

GREENPEACE

Gravelines

A NUCLEAR SAND CASTLE ON THE SEA



EXECUTIVE SUMMARY

**GREENPEACE REPORT
OCTOBER 2024**

Greenpeace is an international organisation which uses non-violent confrontation to protect the environment and biodiversity and to promote peace.

It is independent from all economic and political powers and draws from a committed citizen movement to build a sustainable and fair world.

Published by Greenpeace France

October 2024

Greenpeace France

13 rue d'Enghien 75010 Paris

[Greenpeace.fr](https://www.greenpeace.fr)

Cover illustration: Fred Peault

CONTENTS

THE GRAVELINES NUCLEAR PLANT IS ENCLOSED BY A PROTECTIVE WALL TO BECOME AN 'ISLAND' IF THE AREA IS SUBMERSED	4
NUCLEAR POWER PLANTS INCREASINGLY VULNERABLE TO CLIMATE CHANGE	5
A RELENTLESS RISE IN SEA LEVEL	6
GRAVELINES: A NUCLEAR ENERGY RE-BOOT THAT DEFIES ALL SCIENTIFIC LOGIC	6
AN UNDERESTIMATED RISK OF SUBMERSION AND FLOODING	8
ANTICIPATING RISKS: NOT THE FORTE OF THE FRENCH NUCLEAR SECTOR	8
NEW REACTORS AT THE GRAVELINES SITE: A LESSON IN MALADAPTATION	9

Gravelines

A NUCLEAR SAND CASTLE ON THE SEA

Electricité de France (EDF) earns a red card for its project to build nuclear reactors in an already flood-prone area, despite alarming climate projections of rising sea levels.

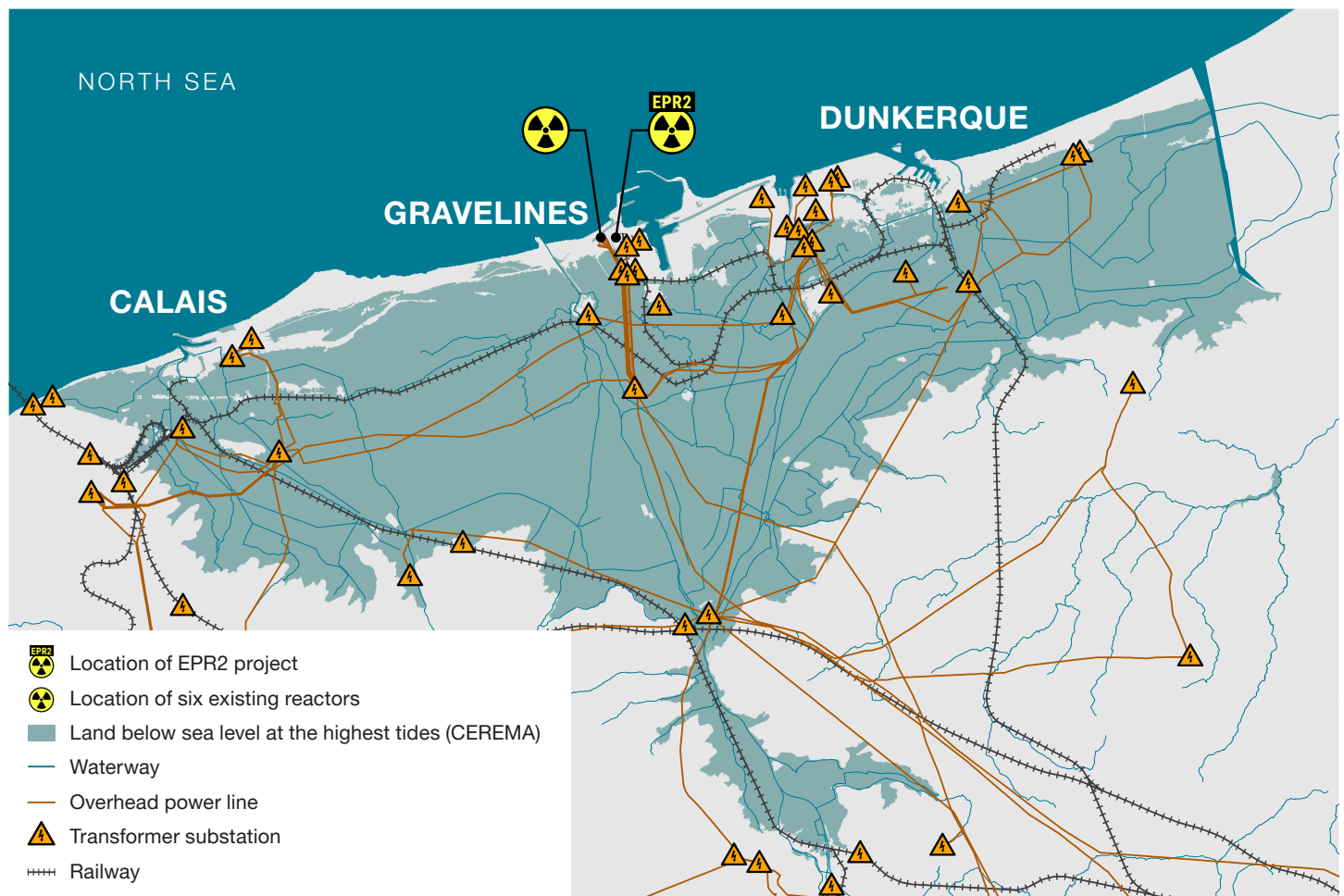
This report reiterates the voices of scientists who warn of the consequences of climate change and rising sea levels. The nuclear energy sector seems to ignore the gravity of the matter, as illustrated by EDF's plans to build two EPR2 nuclear reactors in Gravelines, in the heart of a submersible zone.

