

# *Disaster Preparedness and Environmental Health*

## *The Impact of Natural Disasters on Environmental Health*

Joseph L. McQuirter, DDS

Chairman, Department of Oral and Maxillofacial Surgery  
Charles R. Drew University of Medicine and Science  
Member, Environmental Health and Bioterrorism Task Force  
National Medical Association

# Learning Objectives

- To understand the impact of **natural disasters** on the environment that adversely affect human health.
- To identify element in various events that provide similar experiences in preparing for both **natural and man-made disasters** .
- To appreciate the need for disaster preparation.

# *What are Disasters?*

- The dog ate my homework?
- I am grounded for the weekend?

**OOPs!!!**

**My computer just crashed and  
I didn't save my document?**

# *Disasters*

Situations that occur when significant numbers of people are exposed to **extreme events** to which they are **vulnerable**, with resulting **injury and loss of life**, often combined with damage to property and livelihood.

# Environmental Health

Those aspects of  
human health and disease  
that are determined by factors  
in the  
environment



# Naturally Occurring EVENTS

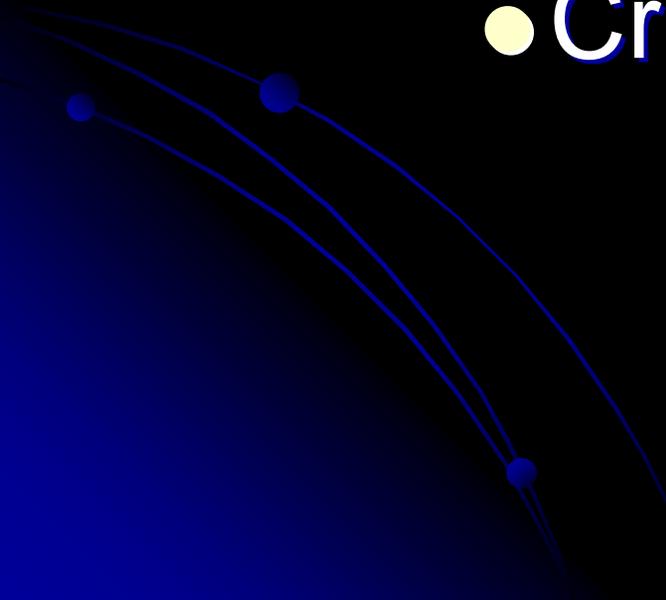
- Disease Outbreak
- Earthquakes
- Extreme Heat (Heat Wave)
- Fire
- Floods
- Hurricanes
- Landslides & Debris Flow (Mudslides)
- Thunderstorms
- Tornadoes
- Tsunamis
- Volcanoes
- Wildland Fires
- Winter Storms and Extreme Cold

# Accidental Disasters

- Industrial Incidents
- Power Outages

(May be caused by natural events or a lack of effective industrial safety measures)

# Intentional Disasters/Events

- Terrorist Acts
  - Criminal Acts
- 

# ***A Terrorist's Arsenal of Weapons***

- Bombs and Bullets
  - Weapons of Mass Destruction
    - Nuclear
    - Chemical
    - **BIOLOGICAL**
  - Cyber Technology
- 

# Weapons of Mass Destruction

## Weapons of Mass Destruction

*A real and present danger to the environment  
in all phases of their existence*

- Research and development (especially testing)
- Wartime use
- Use by terrorist groups or rogue countries
- Storage, transport and disposal

Nuclear

Chemical

Biological

Environmental changes produced  
by any disasters can significantly  
influence human health

*therefore*

studying the impact each disaster  
helps in preparing for other  
catastrophic events

Lessons learned from natural and accidental disasters can even aid in coping with acts of

*Terrorism / Bioterrorism*



# Common Environmental Health Hazards

## Terrorist / Criminal Acts vs Natural Disaster

- Bomb Explosion & Fires

- Bullet & Bomb Projectiles

### Weapons of Mass Destruction

- Nuclear and Chemical

- BIOLOGICAL

- Natural Gas Explosions
- Volcanic Eruption
- Wildfires

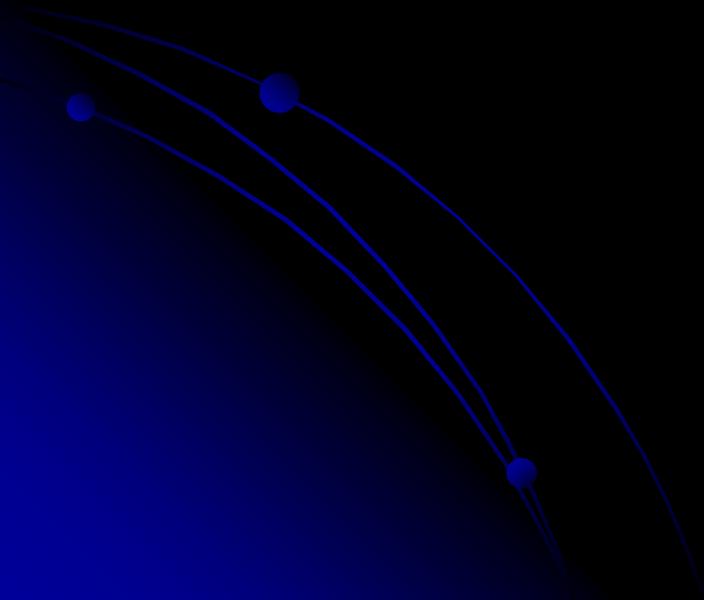
- High Velocity Projectiles from Tornadoes & Hurricanes
- Industrial Accidents associated with explosions

- Hazardous material spill during flood, hurricane, tornado, volcano eruption, severe thunderstorms and extreme thermal exposures.

- Natural Disease Outbreaks
- Post Disaster Diseases Transmission due to Water/Vector-Borne Diseases, Microbial Contaminations, Lack of Sanitation and Medical Aid

# ***Disease Outbreak***

**Diseases Due to Microorganisms (Microbes)**



# Recent Disease Outbreak due to Microbes

- Avian (Bird) Flu
- West Nile Virus
- Severe Adult Respiratory Syndrome (SARS)
- Gastrointestinal Illness aboard Ships

(CDC's Vessel Sanitation Program (VSP))

## Sources:

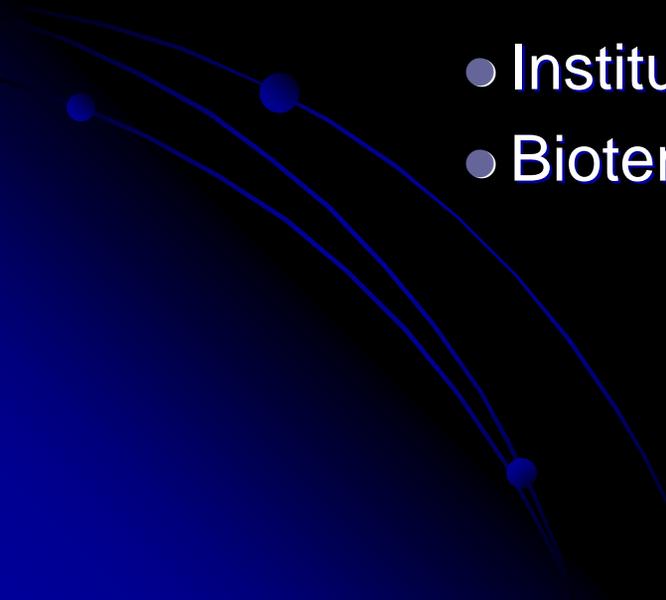
- <http://www.bt.cdc.gov/recentincidents.asp>
- <http://www.cdc.gov/nceh/vsp/surv/GIlist.htm>

# Disease Outbreaks

- Natural Events

- Disease Outbreak
- Loss of Sanitation Due to Other Disaster

- Accidental / Intentional Events

- Institutional Acquired Infections
  - Bioterrorism
- 

# Microorganisms (Microbes)

Microbes are tiny **organisms** - too tiny to see without a microscope, yet they are abundant on Earth.

