



What is the current risk of radiation-related health problems in Japan for those residing near the reactor in comparison to those in other parts of Japan?

- Radiation-related health consequences will depend on exposure, which is dependant on several things, including: the amount and type of radiation released from the reactor; weather conditions, such as wind and rain; a person's proximity to the plant; and the amount of time spent in irradiated areas.
- The Government of Japan's recent actions in response to events at the Fukushima Daiichi nuclear power plant are in line with the existing recommendations for radiation exposure. The Government has evacuated individuals who were living within a 20-kilometre radius around the Fukushima Daiichi plant. Those living between 20 km and 30 km from the plant are being asked to shelter indoors. People living farther away are at lower risk than those who live nearby.
- As and if the situation changes, the Government of Japan may change their advice to the public; WHO is following the situation closely.

Is there a risk of radioactive exposure from food contamination?

- Yes, there is a risk of exposure as a result of contamination in food.
- However, contaminated food would have to be consumed over prolonged periods to represent a risk to human health.
- The presence of radioactivity in some vegetables and milk has been confirmed and some of the initial food monitoring results show radioactive iodine detected in concentrations above Japanese regulatory limits. Radioactive caesium has also been detected.
- Local government authorities have advised residents to avoid these foods and have implemented measures to prevent their sale and distribution.

Ionizing radiation

What is ionizing radiation?

- When certain atoms disintegrate, they release a type of energy called ionizing radiation. This energy can travel as either electromagnetic waves (i.e. gamma or X-rays) or as particles (i.e. alpha, beta or neutrons).
- The atoms that emit radiation are called radionuclides; e.g., radioactive iodine, caesium, and plutonium.
- Ionizing radiation is an essential tool in medicine for diagnosis and treatment and must be used with rigorous attention to safety.

Human exposure to ionizing radiation



Are people normally exposed to ionizing radiation?

- Human beings are exposed to natural radiation (also known as background radiation) on a daily basis. Natural radiation comes from space (i.e. cosmic rays) as well as from naturally-occurring radioactive materials found in the soil, water and air. Radon gas is a naturally-occurring gas that is the main source of natural radiation.
- People can also be exposed to radiation from man-made sources. Today, the most common man-made sources of ionizing radiation are X-ray machines and other medical devices.
- Radiation doses can be expressed in Sievert (Sv) units. On average, a person is exposed to approximately 3.0 milli Sieverts (mSv)/year, of which 80% (2.4 mSv) is due to naturally-occurring sources (i.e., background radiation), 19.6 % (almost 0.6 mSv) is due to the medical use of radiation and the remaining 0.4% (around 0.01 mSv) is due to other sources of human-made radiation.
- In some parts of the world, levels of exposure to natural radiation differ due to local geology. People in some areas can be exposed to more than 200 times the global average.

How are people exposed to ionizing radiation?

- Ionizing radiation may result from sources outside or inside of the body (i.e. external irradiation or internal contamination).
- External irradiation is produced when a person is exposed to external sources (i.e. X-rays) or when radioactive material (i.e. dust, liquid, or aerosols) becomes attached to skin or clothes.
- Internal contamination may result from breathing in or swallowing radioactive material or through contamination of wounds.

What type of radiation exposure could occur in a nuclear power plant accident?

- In the event a nuclear power plant does not function properly, individuals, land, and structures in the vicinity of the plant could be exposed to a mixture of radioactive products generated inside the reactor, also known as “nuclear fission products”. The main radionuclides representing health risk are radioactive caesium and radioactive iodine.
- Members of the public may be exposed directly to radionuclides, either in the air or if food and water become contaminated by these materials.
- Rescuers, first responders, and nuclear power plant workers may be exposed to radioactive materials and higher radiation doses inside or around the power plant due to their professional activities.

Travel advice

What is the WHO travel advice for Japan?



