SUBJECT 6
CHEMICAL WASTE DISCHARGES INTO THE CHANNEL

Operating waste

Operating the Flamanville 3 production unit involves, as it does for the two other units on the site, the discharge of liquid chemical waste, which can be placed in two categories. These two categories are chemical substances associated with liquid radioactive waste and other liquid chemical waste. The EPR unit discharges the same chemical substances as units 1 and 2.

a) The chemical substances associated with liquid radioactive waste and with water from the turbine hall

Chemical products must be added to the water of certain systems. This mainly concerns:

- boric acid, lithium hydroxide and hydrazine for the primary system;
- hydrazine as well as morpholine (or ethanolamine or ammonia) for the secondary system;
- sodium phosphate for the auxiliary cooling and heating systems.

These products are necessary either to control the nuclear reaction (boric acid) or to condition water so as to reduce the corrosion of the equipment.

The chemical treatment of the systems creates waste. This waste is treated so that it can be returned to its original system. Nevertheless, recycling is limited due to quality requirements concerning the system water imposed by technical specifications. The waste that can no longer be recycled is, if necessary, treated and then sent to inspection and discharge tanks. These products are discharged with the liquid radioactive waste or the water from the machine rooms (secondary system).

Other chemical products are also discharged: detergents used by the site laundrette, metals and suspended matter due to the wear of the circuits.

b) Other liquid chemical waste

The other liquid chemical waste comes from:

- the demineralized water production plant and the sea water desalination unit (sodium, sulphates, suspended matter, iron, detergents);
- the chlorination of the cooling water at the pumphouse to avoid the growth of organisms (bromoform, residual oxidants);
- site rain water systems which may contain hydrocarbons (rain water from the car parks and from asphalted surfaces);
- industrial water collection systems in the turbine hall which could contain hydrocarbons (oil used by the machines to run);
- purification plants (5-day Biological Oxygen Demand, etc.).

c) Average daily concentrations discharged into the sea

The following table presents the maximum average daily concentrations which are evaluated in the sea, near the beaches of Vauville and Sciotot bays, for the main substances discharged while the three units are operating simultaneously.

PLEASE NOTE: the EPR plant, during the building and operating phases, occasionally releases some chemical waste into the atmosphere (site machine and emergency diesel generator exhaust fumes, dust during earth-moving and demolition, formaldehyde produced by the heat insulator during temperature tests, ammonia during start-up, etc.) but it is unlikely that this waste impacts on the environment and public health. Nor can these gases be smelt outside of the site.

Chemical substances	Maximum value of the average daily concentration discharged into the Channel near the cove beaches of Vauville and Sciotot	Sea water's natural composition (orders of magnitude)
Boric acid	0.21 mg/L (0.037 mg/L in boron)	28 mg/L (4.9 mg/L in boron)
Lithium hydroxide	0.0001 mg/L (in lithium)	0.18 mg/L (in lithium)
Hydrazine	0.00014 mg/L	-
Morpholine	0.0042 mg/L	-
or Ethanolamine	0.0014 mg/L	-
Nitrates from ammonia	0.053 mg/L	0.51 mg/L
Ammonium from ammonia	0.015 mg/L	0.013 mg/L
Phosphates	0.0077 mg/L	0.055 mg/L
Detergents	0.014 mg/L	-
Metals (zinc, copper, manganese, nickel, chromium, iron, aluminium, lead)	0.0042 mg/L	0.024 mg/L
Suspended matter	0.015 mg/L	11 mg/L
Bromoform	0.0026 mg/L	-
Residual oxidants(equivalent to free chlorine)	0.08 mg/L	-

Discharges during the building phase

Discharges during the building phase vary according to each stage:

- During the preparatory works and buildings construction, waste mainly comprises suspended matter contained in rain water which falls on the building site and water pumped from the foundation pits;
- During the start-up tests, the waste is made up of chemical substances from the flushing of the systems (iron, suspended matter, phosphates, morpholine, lithium hydroxide, hydrazine and boric acid), the desalination unit used to produce demineralized water to fill the systems (iron, suspended matter, sodium, sulphates) and pumphouse tests (residual oxidants and bromoform)

This waste is discharged into the sea via the discharge tunnel of either unit 1 or unit 2. Rainwater, however, is directly discharged into the sea as it is done today.