<http://www.niaid.nih.gov/publications/microbes.htm#a>

# Microorganisms (Microbes)

They live everywhere:

Air

Soil

Rock

Water

<http://www.niaid.nih.gov/publications/microbes.htm#a>

# Microorganisms (Microbes)

Some of them live well in searing heat, and others in freezing cold.

- Like humans, some microbes need oxygen to live, but others cannot exist with it.

# **Microorganisms (Microbes)**

These microscopic organisms are in

Plants

Animals

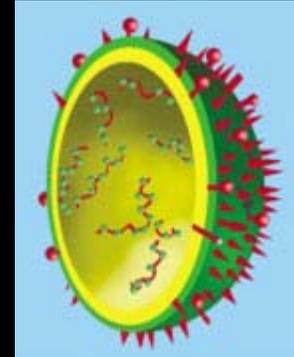
and even in the Human Body.

<http://www.niaid.nih.gov/publications/microbes.htm#a>

# Microbes (germs, bugs)



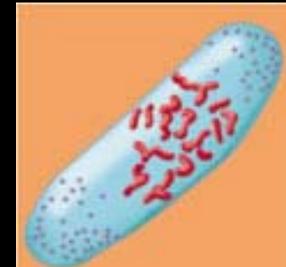
Streptococci Bacteria



Influenza Virus



Penicillin Mold Fungus



Malaria Parasite

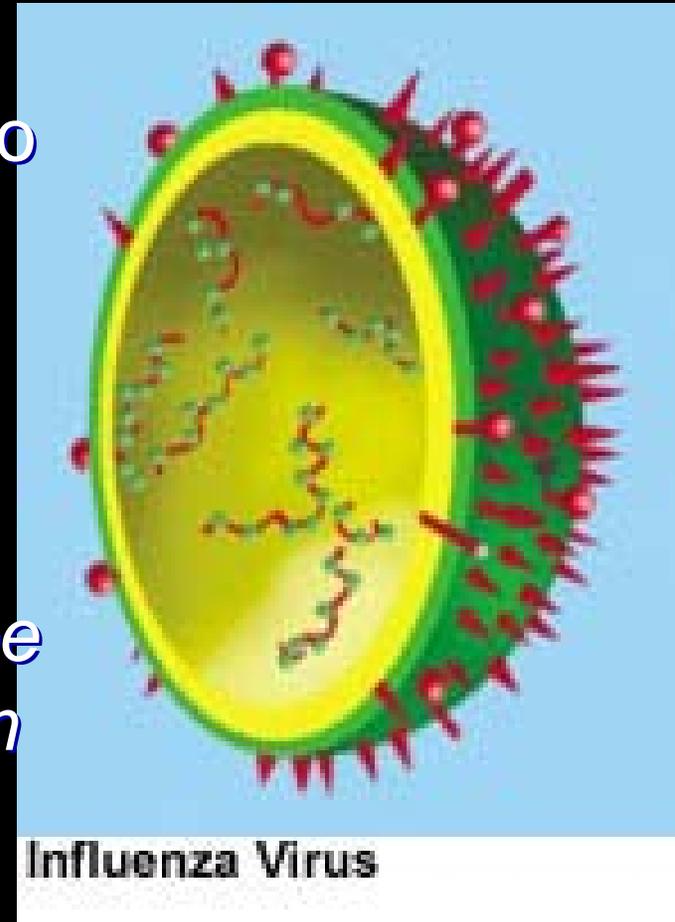
# The Flu Outbreaks (Influenza Viruses)

## ***Pandemic***

Global outbreak of disease due to an new influenza virus that appears in human populations

## ***Epidemic***

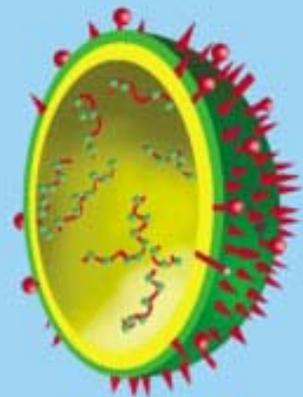
*Seasonal outbreaks of a subtype of the virus already circulating in the human population*



# Influenza Pandemics During the 20<sup>th</sup> Century

1918 – 1919 The Spanish Flu

- $\geq$  50,000,000 deaths worldwide
- $>$  500,000 deaths in United States

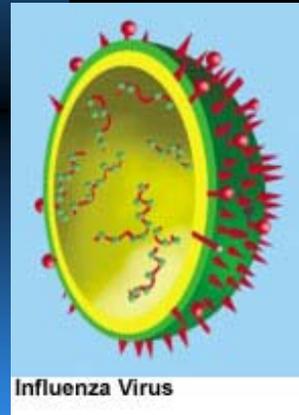


Influenza Virus

# *Influenza Pandemics* *During the 20<sup>th</sup> Century*

1957 – 1958 The Asian Flu

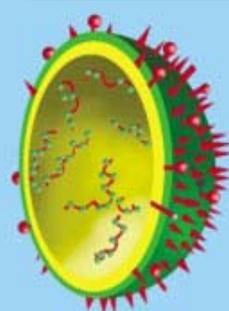
~ 70,000 deaths in United States



# *Influenza Pandemics* *During the 20<sup>th</sup> Century*

1968 – 1969 The Hong Kong Flu

~ 34,000 deaths in United States



Influenza Virus

# *Avian Influenza* *(Bird Flu)*

A naturally occurring intestinal Influenza virus in wild birds.