- At this time, WHO is not advising general restrictions on travel to Japan.
- However, travellers should avoid travel to the areas most affected by the earthquake and tsunami because of disruptions to essential services, such as transport and electric power. The ongoing disaster relief activities, including the nuclear power plant emergency response and control activities, will make travel difficult and could consume resources needed by relief worker and residents. Moreover, as indicated by the Japanese authorities, travel within the evacuation and exclusion zones surrounding the Fukushima Daiichi nuclear power plant is currently prohibited.
- In general, travellers who do not have essential reasons to travel should give careful consideration to deferring travel to any areas where there has been considerable disruption to the normal infrastructure and where authorities are responding to urgent humanitarian needs.

What are the precautions when travelling in Japan?

- Travellers should be aware of the risk of further earthquakes across Japan. Moreover, there may be areas of power, fuel, food and water shortages.
- Travellers in Japan should monitor local media, follow the advice and instructions issued by local authorities, and register their travel and location details with their respective embassy or consulate.
- Information on the status of the nuclear facilities in Fukushima can be found on Japan's [Nuclear and Industrial Safety Agency \(NISA\)](#) website and on the [International Atomic Energy Agency \(IAEA\)](#) website. Additional information can be found on the [WHO web site](#).

Do travellers returning from Japan represent a health risk for others?

- At this time, only those involved in the emergency response near the nuclear power plant remain in the area where there are higher levels of radioactivity. For their own safety, all personnel in these areas should undergo decontamination procedures when they leave the site. Travellers returning from Japan who have come from the 20 km evacuation zone surrounding the Fukushima Daiichi nuclear power plant and who have undergone proper screening and decontamination procedures, and travellers from all other areas, do not pose a radioactive health risk to others and do not require screening.

Health effects

What are the acute health effects of radiation exposure?

- If the dose of radiation exceeds a certain threshold level, it can produce acute effects, including skin redness, hair loss, radiation burns, and acute radiation syndrome (ARS).
- In a nuclear power plant accident, the general population is not likely to be exposed to doses high enough to cause such effects.



- Rescuers, first responders, and nuclear power plant workers are more likely to be exposed to doses of radiation high enough to cause acute effects.

What long-term effects can be expected from radiation exposure?

- Exposure to high doses of radiation can increase the risk of cancer.
- Radioactive iodine can be released during nuclear emergencies. If radioactive iodine is breathed in or swallowed, it will concentrate in the thyroid gland and increase the risk of thyroid cancer. Among persons exposed to radioactive iodine, the risk of thyroid cancer can be lowered by taking potassium iodide pills, which helps prevent the uptake of the radioactive iodine.
- The risk of thyroid cancer following radiation exposure is higher in children and young adults.

Public health actions

Which public health actions are most important to take?

- Health effects can only occur if someone is exposed to radiation, thus the main protective action someone can take is to prevent exposure. Those closest to the radiation are at greatest risk of exposure and the greater the distance away, the lower the risk. This is why, when a nuclear accident occurs, the recommended public health actions involve evacuation and sheltering of those near the site.
- These necessary actions depend on the estimated exposure (i.e., the amount of radioactivity released into the atmosphere and the prevailing meteorological conditions, such as wind and rain. Actions may include: evacuation of the area around or near the nuclear power plant; advising people to shelter in their homes, offices, other secure buildings or designated shelters to reduce exposure; and distributing and administering potassium iodide pills to reduce the risk of thyroid cancer).
- If warranted, public health or national authorities may restrict or prohibit the consumption of vegetables and dairy products produced in the vicinity of the nuclear power plant in order to reduce exposure.
- Only competent authorities who have conducted a careful analysis of the emergency situation are in a position to recommend which of these public health measures should be undertaken.

Personal protective measures

How can I protect myself?

- Keep informed by obtaining accurate and authoritative information (e.g., information from authorities delivered by radio, TV or the Internet) and following your government's instructions.



- The decision to take potassium iodide should be based on information provided by national health authorities who will be in the best position to determine if this step is warranted.

If I have been exposed to high levels of radiation, what should I do?

- If you are coming indoors after radiation exposure, undress in the doorway to avoid further contamination in your home or shelter. Remove clothing and shoes and place them in a plastic bag. Seal the bag and place it in a safe location away from living areas, children, and pets.
- Shower or bathe with warm water and soap.
- Notify authorities that you may have contaminated clothing and personal belongings to be handled appropriately and disposed of according to accepted national procedures.

When people are advised to stay indoors, what does this mean?

