

In the earlier chapter, we have discussed some of the natural hazards that are prevalent in India and their mitigation measures. In this chapter, we shall learn about some common human induced hazards and their prevention. In Class VIII textbook '*Together Towards a Safer India*' Part I, you have already read about some of the common human induced hazards like rail, road, air and fire accidents. In Part II of '*Together Towards a Safer India*' for Class IX we will discuss Nuclear, Chemical & Industrial and Biological accidents which are popularly known as weapons of mass destruction.

Weapons of Mass Destruction :

Weapons of Mass Destruction (WMD) are weapons which bring a huge loss to life, property and environment. The term covers several weapon types, including nuclear, biological, chemical (NBC) and, increasingly, radiological weapons. There is controversy over when the term was first used, either in 1937 (in reference to the aerial bombardment of Guernica, Spain) or in 1945 { with reference to nuclear weapons). Following the atomic bombings of Hiroshima and Nagasaki, and progressing through the Cold War, the term came to refer more to non-conventional weapons. The phrase entered widespread usage in relation to the U.S.-led 2003 invasion of Iraq.

NUCLEAR ACCIDENTS

A **nuclear weapon** is a type of explosive weapon that derives its destructive force from nuclear reactions of fission or a combination of fission and fusion. As a result, even a nuclear weapon with a small yield is significantly more powerful than the largest conventional explosives, and a single weapon is capable of destroying an entire city.

There are two basic types of nuclear weapons. The first are weapons which produce their explosive energy through *nuclear fission* reactions alone. These



The clouds caused by the atomic explosions over Hiroshima

are known colloquially as *atomic bombs*, *A-bombs*, or *fission bombs*. The second basic type of nuclear weapon produces a large amount of its energy through *nuclear fusion* reactions, and can be over a thousand times more powerful than fission bombs as fusion reactions release much more energy per unit of mass than fission reactions. These are known as *hydrogen bombs*, *H-bombs*, *thermo-nuclear bombs*, or *fusion bombs*.

Activity I : Collect pictures and write short summary on the two different types of nuclear bombs mentioned above.

With the advancement of scientific research in the world, several countries have acquired the technology to produce Nuclear Arms. There is also a risk of accidental exposure to harmful radiation from the several nuclear reactors that are used to generate power. Theft of nuclear materials can enable the creation of crude bombs commonly known as 'dirty bombs' which can be used by antisocial elements or terrorist groups.

On August 6, 1945, an American B-29 bomber, the "Enola Gay" dropped an 8,900 pound atomic weapon over the city of Hiroshima. Two thousand feet above the ground, the bomb dubbed "Little Boy" detonated, instantly leveling almost 90 per cent of the city. The destruction was incredible. More than 10 square miles of the city were instantly devastated. A city centre was literally vaporized and many more parts of the city got engulfed with fire. 66,000 people were killed and 69,000 injured.

On August 9, another plane dropped a larger bomb, code named "Fat Man" over Nagasaki. Local geography spared Nagasaki from total devastation but one third of the city was destroyed and it killed more than 39,000 people and injured 25,000.

A young girl who was evacuated from Hiroshima a few days before the explosion said- "Suddenly I felt something warm on my left cheek and turned back. It seemed like a strong reflection from a mirror. Then a roaring sound shook the whole village. While I was wondering what had happened, a column of clouds appeared above the mountains in the south in a bright pink colour. Gradually it assumed the shape of a mushroom and rose to the sky. I felt something unusual had happened. However, I didn't ever imagine that the huge city of Hiroshima had instantaneously become a sheet of fire." She lost her parents in the incident.

How can we protect ourselves from nuclear radiation and attacks ?

Don't panic in the event of the nuclear attack or accident. Common indicators of radioactivity are nausea, dizziness, vomiting and disorientation, with no odour but a wave of heat. A nuclear explosion is followed by a 'blast' like the mushroom cloud in the picture on the previous page.

- Don't look at the fire blast as it can cause instant blindness.
- Close all doors and windows, and stay indoors till further communication from the Government. Radioactivity does not penetrate solid structures, though fire may cause damage to buildings.
- Cover all food and water. Don't consume water, milk, food obtained following a nuclear blast.
- Await government instructions / communications if you have to move out of your house.

CHEMICAL AND INDUSTRIAL ACCIDENTS

In the modern day world with the development of science and technology, the usage of chemicals has increased to a large extent for increasing our crop production



Bhopal Chemical Gas leak Disaster (2-3 December 1984) One of the worst industrial disasters of all time occurred in Bhopal. The tragedy was a technological accident in which 45 Tonnes of highly poisonous methyl isocyanate (MIC) gas along with Hydrogen Cyanide and other reaction products leaked out of the pesticide factory of Union Carbide into the night air of Bhopal at around 13.30 a.m. Bhopal. Thousands died in the immediate aftermath. The official death toll reached 3,598 in 1989. Thousands, who survived, however, face fate worse than death.

