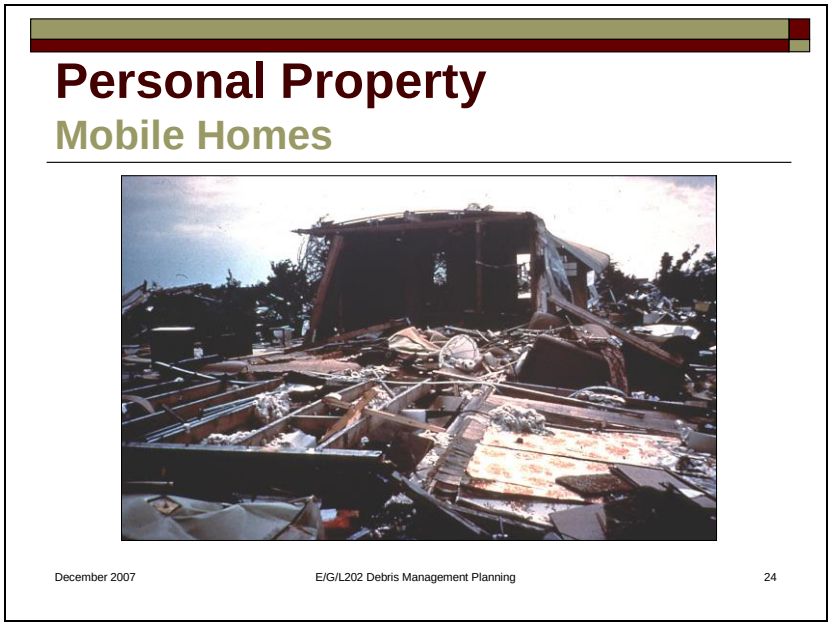
Debris Types and Issues (Cont'd)



- This next series of slides will discuss types of debris and issues associated with removal of debris from private property.
- Destroyed homes will result in significant quantities of debris—C&D and contents. Building materials blown into roadways and yards may include lumber, shingles, and other building materials.
- Local ordinances should require homeowners to have their private contractors haul any debris resulting from the demolition and/or rebuilding process to be taken directly to the landfill and should be paid for from insurance proceeds, when available.

Notes:

Debris Types and Issues (Cont'd)

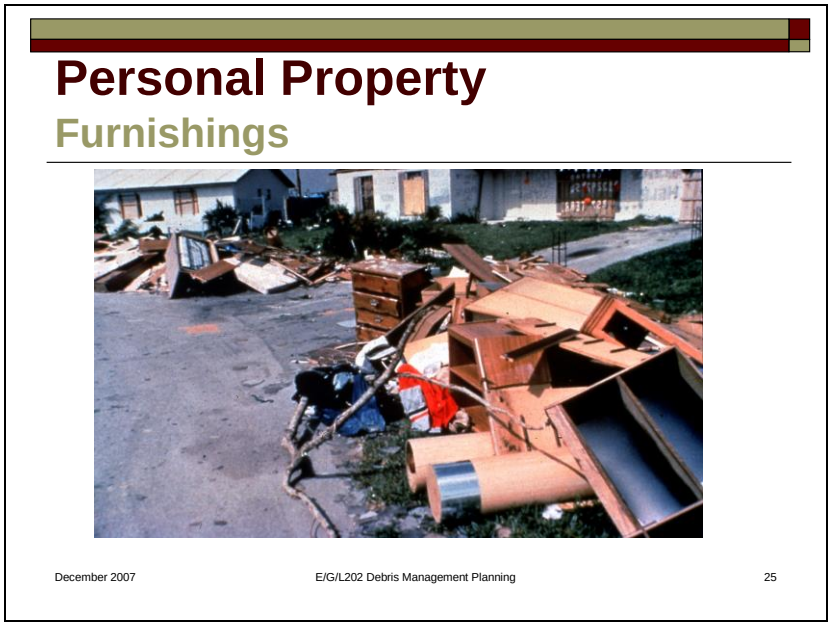


- Mobile homes may present unique cleanup situations:
  - Mobile homes are normally treated as private property and should be removed under the owner's insurance proceeds.
  - However, in some instances, there will be a need to quickly install replacement mobile homes resulting in the damaged home debris being bulldozed to the right-of-way.
  - This will result in large quantities of mixed debris.

