Bruce Power

Innovation at work

WHAT YOU NEED TO KNOW

Radiation and the Environment

Environmental Monitoring Program

Every year, Bruce Power monitors all aspects of the environment surrounding our facility, including the level of radioactivity.

Environmental Monitoring (EM) is an important part of environmental protection at a nuclear facility. It ensures, through measurement, sampling and analysis, that the health of the environment and people are protected. Sampling and analysis of the local area gives Bruce Power a baseline to compare against in the unlikely event that site operations ever had a measurable impact.

EM is also an important component of the regulatory requirements under the terms of the Operating Licence issued by the Canadian Nuclear Safety Commission (CNSC).

Years of study have unequivocally determined that the Bruce site is posing no radiological risk to plants, animals and people near the site.

Sampling

Bruce Power uses various methods to gather the data that is used to determine the risk to the surrounding environment.

Bruce Power samples:

- air
- water/precipitation
- fish, sediment, sand, and soil
- animal feed
- eggs, pork, beef, poultry, deer, fruit (apples and pears) milk, root vegetables, non-root vegetables, honey and grains

Where do samples come from?

- The air and water in areas near Bruce Power Survey and across the Province of Ontario
- Material from homes and farms outside the Bruce site and across the Province of Ontario
- Meteorological data from two near site meteorological towers

What is Bruce Power looking for?

- Tritium (Hydrogen-3)
- Carbon-14
- Iodine-131
- Particulates that are emitting beta or gamma radiation

Surveying near Bruce Power

Local Population Survey

The Local Population Survey provides important information about the human, social, economic and natural environment surrounding the site.

During a Local Population Survey, Bruce Power requests that neighbours within a 10 km radius of site complete a survey, which is mailed to their households. The survey is conducted by an independent consulting firm — International Safety Research — that specializes in supporting environmental protection programs at nuclear facilities.

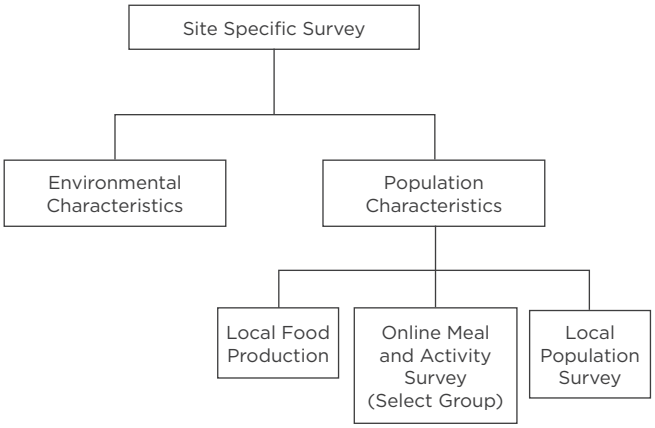
The survey is conducted every five years with 261 people responding to the 2016 survey.

The most recent survey looked at how much of a person's diet is locally produced. A Local Food Production Survey from December 2015 determined what types of foods are grown by regional farmers and where that food is distributed for consumption. That information informed an online Meal and Activity Survey in 2016 that collected information about how much local food people eat and how much time they spend outdoors. All of this information was built into the 2016 Local Population Survey.

Site Specific Survey

Bruce Power gathers information on meteorology and severe weather, land use, population, water usage, agriculture, recreation, food sources, daycares, before/after school programs, long-term care homes, school boards and parks within the vicinity of the Bruce site.

The report combines the results of multiple surveys and uses the data to calculate an annual radiation dose to the public, perform periodic Environmental Risk Assessments and calculate Derived Release Limits. All of these analyses use data from the Site Specific Survey to model how nearby residents are affected by radioactivity, and to confirm that radiation exposure is well below regulatory limits. This data is used for environmental monitoring and it is also important for emergency preparedness. The report is updated every five years to capture developments in the local environment and communities.



Dose to public

What is radiation?

Radiation is simply the energy emitted by an object. There are two types of radiation: non-ionizing and ionizing. Examples of non-ionizing radiation include radio waves and microwaves.

Ionizing radiation comes in the form of alpha, beta and gamma radiation and is the type that poses a health concern and has the potential to contribute to dose to public. Ionizing radiation is a completely natural environmental occurrence — it's in rocks, water, air, plants, food and even within our own bodies. It comes from the sun and the cosmos too. Human-made ionizing radiation sources include medical scans, x-rays, cancer treatments and nuclear power generation.

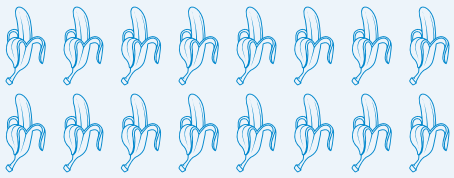
How much dose do I receive?

Everyone is exposed to radiation and how much dose a person gets varies widely and depends on a variety of factors.

- Geological conditions in your area
- Your altitude above sea level
- Lifestyle choice (such as how often you fly)
- Medical treatments, such as CT scans or x-rays

In Canada, the maximum dose a member of the public can receive from a nuclear facility is 1 millisievert (mSv) per year, established to be protective of human health. As a comparison, in Canada people receive about 1.8 mSv per year from completely natural background radiation (e.g., the sun).

The actual dose of a person living next to the property line of the Bruce site in 2016 was calculated at .0016 mSv. It equates to eating 16 bananas in one year.



1 banana = 0.0001 mSv

Radiological Awareness

There are engineered barriers in place at the Bruce site that help protect the surrounding communities and reduce any radiation releases to the environment. These barriers include the high efficiency particulate air (HEPA) filters and high efficiency carbon air (HECA) filters. These air filtration systems are tested annually.

