

Biological Effects from Acute Exposures

General Public

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Division of Environmental Health
Office of Radiation Protection



The average person in the US is exposed to background radiation levels that would result in an annual dose of approximately 360 mrem. Higher and more short-term doses, although unlikely, are termed acute exposures. Whole-body doses of radiation (of the type in X-ray or gamma radiation) in significant doses of 35 rad can cause nausea, weakness and appetite loss within a few hours following an acute exposure. These symptoms will disappear within a few hours of the exposure. At doses between 125 – 300 rad, there is increasing likelihood of severity of nausea, vomiting and weakness with symptoms persisting for up to two days. There is 50% mortality from acute exposures greater than 350 rad without medical treatment.

Infection is the main cause of death after irradiation. However, cells differ in their sensitivity to ionizing radiation damage. After exposure, many sufficiently healthy cells are used up defending the body from infection, and others are prevented from performing their duty. Virtually no new replacement cells are produced because of the extensive damage to stem cells in bone marrow.

Biological Effects of Short Term Radiation on Humans	
Dose (Rad)	Effect
0-20	No detectable effects
20-100	Measurable transient blood changes. Temporary decrease in white blood cell count.
100-200	Acute radiation sickness - nausea, vomiting, longer-term decrease in white blood cells.
200-300	Vomiting, diarrhea, loss of appetite, listlessness, death in some cases.
300-600	Vomiting, diarrhea, hemorrhaging, deaths occurring in 50% of cases at 350 rad or above.
Above 600	Eventual death in almost all cases

This second table identifies specific health effects that can occur if the various organs receive the indicated levels of radiation, in absorbed dose.

Radiation Effects Following Acute Exposures In Rads To Target Organs		
Exposure Health Effect	Organ	Absorbed dose in Rad
Temporary Sterility	Testes	15
Nausea	Whole body	35
Depression of blood cell forming process	Bone marrow	50
Reversible skin effects (e.g., early reddening)	Skin	200
Permanent sterility	Ovaries	250-600
Vomiting	Gastrointestinal tract	300
Temporary hair loss	Skin	300-500
Permanent sterility	Testes	350
Skin Erythema	Skin	500-600

Reference: NCRP Report No.138

The radiation absorb dose (rad) in this table, refer only to acute exposure from sources such as energetic electron beams, x-rays or gamma rays.

Sources

College of William and Mary, Chemistry Department
NCRP Report No. 138

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