Nuclear Disaster Management

1 Introduction

Environmental degradations like removal of trees and forest cover from a watershed area causing soil erosion, expansion of flood plain area in upper and middle course of rivers and groundwater depletion.

Developmental processes like exploitation of land use, development of infrastructure, rapid urbanization have caused increasing pressure over the natural resources.

Political issues like war, nuclear power aspirations, fight between countries to become super power have resulted into wide range of disaster events such as Hiroshima nuclear explosion, Syrian civil war, growing militarization of oceans and outer space.

Even industrialization has resulted into warming of earth and frequency of extreme weather events has also increased.

These tragedies highlight the gaps in Disaster Management framework of India Disaster is an undesirable occurrence resulting from forces that are largely outside human control. It strikes quickly with little or no warning and requires major efforts in providing statutory emergency service.

2 Classification:

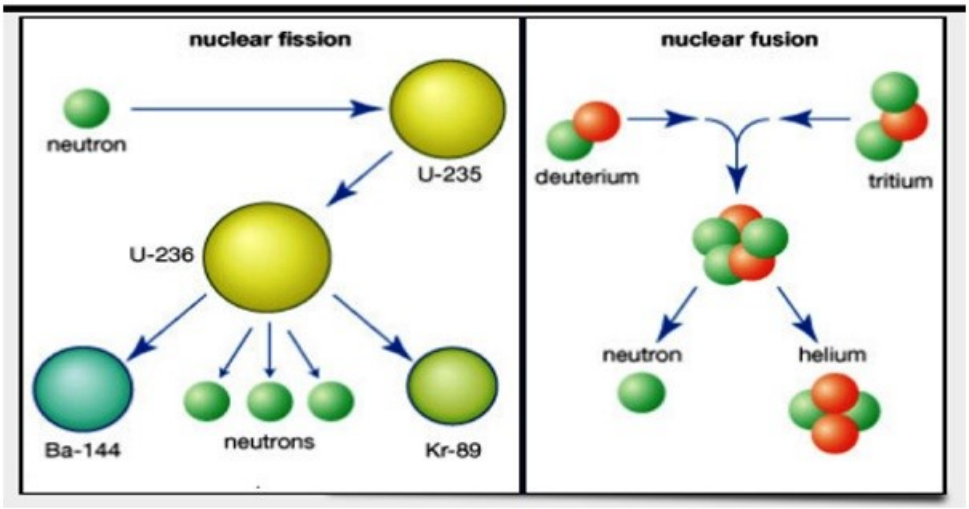
Disasters are classified as per origin, into **natural** and **man-made** disasters.

As per severity, disasters are classified as **minor** or **major** (in impact).

Man-made disaster

Man-made disasters can include hazardous material spills, fires, groundwater contamination, transportation accidents, structure failures, mining accidents, explosions and acts of terrorism.

Nuclear Fission and Nuclear Fusion



3 Nuclear Disaster

3.1 Causes of Nuclear disaster

i. Nuclear power plant accidents

ii. Nuclear reactor attacks

iii. Trafficking and thefts

iv. Worldwide nuclear weapon testing

3.2 Categories of nuclear accidents

i. Nuclear reactor meltdown

ii. Criticality accidents

iii.Decay heat

iv. Transport

v. Equipment failure

vi. Human error

vii. Lost source

3.3 Nuclear reactions

Nuclear disaster is due to meltdown of nuclear reactor plant and release of massive amount of radiation and radioactive materials into the environment .

It is a type of explosion deriving its force from nuclear reactions- fission and fusion .

It may be due to human error, system failure, earthquake, cyclone, flood etc.

3.4 Nuclear reactor meltdown

Nuclear disasters are usually associated with reactor meltdowns.

A core meltdown accident occurs when the heat generated by a nuclear reactor exceeds the heat removed by the cooling systems.

If the core continues to heat, the steel wall of the core would melt.

In a complete reactor meltdown, the temperature may exceed 2700^0C

Molten uranium fuel rods would melt through the bottom of the reactor.

If molten uranium reacts with ground water, produces large explosions of radioactive steams that affects nearby towns.

3.5 Consequences of nuclear disaster

Nuclear explosions produce both **immediate** and **delayed** destructive effects

Immediate effects

- Deaths
- Disability
- Increase in communicable diseases

• Psychological problems

• Shortage of food, medicines and medical supplies

• Socioeconomic losses

• Environmental disruption

Delayed effects

• Huge amounts of radioactive substances may be released into the environment.

• That mixes with groundwater and soil, thus, enters into the food chain.

• It can cause severe genetic disorder, mutation of cells, cancerous growth of cells, deformation of zygote

• A series of large atmospheric explosions could significantly deplete the ozone layer

3.6 Other artificial sources of radiation

• Medical equipment

• Radio pharmaceuticals

• Industrial instruments

• Food irradiation facilities

• Nuclear research laboratories

• University research reactors

• Nuclear weapons

4 What is disaster management ?

• Disaster Management can be defined as the management of resources and responsibilities for dealing with emergencies, in particular preparedness, response and recovery in order to lessen the impact of disasters.

• Disaster management in India refers to the conservation of lives and property during natural or man-made disasters.