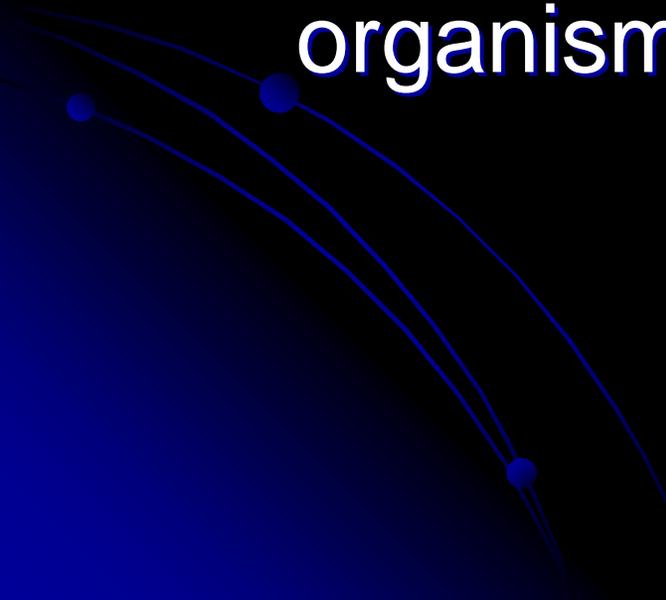
Recently of concern due to

infection and death in domestic birds  
and bird to human transmission

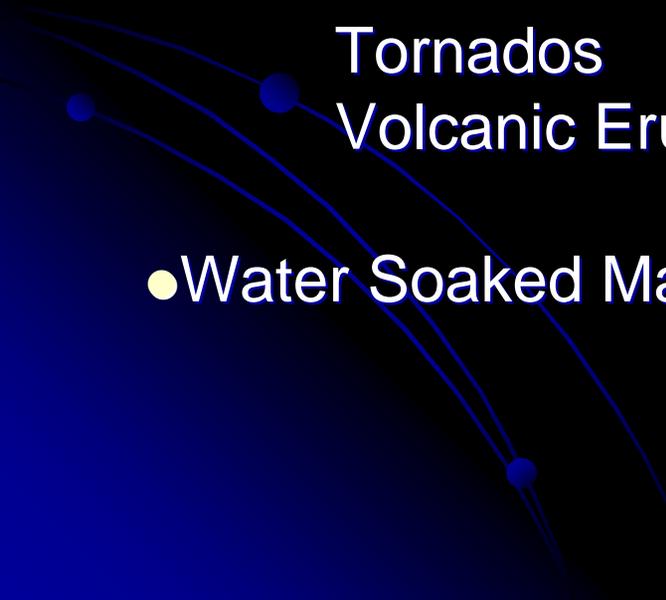


# *Exposure to Mold and Mildew*

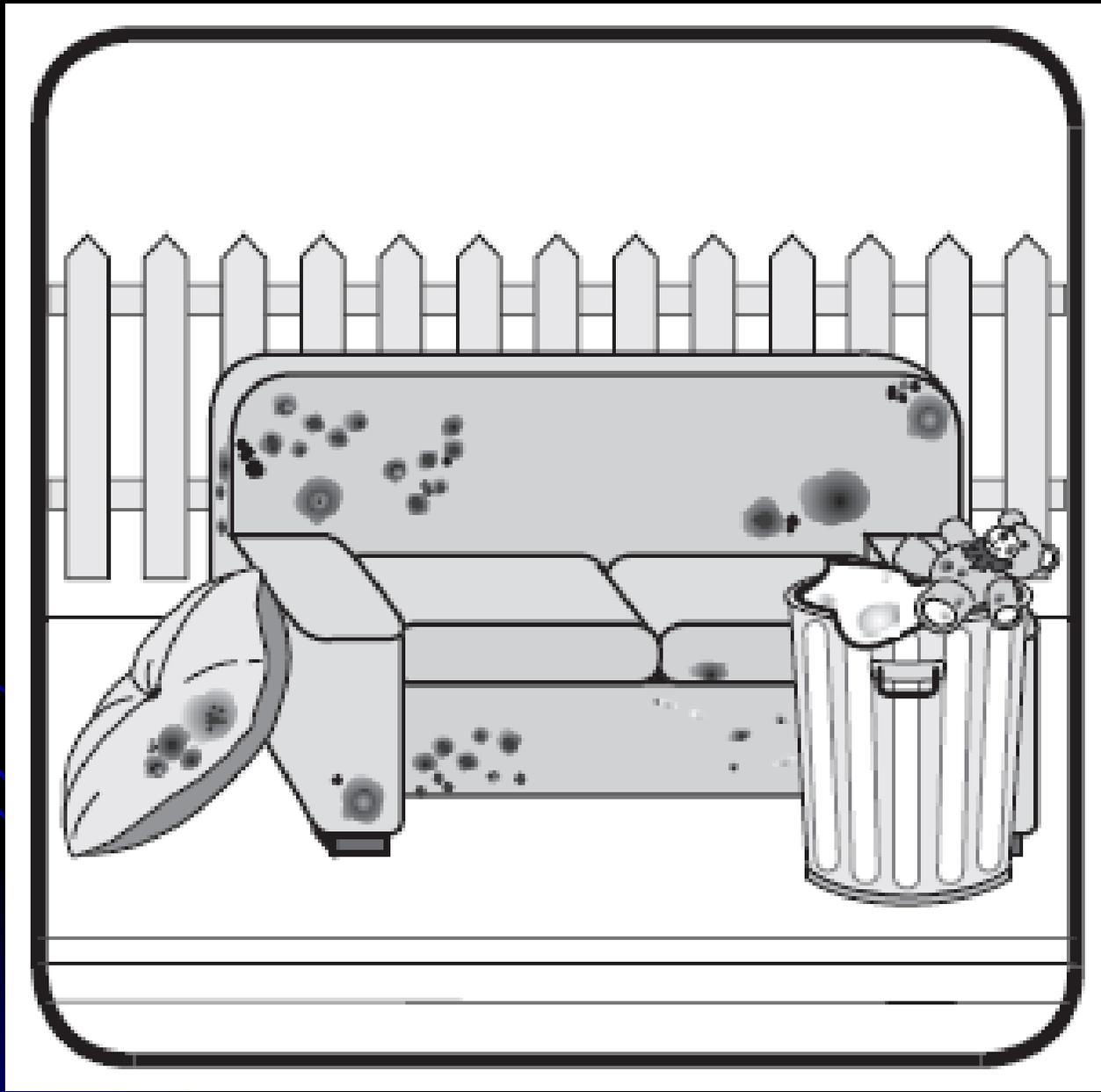
Molds, mildew, yeast and mushrooms are all classified as fungi, a kingdom of organisms distinct from plants and animals.