The Gravelines nuclear plant is enclosed by a protective wall to become an 'island' if the area is submersed

EDF currently protects the Gravelines plant's six reactors from rising sea levels and risks of flooding with backfilled and reinforced concrete seawalls, steel fencing between the reactors and the shore, and watertight blue doors in the car parks: if the sea rises and surrounding areas are submersed, the site becomes an island.

It is on this North Sea shore polder – on land artificially drained by a dense network of canals and enclosed by dykes – that EDF aspires to build two new EPR2 nuclear reactors. Most of the area already lies below sea level at the highest tides (indicated in light blue on the map next page).

The two new 'raised' reactors would be built next to a rising sea, on land increasingly exposed to submersion, on top of an 11 metre-high platform intended to turn the plant into an island, jeopardising the safety of operations.



Map 1 - Areas in the Aa delta below sea level at the Highest Astronomical Tide and Gravelines nuclear plant infrastructure.

Nuclear power plants increasingly vulnerable to climate change

Annie Podeur, President of the Second Chamber of the French Court of Auditors, has declared that **“the consequences of climate change will affect – already affect, to various but growing degrees – our existing fleet of reactors”**.¹

Climate change continues to worsen. One climate science report after another confirms increasingly alarming disruptions to our planet’s equilibrium. The summer of 2024 was the hottest on record².

- 1 Statement made at a hearing of the Finance Committee of the French Senate following the publication in March 2023 of the report: *L’Adaptation au changement climatique du parc de réacteurs nucléaires* (in French) (Adapting the Nuclear Reactor Fleet to Climate Change).
- 2 Audrey Garric, “L’été 2024 est le plus chaud jamais enregistré dans le monde”, *Le Monde*, September 2024 (in French) https://www.lemonde.fr/planete/article/2024/09/06/l-ete-2024-est-le-plus-chaud-jamais-enregistre-dans-le-monde_6305244_3244.html#:~:text=Mais%2C%20au%20niveau%20mondial%2C%20la

A relentless rise in sea level

Even if the Earth's overall temperature stopped rising, it is thought that glaciers and ice caps in Antarctica and Greenland would continue to melt for centuries to adjust to new temperatures. **The question is no longer if, but to what extent, and at what pace, sea levels will rise.**

Cryospheric scientists predict more pessimistic scenarios than those described in the Sixth Assessment Report of the International Panel on Climate Change (IPCC).

For glaciologist Heïdi Sevestre: “If business continues as usual, sea levels will rise one metre by 2070 and three metres³ by the end of the century⁴.”

Rising water levels are worrying for the roughly 41% of the world's nuclear power plants that operate near a seacoast⁵.

Gravelines: a nuclear energy re-boot that defies all scientific logic

Using different IPCC scenarios, Greenpeace mapped projected changes in zones exposed to sea flooding at Gravelines.

Maps next page show that in 2100, the entire Gravelines nuclear power plant site could temporarily be below sea level⁶.

The plant will be especially vulnerable to extreme weather events and surge conditions, and safety will depend entirely on the robustness of the site's protection infrastructure.

