

UNIT-II

NUCLEAR RADIATION AND ITS EFFECTS ON THE BODY

2.3 LD₅₀ CAUSE OF RADIATION DEATH

The LD₅₀ (Lethal Dose for 50% of the population) refers to the amount of radiation required to cause death in 50% of an exposed population within a specific time frame, usually without medical intervention. For ionizing radiation, the LD₅₀ for humans is roughly 4 to 5 Sieverts (Sv) when exposure occurs over a short period.

Causes of Radiation Death at LD₅₀:

1. Acute Radiation Syndrome (ARS):

Hematopoietic Syndrome: Damage to bone marrow reduces the body's ability to produce blood cells, leading to infections, anemia, and bleeding.

Gastrointestinal Syndrome: Damage to the lining of the intestines causes nausea, vomiting, diarrhea, dehydration, and severe electrolyte imbalance.

Neurovascular Syndrome (at higher doses >10 Sv): Direct damage to the central nervous system can cause confusion, seizures, coma, and rapid death.

2. Cellular Damage:

Radiation causes ionization of molecules within cells, leading to DNA damage.

Cells that divide rapidly (like those in bone marrow, the gastrointestinal tract, and hair follicles) are particularly vulnerable.

3. Immune System Suppression:

The destruction of white blood cells and bone marrow leads to severe immunosuppression, making infections a major cause of death.

4. Internal Organ Failure:

Severe radiation exposure can cause multi-organ failure due to widespread cellular damage and tissue necrosis.

At doses near the LD₅₀, medical intervention such as antibiotics, blood transfusions, and bone marrow transplants can significantly improve survival rates.