

Cleanup & Removal after Natural Disasters



Natural Disasters and Waste Produced in the United States

Here's a detailed examination of the types of waste materials generated from natural disasters in the United States, including high-profile incidents such as the Hawaii and Southern California wildfires, and Hurricanes Milton and Helene:

Natural Disaster Waste in the United States: Types and Sources

Overview

Natural disasters generate massive amounts of solid waste, often overwhelming local waste management systems. These materials can pose **environmental hazards**, block access to critical infrastructure, and delay recovery efforts if not properly managed.

Types of Natural Disasters & Associated Waste Materials

1. Hurricanes (e.g., Hurricanes Milton and Helene)







In 2024, Hurricanes Helene and Milton inflicted widespread devastation across the southeastern United States, leading to significant debris accumulation and complex waste management challenges. Below is an updated analysis of the waste materials generated by these storms, along with details on cleanup efforts and associated costs.

Hurricane Helene (September 2024)

🖣 Impact Overview

- Landfall: Florida's Big Bend region
- Affected States: Florida, Georgia, South Carolina, North Carolina, Tennessee, Virginia
- Fatalities: At least 232
- Estimated Damages: \$78.7-\$93.5 billion

Types of Waste Generated

- Construction & Demolition Debris: Damaged homes and infrastructure
- Vegetative Debris: Uprooted trees and landscaping

- Household Hazardous Waste: Chemicals, paints, and solvents
- Electronic Waste: Destroyed appliances and devices
- Agricultural Waste: Ruined crops and farming equipment

K Cleanup Efforts

- Debris Volume: Approximately 1.9 million cubic yards in Georgia alone
- Cleanup Costs: Spartanburg County, SC, projected over \$10 million
- Federal Assistance: FEMA provided aid across 92 counties, with the U.S. Army Corps of Engineers awarding \$56.9 million in contracts for debris removal

Murricane Milton (October 2024)

¶ Impact Overview

- · Landfall: Near Siesta Key, Florida
- Affected Areas: Southwest and Central Florida
- Fatalities: At least 45
- Estimated Damages: \$34.6 billion

Types of Waste Generated

- Structural Debris: Collapsed buildings and infrastructure
- Vegetative Debris: Fallen trees and plant matter
- Household Waste: Destroyed furniture and personal belongings
- Hazardous Materials: Chemical spills and contaminated materials
- Sand Deposits: Storm surges deposited massive amounts of sand inland

K Cleanup Efforts

- Debris Volume: Florida processed over 36 million cubic yards of debris statewide
- Cleanup Costs: Hillsborough County approved \$60 million for debris pickup
- Operational Challenges: Communities faced difficulties with sand removal, requiring significant resources and time

III Comparative Debris Management Overview

Disaster Type	Debris Volume	Cleanup Cost	Notable Challenges
Hurricane Helene	~1.9 million cubic yards (GA)	\$56.9 million (USACE contracts)	Widespread flooding, infrastructure damage
Hurricane Milton	36 million cubic yards (FL)	\$60 million (Hillsborough County)	Massive sand deposits, hazardous waste

The back-to-back occurrence of Hurricanes Helene and Milton in 2024 underscored the immense challenges in disaster waste management, highlighting the need for robust preparedness and efficient response strategies.

2. Wildfires (e.g., Hawaii & Southern California)







The January 2025 wildfires in Los Angeles and surrounding areas significantly exacerbated the challenges of disaster-related waste management in the United States. These fires, particularly the Palisades and Eaton Fires, were among the most destructive in California's history, generating unprecedented volumes of hazardous and non-hazardous debris.

- A January 2025 Los Angeles Wildfires: Impact and Waste Generation
- Scope and Destruction
 - Duration: January 7–31, 2025
 - Affected Areas: Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura counties
 - Total Acreage Burned: Approximately 57,636 acres
 - Structures Destroyed or Damaged: Over 18,000
 - Fatalities: At least 30
 - Evacuations: More than 200,000 residents
- Major Fires
 - Palisades Fire:
 - Location: Pacific Palisades
 - Acreage Burned: 23,448 acres
 - Structures Affected: Approximately 7,854
 - Containment Date: January 31, 2025

Eaton Fire:

Location: Altadena and Pasadena

Acreage Burned: 14,021 acres

Structures Affected: Approximately 10,491

Containment Date: January 31, 2025

Types of Waste Materials Generated

The wildfires produced an estimated 4.5 million tons of waste, nearly half of Los Angeles County's typical annual waste output . The waste materials included:

- Structural Debris: Ash, charred wood, melted metals, and concrete from destroyed buildings
- Hazardous Materials: Asbestos, lead-based paints, household chemicals, and electronic waste
- Vegetative Waste: Burned trees, shrubs, and landscaping materials
- Vehicles and Appliances: Destroyed cars, refrigerators, and other large appliances
- Contaminated Soil: Soil polluted with hazardous substances from burned structures