3 International Cryosphere Climate Initiative, ICCI, 2023. *State of the Cryosphere 2023 – Two Degrees is Too High*. International Cryosphere Climate Initiative (ICCI), Stockholm, Sweden. 62 pp., November 2023. The report states that “three meters might be passed early in the 2100s”, meaning that a three-metre rise could occur at the start of the next century. <https://iccinet.org/statecryo23/>

4 Mickaël Correia, “Avec la montée des eaux on risque de perdre une partie de nous-mêmes”, *Mediapart*, 6 August 2024 (in French) <https://www.mediapart.fr/journal/ecologie/060824/avec-la-montee-des-eaux-risque-de-perdre-une-partie-de-nous-memes>

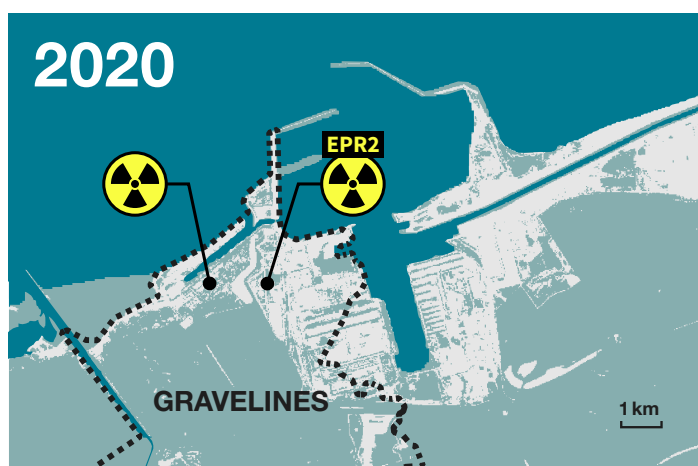
5 Jordaan et al., “The Climate Vulnerabilities of Global Nuclear Power”, *Global Environmental Politics*, 1 November 2019 https://doi.org/10.1162/glep_a_00527

6 At the Highest Astronomical Tide and in centennial-scale surge conditions.

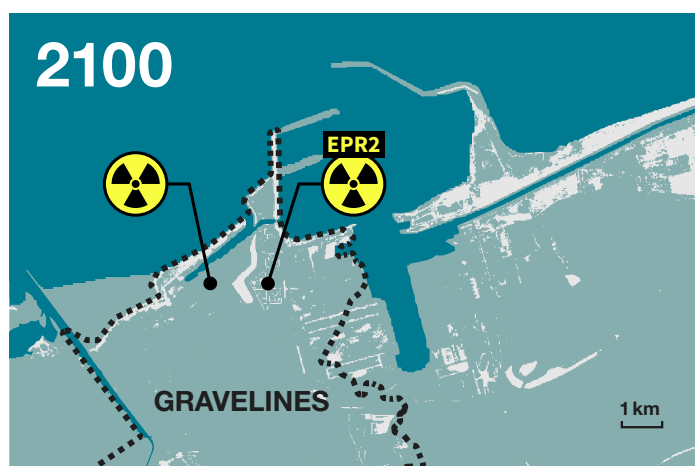
Should an extreme event occur, the plant must at all costs be able to evacuate the produced power and cool the reactors to prevent core meltdown and the release of radioactive materials into the atmosphere and water.

But how long can the safety of the Gravelines power plant be ensured if it becomes an island? What happens if a combination of extreme weather events occurs in a region already subject to a risk of serious flooding and made worse by climate change?

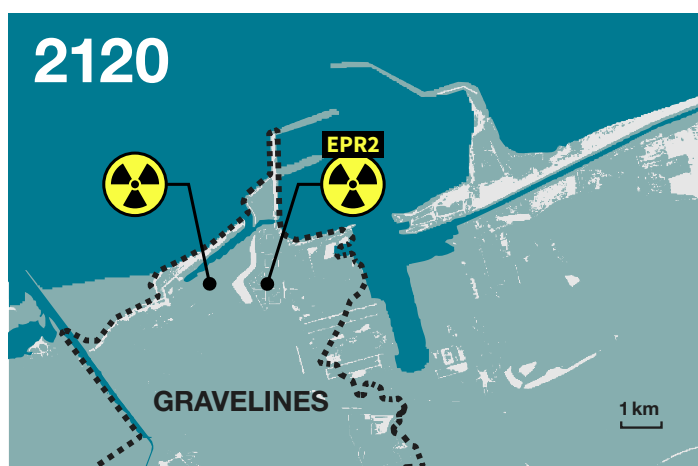
Map 2 - Exposure of the Gravelines power plant to the risk of submersion.



