

DISASTERS DUE TO HUMAN ERRORS: NUCLEAR, BIOLOGICAL AND CHEMICAL

Disaster is that phenomenon which creates such a situation of crisis, suddenly and without warning, for not only human beings but also for other living beings when it causes heavy loss to life and property. Disasters are of many types but normally disasters can be put into two categories – (A) Natural disasters and (B) Disasters caused by human errors.

Natural disaster includes those mis-happenings whose origin is associated with natural factors. Regions affected by incidents like earthquake, Tsunami, volcanic eruption, hail storm, sudden snowfall, landslide etc. experience sudden crisis for human beings and animals. The causes, results and management of these disasters will be studied in next class (Class X).

In the present class causes, results and management of disasters caused by human errors will be studied. Man has achieved new heights of success in industrial development. Reaching Moon and preparing to put his step on Mars, India's ambitious Chandrayan project, missile and development of nuclear weapons has brought mankind to such a place where the pace of development, time and again, give birth to disasters. This crisis is the outcome of human error.

Among the disasters caused by human error - nuclear, chemical and biological disasters are most important. Due to these three disasters large scale destruction not only of mankind but also wild life around it, is destroyed or they become disabled which causes permanent crisis in their life. Since

time immemorial it is called God's curse but we cannot defend our mistakes by calling incidents like atomic bomb explosion on Hiroshima and gas leakage at Bhopal as curses of God. The objective of the technical development was public welfare, eradication of the poverty and to provide opportunity to everybody to live happily and peacefully but in the name of these objectives the scientific knowledge has been misused and this has continuously increased the disasters caused by human error. If these disasters are not controlled in time then human induced disasters will cause more deaths than the deaths caused by natural disasters.

11.1 NUCLEAR DISASTER

The development of nuclear energy is one of the unique achievements of science. Minerals like Uranium and Plutonium are processed through reactor because of which there is nuclear disintegration through which releases energy. This energy can provide impetus to socio-economic development but when it is utilised to make nuclear weapons then this

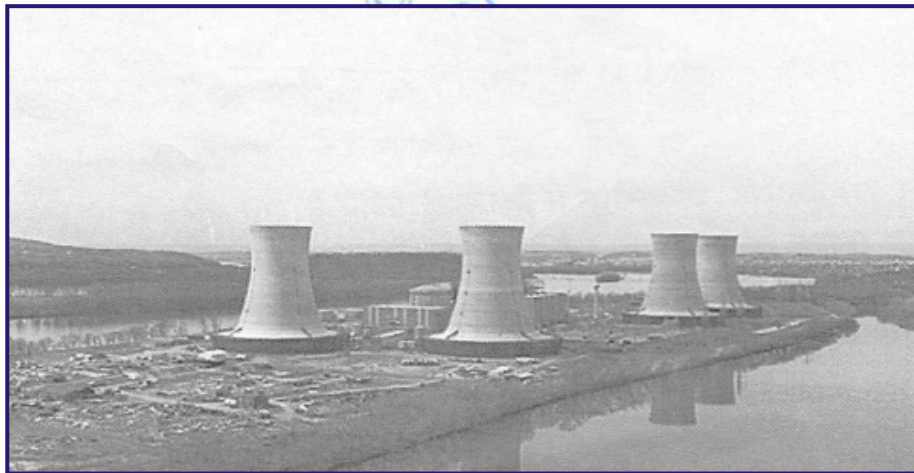


Fig. - 11.1 Nuclear reactor: Nuclear energy producing center

energy becomes a cause for disaster. Presently, a number of nations have manufactured nuclear weapons. India is also one of them. India has exhibited its extraordinary strategic capability through nuclear weapon explosions, in

the Rajasthan desert. The neighbouring countries of India, China and Pakistan, have also manufactured nuclear weapons and exploded it to exhibit their war capabilities (Fig. 11.1).