Environmental and Health Hazards

The fires released toxic substances into the environment:

- Air Quality: Elevated levels of lead and arsenic detected miles from burn sites
- Soil Contamination: Hazardous chemicals from burned materials seeped into the ground
- Water Pollution: Runoff from firefighting efforts and debris posed risks to water sources

X Debris Removal and Management Efforts

Phase 1: Hazardous Material Removal

- Lead Agencies: U.S. Environmental Protection Agency (EPA) and California
 Department of Toxic Substances Control (DTSC)
- Actions: Assessment and removal of hazardous materials from over 9,000 properties
- Completion: February 27, 2025

Phase 2: General Debris Removal

- Lead Agency: U.S. Army Corps of Engineers (USACE)
- Scope: Removal of approximately 4.25 million tons of structural debris, excluding vehicles and trees
- Timeline: Ongoing, with significant progress reported as of May 2025

Comparative Analysis: Natural Disaster Waste in the U.S.

Disaster Type	Average Debris Volume	Estimated Cleanup Cost (Per Ton)	Typical Timeline
Hurricane	5–15 million tons	\$25–\$100	6–18 months
Wildfire	50,000–2 million tons	\$80-\$500	6–24 months
Tornado	5,000–100,000 tons	\$30–\$120	3–6 months
Flood	50,000–500,000 tons	\$20–\$75	6–12 months
Earthquake	1–10 million tons	\$50-\$200	12-24 months

Note: The 2025 Los Angeles wildfires exceeded typical wildfire debris volumes, highlighting the severity of the event.

(S) Lessons and Future Preparedness

- Infrastructure Resilience: Enhancing building codes to withstand fire hazards
- Emergency Planning: Developing comprehensive evacuation and response strategies
- Environmental Monitoring: Implementing real-time air and water quality assessments
- Community Engagement: Educating residents on disaster preparedness and waste management

The January 2025 wildfires underscore the critical need for robust disaster waste management systems and proactive environmental safeguards to mitigate the impacts of such catastrophic events.

3. Tornadoes

Key Regions: Midwest (Tornado Alley), Southeast U.S.

Types of Waste:

- **Demolished buildings:** Structural timber, shingles, sheet metal, glass, bricks
- Vehicle debris: Wind-tossed and crushed vehicles
- Power infrastructure: Downed lines, transformers (can include oil-filled equipment)
- Agricultural debris: Irrigation systems, fencing, damaged silos or barns
- Asbestos: Especially if older structures are torn apart

4. Floods

Key Examples: Mississippi River floods, Kentucky & Louisiana flash floods

Types of Waste:

- Waterlogged furniture and personal belongings
- Contaminated drywall and flooring materials
- Mold-infested materials: Insulation, carpets, ceiling panels
- Sanitary waste: From compromised septic tanks and wastewater systems
- Mud and silt: Carried and deposited in homes, roads, and public spaces
- Appliances and electronics
- Animal carcasses: From livestock or wildlife

5. Earthquakes

Key Regions: California, Pacific Northwest

Types of Waste:

- Building collapse debris: Concrete, steel, glass, tile
- Infrastructure failure: Bridge segments, pavement, pipeline fragments
- Natural gas and chemical spills: From ruptured lines or tanks
- Trapped vehicles
- Electronic and telecommunications equipment

6. Winter Storms & Ice Storms

Key Regions: Northeast, Midwest, Northern Plains

Types of Waste:

- Downed tree limbs and branches
- Roof collapses: Especially on flat roofs due to snow load
- Damaged insulation and piping: From frozen and burst plumbing
- Vehicle collisions and breakdown debris
- Abandoned heating oil tanks

B Debris Management and Cost Estimates

Disaster Type	Average Debris Volume	Estimated Cleanup Cost (Per Ton)	Typical Timeline
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Tornado	5,000–100,000 tons	\$30–\$120/ton	3–6 months
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Hazards from Disaster Waste

- Asbestos from old buildings
- Heavy metals from burnt electronics
- **Lead-based paint** in demolished homes
- **Petroleum residues** from damaged vehicles and tanks
- **Toxic ash** (especially after urban or industrial wildfires)
- **Medical biohazards** from flooded or collapsed hospitals

% Waste Handling Strategies

- Sorting and separation: C&D debris, hazardous waste, vegetative waste
- Temporary staging: Emergency debris sites for triage and assessment
- Recycling programs: Concrete crushing, metal recovery, e-waste recycling
- Hazardous waste management: Requires hazmat-certified handlers
- FEMA & EPA protocols: Emergency Debris Removal Guidance