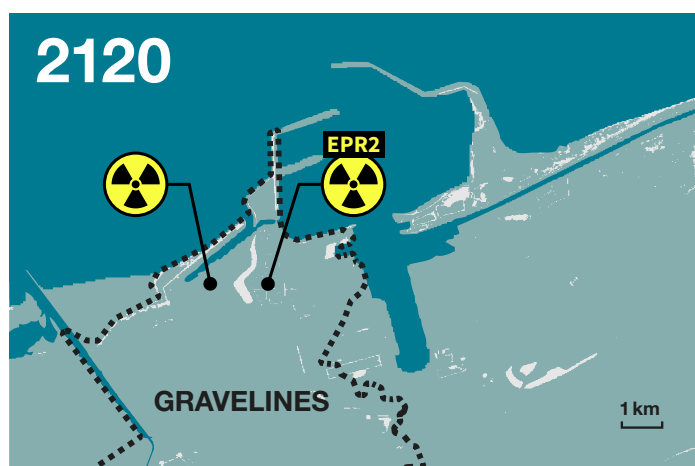
Land below sea level at the highest tides* in 2020



Land below sea level at the highest tides* in 2100 in IPCC scenario SSP5 8.5



Land below sea level at the highest tides* in 2120 in IPCC scenario SSP5 8.5



Land below sea level at the highest tides* in 2120 in IPCC scenario SSP5 8.5 including ice cap instability

-  Location of EPR2 project
-  Location of six existing reactors
-  Land below sea level at the highest tides*

* The Highest Astronomical Tide combined with centennial-scale surge conditions

Sources: IGN (MNT RGE Alti and BD Carthage), CEREMA-SHOM (surge), IPCC and NASA sea level change projection data)

Map created by: Greenpeace (September 2024)

An underestimated risk of submersion and flooding

Greenpeace believes that EDF must ensure the protection of the new reactors against the risks of sea flooding and submersion until the end of their life cycle: early in the next century.

In the project owner's file (DMO), EDF mentions 2070, timed with *“the third ten-year inspection of the EPR2 reactors, halfway through the 60 minimum years of operation”*, with an objective of *“ongoing improvement”*⁷. This objective is not enough.

Calculations in the DMO regarding safety do not reflect the latest scientific data on the highest-impact climate scenarios. EDF's theory of a 10,000-year 'return period' makes no sense in light of proven risk assessment methods. Security margins are provided with no explanation.

The terms 'erosion', 'surge', 'storm', 'subsidence' – all crucial factors to consider when mapping the evolution of a coastline and submersion risk – are mentioned nowhere in the project owner's file.

Greenpeace denounces a short-sighted management of climate change-related risks. EDF must not build reactors when it cannot fully guarantee their nuclear safety as long as they operate.

Anticipating risks: not the forte of the French nuclear sector

Generally speaking, the approval process to build nuclear power plants has not evolved in line with climate realities. It does not anticipate the risks of worsening climate change for society.

The operator's request for building approval includes a demonstrated acknowledgement of climate change, but it comes very late in the project roll-out process, when major investments have already been made.

7 EDF, Dossier des maîtres d'ouvrages, Gravelines – Projet de construction d'une paire de réacteurs EPR2 Débat public sous l'égide de la CNDP du 17 septembre 2024 au 17 janvier 2025, publié par la CNDP en 2024, p. 34 <https://www.debatpublic.fr/projet-nouveaux-reacteurs-nucleaires-gravelines/le-projet-en-bref-6068>

Greenpeace considers that climate vulnerability assessments conducted by independent experts should be mandatory and made public early in the process, as soon as a project is drafted and before mobilising any resources or economic investments. These assessments are also essential for effective public consultation and informed decision-making that takes the climate into account.

New reactors at the Gravelines site: a lesson in maladaptation

Climate scientist Valérie Masson-Delmotte stated in an interview: “Addressing rises in sea levels requires very long-term planning. **Only two preventive measures are effective: not building in areas that will be exposed to coastal risks, and planned relocation.** Anything else just buys time⁸”.

This is not the time for squabbles over numbers or complex calculations – sometimes to the tenth of a centimetre – to determine the ideal height of a platform or dyke or a required margin. It is time to listen to the increasingly pessimistic forecasts of scientists.

For Professor Catherine Meur Ferec at the Université de Bretagne Occidentale in Brest (France), “Nuclear power plants are one of the most strategic and most dangerous challenges. They face the growing natural risks of erosion and submersion and pose a major technological threat in and of themselves. If we are to sustainably adapt coastal areas to climate change, lowlands – and particularly polders – must be off limits to power plants.”

Given the risks to people and the environment, Greenpeace urges nuclear industry and safety stakeholders to think clearly and pull out of a process that is obsolete in an advanced state of climate crisis. This project can still be stopped in order to not add a new nuclear risk to existing climate risks and avoid building infrastructure that would become a maladaptation to climate change.

8 Valérie Masson-Delmotte, Director of the French Alternative Energies and Atomic Energy Commission (CEA), Climate And Environment Sciences Laboratory (LSCE) at Paris Saclay, Greenletter Club #104, “*Un climat qui s'emballe?*” (in French) <https://www.youtube.com/watch?v=UXVS9e9le90>

Gravelines

A NUCLEAR SAND CASTLE ON THE SEA

**GREENPEACE REPORT - EXECUTIVE SUMMARY
OCTOBER 2024**

GREENPEACE