The metal frames, light metal porches, and outbuildings may be suitable for metal recycling efforts.

Notes:

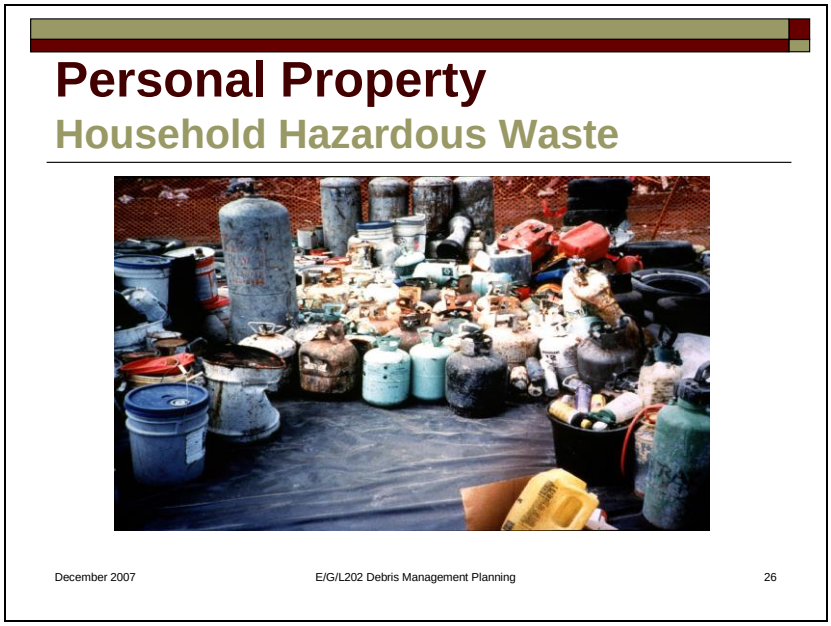
Debris Types and Issues (Cont'd)



- Household furnishings and personal effects will become debris as a result of many disasters
- If residents do not have sufficient time to move contents, as would be the case in tornadoes, flash floods, and earthquakes, the quantities of personal effects will be significant.
- Quantities increase when roofs are damaged during rain events.
- Household furnishings normally make up the second wave of debris that will come to the right-of-way.
- Rugs, furniture, and mattresses should be treated as mixed debris and taken directly to a landfill.

Notes:

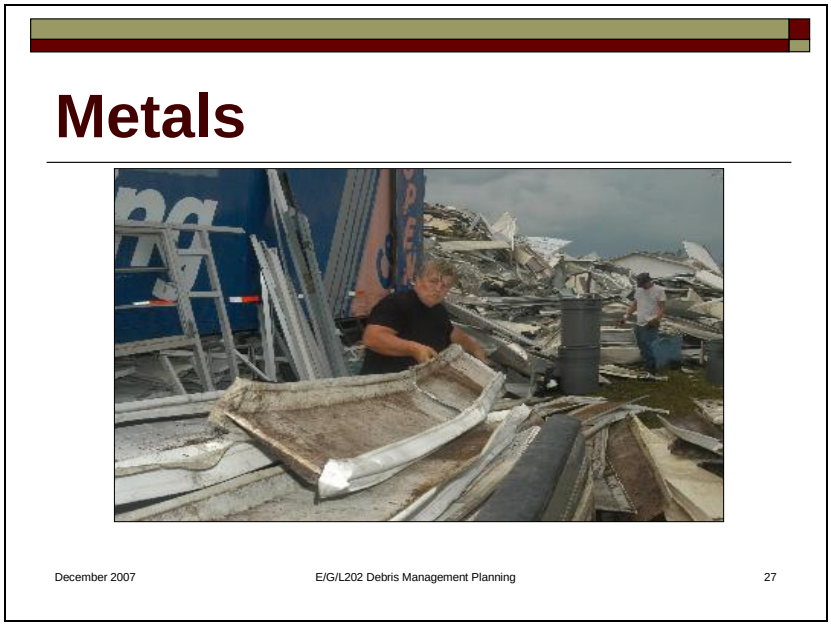
Debris Types and Issues (Cont'd)



