IRSN
INSTITUT
DE RADIOPROTECTION
ET DE SÛRETÉ NUCLÉAIRE

Information note on iodine releases associated with the October 2016 incident at the HBWR Norwegian research reactor located in Halden

The HBWR reactor in Halden

The Norwegian research reactor HBWR (Halden Boiling Water Reactor), located in the south-east of Halden, Norway, is operated by the Institute for Energy Technology (IFE).

Commissioned in 1959, this reactor with a maximum thermal output of 25 MW is moderated and cooled with heavy water. In operation, the pressure in the reactor is around thirty bars and heavy water temperature is about 240°C. The reactor core can deliver a neutron flux of the order of 10^{14} $n/cm^2/s$, which is the neutron source used for the experiments.

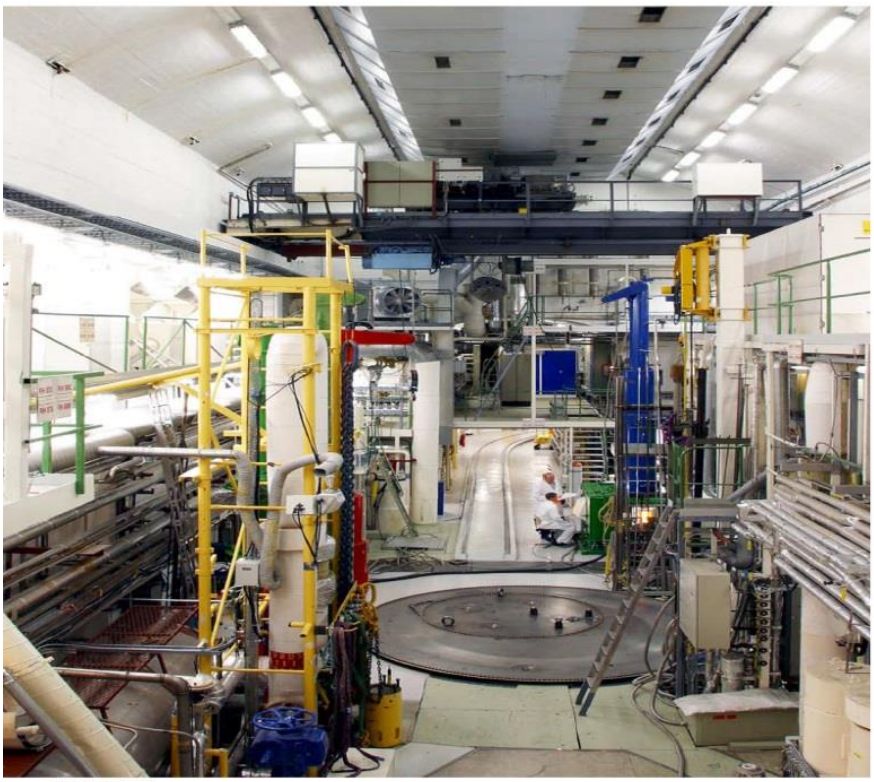
The central part of the reactor core can be up to 120 fuel assemblies positioned according to an hexagonal network. Each fuel assembly consists of 8 UO_2 rods enriched with 6% uranium 235 with a zirconium cladding. Several locations in the core are dedicated, on the one hand, to the control and safety bars of the reactor and on the other to the test assemblies used for the research programs.

The reactor can also carry out, by means of test loops, experiments on fuels or materials under conditions liable to be encountered in light water nuclear reactors.

The reactor building is located in a cavity dug on a hillside, and accessible through a tunnel. In addition to the reactor building, the facility houses several laboratories and experimental cells for the preparation of the experiments and the exploitation of the resulting data.

In December 2015, the Norwegian Radiation Protection Authority (NRPA) authorized the continuation of the reactor operation until 2020.

The two images below show, the first the reactor building and the second a diagram of the reactor core



The reactor hall.

Photo credit: "50 Years of Safety-related Research – The Halden Project 1958 – 2008"

