

# [Effects of nuclear radiation on the environment](https://assignbuster.com/effects-of-nuclear-radiation-on-the-environment/)

Nuclear power is generated through the use of nuclear fission. This process produces a large amount of heat and electricity. The nuclear waste and radiation that nuclear fission produces are harmful to living organisms; however, the benefits of nuclear power are too tempting to refuse.

As a testament to that fact, there are currently 437 nuclear power plants worldwide, generating a total of 372, 210 megawatts worth of electricity. A further 68 nuclear power plants are under construction with an expected net output of 65, 406 megawatts.[1]

This report will outline the effects of nuclear radiation on the environment, including all biological organisms and the abiotic environment as well as both benefits and drawbacks.

## Effects on Organisms

Using humans as an example, nuclear radiation have very detrimental and adverse effects on human beings. Being exposed to high amounts of radiation for an extended period of time will cause humans to experience radiation sickness. Symptoms of radiation sickness can include headaches, nausea, fevers as well as the possibility of obtaining cancer or causing severe damage to ones DNA.[2]

Nuclear radiation consists of ionizing particles, which are particles that individually have enough energy to displace electrons in an atom or molecule. By forcibly removing an electron and taking its place, the particle forms an ion-pair that are immensely reactive. This reactivity can cause major damage to cells and DNA.[3]

The Diagram shows how an Ionizing particle displaces an electron.

As seen in the previous diagram, the ionizing particle, represented in yellow, will have enough energy to “ knock off” the electron of an atom, represented in green. The resulting ion-pair is very reactive and the reactions that follow can damage human DNA and tissue.

## Radiation Chart: Relation between Dosage and Symptoms

Sieverts, or Sv, is the international standard for measuring radiation dosage. It is meant to measure the biological effects of ionizing particles. Below is a chart provided by environmental journalist Ben Jervey that shows the dosage as well as consequences of exposure to nuclear radiation.[4]

## The Effects of Nuclear Radiation on Plants and Soil

Similarly to humans and animals, plants and soil are also affected negatively from high amounts of nuclear radiation. Just like in humans, radioactive material can damage plant tissue as well as inhibit plant growth. Mutations are also possible due to the damage caused to the DNA. Radioactive material in soil can prevent nutrient from being taken in by plants, causing it to be infertile.

The effects of nuclear radiation can sometimes change the biodiversity of an area completely. Taking the “ Red Forest” in Chernobyl, Russia as an example, the area is filled with radioactive material such as Iodine-131 and Cesium-137 due to the nuclear power plant disaster.[5]Many plants and organisms died within days of the disaster and the soil of the forest could not support life. However, after many years, as the radioactive material began to reach their half-life, sturdier plants and animals began to inhabit the contaminated zone. Although the Red Forest is still too radioactive for humans to settle in, it has been proven that the biodiversity of life within the forest is currently higher than it was before the nuclear disaster. The forest is now currently a wildlife refuge where all kinds of animal and plant species thrive.[6]

Another example of nuclear radiation’s effects on soil is the Fukushima Daiichi nuclear disaster in Japan. The explosion at the nuclear reactor released clouds of radiation over much of Japan’s agricultural land. This caused crops to become irradiated and unsafe for consumption. The irradiated soil also bore irradiated plants or became infertile. Over 81, 000 hectares of land were affected by the radiation.[7]Unlike Chernobyl, where European soil is good at absorbing radiation, and thus limits the amount of radiation absorbed by plants, Japanese soil is sandy, offering less resistance to radiation. Due to the lack of crops and food, many of Japan’s consumers have to rely on aid from other countries or imports. This has put considerable stress on Japan’s economy, not including the $13 billion that will cost Japan to completely decontaminate the affected area.[8]http://gdb. rferl. org/65D2A05D-CADB-40BA-92D2-533441CAE636\_w640\_r1\_s. jpg

A Journalist checking radiation levels at Fukushima Daiichi power plant.

## Radiation Therapy

Ironically, while radiation in high, uncontrolled doses can be detrimental and even fatal to a person’s wellbeing, it also has been proven that radiation can be used to treat certain health problems. The most significant of which are tumours and cancer cells. Radiation therapy is the use of x-ray, gamma rays or charged particles to kill cancer cells and reduce tumour growth. The treatment works by using the radiation to selectively damage the cancer cell’s DNA impeding or stopping its ability to replicate and grow. As the cancer cells slowly degrade, the human body’s natural defenses are able to naturally destroy the cancer cells.

Radiation therapy is not without risks. The radiation used is also very harmful to every other type of cell within the human body. This is why the radiation used is mostly in the form of a pin-point laser directed at an angle so as to not affect other tissue other than the cancer cells and tumours.[9]Radiation Therapy

## Food Irradiation

Another benefit of nuclear radiation can be found in our everyday lives in the form of food irradiation. As explained in the Fukushima case study previously, irradiation of food will make it unsafe for consumption, however, small amounts of nuclear radiation are able to kill bacteria and sterilize food, preventing spoilage. The amount of radiation needed for the process is so minute that it is safe for human consumption.

To emphasize the safety of the food irradiation process, only gamma rays are used, which means that no neutrons are present to cause radioactivity in the food. Furthermore, the source of the gamma radiation never makes contact with the actual foodstuff.

The extension of shelf life due to killing bacteria and other organisms can result in the lesser use of pesticide and preservatives in food. This also means that there is a lower risk of invasive species being exported to another country through the food. The increased spoilage time also allows for easier exporting over long distances.[10]

## Conclusion

Based on the information and case studies presented in this report, we can conclude that nuclear power and radiation can be both beneficial and harmful to humans and the environment. Nuclear energy is dangerous and unstable and may result in great damage to the environment if something goes wrong. However, if used properly, it can provide large amounts of energy for in place of fossil fuels and other non-renewable resources. Nuclear radiation has also proven to be effective in certain medical treatment and food processing that benefit humanity. On the other hand, many are skeptical about the use of radiation in everyday life due to the volatile and dangerous nature of radiation.