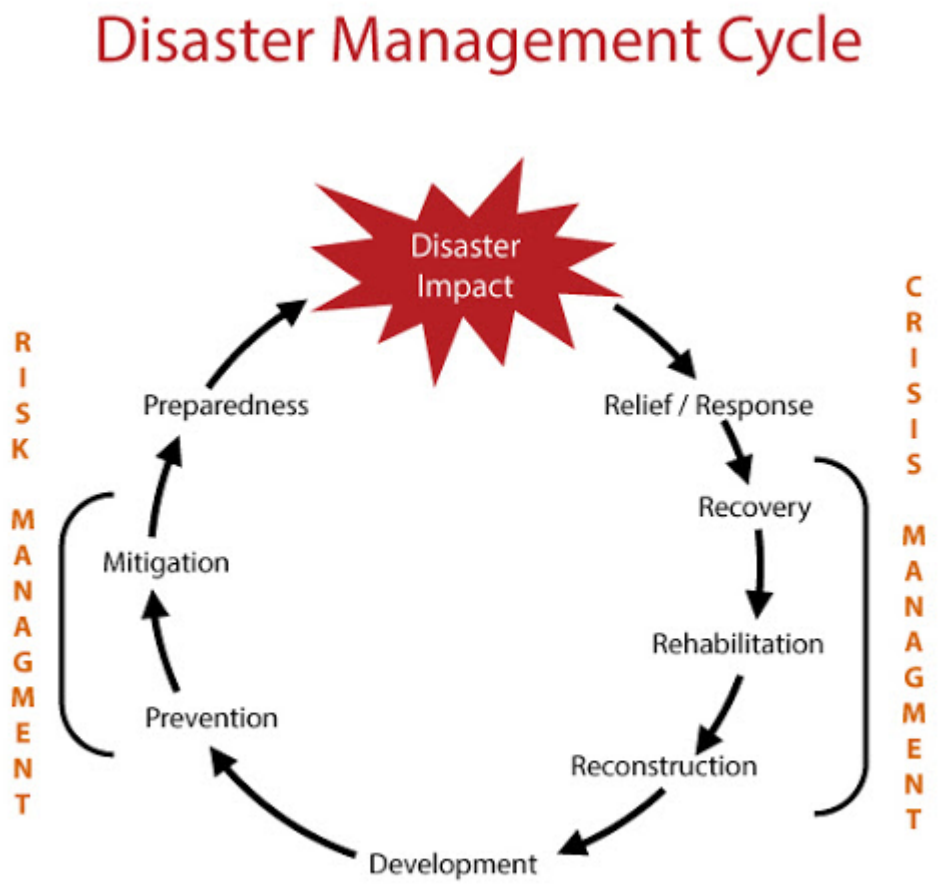
4 stages or phases of disaster management

1. Mitigation Phase
2. Preparedness Phase
3. Recovery Phase
4. Response Phase

4.1 Nuclear disaster mitigation measures

• Stabilize the electricity supply system

  • Store spent fuel in dry casks



• Install filtered vent systems

• Nuclear reactors must be enclosed in broad concrete walls to prevent the radiation from emerging out

• Workers should wear protective garments and glass spectacles

• Extreme care should be exercised in the disposal of industrial waste contaminated with radionuclides

• Prevent sabotage at nuclear facilities

- Ratify a treaty to prohibit military attacks

4.2 Disaster Preparedness

The objective of disaster preparedness is to ensure that appropriate systems, procedures and resources are effectively used for the assistance of disaster victims.

Preparedness includes:

- Personal preparedness
- Professional preparedness
- Evaluating the risk of disaster at a particular country or region
- Adopting standards and regulations
- Organizing communication, information and warning systems
- Developing public education program
- Coordinating information sessions with news media
- Organizing disaster simulation exercises

4.3 Responses:

(Instructions issued by Department of Atomic Energy, Govt. of India).

The response phase is a reaction to the occurrence of a catastrophic disaster or emergency.

Dos:

- Go indoors. Stay inside. Close doors/windows
- Switch on radio/TV and look out for public announcement from your local authority
- Cover all food, water and consume only such covered items

• If in the open, cover your face and body with a wet handkerchief/towel. Return home. Have a complete wash and use fresh clothing

• Extend full cooperation with local authorities and obey their instructions.

Don'ts:

• Do not panic

• Do not spread and/or believe in rumors

• Do not go outside

• Avoid water from open well/ponds, exposed crops and vegetables

• Do not disobey any instruction of the district or civil defence authority who are working tirelessly to ensure safety of yourself, your family and property.

4.4 Recovery

•This phase consists of those activities that continue beyond the emergency period to restore critical community functions and begin to manage stabilization efforts.

•The recovery phase begins immediately after the threat to human life has subsided.

•The goal of the recovery phase is to bring the affected area back to some degree of normalcy.

Action taken during or immediately after disaster

(Crisis management)

• Evacuation, search and rescue, saving lives and identification of dead

• Meeting basic needs of the survivor, ie. Shelter, hospitalization, food and water, personal hygiene, sanitation etc.

• Activating public warning systems

• Rehabilitation and reconstruction of damaged infrastructure Post disaster recovery plans

5 Post disaster recovery plans

• Resilience after a nuclear power plant or other radiation emergency requires response and recovery activities that are appropriately safe, timely, effective, and well organized.

• Use of high-level scientific, medical, communication, and policy expertise

• Health and medical issues are given the central role.

• Restoration of physical, environmental, economic and social stability

• Removal and disposal of contaminated material in sealed underwater cask before transporting the containers to a storage building.

6 Facts about Nuclear Disasters

Nuclear Disasters can release high level of radiations

Nuclear reaction can damage DNA

Radiation can remain in atmosphere for decades and settle down on earth surface

Nuclear disasters causes the depletion of the ozone layer which leads to skin diseases

The only way to ensure safety of people is to build robust nuclear reactors and efficient coolants