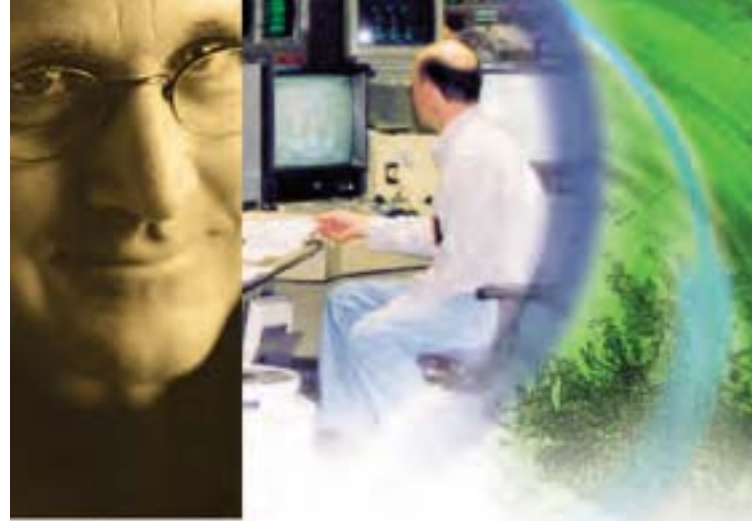


# NUCLEAR *facts*



## *How safe are CANDU nuclear reactors?*

CANDU NUCLEAR REACTORS ARE VERY SAFE. IN MORE THAN 45 YEARS OF USING NUCLEAR ENERGY, NOT ONE SINGLE FATALITY HAS RESULTED FROM RADIATION EXPOSURE AT A CANADIAN NUCLEAR POWER PLANT OR WASTE STORAGE FACILITY.

The many safety systems of the CANDU nuclear reactor take into account not only human error but also equipment failure and external risks such as earthquakes. Should an accident occur, CANDU reactors are designed to contain radioactive emissions within reactor buildings.

A 2008 study by the Canadian Energy Research Institute cites various studies that show that the nuclear power industry results in many fewer deaths worldwide than other forms of energy production. According to these studies, between 1970 and 1992 there were 6,400 immediate fatalities attributed to coal-fired power; 4,000 to hydroelectric production; 1,200 to natural gas; and 31 to nuclear power.

### **What is the safety philosophy?**

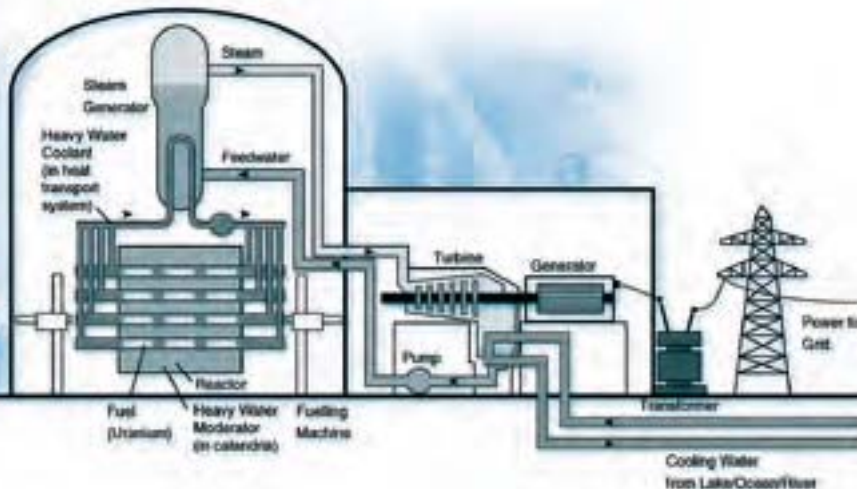
The safety philosophy used in CANDU nuclear power plants is to limit the chances of an accident occurring and to limit the effects of an accident, should one occur. This is called the “defence-in-depth” approach and sets high standards for designers, constructors and operators.

There are five main aspects to defence-in-depth:

- high-quality station equipment;
- nuclear plant operator training;
- fault detection and correction;
- special, independent safety systems;
- containment systems.

### **What is meant by high-quality station equipment?**

All suppliers of components to our CANDU nuclear power plants, such as manufacturers of pumps, valves, piping and electrical systems, must meet stringent qualifications. In addition, critical control components are duplicated. This means that if one component malfunctions, another will take over and the safety of the station will not be jeopardized.



*CANDU nuclear reactors contain multiple safety barriers to ensure protection of workers and the public in the event of an accident.*

## How are nuclear reactor operators trained?

The training of nuclear reactor operators is a very important aspect of the defence-in-depth nuclear safety philosophy.

Nuclear power station control room operators are carefully selected and spend approximately eight years in training. The Canadian Nuclear Safety Commission sets the requirements for training programs and examinations and certifies the individuals. Part of the testing is conducted on simulators that replicate the control room and are capable of reproducing normal and emergency operating conditions.

## What is fault detection and correction?

Each Canadian nuclear power station is continuously monitored through a program of special testing and inspection of its components and safety systems. Constant and prompt detection ensures that nuclear power stations operate within limits prescribed by the CNSC and set out in the Operating Licence. The Commission has inspectors on-site at these stations and can withdraw an operating licence at any time if regulations or licence conditions are not met.

## What are the special safety systems?

All Canadian nuclear reactors are equipped with special safety systems whose sole functions are to automatically shut down the reactor in the event of any major equipment malfunction and to maintain cooling of the fuel in the event of a failure of the reactor cooling system. These systems are:

- Shutdown system #1 – high-speed insertion of shut-off rods into the reactor to immediately stop the nuclear reaction;
- Shutdown system #2 – injection of neutron-absorbing materials into the moderator, which can also halt the nuclear reaction;
- Emergency core cooling system – injection of high-pressure water into the reactor cooling system if there is a failure of the piping.

These systems are designed to be tested while the reactor is operating and must meet stringent availability requirements.

## What is the function of containment systems?

A containment system surrounding a nuclear reactor is designed to prevent the release of any radioactive material to the outside environment in the event of an accident.

The containment system at all Canadian nuclear generating stations consists of an airtight reactor containment building (with reinforced concrete walls up to 1.8 metres thick) for each reactor.

Where multiple nuclear reactors exist, such as at the Pickering, Bruce and Darlington stations, each reactor building is connected to a common vacuum building, which assumes the containment function. This building acts like a vacuum cleaner. In the event of a release of radioactive steam into the reactor building, this steam would be vented to the vacuum building and prevented from escaping into the environment. Once in the vacuum building, the radioactive steam is condensed into liquid and contained. This safety design is unique to CANDU design.



*All aspects of reactor operation are monitored from the control room. CANDU nuclear reactors have a number of independent safety systems capable of shutting down the reactor to prevent accidents.*

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