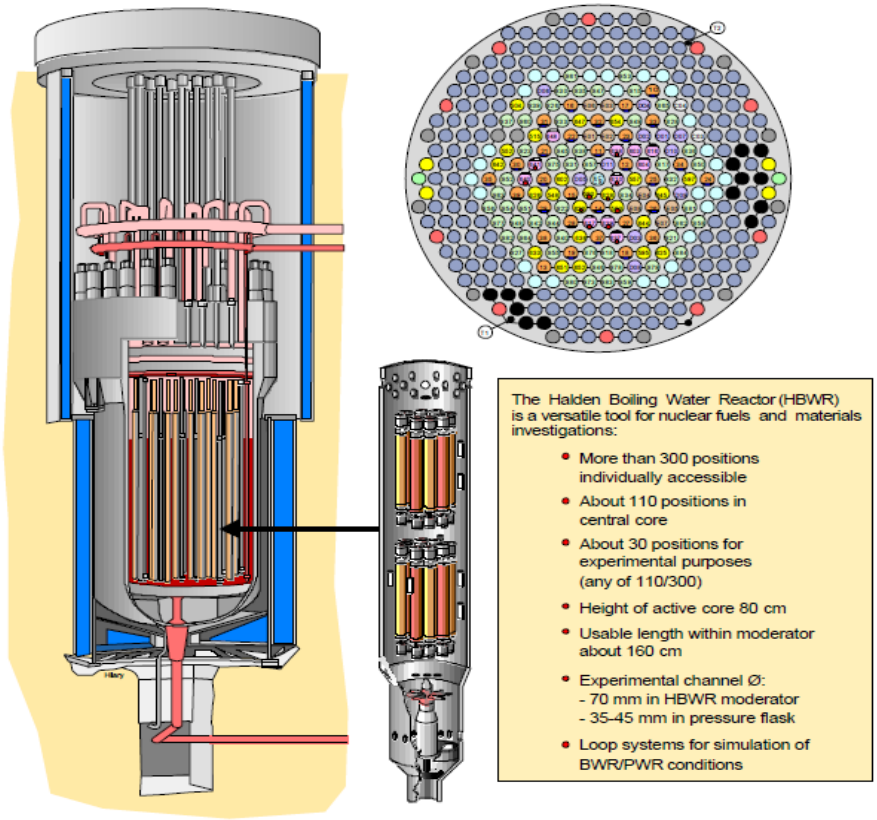


Photo credit: Institutt for Energiteknikk (IFE)

The Halden Project

The HBWR reactor is dedicated to research activities under the auspices of the OECD / NEA ("HALDEN project"). Many organizations, including IRSN, take part in this international project concerning in particular:

- the study of the behaviour of fuels and materials in normal and accidental reactor operating situations (high-combustion fuel tests were conducted in particular up to 2008);
- organizational and human actions related to the safety of nuclear installations (man-machine interface, design of control stations, instrumentation, etc.).

The incident and the related iodine releases

In the early afternoon of October 24, 2016, while the HBWR was shut down for maintenance since October 8, an incident during handling operations of a test assembly led to the release of radioactive substances. The assembly concerned had been removed from the reactor a few days earlier, on October 17, and placed in the “handling compartment” of the reactor building.

On October 20, an increase in rare gas activity is detected in the "handling compartment." The IFE then inspects the assembly and finds that several fuel rods are damaged. During the operations for separately storing these damaged rods, an increase in iodine activity levels in the ambient air of the reactor building is detected.

Upon detection of radioactivity in the reactor building, the personnel present were evacuated. Due to the increase in activity in the reactor building, the normal ventilation of this building was stopped on October 25, the air in the building being purified by circulation in activated carbon filters.

Releases to the environment occurred during this incident. According to NRPA, they continued until November 2016, until leaks from the storage containing the damaged rods were controlled.

The information provided by NRPA about the release of iodine due to the incident reveals releases close to 160 MBq of ^{131}I and 27 MBq of ^{132}I, i.e. around 5% of the annual discharge permit of gaseous releases of the facility for ^{131}I and about 1% for ^{132}I. It should be noted that as the damaged rods were from an assembly irradiated in the reactor, other radioelements (notably rare gases) were released at the same time as the iodine in the reactor building and then also rejected in the same way in the air.

IFE also indicates that water contaminated during the event was treated from October 28 and discharged into the Tista River after radiological measurements and NRPA authorizations. Liquid iodine releases to the environment would account for less than 20% of the liquid annual discharge permit for iodine.

Finally, it should be noted that the incident was provisionally classified at level 1 of the international nuclear event scale (INES), the final classification being under investigation by NRPA, and that the reactor is currently in a situation of safe shutdown awaiting the resumption of the experiments.

In conclusion, the Halden HBWR incident at the end of October 2016 resulted in limited release of radioactivity into the environment. This release concerned the period October - November 2016; it cannot therefore be responsible for the atmospheric measurements of iodine detected in several European countries since January 2017.

In addition, the timeframe during which the traces of iodine were detected in the air at the ground level in Europe at the beginning of the year makes it more likely that the release comes from a facility producing radioactive iodine for applications in the medical field. Since the levels of iodine were very low, the emission source could not be determined with precision, but it is likely located in Eastern Europe.

In any case, the levels of iodine-131 measured in France are tiny, 1,000 times lower than those observed in France during the weeks following the Fukushima accident. **These levels are without any health consequences and do not require stable iodine intake.**

ooOoo