- Household Hazardous Waste (HHW) may result from flooding conditions, as well as from other disasters that result in damage to residences.
- HHW may be mixed in with personal property debris.
- Every effort should be made to segregate HHW from the debris stream at the curbside as these materials require special handling and disposal.
- HHW includes such items as:
  - Paint
  - Solvents
  - Cleaning supplies
  - Insecticides
  - Pool chemicals
  - Propane
  - Gasoline
  - Oils

Notes:

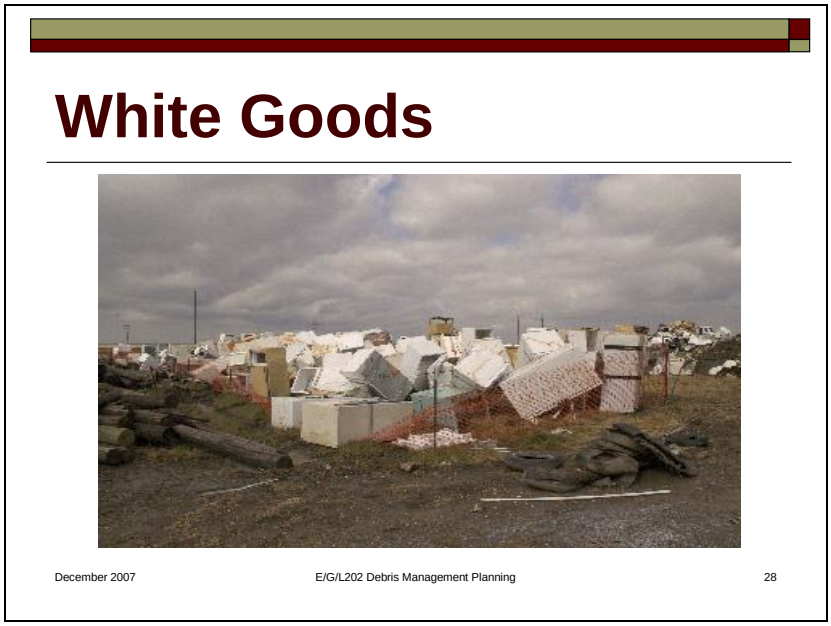
Debris Types and Issues (Cont'd)



- Metal debris may include:
  - Roofing
  - Mobile homes
- Some metals might be suitable for recycling.

Notes:

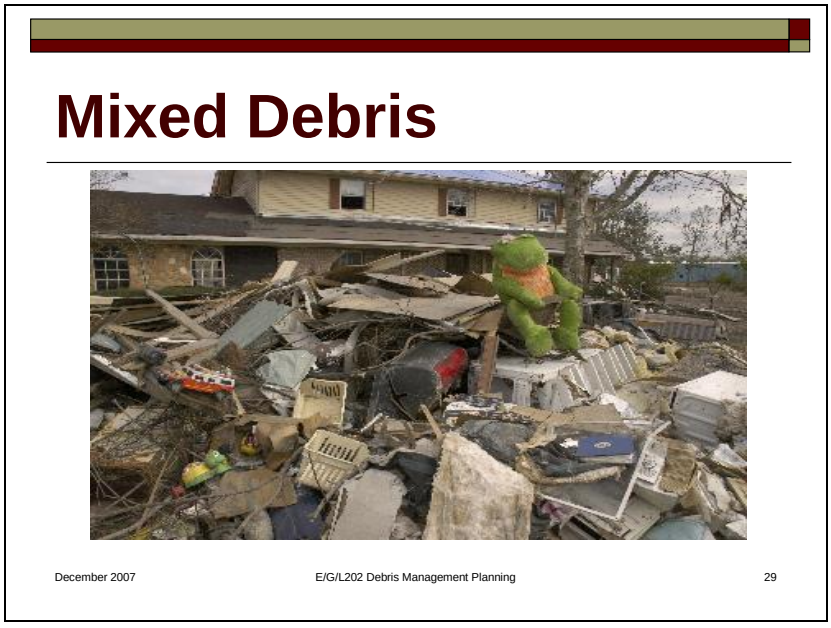
Debris Types and Issues (Cont'd)



- White metals may include:
  - Refrigerators
  - Freezers
  - Washers
  - Dryers
- White goods, such as refrigerators, stoves, washers, dryers, etc., should be segregated and recycled if possible. Care must be exercised to ensure that refrigerants are removed from cooling units by a certified air-conditioning technician.