- When a radiological or nuclear event occurs, public health authorities may order residents in the affected areas to stay indoors rather than evacuate. You may be advised to take shelter at home, at work, or in public shelters. Shelter can provide protection from external exposure and from inhalation of radioactive material.
- If you are advised to stay indoors, you should find the safest room in your house or office building: if possible, one which has no windows and no external doors. Ventilation systems, such as heating and cooling systems, should be shut down.
- In sub-zero temperatures, it is important to keep warm. If you have been instructed to shelter in your home, office, or other structure, it may not be safe to burn fuels—such as gas, coal, or wood—to keep warm. Doing so may result in carbon monoxide poisoning, which can occur when rooms are not adequately ventilated. If it is available, electrical forms of heating are safer.

What are potassium iodide pills?

- Potassium iodide pills are a source of stable (i.e. non-radioactive) iodine. The thyroid gland requires iodine to produce thyroid hormones. The presence of stable iodine in the body in an appropriate amount blocks the thyroid from absorbing radioactive iodine (radioiodine), reducing the risk of thyroid cancer which may follow from exposure to radioiodine.
- Potassium iodide pills are not “radiation antidotes”. They do not protect against external radiation, or against any other radioactive substances besides radioiodine. They may also cause medical complications for some individuals with poorly functioning kidneys. Potassium iodide should be taken only when there is a clear public health recommendation.

When and why should I take potassium iodide?



- You should only take potassium iodide when it is recommended by public health authorities. If you are at risk or have been exposed to radioiodine, potassium iodide pills may be given to protect the thyroid gland from uptake of radioiodine. This can reduce the risk of thyroid cancer in the long run, when given before or shortly after exposure.

Should I take iodized salt to protect myself from radiation?

- No, you should not take iodized salt to protect yourself from radiation. It is dangerous to take large amounts of iodized salt in order to increase the amount of stable iodine in the body.
- Increasing one's daily intake of iodized salt will cause more harm than good. The main ingredient of iodized salt is sodium chloride, which is linked with hypertension (high blood pressure) and other medical disorders. The iodine content in iodized salt is too low to prevent uptake of radioiodine.
- Sodium chloride is acutely toxic in large amounts: even tablespoon quantities of salt repeatedly taken over a short period of time could cause poisoning.

Can I take other forms of iodine?

- No, you should not take products that contain iodine, other than medicines recommended by public health authorities.
- Iodine is found in a variety of household and industrial products. For example, iodine may be found in some disinfectants, antiseptics, and water-sterilizing solutions. These products should not be taken as an alternative to potassium iodide pills, because such products contain other ingredients that can be harmful if swallowed.

Can pregnant women take potassium iodide pills?

- Yes, most pregnant women can take potassium iodide pills, following the instructions of public health authorities. Potassium iodide will cross the placenta and protect the thyroid of the growing foetus, as well as the mother.

Can breastfeeding women take potassium iodide?

- Yes, most breastfeeding women may take potassium iodide, following the instructions of public health authorities.

What are the recommendations for breastfeeding women regarding potassium iodide?

- As with the rest of the population, breastfeeding women should take potassium iodide tablets only when advised by public health authorities. However, this will not be sufficient to fully protect the breastfed child who will need potassium iodide as well, in special doses adapted for newborns and infants.
- Under these conditions, breastfeeding can continue.



Food safety

The recent damage to the Daiichi nuclear power plant in Fukushima, Japan, and the subsequent detection of radioactivity in certain food samples from neighbouring areas have raised concerns about the safety of food from Japan. The Japanese authorities have regulations in place relating to provisional regulatory limits of radioactivity in food and food monitoring is being implemented. Measurements of radionuclide concentrations in food are now taking place and are being released by the Japanese authorities. The presence of radioactivity in some vegetables and milk has been confirmed and some of the initial food monitoring results show radioactive iodine detected in concentrations above the Japanese regulatory limits. Radioactive caesium has also been detected, but at lower activity concentrations.

The following questions and answers produced by the FAO and WHO address some of the growing international concerns over the safety of food produced in Japan.

What are the international implications of the recent reports of radioactivity in food in Japan?