In the Picture : (Left) The killer MIC plant, (Right Top) Ruins of the Union Carbide Pesticide Factory-Toxic Gas Release, (Right bottom) Slogans on factory wall.

purifying our drinking water, painting our beautiful homes etc. But we have hardly realized that these chemicals which are helpful to mankind in some way or the other are also hazardous to human and environment. Nearly every household uses products containing hazardous materials or chemicals. Some of the hazardous chemicals that fall under this category and are found in every household are hair spray and deodorant, nail polish and nail polish remover, toilet bowl clearers, wall paint and furniture polish.

Manufacturing of chemicals are a major source of contamination through hazardous materials, but there are many others, including service stations, hospitals, and hazardous materials waste sites. Hazardous materials come in the form of explosives, flammable and combustible substances, poisons, and radioactive material. These substances are most often released as a result of transportation accidents, lack of proper storage, use or disposal or because of chemical accidents in plants.

Chemical Weapons of Mass Destructions (WMD) are normally easy to manufacture using simple chemicals. Further they are difficult to detect as most of the Chemical WMD are colourless and odourless.

Dispersion is the simplest technique of delivering an agent of its target. It consists of placing the chemical agent upon or adjacent to a target immediately before dissemination, so that the material is most efficiently used.

World War I saw the earliest implementation of this technique, when German forces at Ypres simply opened cylinders of chlorine and allowed the wind to carry the gas across enemy lines. While simple, this technique had numerous disadvantages. Moving large numbers of heavy gas cylinders to the front-line positions from where the gas would be released was a lengthy and difficult logistical task. Stockpiles of cylinders had to be stored at the front line, posing a great risk if hit by artillery shells. Gas delivery depended greatly on wind speed and direction. If the wind was fickle, as at Loos, the gas could blow back, causing friendly casualties. Gas clouds gave plenty of warning, allowing the enemy time to protect themselves, though many soldiers found the sight of a creeping gas cloud unnerving. Also gas clouds had limited penetration, capable ! only of affecting the front-line trenches before dissipating. Although it produced limited results in World War I, this technique shows how simple chemical weapon dissemination can be..

You and your community are at risk if a chemical is used without following safety precautions or released in harmful amounts into the environment where you live, work, or play. One of the significant events in India includes the Bhopal Disaster of 1984, where a highly toxic gas was released into the air at a Union Carbide pesticides facility and killed more than 3,000 people.

Warning : The onset of an industrial/chemical accident can be rapid (minutes and hours) and/or sudden with no warning depending on the nature of occurrence. Release of chemicals may be because of human error, technological failure or natural activities which include geological activity like earthquake, natural fires, floods etc.

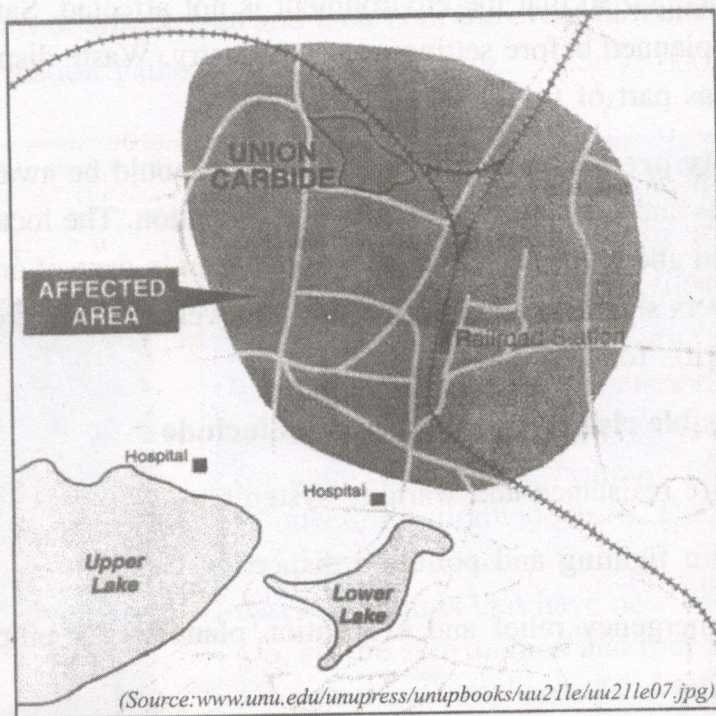
Impact and elements at risk

Since there is little or no warning in case of an industrial/chemical accident, the loss incurred is very high. There is a huge loss to life, property, livelihood and environment. Hazardous materials in various forms can cause death, serious injury, long-lasting health effects, and damage to buildings, homes, and other property. The areas close to an industrial setup are under immediate threat. People working in that industry or people residing in the neighbouring areas are normally affected. There has been a large number of incidents where the farmers have faced the brunt of crop loss because of the toxic gases released by the industries into the air or polluting the water.