The table below presents the maximum values of the average daily concentrations discharged into the sea, in the area close to the waste outlets, for the main substances discharged during the building phase.

Chemical substances	Maximum value of the average daily concentration discharged into the Channel in the area close to the waste outlets (µg/L)	Sea water's natural composition (orders of magnitude) µg/L
Boric acid	0.18	28,000
Lithium hydroxide	0.00028	620
Hydrazine	0.00007	-
Morpholine	0.042	-
Phosphates	0.07	55
Iron	0.1	10
Suspended matter	600	11,000
Sodium	0.85	11,000,000
Sulphates	0.65	2,700,000
Bromoform	2	-
Residual oxidants (equivalent to free chlorine)	50	-

Impact of liquid chemical waste on the environment

Hydro-ecological monitoring has been performed every year since 1983 by IFREMER[9] off the shore of the Flamanville CNPE. Such monitoring means the changes to the physical-chemical and biological characteristics of the Channel in the Flamanville CNPE area can be identified and it establishes the extent to which such changes are caused by the operation of the electro-nuclear plants.

The results of this regular monitoring programme reveal that waste from units 1 and 2 does not have a noticeable impact on the physical-chemical quality of the water nor on the organisms living in the Channel.

Considering the added concentrations after the EPR unit has been brought into service, the operation of the site will continue to not significantly affect the Channel environment and it will remain in line with the guidelines and the general aims of the SDAGE[10] for the area of Seine Normandie, as well as the measures to protect sensitive species and areas in the vicinity of the CNPE (natural areas of ecological interest, fauna and flora interest (ZNIEFF) and Natura 2000 areas).

Concerning the construction site, regardless of the construction stage, liquid waste does not impact on the marine ecosystem. This can be explained by two reasons: either the quantity of the substances already present in the sea water in comparison to the quantity of discharged substances is very low so that the organisms are used to the presence of such substances, or comparing their concentration levels in the sea with reference values (ecotoxicological or others) results in a lack of risk in the area close to the discharge outlet and, by deduction, in more distant areas.

Impact of liquid chemical waste on public health

An evaluation of the effects of liquid chemical waste from the site on the health of local people was performed. The Quantitative evaluation of health risks (EQRS) method, which adopts the recommendations of the National Institute for Public Health Surveillance (InVS) and the National institute for the industrial environment and hazards (INERIS), was used.

In the case of liquid chemical waste from the Flamanville 3 unit, as in the case for the two current units, the principal forms of exposure, in consideration of the substances studied and the use of the water in the site's area of influence, are the consumption of sea food (fish, molluscs, shellfish) fished near the discharge outlets and the swallowing of sea water while bathing. The Quantitative evaluation of health risks (EQRS) thereby concludes that the liquid chemical waste from the EPR unit, and also the total chemical waste from all of the three plants together, does not pose a risk to public health. Regarding the building site, the substances, which are potentially harmful to man also underwent a quantitative evaluation analysis (EQRS). The impact study concluded that there were no risks connected to these substances.

Measures foreseen to eliminate, reduce and if possible compensate the effects of Flamanville 3

As is the case for liquid radioactive waste, optimising the discharge of chemical waste from the production stage up until the discharge of waste during operation is sought, at the design stage, through the use of the best tried and tested methods available at an acceptable cost. The waste is sorted, treated and recycled as far as possible.

Non-recyclable chemical waste combined with radioactive elements is treated in the EPR unit's Radioactive Waste Processing Building and is sent to the site's joint tanks for monitoring before being discharged offshore through the underwater tunnels of units 1 and 2. The design and operating options adopted for the EPR reactor mean that the amount of this type of waste can be cut significantly in comparison to that of the existing units. The following kinds of waste can be reduced:

- boric acid, by using boron enriched with isotope 10 and greater recycling,
- lithium hydroxide by implementing a system which optimises the injection and recovery of the lithium hydroxide,
- hydrazine by implementing a method which destroys the hydrazine in the tanks prior to discharge,
- and phosphates by implementing measures which limit the transformation of phosphates in the systems.