Emissions occur during normal operations which may include maintenance work on systems such as the heat transport system, moderator and boilers, etc. However, the air filtration systems in place minimize emissions and ensure there is low to negligible risk to the public. (Air emissions from station operations that do pass through the air filters are significantly below regulatory limits.)

Airborne radionuclides that are monitored in atmosphere emissions include tritium, noble gases, iodine-131, carbon-14 and alpha- and beta-emitting particulates. Waterborne radionuclides that are monitored include tritium, carbon-14 and alpha- and beta-emitting particulates.

Bruce Power monitors all airborne and waterborne emissions and routinely reports the results to the CNSC in accordance with the operating licence.

Continuous Improvement

Bruce Power's highest priority is safety first and it applies to employees, as well as the public. Even though the radiation the public receives from the Bruce site is 1,000 times lower than that received from the natural environment, Bruce Power is always committed to reducing its emissions.

- Upgrading Radiological Effluent Monitoring equipment.
- Transitioning to the use of NuclearIQ — a Laboratory Information Management System that will maximize quality assurances and quality control in data recording from sampling and analysis.
- Annually testing monitoring capabilities.
- The Canadian Nuclear Safety Commission (CNSC) operates an independent environmental monitoring program. It analyzes samples from near the Bruce site to confirm public safety.

Tritium is a naturally occurring radioactive form of hydrogen. It's produced in the atmosphere when cosmic rays collide with air molecules. As a result, tritium is found in small amounts in water throughout the world. Tritium is also a byproduct of nuclear power generation. Tritium moves easily through the environment because it behaves just like water.

Tritium and Drinking Water

Bruce Power measures the concentration of tritium in drinking water from:

- Local municipal water supply plants in Kincardine and Southampton
- Lake Huron
- Wells and streams within the vicinity of the site

Becquerels (Bq): The measure of the rate at which radiation is emitted from a substance. One Becquerel is equal to one disintegration per second; the higher the Becquerels, the higher the radiation.

Regulatory Guidelines

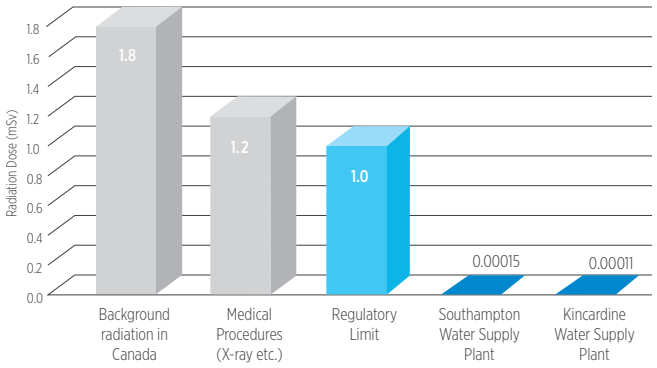
The limit for tritium in drinking water is an annual average of 7,000 Bq/L. Bruce Power has made a commitment to maintain tritium concentrations much lower and has self-imposed a limit of 100 Bq/L at all local municipal water supply plants.

How much tritium is in your water?

Bruce Power uses data from drinking water samples collected twice a day from municipal supplies. The 2016 annual average in Kincardine was 7.3 Bq/L and in Southampton it was 10 Bq/L. That's far below the limit — in fact, it's not even one per cent of the limit.

What does this all mean?

For a typical adult, the daily consumption of water from the Southampton water supply plant corresponds to a radiation dose of 0.00015 mSv per year. This is a tiny component of the annual dose limit for the general public (1 mSv) and is also small in comparison to other natural background sources of radiation.



Release Limits and Levels

As with all nuclear facilities, Bruce Power's operation does result in radiological releases to the environment. These releases are low, and in most cases, are not detectable in the environment.

Bruce Power has limits on how much radioactivity can be released — called Derived Release Limits. To ensure that limits are never reached, Bruce Power has put administrative limits in place to ensure action is taken well before there is any emission that would contribute to public dose. These admin levels are called Environmental Action Levels and Internal Investigation Levels.

Derived Release Limits (DRL)

Bruce A, Bruce B and the Central Maintenance and Laundry Facility each have their own regulator-imposed limits for emissions. Using meteorological data, the site specific survey data and other information, limits that prevent unacceptable dose to the public are determined for airborne and waterborne radiological emissions.

Environmental Action Levels (EAL)

Up until now, Bruce Power's Environmental Action Levels were calculated to be 10 per cent of the DRL. This means that there is a safety margin in place to prevent Bruce Power from ever reaching a licensing limit. Going forward, Bruce Power is working to further enhance environmental protection by establishing an even more conservative EAL above which any release to the environment is considered to be just above normal operating range. These new limits will be approximately 1,000 times lower than the EALs that have been in place — or 0.01 per cent of current DRLs.

Internal Investigation Levels (IIL)

An Internal Investigation Level is set at the upper range of normal releases (both airborne and waterborne) for each radionuclide. If an IIL is exceeded, Bruce Power immediately begins an investigation to determine why it happened and put corrective actions in place to ensure potential future releases remain within the normal range.

The Future of DRLs and EALs

Bruce Power is required to review, and if necessary, revise and reissue DRLs and EALs at least once per licence period. Currently, the CNSC is looking at ways to revise these limits to assist Bruce Power in further protecting people and the environment to the best of its ability.

Bruce Power is always striving to represent the industry best practice and frequently requests to adopt new standards. Bruce Power takes the health and safety of the local communities and environment very seriously, and works tirelessly to ensure that the site is fully compliant with regulations. Often times, Bruce Power goes above and beyond what is required by its regulators to ensure that all people, working on site or living nearby, can feel comfortable knowing that there is low to negligible risk posed to themselves or their families.

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