23 Dec 2003, Gas Well Blowout in GaoQiao, Chongqing, China 243 people died, 9,000 were injured, and 64,000 were evacuated. Many of the confirmed dead were children or elderly people who were unable to flee after the explosion. Those who did not escape in time suffered burns to their eyes, skin and lungs from the gas, (Source: www.uneptie.org)

Activity 2 : Look for articles on the internet, magazines, and books and find out incidents where improper usage of chemical has affected the local community.



Bhopal, showing the area affected by the leakage of toxic gas.

Mitigation Strategies

Although the risk of a chemical accident is slight, knowing how to handle these products and how to react during an emergency can reduce the risk of injury.

Some of the possible risk reduction measures are as follows :

1. **Hazard Mapping :** Inventories and maps of storage locations of toxins or hazardous substances along with the possible characteristics should be displayed and known to all. The community staying in the immediate vicinity should be aware of this hazard and its possible effects in case of an accident. The map should also determine the area that may get affected in case an accident occurs. The nature of the accident can be different. It can be fire, explosion, spillage, gas cloud etc.

A safe route for evacuation in case of emergency should be marked on the map.

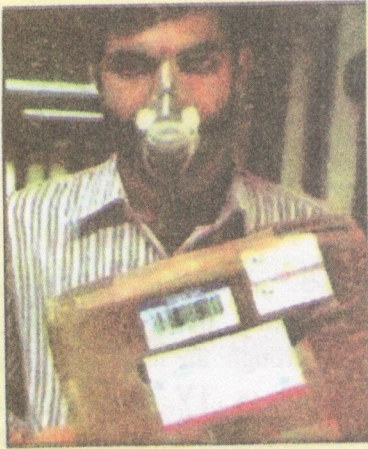
2. **Land use planning :** Densely populated residential areas should be located at a distance from industrial areas. A buffer zone (green belt) should separate the industrial and the residential zone. Better planning is required to handle the waste that is generated so that the environment is not affected. Safe disposal methods should be planned before setting up any industry. Waste disposal sites should be identified as part of the planning process.
3. **Community preparedness :** The community should be aware of the hazardous installations and know how to combat the situation. The local community has to be informed about the response steps to be taken in case of an accident. Community members should monitor the pollution levels of the industry and participate in mock drills for evacuation.
4. **Other possible risk reduction measures include :**
 - Improve fire resistance and warning systems.
 - Improve fire fighting and pollution dispersion capabilities.
 - Develop emergency relief and evacuation planning for employees and nearby settlements.
 - Incident response training should be provided to the employees of the industry.
 - Maintain a wind flow diagram of the region.
 - Limit storage capacity of the toxic substances.
 - Insurance for industries and Safety legislation.

ACTIVITY 3 : How can we prevent and prepare for chemical disasters ?

1. Find out what industries exist close to your city or village, and whether any of the chemicals they use are hazardous.
2. Find out whether an emergency plan is in place to deal with industrial accidents, and what antidotes can be used in case of poisoning of people, animals, water sources, etc.
3. Find out whether your local medical association is aware of how to treat patients suffering from exposure to these chemicals.

4. Make a report of your findings and take the help of your teacher to inform concerned authorities such as the District Magistrate, Block or Taluka Development Officer, or Municipal Corporation as well as the closest PHC.
5. Make a chart of simple Dos and Don'ts in the event of a chemical disaster based upon information gathered from the industry.

Anthrax 'likely' in US postal deaths
Monday, 22 October, 2011, 20:57 GMT
21:57UK



A Postal worker in India with a package from the US during the anthrax scare of 2001

Two postal workers in Washington DC who died from unexplained causes were “likely” to be infected with anthrax, US officials said. Their bodies are being tested for anthrax symptoms amid circumstances described by health officials as “highly suspicious”. The revelation came as US authorities confirmed that a second postal worker in the city had tested positive for anthrax infection, bringing the number of cases of infection nationwide to 10. The new victim had the more serious inhaled form of the disease. Of the cases of anthrax that have now been identified in the US, six are skin anthrax and four are inhaled anthrax. One man, an employee of a tabloid newspaper in Florida, died as a result of anthrax inhalation.

Source:BBC New Service

Biological Disastes

Biological weapons are referred to as a “poor man’s nuclear bomb” because they are easy to manufacture, can be deployed without sophisticated delivery systems, and have the ability to kill or injure hundreds of thousands of people. Simple devices such as crop dusting airplanes or small perfume atomizers are effective delivery systems for biological agents. In contrast to chemical, conventional, and nuclear weapons that generate immediate effects, biological agents are generally associated with a delay in the onset of illness (hours to days). Moreover, illnesses from biological weapons are not likely to be recognized in their initial stages. With highly transmissible agents (eg; plague and small-pox), the time delay in recognition can result in widespread secondary exposure to others, including doctors and health staff.

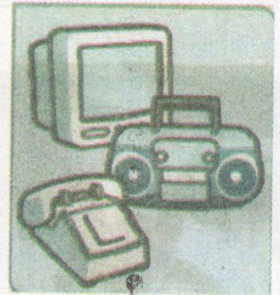
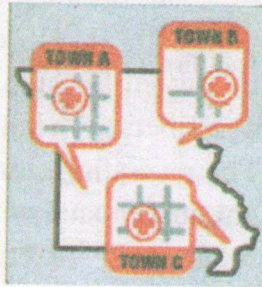
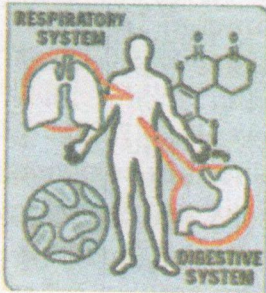


Do you know ?

That 100gms. of Anthrax released over a major city may cause upto a million casualties

How do we protect ourselves from Biological WMD ?

Do's and Don'ts for Biological Disaster :



1. A biological attack is the release of germs or other biological substances. The germs must be inhaled, enter through a cut in the skin or be eaten to make the victim fall sick. Some biological agents cause contagious diseases, others do not.

2. A biological attack may or may not be immediately obvious. While it is possible that you will see signs of a biological attack it is perhaps more likely that local health care workers will report a pattern of unusual illness.

3. You will probably learn of the danger through an emergency radio or TV broadcast. In rural areas, a loudspeaker or other methods such as used for a cyclone warning, may be used to warn you.



4. If you become aware of an unusual or suspicious release of an unknown substance nearby, it doesn't hurt to protect yourself and others.

5. Get away from the substance as quickly as possible.

6. Cover your mouth and nose with layers of fabric that can filter the air but still allow breathing.

Activity 4 : Organize most drill in your class for the various manmade disasters, and see how you will prepare and respond to them.



Do you know

- That the first symptoms of a possible chemical leakage are irritation, burning and redness in the nostrils and eyes, followed by nausea, dizziness and disorientation ? Pungent or bitter-sweet smells indicate the presence of a gas in the air.
- That panic induced fleeing during a gas leakage is harmful ? Stay calm, in the same place, put a wet cloth on your face and breath through it. Most gases will dissolve in water.
- Lying down close to the ground may help, since most hazardous gases are lighter than air, and will tend to rise upwards.

Web Resources :

You may refer to the following websites for more information

1. <http://www.fema.gov/hazard/hazmat/index.shtm>
2. www.unep.org/pc/apell the United Nations Environmental Programme (UNEP) has developed a programme called as Awareness and Preparedness for Emergencies at Local Level (APELL), in conjunction with governments and industry with the purpose of minimizing the occurrence and harmful effects of technological accidents and environmental emergencies.
3. www.ilo.org/public/english/region/asro/bangkok/asiaoash/ilorepor/prevt/sec2.htm International Labour Organisation, Preventing major industrial accidents in Asia: A guide.
4. <http://www.unep.org/unep/regoffs/roap/nettlap/Products/Training Materials/ Accidents/index.html> UNEP Training Material on Management of Industrial Accident Prevention and Preparedness.

EXERCISE

1. Why are nuclear bombs more hazardous than conventional bombs ?
2. Find at least 2 examples of common human-induced disasters in your environment. Suggest how they can be reduced or removed.
3. What are the common human-induced hazards in your locality which according to you have the likelihood of becoming a disaster ? What are the five different steps that you would take to reduce their impact ?
4. Why do radiation disasters affect a larger area than chemical disasters ?
5. How will you use the dates August 6 and August 9 to create awareness about the ill effects of nuclear disasters ?
6. What care must be taken for the disposal of biological waste from pathological laboratories and hospitals ?
7. List 5 measures to protect yourself from nuclear radiation and attacks.
8. Study figure 1.1 and identify which natural disaster is most common and what parts of the Earth are most affected by it.