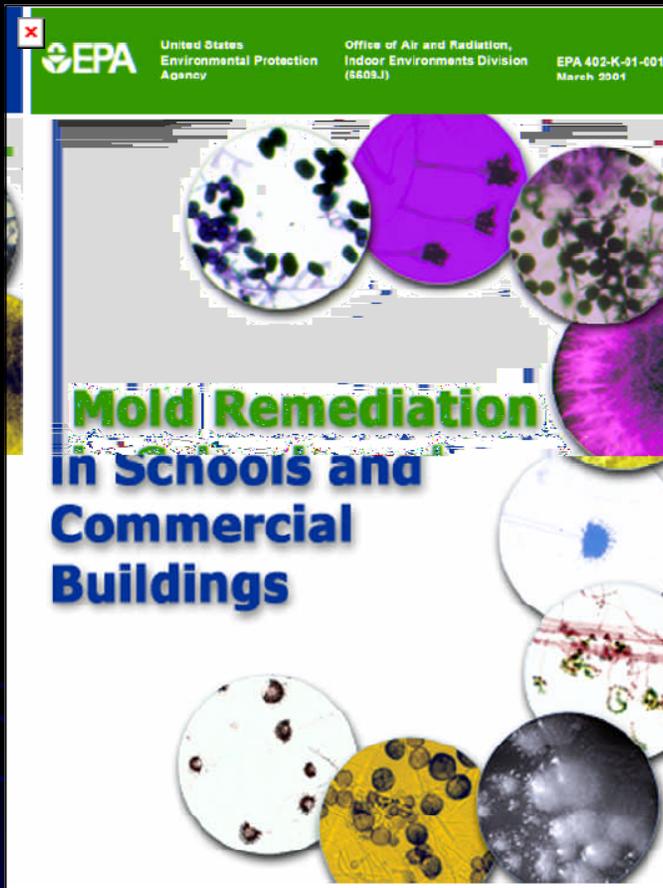
# Moisture laden materials are excellent sites for mold growth

- Flood Waters
    - Excessive Rainfall
    - Broken Dams
    - Hurricanes
    - Tornados
    - Volcanic Eruption on Snow Capped Mountains
  - Water Soaked Materials from Extinguished Fires
- 

<http://www.bt.cdc.gov/disasters/pdf/flyer-get-rid-of-mold.pdf>



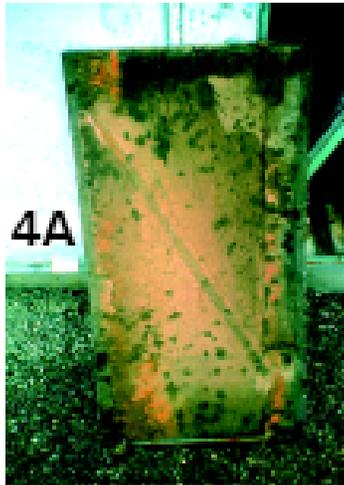
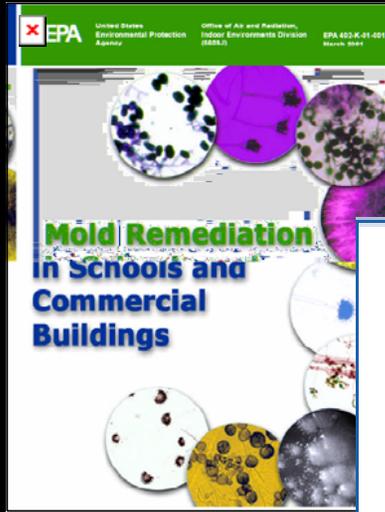
[www.epa.gov/iaq/molds/images/moldremediation.pdf](http://www.epa.gov/iaq/molds/images/moldremediation.pdf)



Molds gradually destroy the things they grow on. Prevent damage to building materials and furnishings, save money, and avoid potential health risks by controlling moisture and eliminating mold growth.



*Photo 2: Extensive mold contamination of ceiling and walls*



*Photo 4A: Contaminated fibrous insulation inside air handler cover*

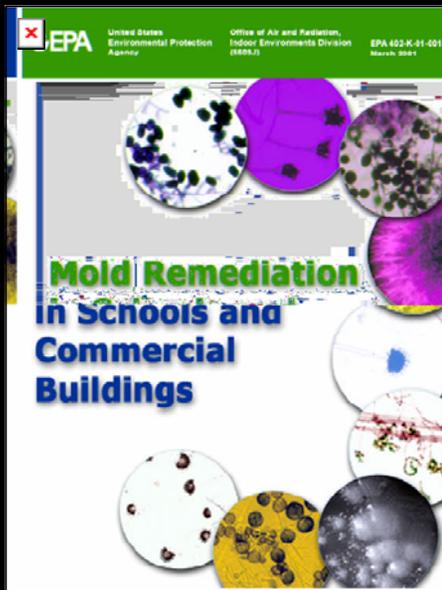


*Photo 4B: Mold growth on air diffuser in ceiling*



*Photo 4C: Moldy air duct*

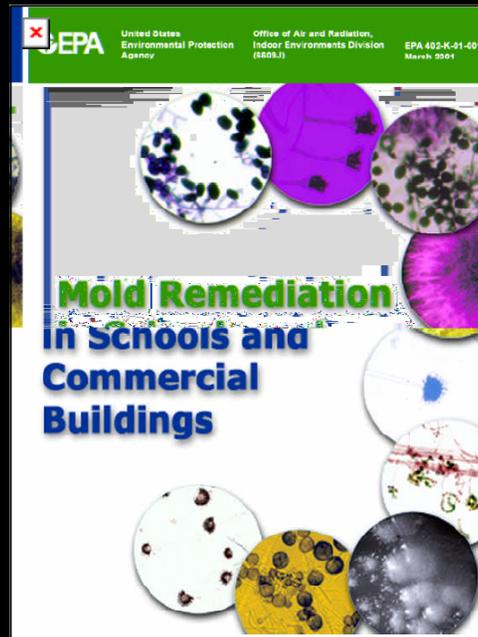
[www.epa.gov/iaq/molds/images/moldremediation.pdf](http://www.epa.gov/iaq/molds/images/moldremediation.pdf)



## Hidden Mold Growth



*Photo 5: Mold growth behind wallpaper*



## Molds Can Damage Building Materials and Furnishings

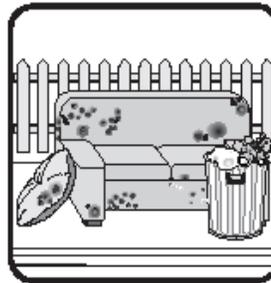
Mold growth can eventually cause structural damage to a school or large building, if a mold/moisture problem remains unaddressed for a long time. In the case of a long-term roof leak, for example, molds can weaken floors and walls as the molds feed on wet wood. If you suspect that mold has damaged building integrity, you should consult a structural engineer or other professional with expertise in this area.



*Photo 6: Heavy mold growth on underside of spruce floorboards*

# Get Rid of Mold

After a flood, mold will grow in your house. It can make you sick. You will need to clean your house.



Take things that were wet for 2 or more days outside.

Things that stayed wet for 2 days have mold growing on them even if you can't see it.

Take out stuff made of cloth, unless you can wash them in **hot** water. Also take out stuff that can't be cleaned easily (like leather, paper, wood, and carpet).