- The findings suggest that some foods produced in Japan are likely to be contaminated by radionuclides at levels unsuitable for human consumption. Food producers and consumers in Japan are those most immediately affected and are being advised by their government on the implications of these findings. Currently, however, there is no evidence that radioactivity from the Fukushima Daiichi nuclear power plant has contaminated food produced in any other country.

What are the potential health effects of consuming contaminated food?

- Consuming food contaminated with radioactive material will increase the amount of radioactivity a person is exposed to and could increase the health risks associated with exposure to radiation. The exact effect will depend on which radionuclides have been ingested and the amount. According to data reported so far, radioactive iodine is the main contaminant and concentrations in some food samples have been detected at levels above the Japanese regulatory limits. Radioactive iodine has a half-life of eight days and decays naturally within weeks. If ingested, it can accumulate in the body, particularly the thyroid gland, increasing the risk of thyroid cancer, particularly in children.
- The ingestion of potassium iodide is an established method to prevent the accumulation of radioactive iodine in the thyroid.
- Radioactive caesium has also been detected in some foods. The situation has to be monitored carefully as ingestion of food contaminated with radioactive caesium can also have long-term health effects.

Is all food production in Japan affected by the nuclear emergency?



- No, not all foods will be affected. Food that was dispatched or commercially packaged before the emergency situation would not be affected. However, some food produced in areas where radioactive material has been deposited has been found to be contaminated. This is why the Japanese authorities have instituted monitoring and are taking measures to address the issue.

What impact will this have on food and food production in Japan?

- The impact on food and food production in Japan will depend upon the types of radionuclides and the amount of radioactivity deposited or present where food is being produced or harvested. Although radioactive iodine in food is of immediate concern, it has a relatively short half-life and will naturally decay over a short time frame. Radioactive caesium has also been detected in food. In contrast to radioactive iodine, radioactive caesium can linger in the environment for many years and could continue to present a longer term problem for food, and food production, and a threat to human health.

How do food products become radioactive?

- Foods can become contaminated with radioactive materials when they are released as the result of a nuclear or radiological emergency. In these circumstances, radioactive material falling from the air or carried in rain water or snow, can deposit on the surface of foods like fruits and vegetables or animal feed. Also, over time, radioactivity can build up within food, as radionuclides are transferred through soil into crops or animals. Radioactivity can also be washed into rivers, lakes and the sea where fish and seafood could take up the radionuclides. The severity of the risk depends on the radionuclide mix and the level of contaminant released.
- Radioactivity cannot contaminate food that is packaged; for example, tinned or plastic-wrapped food is protected from radioactivity as long as the food is sealed.

Why is food affected in areas beyond the evacuation zone?

- During a nuclear emergency, an evacuation zone is established to prevent people from being exposed to *immediate* and unacceptable levels of radiation posing a threat to human health. However, contamination of food can occur through uptake from soil to crops, or to animals through feed, even when levels of radioactive contamination are lower than those which might pose a direct threat to human health. The standards for acceptable limits for radioactivity in food are set at low levels in order to take into account the possibility of contaminated food being eaten over an extended period of time and resulting in a cumulative dose.

Are there rules for radioactivity in foods for international trade?

- There are internationally agreed Codex Guideline Levels (GLs) for radionuclide levels in internationally traded food following a nuclear or radiological emergency. These GLs are published by the Joint FAO/WHO Codex Alimentarius Commission.



- Food with radioactivity levels below these GLs is safe for people to eat. When the GLs are exceeded, national governments must decide whether and under what circumstances the food should be allowed to be distributed within their territory or jurisdiction.
- Guideline Levels (GLs) for radionuclide levels can be found at the Joint FAO/WHO Codex Alimentarius Commission. [Link to http://www.codexalimentarius.net/web/more_info.jsp?id_sta=17]

What general advice can be given to food consumers and producers in the event of a nuclear emergency?

