

Nuclear Energy's Environmental Footprint

Nuclear Energy · Answer Key · 16 Questions

1. Which radioactive isotope, commonly found in nuclear waste, has a half-life of approximately 24,100 years and poses a significant long-term environmental hazard due to its mobility in groundwater?

- A) Strontium-90
- B) Cesium-137
- C) Plutonium-239
- D) Iodine-129**

2. Chernobyl Exclusion Zone wildlife populations, such as wolves and Przewalski's horses, have shown increased resilience and abundance since the 1986 disaster. What is a primary ecological theory explaining this phenomenon despite elevated radiation levels?

- A) Radiation-induced accelerated evolution leading to resistance
- B) Absence of human hunting and habitat fragmentation allowing natural recovery**
- C) Microbial degradation of radionuclides by specific fungi
- D) Migration of less affected individuals from surrounding areas

3. The thermal pollution from nuclear power plant cooling systems can affect aquatic ecosystems. What is a typical observed effect on fish populations in rivers or lakes receiving this heated water?

- A) Increased biodiversity due to higher metabolic rates
- B) Shift towards species preferring warmer water, potentially reducing overall native species diversity**
- C) Enhanced growth rates for all age classes across all species
- D) Stimulation of spawning cycles leading to population booms

4. Bioaccumulation of radioactive isotopes like Cesium-137 can occur in the food chain. In terrestrial ecosystems, which trophic level is most likely to accumulate the highest concentrations of such isotopes from contaminated vegetation?

- A) Primary producers (plants)
- B) Primary consumers (herbivores)
- C) Secondary consumers (carnivores)**
- D) Detritivores (decomposers)

5. Fukushima Daiichi nuclear disaster led to significant radioactive contamination. Studies on wild boars in the affected areas revealed high levels of Cesium-137. What is a key factor contributing to the persistence of this contamination in these animals?

- A) Direct absorption from contaminated water sources
- B) Consumption of contaminated fungi and roots that sequester cesium**
- C) Absorption through skin contact with irradiated soil
- D) Inhalation of radioactive dust particles over prolonged periods

6. Small marine organisms like phytoplankton and zooplankton play a crucial role in the oceanic food web. In the event of a nuclear accident releasing radionuclides into the ocean, which process is most likely to lead to the initial concentration of these isotopes in these organisms?

- A) Passive diffusion across cell membranes
- B) Active uptake for essential biological functions**
- C) Adsorption to external cellular structures
- D) Phagocytosis of contaminated particulate matter

7. The siting of nuclear power plants often requires access to large bodies of water for cooling. What is a common environmental concern related to the intake structures of these plants concerning aquatic life?

- A) Increased water temperature downstream
- B) Entrainment of small organisms into cooling systems**
- C) Algal blooms due to nutrient release
- D) Disruption of fish migration routes

8. The disposal of low-level radioactive waste from nuclear facilities can involve burial. What is a primary environmental concern regarding the potential long-term migration of these isotopes into soil and groundwater?

- A) High vapor pressure causing atmospheric dispersal
- B) Formation of stable, insoluble compounds
- C) Chemical reactivity leading to rapid neutralization
- D) Mobility due to solubility and half-life characteristics**

9. During routine operations, nuclear power plants release very small, controlled amounts of radioactive gases. What is a key characteristic of these releases that limits their immediate environmental impact on local flora and fauna?

- A) High isotopic concentration
- B) Short half-lives of the isotopes**
- C) Long-term persistence in the atmosphere
- D) Tendency to condense into heavy aerosols

10. In the aftermath of a nuclear accident, the deposition of radionuclides can affect soil composition. What is a potential long-term consequence for soil microorganisms and nutrient cycling?

- A) Increased microbial diversity and activity
- B) Reduced microbial respiration and enzyme activity**
- C) Stimulation of nitrogen fixation processes
- D) Accelerated decomposition of organic matter

11. The energy production from nuclear fission generates heat. Beyond direct thermal pollution, what is an indirect environmental consequence of this heat release on surrounding air and water vapor?

- A) Increased localized precipitation
- B) Reduced atmospheric humidity
- C) Enhanced evaporation rates**
- D) Formation of stratospheric ice crystals

12. The remediation of contaminated sites after nuclear accidents often involves long-term monitoring. What biological indicator species are frequently used to assess the ongoing impact of low-level radiation on terrestrial ecosystems?

- A) Apex predators like eagles
- B) Insects with short life cycles, such as fruit flies**
- C) Large mammals with slow reproductive rates
- D) Trees with long lifespans

13. Uranium mining, a precursor to nuclear energy production, can result in the release of naturally occurring radioactive materials (NORM). What is a significant environmental hazard associated with the tailings (waste rock) from uranium mines?

- A) High emission of greenhouse gases
- B) Leaching of heavy metals and radionuclides into water bodies**
- C) Production of ozone-depleting substances
- D) Generation of large volumes of thermal pollution

14. High-level radioactive waste requires secure, long-term storage. Deep geological repositories are considered a solution. What is the primary environmental principle guiding the selection of geological formations for these repositories?

- A) High seismic activity to facilitate natural mixing
- B) Presence of abundant groundwater for cooling
- C) Geological stability and low permeability to prevent radionuclide migration**
- D) Proximity to human populations for monitoring

15. The impact of radiation on plant genetics can be studied by observing mutations. In irradiated plant populations, what is a common observed effect on genetic diversity and mutation rates?

- A) A decrease in spontaneous mutation rates
- B) An increase in genetic mutations, potentially affecting fitness**
- C) Stabilization of gene expression profiles
- D) Homogenization of the gene pool

16. The Chernobyl disaster released significant quantities of Iodine-131. Why was this specific isotope a particular concern for terrestrial animals, especially herbivores?

- A) It is a potent greenhouse gas
- B) It mimics calcium and is readily absorbed by bone
- C) It is preferentially absorbed by the thyroid gland, affecting metabolism**
- D) It is highly soluble and easily leaches from soil