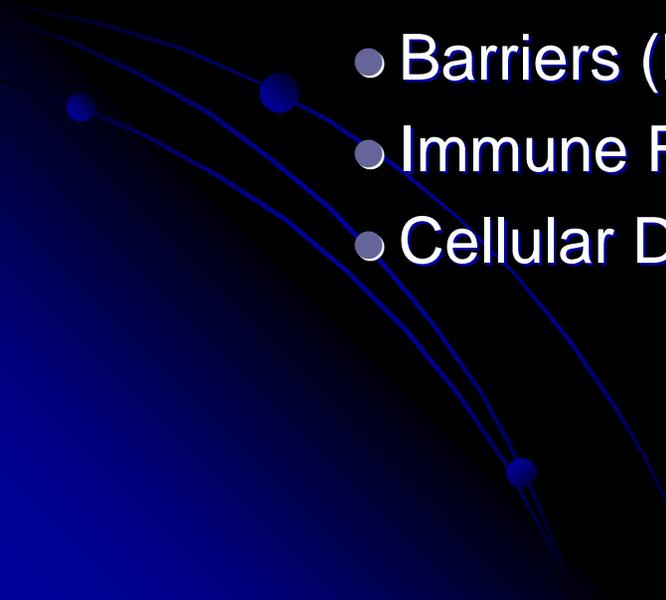
Use bleach to clean mold off hard things (like floors, stoves, sinks, certain toys, countertops, flatware, plates, and tools).

Follow these steps:

- Never mix bleach with ammonia or other cleaners.
- Wear rubber boots, rubber gloves, goggles, and N-95 mask.
- Open windows and doors to get fresh air when you use bleach.
- Mix 1 cup of bleach in 1 gallon of water.
- Wash the item with the bleach and water mixture.
- If the surface of the item is rough, scrub the surface with a stiff brush.
- Rinse the item with clean water.
- Dry the item or leave it out to dry.



# Factors Influencing Disease from Infections by Microbes

- Virulence of the Microbe
  - Critical Number of Microbes Present
  - Host Defense
    - Barriers (Intact Skin and Mucous Membranes)
    - Immune Function
    - Cellular Defense
- 

# Floods can also potentially increase the transmission of the following communicable diseases:

- Water-borne diseases, such as typhoid fever, cholera, leptospirosis and hepatitis A
- Vector-borne diseases, such as malaria, dengue and dengue haemorrhagic fever, yellow fever, and West Nile Fever

# ***Biological Weapons***

## Definition of Bioterrorism

The deliberate or threatened use of bacteria, viruses and toxins to cause disease, death or fear. Bioterrorism could also be directed against livestock, food crops, and environmental resources such as reservoirs.

<http://www.fema.gov/hazards/terrorism/>

# ***Biological Agents***

The Central Intelligence Agency reports that as least 10 countries are believed to possess or be conducting research on biological agents for weaponization

<http://www.fema.gov/hazards/terrorism/>



# *Biological Weapons*

A large-scale bioterrorist attack is thought to be unlikely because the development and deployment of a weapon grade biologic agent that could infect massive number of people requires a high level of technical expertise

In Japan, a terrorist group has dispersed airborne formulations of anthrax and botulism throughout Tokyo on at least eight occasions but for unclear reasons, the attacks failed to produce illnesses

(JAMA. 1999; 281:1735-1745)

# ***Biological Agents***

*(Bacteria, viruses, fungi or toxins)*

CDC *Category A* – biological warfare agents that produce diseases of greatest concern due to likelihood of occurrence and severity of disease

- ***Botulism (Clostridium Botulinum)***
- ***Plague (Yersinia Pestis)***
- ***Smallpox Virus (Variola Major)***
- ***Tularemia (Francisella Tularensis)***
- ***Viral Hemorrhagic Fever***
- ***Anthrax (Bacillus Antracis)***

# *Biological Agents*

*(Bacteria, viruses, fungi or toxins)*

- Q Fever (*Coxiella Burnetti*)
- Brucellosis (*Brucella* Species)
- Glanders (*Burkholderia Mallei*)
- Ricin Toxin (From *Ricinus Communis* - Castor Bean)
- Epsilon Toxin of *Clostridium Perfringens*
- Staphylococcus Enterotoxin B

CDC Category B

CDC Public Health Emergency  
Preparedness & Response

<http://www.bt.cdc.gov/Agent/Agentlist.asp>

Nipah Virus

- Hantaviruses
- Tickborne Hemorrhagic Fever Viruses
- Tickborne Encephalitis Viruses
- Yellow Fever
- Multidrug-resistant Tuberculosis

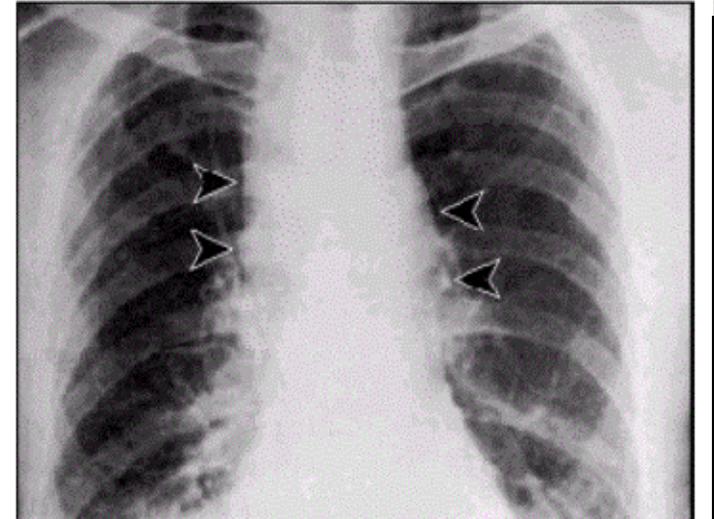
CDC Category C

Anthrax

Smallpox

# Germ Warfare

# Bioterrorism



# *Weapons of Mass Destruction*

## *Weapons of Mass Destruction*

Fortunately, the development and of a weapon grade chemical, nuclear or biologic agent that could injury or infect a massive number of people requires a high level of technical expertise and resources for development.



# Disasters Due to Chemical & Radiation Exposure

Manufacturing  
Storage  
Transport  
Waste/Disposal

**Industrial Chemical / Radiation Material**

- Industrial Incidents/Accidents

**Chemical / Nuclear Weapons**

- Wartime Deployment
- Use by Terrorist

# *Chemical Agents*

Chemical agents have been used as weapons since World War I

They are compounds that cause damaging or lethal effects on humans, animals and even plants.

- The Department that as many as 26 nations may possess chemical agents and/or weapons and an additional 12 may be seeking to develop them

<http://www.fema.gov/hazards/terrorism/>



# ***Chemical Agents***

*Chemical agents includes incendiaries, poison gases, herbicides and other types of chemical substances that can kill, maim or temporarily incapacitate.*



# *Chemical agents*

- Blister/Vesicants
- Blood
- Choking/Lung/Pulmonary/Damaging
- Incapacitating
- Nerve
- Riot Control/Tear
- Vomiting
- Other Industrial Chemicals



Mustard agents are usually classified as "blistering agents" owing to the similarity of the wounds caused by these substances resembling burns and blisters. However, since mustard agents also cause severe damage to the eyes, respiratory system and internal organs, they should preferably be described as "blistering and tissue-injuring agents". Normal mustard agent, bis-(2-chloroethyl)sulphide, reacts with a large number of molecules. The effect of mustard agent is delayed and the first symptoms do not occur until between 2-24 hours after exposure.