Notes:

Debris Types and Issues (Cont'd)



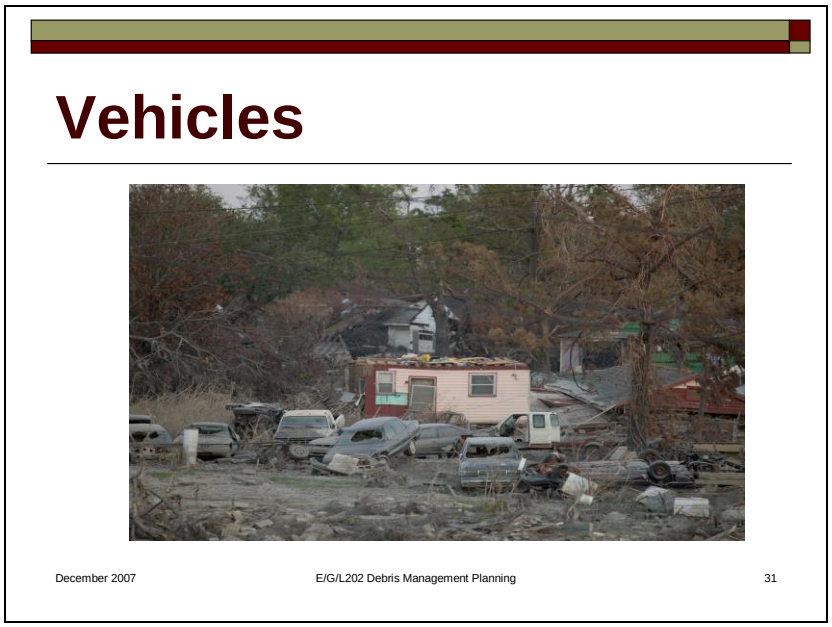
- Debris becomes mixed by:
  - Uncontrolled collection and disposal
  - Disaster effects such as high winds from hurricanes and tornadoes
- Roadside debris piles often contain a mixture of debris types.
- Separation of the mixed debris is often not cost effective. Most often the debris is taken directly to the landfill.

Notes:

Debris Types and Issues (Cont'd)

Removal of boats and vessels requires coordination with the appropriate governing authorities; generally removal and disposal of vessels is the owner's responsibilities

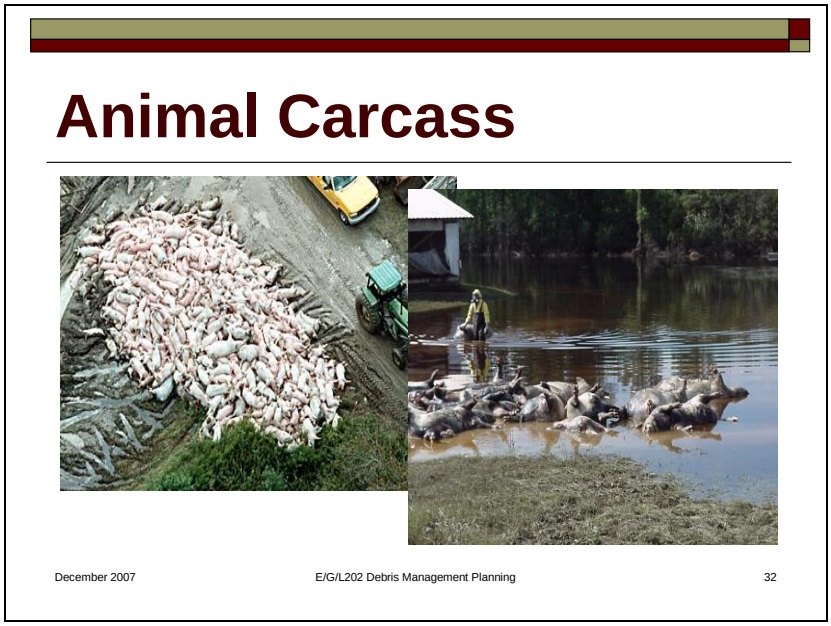
Notes:



- Disposal of vehicles has become a BIG issue in disasters.
- Removal and disposal of vehicles should be coordinated with the appropriate governing authorities.
- Removal and disposal of vehicles is generally the responsibility of the owner.

Notes:

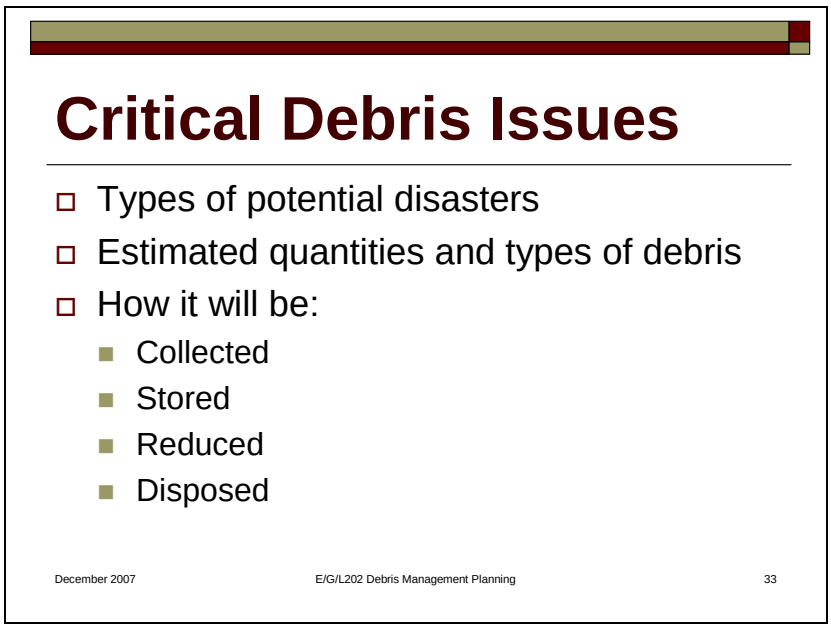
Debris Types and Issues (Cont'd)



- Disposal of animal carcasses can be an issue in disasters, especially in floods.
- Often times, a storm will cause a farmer to not have access to the animals which can cause additional deaths.
- Farmers and/or animal owners should be responsible for the disposal of their animals, but when large numbers of animals are affected, it may be beyond the means of the farmer to properly dispose of them.
- Additionally, particularly in floods, animals may have washed into trees and onto public and private property. To determine ownership of these animals is often impossible.
- In a large-scale flood, wild animals will also be a problem for collection as well as disposal.
- Disposal of animals presents an environmental/health issue:
  - The health and safety of those conducting the cleanup, as well as the citizens at large, must be considered.
  - Long-term environmental impacts of disposal must be considered.
  - The traditional method for disposal is burying. However, for large numbers, this may present a health issue. Composting and incineration are also effective means of disposal, but must be evaluated against environmental regulations.

Notes:

Critical Debris Management Issues

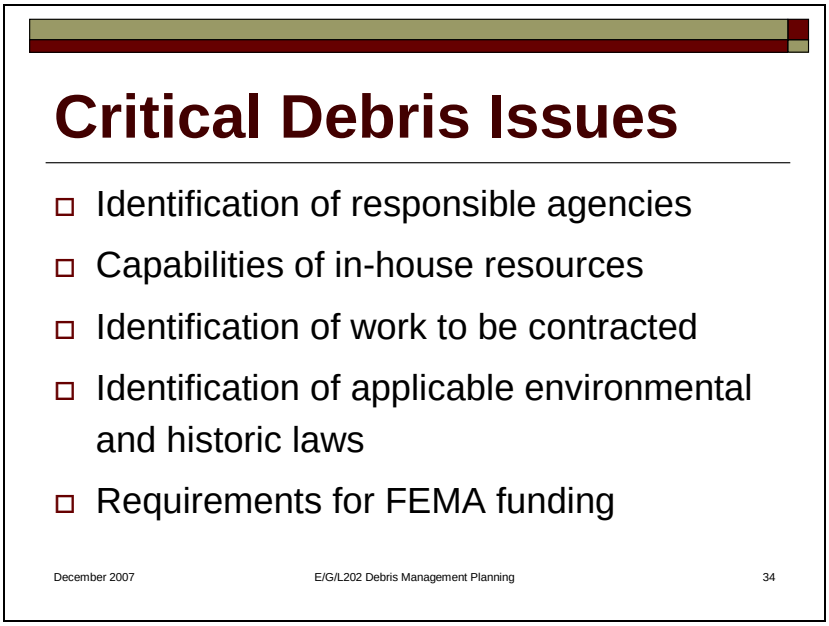


- To effectively manage debris activities, it is important to identify and address critical debris issues, including:
  - What type of disasters should be planned for in this community?
  - How much and what types of debris can be generated in these events?
  - How will the material be collected, stored, reduced, and disposed of?

Notes:

- Additional considerations are provided on the next slide.

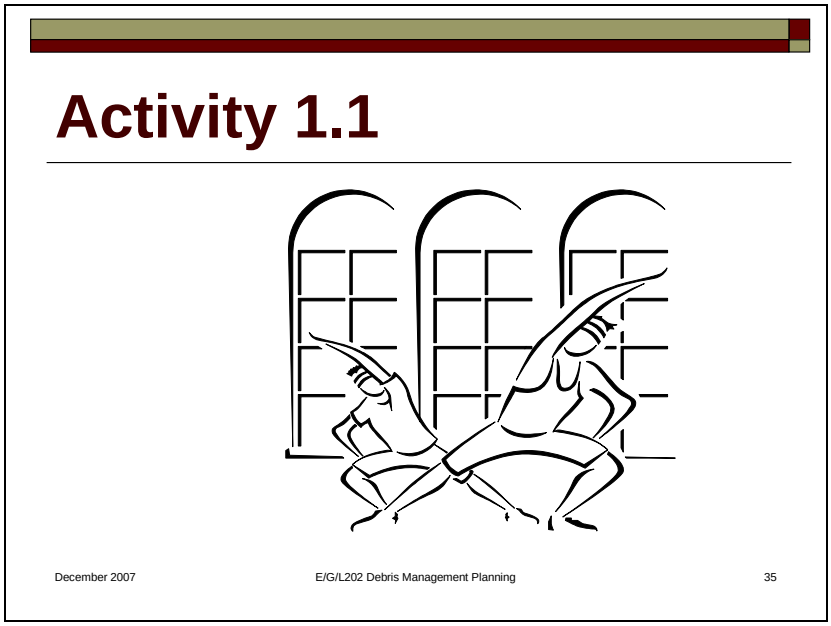
Critical Debris Management Issues (Cont'd)



- Additionally, the community must identify how the work will be organized, performed, and managed:
  - Identify agencies available to assist in the debris efforts and what their responsibilities will be.
  - Identify the capabilities of in-house resources and how they can best be used.
  - Identify the types of work that should be contracted.
    - What types of contracts will be most appropriate for the type of work?
  - Identify the Federal, State, and local environmental and historic preservation laws that might apply to the anticipated work.
  - Identify the types of documentation that may be required to support FEMA funding.
    - In large disasters, Federal funding may be available through FEMA.
    - It is in the communities' best interest to develop their debris management strategy to consider FEMA requirements for funding.

Notes:

Critical Debris Management Issues (Cont'd)



Activity 1.1: Debris Issue Assessment

- This activity will provide you with the opportunity to apply the teaching points covered in this unit.
- Turn to Activity 1.1 in your Student Manual, Volume II (Group Activity Materials).

Notes: