

Effects of Nuclear Weapons

The Nuclear Weapon Archive



A Guide to Nuclear Weapons

Lesson topic 5.2

Enabling Objectives



- ☆ Describe the physiological effects of ionizing radiation
- 🕒 Describe the blast and thermal effects on personnel and equipment from a nuclear explosion

Blast Effects



⌘ Equipment/structures

- ☒ Warping, buckling of flight decks
- ☒ Distortion of airplane elevators
- ☒ Distortion of hull framing
- ☒ Cracking of seams
- ☒ Rupturing of boilers
- ☒ Collapsing structures
- ☒ Rupturing of piping systems

Blast effects



⌘ Personnel

- ☒ Ear injury due to over pressure
- ☒ Lung injury due to pressure difference (collapse/over inflate)

Water shock wave effects



⌘ Equipment/structures

- ☒ Foundation damage to machinery
- ☒ Rupture of feed-water & steam lines
- ☒ Damage to gun mounts
- ☒ Damage to electronic systems components and disruption of system performance

Water shock wave effects



⌘ Personnel

- ☒ Body is displaced, thrown against bulkheads/equipment
- ☒ Missile hazards

Thermal effects



⌘ Equipment/structures

- ☒ Spontaneous ignition of flammable and porous materials due to intense heat
- ☒ Fires can spread throughout

⌘ Personnel

- ☒ Eye damage from light released at detonation
- ☒ Burns to exposed skin
- ☒ 100 KT air burst can cause second degree burns up to 4 miles from ground zero

Physiological Effects of Ionizing Radiation



⌘ Types of radiation doses

- ☒ Acute - less than 24 hours
- ☒ Chronic - longer than 24 hours
- ☒ Whole body - Neck to waist including eyes
- ☒ LD 50-30 - lethal dose. 50% personnel will die within 30 days
- ☒ Skin dose - dose to skin from beta and weak gamma radiation that causes burn like injuries

Radiation exposure terms



⌘ TERMS

- ☒ Combat Effective (CE) - personnel can perform task with little problem
- ☒ Combat Ineffective (CI) - Personnel can not perform assigned tasks due to sickness or incapacitation. Less than 25% performance
- ☒ Demanding task (DT)
- ☒ Undemanding task (UT)
- ☒ Performance degraded (PD) - 25 to 75%

Dose related to symptoms

⌘ 0 TO 70 RADS

- ☒ Symptoms - 6 to 12 hours after exposure (CE)
- ☒ None to slight transient headache and nausea
- ☒ Vomiting in up to 5% of personnel in upper dose range
- ☒ No medical care; return to duty; no deaths anticipated

Dose related to symptoms

- ☒ 70 to 150 RADS
- ☒ Symptoms - 2 to 20 hours (CE)
- ☒ Transient mild nausea and vomiting in 5 to 30% of personnel
- ☒ No medical care, return to duty; no deaths anticipated

Dose related to symptoms



- ☒ 150 to 300 RADS
- ☒ Symptoms - 2 hours to 2 days
- ☒ Transient mild nausea and vomiting in 20 to 70% of personnel
- ☒ Mild to moderate fatigability and weakness in 25 to 60%
- ☒ Low end range less than 5% deaths
- ☒ High end range deaths may occur for more than 50%; survivors return to duty

Dose related to symptoms



- ☒ 300 to 530 RADS
- ☒ Symptoms - 2 hours to 3 days
- ☒ Transient moderate nausea and vomiting in 50 to 90% of personnel
- ☒ Moderate fatigability in 50 to 90%
- ☒ Low end range less than 10% deaths
- ☒ High end range deaths may occur for more than 50%; survivors return to duty

Dose related to symptoms

- ☒ 530 to 800 RADS
- ☒ Symptoms - 2 hours to 3 days
- ☒ Moderate to severe nausea and vomiting in 80 to 100% of personnel
- ☒ From 2 to 6 weeks moderate to severe fatigability and weakness in 90 to 100%
- ☒ Low end range more than 50% deaths at six weeks
- ☒ High end range deaths may occur for 99% at 3 1/2 weeks

Dose related to symptoms



- ☒ 830 to 3000 RADS
- ☒ Symptoms - 30 MIN to 2 days
- ☒ Severe nausea, vomiting, fatigability, weakness, dizziness, and disorientation
- ☒ 1000 RADS 100% deaths in 2 to 3 weeks
- ☒ 3000 RADS 100% deaths in 5 to 10 days

Dose related to symptoms



- ☒ 3000 to 8000 RADS
- ☒ Symptoms - 30 MIN to 5 days
- ☒ Severe nausea, vomiting, fatigability, weakness, dizziness, disorientation, and fluid imbalance
- ☒ 4500 RADS 100% deaths in 2 to 3 days

Dose related to symptoms



- ☒ Greater than 8000 RADS
- ☒ Symptoms - 30 MIN to 1 day
- ☒ Severe and prolong nausea, vomiting, fatigability, weakness, dizziness, disorientation, and fluid imbalance
- ☒ 8000 RADS 100% deaths in 1 day

Cumulative nature of radiation exposure



- ⌘ Damage depends on length of exposure and total dose received
- ⌘ Body cannot repair all damage
- ⌘ Each subsequent exposure adds to permanent damage
- ⌘ Latent effects
 - ☒ Cataracts, cancers (Leukemia) and shortened life span

Radiation exposure guides



⌘ Wartime

- ☒ Setting Maximum Permissible Exposure (MPE)
- ☒ Considers past and future exposures
- ☒ Set by Commanding Officer on DCA's recommendation
- ☒ Usually set at 150-R but depends on tactical demands

Summary and Review



⌘ Blast effects

⌘ Water shock wave effects

⌘ Thermal effects

⌘ Physiological effects of ionizing radiation