- The response to an emergency involving radioactivity should be the same as the response to any emergency involving any hazardous material contaminating food. In the early stages of an emergency, and if it is safe to do so, it is possible to take immediate actions to prevent or minimize the contamination of food by radiological materials. For example, it is possible to do the following:
 - protect food and animal fodder which is stored in the open; cover with plastic sheets or impermeable tarpaulins;
 - close the ventilation of greenhouses to protect growing vegetables;
 - bring livestock in from pastures and move animals into a shed or barn;
 - harvest any ripe crops and place under cover before any fallout has been recorded; and
 - don't harvest after fallout – wait for further instructions after contamination has been recorded.

Many other short-, medium- and long-term actions need to be considered in areas confirmed to be seriously contaminated, such as:

- avoid consumption of locally produced milk or vegetables;
- avoid slaughtering animals;
- avoid consumption and harvesting of aquatic animals and plants (including fish, shellfish, and algae); and
- avoid hunting or gathering mushrooms or other wild or collected foods.

Additional information on emergency preparedness and response

[link to <http://www-naweb.iaea.org/nafa/emergency/index.html>]

Joint FAO/IAEA Programme

Water contamination

Can I drink the tap water in Japan?

- Drinking tap water in Japan poses no immediate health risk, but local conditions will differ and may fluctuate.
- The Japanese authorities are closely monitoring the situation and are issuing advice, when needed, against consumption of tap water, including specific recommendations for infants. Essential hydration of infants should not be compromised in an attempt to reduce exposure to radionuclide contamination.



- The standards adopted by the Japanese authorities for this emergency are precautionary. Currently, radioactive iodine is the most common detected contaminant; the standard for adults is 300 Becquerels per litre in drinking-water. In the very unlikely scenario that drinking-water was contaminated and consumed for an entire year at this level, the additional radiation exposure from this water would be equivalent to natural background radiation during one year.
- WHO urges people in the area to heed the advice of local authorities, as they will have access to the latest measurements of radiation levels in water to compare against the standards for adults and children.

Can radioactive contamination be removed from water?

- Standard water treatment procedures may remove significant amounts of radioactive contaminants. Other options to reduce concentrations of radiation contaminants include controlled dilution of contaminated water with non-contaminated water.
- Boiling water will not remove radioactive iodine.

Why do the guidance levels for radioactive Iodine-131 in drinking water vary?

The guidance levels found in different sets of recommendations vary because some apply to routine situations and others to emergency situations. The table below summarizes the guidance on radioactive Iodine-131 in drinking water and provides an indication of the equivalent exposure from routine activities.

Guideline name	Advised maximum levels for radioactive activity in water (Bq/L)	Approximate equivalent radiation exposure if consuming water at this activity level for a year
WHO Guidelines for Drinking-water Quality (1)	10	A New York - London flight
Japanese provisional (emergency) standard for adults (2)	300	One year's exposure to natural background radiation, or 10-15 chest X-rays
Japanese provisional (emergency) standard for infants (3)	100	
IAEA Operational Intervention Level for nuclear emergencies (4)	3000	Not applicable. The advised maximum level should be used only to trigger action in the early stages of the emergency

(1) WHO Guidelines for Drinking-water Quality should not be taken as the reference point for nuclear emergencies because the levels set are extremely conservative, and designed to apply to lifetime routine intake.



(2) Provisional regulation values relating to limits on food and drink ingestion, established by the Japanese Food Sanitation Act, as indicated by the Nuclear Safety Commission of Japan. These standards are precautionary and have taken international guidance into consideration, including recommendations of the IAEA and the International Commission on Radiological Protection.

(3) As in (2) above, but applicable to drinking-water used to prepare baby food. This level is equivalent to the international guideline set by Codex Alimentarius for infant food.

(4) IAEA Safety Guide GSG-2 established Operational Intervention Levels (OILs) which would be the default international guidance levels for the early stage of an emergency.

WHO's response

What is WHO's role in nuclear emergencies?

- In accordance with its Constitution and the International Health Regulations, WHO is mandated to assess public health risks and provide technical consultation and assistance in association with public health events, including those associated with radiation events. In doing so, WHO is working with independent experts and other UN agencies.
- WHO's work is supported by a global network comprising more than 40 specialized institutions in radiation emergency medicine. The network, the Radiation Emergency Medical Preparedness and Assistance Network (REMPAN), provides technical assistance for radiation emergency preparedness and response.