Nuclear bomb was at first exploded in 1945 by America in the last phase of Second World War by dropping bombs on the two cities of Japan. The first bomb was dropped on 6th August, 1945, through air attack, on Hiroshima and again on 9th August, 1945 on Nagasaki. It killed lakhs of people. The cities of towering buildings and industrial units turned into graveyard. Over one lakh people were injured (Disabled) who suffered from diseases like cancer, skin disease. The people who survived were separated from their family and this led to the problem of mental disease. The nuclear bomb attack shook Japan and they surrendered before this inhuman act. The American victory along with nuclear bomb explosion was a tragedy of the human civilisation.



Fig. 11.2 Nuclear explosion: one of the main causes for human destruction.

Though after this tragedy, up till now, nuclear weapon has not been used in any war but there has been massive increase in the production of nuclear weapons. Human error has been the testimony of accidents on the nuclear energy producing centers. In 1986, in erstwhile Soviet Union, due to human error in Chernobyl City, radio activity from one reactor killed hundreds of people and its adverse effect remained for years on the nearby

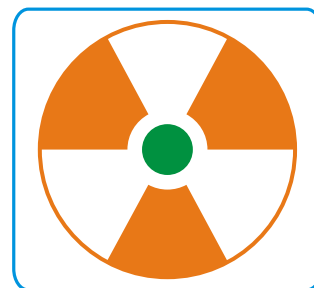
accident was narrowly averted.

On every nuclear energy producing center, automatic process of radiation remains active. So, scientists and other workers working there use anti radiation jackets. In a country like India neither the optional labourer are trained to protect themselves from radiation and nor the special type of jackets have been made available to them. This type of negligence has been reported several times in India, at Tarapur (Maharashtra) nuclear power station. Almost similar type of situation prevails at Kalpakam nuclear power station (Chennai).

The improper disposal of nuclear waste after the use of the nuclear energy, begins radiation process again after some interval of time . Therefore, for the disposal of nuclear waste, it is essential to construct specially designed store houses for its storage or it should be dumped at a greater depth. It can be dumped at a greater depth far away from the human habitats but it has been reported several times that nuclear power capable nations dump their nuclear waste either on waste lands of poor nations or they are dumping it in the ocean waters. There is information that countries like Russia and America which are having nuclear submarines dump nuclear rods in to the Sea after its use.

NECESSITY OF MANAGEMENT AND WORK

The use of nuclear power is not always destructive and this is the reason why India has made an agreement on nuclear power with America this year. About twenty nuclear technique rich nations of the world have agreed to supply enriched uranium to India for the production of nuclear power. In this context India has made it clear that production of this energy by India is not for making nuclear bombs but for the production of electrical energy for development. Therefore, on international level it is essential that all the countries agree on nuclear non - proliferation policy. In other words, decision of not making



Logo of International Radiation

bomb can make this technique more useful and messenger of development. Finally, after the nuclear explosion on Japan, to escape from the tragedy, sensible people started showing togetherness. It was the result of this unity that after one year in 1946, an international journal was developed by California University for prevention from radio - radiation disaster, symbolising of togetherness on the issue.

The agreement of not making the nuclear bomb is not sufficient. It is also essential for the nuclear power producing centers to stop ill effects of radiation. Lakhs of people can be killed by bomb explosion only, without the malfunctioning of the reactor and human error. Therefore, these centers can be established far away from the human settlements. The kaiga nuclear plant, in India, is an example of this. Similarly in Russia, United States of America and Canada nuclear centers are situated in extreme remote areas. Health checkups of the personnel serving in these centers at regular intervals are also essential. The use of radiation protective jackets should be mandatory for the persons working in nuclear stations. Not only this, the people living nearby and in cities adjacent to the nuclear establishment should have sufficient knowledge of protecting themselves in case of any accident. In case of any tragedy the population expected to be affected should be informed through modern electronic information system. The information regarding



Fig. 11.3 Radiation protective jackets and Masks: A way of safety

safety should also be given regularly. In case of accidents, DOs and DON'Ts must be intimated at the community level. It must be adequately informed that as soon as people get information about accident they must wear radiation protective jackets and masks (Fig. – 11.3). They must not eat in open, or ignite fire, etc. The people must be supplied with relief materials immediately. Food packets not affected by radiation should be distributed. The students of the schools should be trained regularly by self help institutions about preventive and safety measures. Awareness among people living nearby is essential. In these areas adequate number of cellars should be built and people should have prior direction to enter inside it as soon as warning of the accident is given. After a certain depth the effect of the radiation becomes less.

DO YOU KNOW?

1. Where did the first nuclear explosion take place in the world?
2. At which place was the first nuclear explosion by India done?
3. Where was first nuclear power center established in India was? If you don't know then take the help of your teacher to know it.

EXERCISE QUESTIONS

OBJECTIVE TYPE QUESTIONS

1. Which among the following is nuclear power center?
(a) Kaiga (b) Varanasi
(c) Delhi (d) Meerut
2. In which country is Hiroshima located?
(a) India (b) Japan
(c) China (d) Taiwan
3. Who at first developed the logo to escape from the nuclear explosion?
(a) Tokyo University (b) Cambridge University
(c) California University (d) None of these

SHORT ANSWER TYPE QUESTION

1. What is nuclear energy?
2. On which country, was the nuclear bomb dropped first in the world?
3. In which state of India was nuclear test done?

LONG ANSWER TYPE QUESTION

1. What are the hazards of Radiation? Give information about its ill-effects on human beings?
2. What are the uses of nuclear energy? Describe.

PROJECT WORK

What is disaster? Has any disaster occurred around you? If yes, then collect data associated with it?

11.2 CHEMICAL DISASTER

With the achievement of Industrial development several problems have also started. In the problems associated with the industrial produce, the problems associated with the production of chemical materials have taken the form of disaster. This disaster can be divided into three important parts –

- (A) Hidden hazards caused by Toxic Chemical Products.
- (B) Chemical Warfare Hazards.
- (C) Seepage in Chemical industrial units and hazards caused by waste materials.

(A) Hidden hazards caused by Toxic Chemical Products:

This disaster is not felt immediately. Its maximum effect is seen on agriculture. The use of chemical fertilizer and insecticide not only destroys the soil micro organisms but the produce also becomes poisonous. Its continuous consumption gives rise to different diseases which, at times, becomes fatal. Sometimes, by the use of the insecticides, the water of agricultural fields and ponds becomes poisonous and domestic animals and

The indirect disaster of the metro cities is mainly associated with adverse effect of the Carbon dioxide and Methane produced by the use of fossil fuel in the transport sector. It fatally affects wind pipe (Trachea), skin, eye and other sensitive human organs. The scarcity of oxygen creates problem of fatal suffocation. International logo has been developed for this disaster as

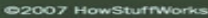


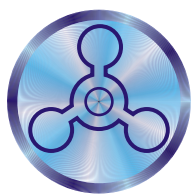
Fig – 11.4: Causes of acidic rainfall, process and result

Acidic rainfall is also an indirect disaster. It is a serious problem in Damodar valley. It increases the amount of acid in vegetation, soil and water to a large extent. The main cause of acidic rainfall is due to the effect of Sulphur dioxide (SO_2) and nitrogen oxide in the atmosphere by the industrial emission. It can be understood by fig. 11.4. It adversely affects human body, crops, vegetation, fruits and fishes. The use of all these things causes fatal



Fig 11-5 – The situation of the trees in the forest due to the effect of acidic rainfall

diseases. Due to acidic rainfall the leaves of the trees become almost dead and there is hardly any growth of fresh leaves (Fig. 11.5).



Logo of chemical war disaster

(B) Chemical Warfare Hazards:

The chemical weapons have been in use since Second World War. Lakhs of Jews were killed by the Germans in the gas chambers only. The main cause cited for the attack on Iraq by the United States of America was, that Iraq has amassed large scale chemical weapons. In chemical weapons along with the use of different gases,

similar gases are also induced in explosives because of which burning and melting of skin occurs. Suffocation through internal effects by breathing, faintness and situation of death is also created.

(C) Seepage in Chemical industrial units and hazards caused by waste materials:

The seepage in the chemical industrial units also takes the form of big disaster. The Bhopal gas tragedy is its biggest example. The Bhopal chemical gas leak disaster occurred on 2-3 December, 1984 which is the largest disaster of industrial world.



Fig. 11.6 Chemical gas seepage disaster: Relief effort

Along with hydrogen cyanide and other reactive products, 45 tons of highly poisonous Methyl isocyanides gas leaked from the insecticide factory of Union Carbide and it got mixed with the air and spread all around the nearby areas. It instantly killed 2000 people and rendered over 10,000 persons disabled. Due to its affect the death toll kept on increasing up to 1989. Presently the total number of death has grown to about 16, 000 and number of injured has gone up to 50, 000. The disabled people are still suffering from diseases like breathing trouble, frequent fever, continuous cough, mental disability, depression etc.

Similarly, 90 girls were affected in the copper melting factory due to gas leak in Tuticorin in Tamil Nadu on 5th July, 1997. They suffered from vomiting, burning sensation in chest and Pneumonia. Similarly, there is continuous adverse effect on the health of workers serving in most of the cracker and explosive factories.

MANAGEMENT

To escape from the chemical disaster, immediate and long term management is required. In the immediate management, in the campus of all the chemical factories sufficient amount of water and fire extinguisher is required. Again, the installation of wind measuring instrument is also essential. In case of gas leak, the present people should be given correct direction to move in the opposite direction of the wind. So many people lost their life in Bhopal, since there was no such information available. It should be mandatory for the people serving in chemical factories to be supplied with mask and gloves, specially designed trousers and shoes etc. The health check up of the workers after a certain period of time is also essential. The chemical industries should be established far away from the densely populated areas. For this, there should be sustainable use of these techniques so that the incidents of such accidents of seepage



may be reduced.

It's not enough that the production of chemical weapons should be prohibited. There should also be a joint policy agreement among the nations that keep these weapons and those that manufacture it to minimise the possibilities of its use. The chemical weapon expert, G. Harizel has called chemical weapons as "weapons of terror and mass destruction". Therefore, worldwide prohibition on its production and use can only save human beings from this disaster.

Long term sustainable agricultural development policy is required to be made to protect ourselves from the hidden disaster created by chemical fertiliser and Insecticides. The use of organic fertiliser is required in place of chemical fertiliser. The world health organisation (WHO) has declared 80% of insecticides used in India as highly poisonous and said to have adverse effect on human health. The increase in the use of insecticides is related to the increased use of new hybrid seeds. There has been huge increase in the use of these seeds but these produced materials are becoming a challenge for human health. Therefore, there is also need for preservation and popularisation of the traditional seeds. According to Prof. Swaminathan, this process can convert green revolution into ever green revolution.

The continuous increase in the amount of carbon dioxide, Methane and acid can have destructive effects not only on lower layer of the atmosphere but also on whole living world. To reduce the emission of these destructive gases is a serious challenge for available technology. Therefore, it is essential for those industrial units that emit these gases to utilise such technologies that ensure the least emission of poisonous gases. The best example for this is the new technology based generator.

Presently, the first essential component of any disaster management is to make available safe place, clean water and emergency medical facilities to the people living around the affected area. After this, injured and unconscious persons should be taken to nearby hospital. The people engaged in relief work should themselves also wear masks and other necessary clothes.

For this type of quick response action, self help organisations in the nearby areas, should train people and arrange counseling facilities.

Through the above mentioned methods the process of chemical disaster management can be brought to optimum level.

DO YOU KNOW?

1. Which gas was leaked out in Bhopal gas tragedy?
2. What are the harmful effects of insecticide materials?
3. Who is affected by acid rainfall? Collect more information about it with the help of your class teacher.

EXERCISE QUESTIONS

OBJECTIVE TYPE QUESTIONS

1. When did chemical seepage take place in Bhopal?
(a) 1984 (b) 1990
(c) 1930 (d) 2004
2. Which disease occurred from the seepage of gas in Tuticorin in 1997?
(a) Vomiting (b) cold and cough
(c) Vomiting and burning in chest (d) Brain fever
3. Where does the maximum effect of acid rainfall occurs?
(a) Patna (b) Damodar Valley
(c) North Bihar (d) Assam Valley

SHORT ANSWER TYPE QUESTION

1. Which did country use gas to kill Jews?
2. Which chemical material is used in insecticide?

LONG ANSWER TYPE QUESTION

1. Which type of precautions should be taken in the event of gas leak?
2. Describe the problems that occur at the time of chemical disaster.

11.3 BIOLOGICAL DISASTER

The root causes of Biological disaster are those organisms and material derived from the organisms whose utilisation and contact can take the form of disaster for human life. In this category those living organisms are also included which also adversely affect the health of the animals. For this, United Nations Organisation has developed an international biological disaster logo also. The centre for disease control and prevention of United States of America has divided biological disaster into four categories –



- (A) In the first category those diseases are included which are caused by such Bacteria and Virus. Bacteria and virus create diseases like chicken pox, Kenin hepatitis etc. These are diseases are not very destructive. For immediate protection from these diseases, it is essential to follow normal rules like – compulsory use of equipments like gloves, masks, etc. Utilisation of contaminated materials also creates disasters.
- (B) Under this biological disaster those diseases are kept whose main cause is Bacterias and Viruses. The possible diseases caused under this category are hepatitis A, B, and C, Influenza, Lime disease meseales, chicken pox and AIDS etc. To protect ourselves from these diseases health check up is essential from time to time. Clean eatable materials and boiled water recommended by United Nation Organisation's to protect ourselves from the effect of virus.

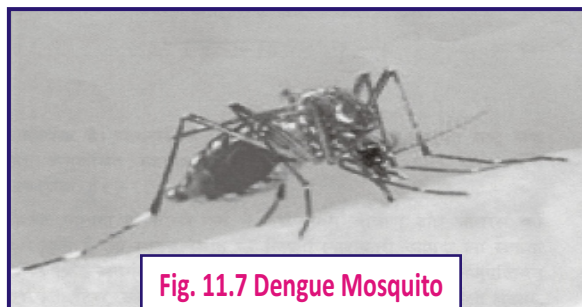


Fig. 11.7 Dengue Mosquito

- © In the third category of biological disaster those Bacterias and viruses are kept which can bring destructive disaster for human beings. Important among them are anthrax, western nil virus, Venezuelan encephalitis, small pox, tuberculosis virus, rift valley fever, yellow fever and malaria, diarrhoea, etc. The disaster of Kala-azar disease is mainly found in Bihar, West Bengal, and Uttar Pradesh. The main source of this disease is the infection spread by Sand Fly. Irregular fever, jaundice and enlargement of lever occur in this disease. Due to its infection, 77000 and about 256000 people died in 1992 and 1995 respectively in India. In this category, Bacteria and viruses that develop these diseases are very dangerous. In most of the poor countries these diseases acquire the status of biological disaster.
- (D) In the fourth category of biological disaster very destructive virus has been kept. The main diseases spread by these viruses are Bolivian, Argentine fever and Bird flu, AIDS, Dengue fever, Mar berg fever, Ebola fever etc. In the Delhi Metro region, 423 people died in 1996 from Dengue. This is the most risky disaster. Figure 11.8 shows through a graph that the number of people infected and number of people died due to Dengue from 1974 to 2002. AIDS is caused by HIV (Human Immunodeficiency Virus). In India it was detected in 1986. Though it does not cause any sudden tragedy but it is a fatal disaster at family level. The AIDS virus spread through heredity, by infected blood transfusion and the mother transmit this disease to her children.

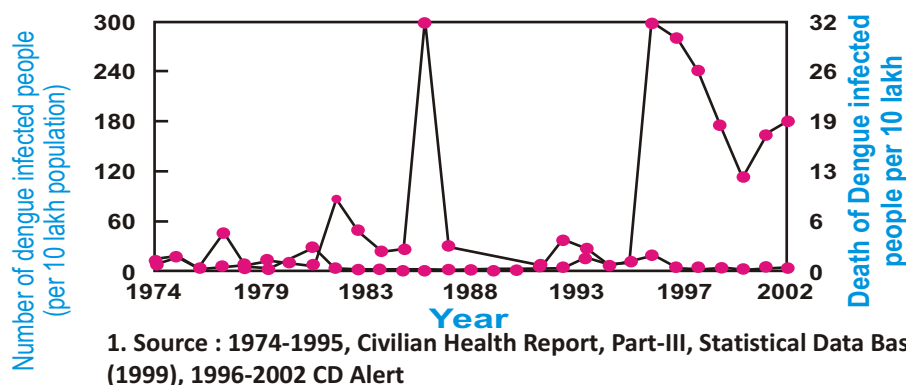


Fig.11.8

According to World Health Organisation (WHO), in India, about 25 lakh people are suffering from this disease. No effective medical facility has been developed as yet to counter this fatal disease.

Bacteria and virus, basically develop different types of infectious diseases which take the dangerous form of epidemic. The infectious diseases spread very quickly in their respective areas. There is urgent need for management of these disasters. Therefore, following important points are to be followed seriously –

1. To consume boiled water as well as clean and fresh food as much possible as one can.
2. Do not allow dirty water to accumulate at a place so that the dengue larva may not germinate.
3. To continuously clean and sprinkle the nearby areas.
4. To get blood tested from time to time.
5. Training and counseling of the people by self help organisations.
6. To sprinkle DDT etc.
7. To keep the public toilets clean.
8. To give essential information to school students in this context.
9. To arrange fresh drinking water.

DISASTER CAUSED BY BIOLOGICAL WEAPONS

In the modern warfare biological weapons are also included. These are called weapons of mass destruction. The technology for biological weapons was developed by the Japanese but the real use of biological weapon started after the terrorist attack on world trade center of United States of America in 2001. Terrorists started sending Anthrax bacteria to important strategic areas of America through postal service and by unknown persons. The main cause of attack on Iraq by American administration was due to this apprehension that Iraq has amassed biological weapons. These are those bacteria which

enter our body through breathing system and create poison inside our body. They are also called “Dirty Bomb”. Apart from Anthrax there are many more bacterias which are used in biological weapons. Other bacterias are called “Disease Organism”. For the protection from the fear of its war and to create awareness amongst people regarding biological weapons an international logo has been developed. This logo has been created by four rings which symbolise that if we work together against this disaster then biological disaster can be mitigated.

PROTECTION FROM BIOLOGICAL DISASTER

For the protection from the biological disaster, disaster risk management is needed. For this drinking of boiled water, intake of fresh food, sprinkling and commitment of administration is required. There is no need to lay hand or touch packets given by unknown persons because there could be possibility of Anthrax in it. Gloves should be used as safety measure. The place of biological weapons can be traced with the help of dog squad. Also there is need of strict laws that prohibits the use of biological weapons. For this international effort is also needed.

EXERCISE QUESTIONS

OBJECTIVE TYPE QUESTIONS

1. What is the cause of dengue disease?

- | | |
|------------------|---|
| (a) Fire | (b) Water kept in a utensil for longer time |
| (c) Due to flood | (d) Dirty food |

2. What is Anthrax?

- | | |
|--------------------|---------------------|
| (a) Micro organism | (b) Battle ship |
| (c) Wild animal | (d) A weapon of war |

3. How many people are affected by AIDS in India?

- | | |
|---------------|--------------|
| (a) 25 Lakhs | (b) 30 Lakhs |
| (c) One crore | (d) 50 Lakhs |

SHORT ANSWER TYPE QUESTION

1. What are the causes of Plague and diarrhoea?
2. Mention the causes of AIDS disease?
3. Mention the causes of hepatitis disease?

LONG ANSWER TYPE QUESTION

1. How many types of biological disaster are there? Give a brief account of them?
2. What is biological weapon? Describe problems created by them?
3. Describe the safety measures to be taken to save ourselves from biological disaster.

PROJECT WORK

1. Make a list of those people who has suffered from Pox, Malaria and diarrhea in your village.