# *Other Environmentally Sensitive Areas*

*Susceptible to*

*Industrial Accidents*

*Natural Disasters*

*Terrorist Acts*

# *Other Environmentally Sensitive Areas*

- Four (4) million tons of hazardous chemicals are shipped annually
- Approximately 10% of all trucks (Quarantel, 1981a) and 35% of all freight trains carry dangerous cargo (Kasperson, 1985).

# Weapons of Mass Destruction

## Weapons of Mass Destruction

*Storage, transport and disposal*

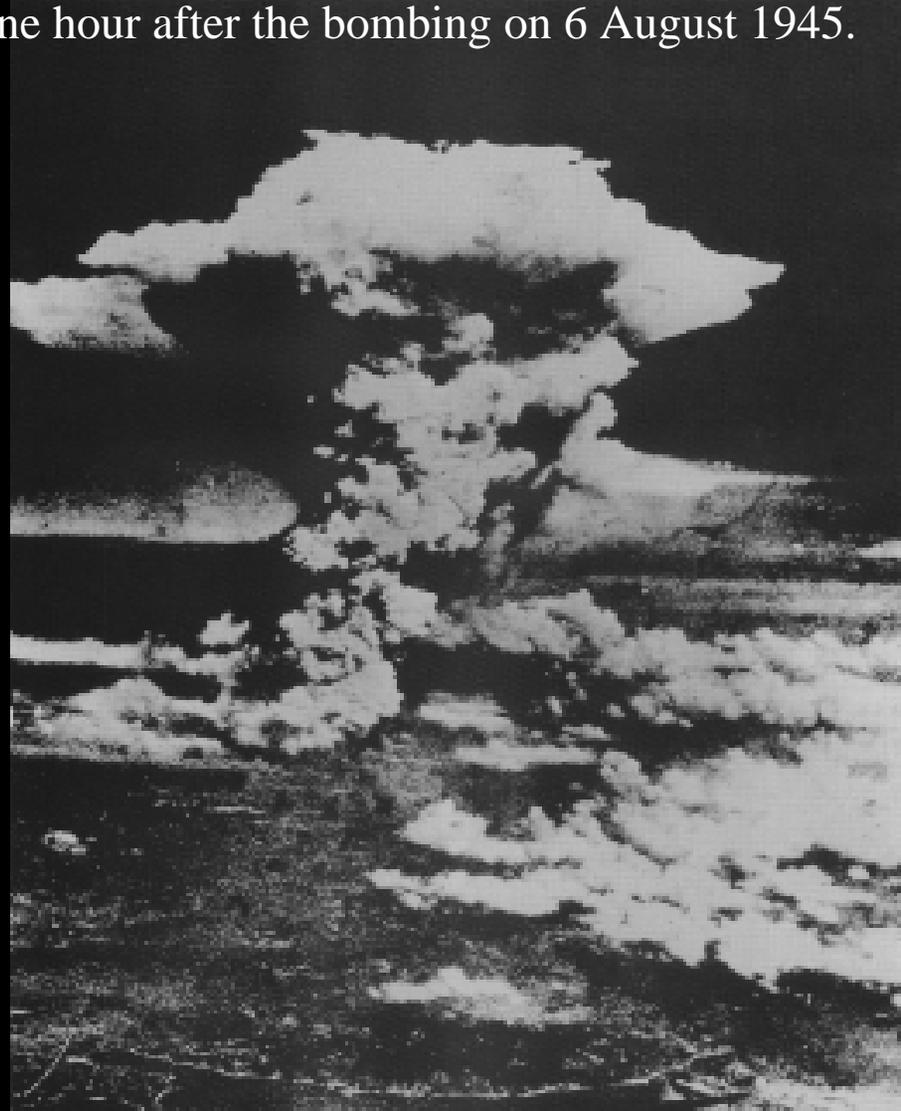
*A critical environmental problem*



# *Nuclear Weapons*

About one hour after the bombing on 6 August 1945.

- Nuclear Bomb
- Dirty Bomb
- Nuclear Waste and Debris
  - Wartime Site Contaminants
  - Production
  - Transportation
  - Disposal of Waste



# ***Bombs and Bullets***

- Bombings have been the most frequently used terrorist method in the United States
  - World Trade Center in New York (February 29, 1993)
  - United States Capitol Building in Washington, D.C.
  - Mobil Oil Corporation Headquarters in New York City

<http://www.fema.gov/hazards/terrorism/>

# *The Intented Impact of Terrorism*

Typically, the intent is bring to the forefront of attention the terrorist's social/political agenda. This is accomplished by any means they feel necessary - the more dramatic and devastating, the better.

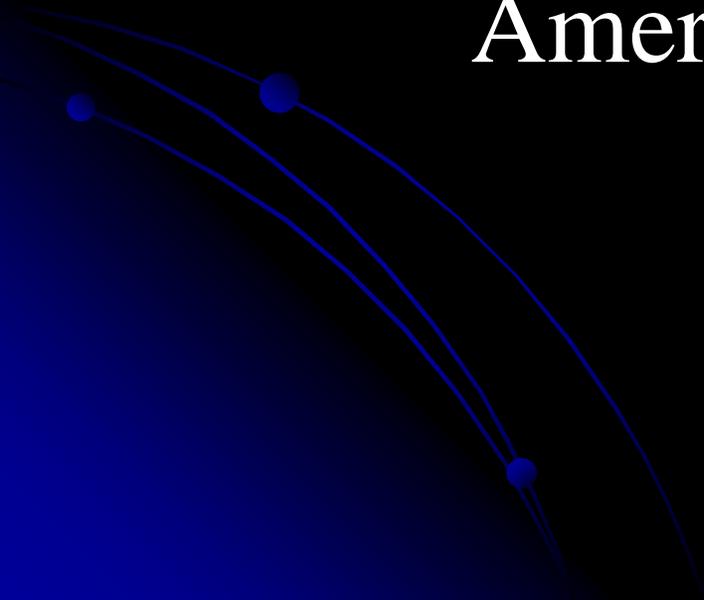
- Loss of human life and injuries
- Property damage
- Severe disruption of public services  
(Electrical, water supply, public transportation and communications)

<http://www.fema.gov/hazards/terrorism/>

The tragic terrorist events of

SEPTEMBER 11, 2001

and the subsequent sporadic episodes of  
anthrax exposure has forever changed the  
American Way of Life



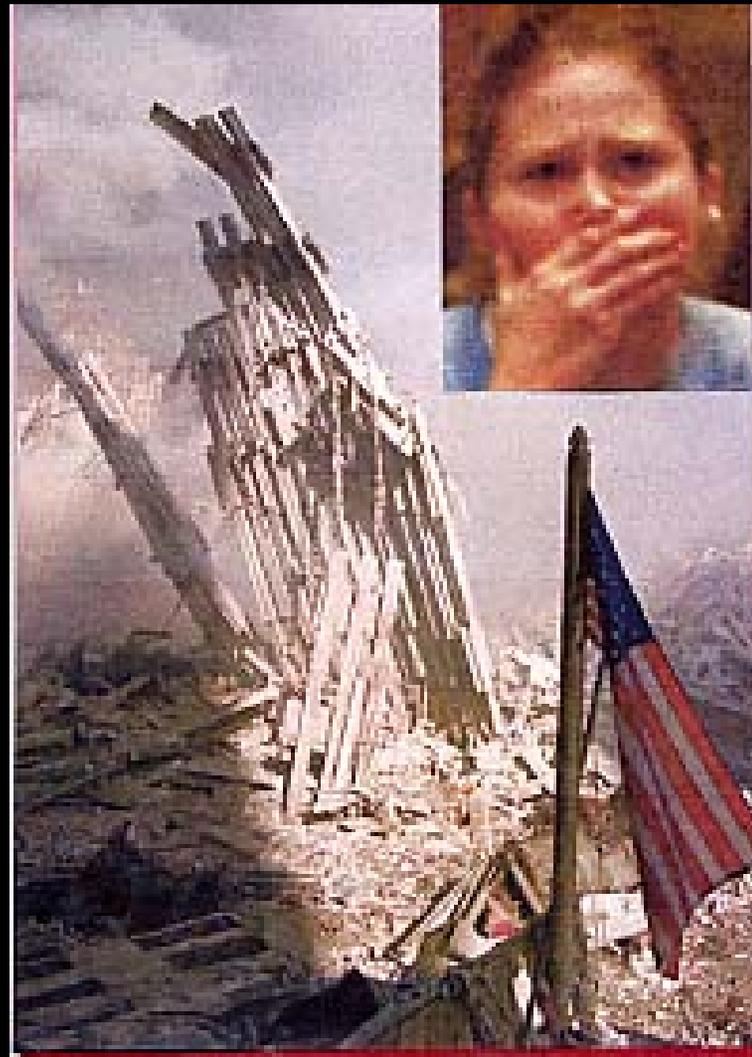
# ***Bombs and Bullets***

- Blast type Injuries (high-order/low-order explosives)
  - Penetrating Injuries (explosive debris or shootings)
  - Fall Injuries
  - Hazmat concerns for exploding buildings, vehicles, projectiles, etc. (biological, chemical or radiation hazardous materials incorporated into the explosive device or in close proximity of the explosion)
- 

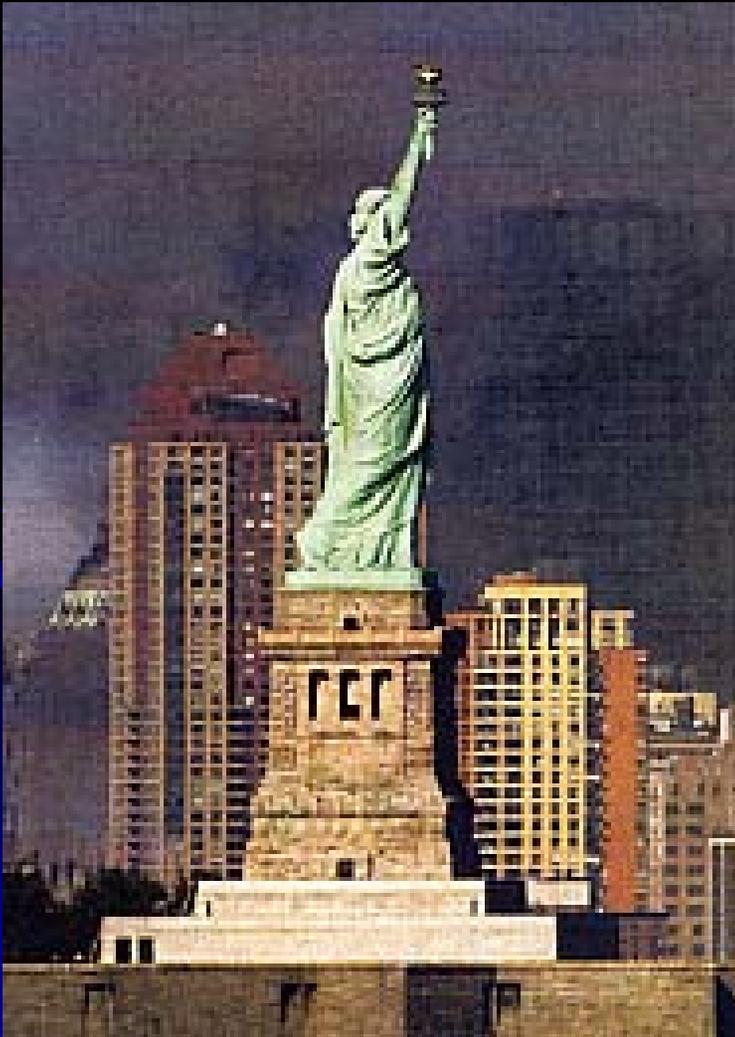
# September 11, 2001

# TERRORISM  
STRIKES HOME

The World Trade Center is highly symbolic in its representation of western economic dominance and has been the site of repeated acts of terrorism



*The World Trade Center* was the second largest building in the world and houses 100,000 workers and visitors each day



# *World Trade Center Bombing*

*September 11, 2001*



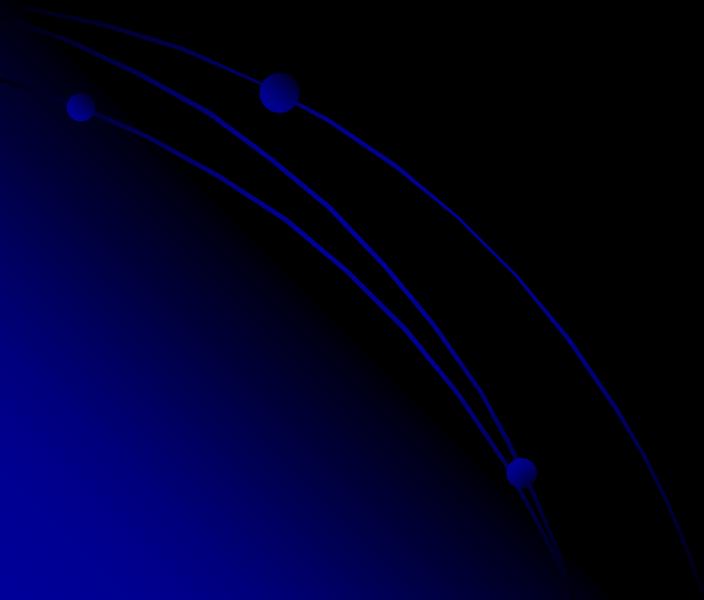
Work continues 24 hours a day at the Trade Center site. It could take as long as a year to remove the 1.2 million tons of rubble from the collapsed tower.

# ***World Trade Center Bombing***

***February 29, 1993***

- Bomb loaded in vehicle in the parking garage
- Five (5) dead
- Thousands injured
- Bomb created crater 200 X 100 feet wide  
crater five stories deep

**Although preparing for a wide range of disasters (terrorist threats, natural and incidental events) is a formidable challenge, the consequences of being unprepared could be devastating**



# Disaster Preparedness

## Traumatic Injuries

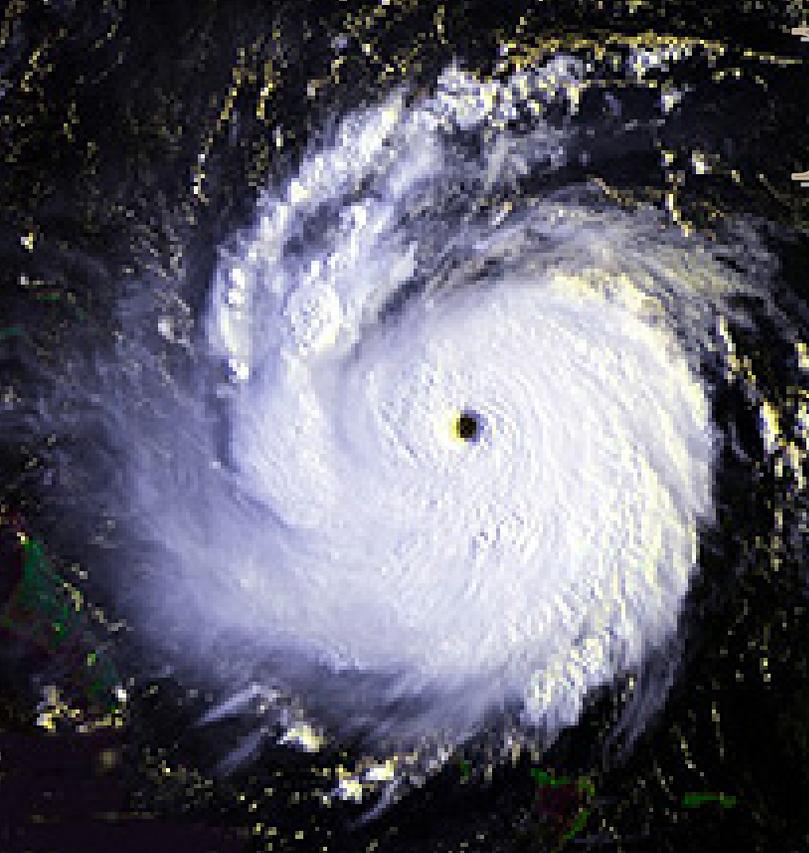
Several natural disasters simulate the Physical Injuries, Mass Casualties and Property Destruction that is seen with the Blast, Crush and Penetration-Type Injuries associated with terrorist acts

# Earthquakes



Alaska 1964, SF Marina District 1989





# Hurricanes



# Tsunamis



Pictures: AFP/Australian Defense Force/Belinda Mephem  
Banda Aceh, Indonesia

Pictures: AP/David Longstreath A Shattered Hotel, Khao Lak, Thailand

# Wildfires







# Volcanos



# Water Damage Associated With

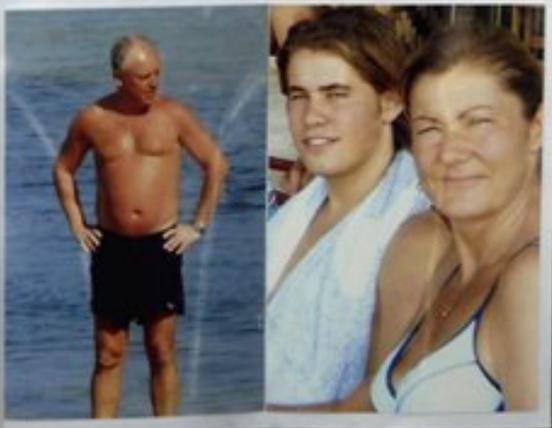
- Earthquakes
- Floods
- Hurricanes
- Thunderstorms
- Tornadoes
- Tsunamis



# Looking for Loved Ones

Sean Sim (Singapore)  
 Thai Mobile : 050-750-93  
 沈德偉  
 ↑  
 SINGAPORE  
 TOURIST ~~NEED~~  
 NEED HELP

Weight / ตั้หนัก	45 Kgs	48 Kgs	55 Kgs
Short Gray Hair / ผมสีเทาสั้น	Long light brown hair / ผมสีน้ำตาลอ่อนยาว	Long Hair / ผมยาว	Long Hair / ผมยาว
Blue Eyes / ตาสีฟ้า	Green Blue Eyes / ตาสีฟ้าเขียว	Blue Eyes / ตาสีฟ้า	Blue Eyes / ตาสีฟ้า
Red Hawaii Shirt w/ white accents / เสื้อฮาวายสีแดง	White / สีขาว	White / สีขาว	White / สีขาว
Dark Green / สีเขียวเข้ม	Dark Blue / สีน้ำเงินเข้ม	Dark Blue / สีน้ำเงินเข้ม	Dark Blue / สีน้ำเงินเข้ม
Dark Green / สีเขียวเข้ม	Dark Blue / สีน้ำเงินเข้ม	Dark Blue / สีน้ำเงินเข้ม	Dark Blue / สีน้ำเงินเข้ม
Dark Brown / สีน้ำตาลเข้ม	Black / สีดำ	Black / สีดำ	Black / สีดำ
Phone call Mr. 06-971-8100			
Phone Call: 050-750-93	Phone Call: 050-750-93	Phone Call: 050-750-93	Phone Call: 050-750-93
Mr. Lohak, Mr. Nohak, Mr. Philip Wilson Stay at Thakwin Hosp. Surathani 077-281-741-5 Room 1014	Mr. Lohak, Mr. Nohak, Mr. Philip Wilson Stay at Thakwin Hosp. Surathani 077-281-741-5 Room 1014	Mr. Lohak, Mr. Nohak, Mr. Philip Wilson Stay at Thakwin Hosp. Surathani 077-281-741-5 Room 1014	Mr. Lohak, Mr. Nohak, Mr. Philip Wilson Stay at Thakwin Hosp. Surathani 077-281-741-5 Room 1014



Pictures: AP/David Longstreath

Posters searching for missing loved ones hang at a community center in Takuapa, Thailand. The death toll in Thailand, according to authorities, is expected to rise above 3,000. Worldwide, more than 70,000 have been reported killed as of Dec. 30.

# The Basics

Food

Shelter

Clothing



Pictures: AFP/Indranil Mukherjee |

## Homeless Boys

Homeless Sri Lankan boys scramble for relief clothes being thrown from a truck at the Kilinochchi central college camp for homeless people in a Tamil Tiger-controlled area northeast of the Sri Lankan capital of Colombo. The government said nearly 25,000 people died in Sunday's tsunami strike, the worst tragedy to hit the island nation known for its palm-fringed beaches.

# Timely Access to Medical Care and other public services



Pictures: AP/Sakchai Lalit |

A Survivor

Tsunami survivor Gunilla Lilljeqvist from Sweden arrives at Bangkok military airport from Phuket, Thailand on Dec. 29. Rescuers converged on beaches and islands to search for survivors of the devastation that destroyed idyllic resorts in southern Thailand.

Being Spared

Requires

Being Prepared