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(9) IFREMER: French Research Institute for Exploitation of the Sea

10 Guidelines for water resource planning and management

These chemical substances are checked regularly in the waste contained in the tanks for monitoring before discharge.

The other chemical waste also undergoes specific measures:

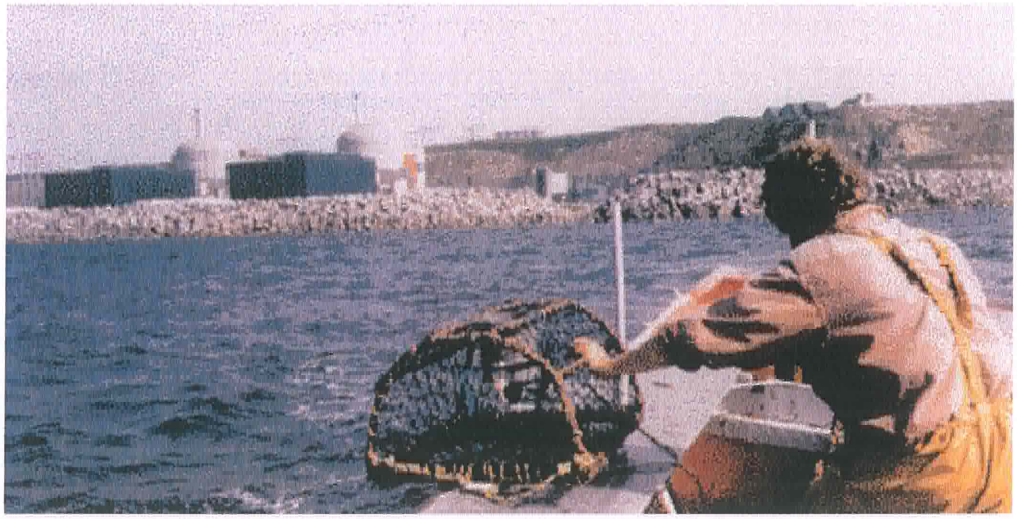
- industrial water and rain water from the car parks are treated with an oil filter,
- treatment of (bathroom) sewage at the purification plant,
- reduction in demineralization waste through the building of a sea water desalination unit that produces less waste than a fresh water demineralized station.

Chemical substance emissions are monitored as close to their discharge points as possible.

During the construction phase, measures are also taken to treat chemical waste (industrial water, sewage), to recycle them as far as possible (waste coming from start-up tests and crushing unit) and to make sure such waste is monitored and correctly dispersed following the tests.

The Channel, as a receiving water body, is also the subject of hydro-ecological surveillance. Regular monitoring of the physical-chemical properties of the Channel's water, aquatic flora and fauna (phytoplankton, zooplankton, microbiology, intertidal[11] benthic division and fishing resources) is performed as part of the area's hydro-ecological monitoring programme. It shows that waste from units 1 and 2 dos not have a noticeable impact on the physico-chemical quality of the water nor the organisms living in the Channel.

In the future, the continuation of hydro-ecological monitoring will ensure that the additional waste produced by the new EPR unit does not have a significant impact.



Fisherman in front of Flamanville

☞ **TO FIND OUT MORE**, please see:

- ***Documents 6 Piece B - Chapters IV.1.5, IV.2.5, IV.4.1, V.2.2, V.3.7****: Liquid chemical waste and waste to the atmosphere*
- ***Document 6 Piece C - Chapters I.4, I.5****: Reference state of physical chemistry and marine biology*
- ***Document 6 Piece E - Chapter III.1.4****: Impact of chemical waste discharges into the sea*
- ***Document 6 Piece E - Chapter IV.2****: Impact of chemical waste on public health*
- ***Document 6 Piece E - Chapters VI.1.2.2, VI.2.1.2, VI.3****: Measures foreseen regarding environment and public health*

[11] Domain of marine bottoms located on the shore, alternatively submerged and emerged depending on the tides.