ENVIRONMENTAL IMPACT ASSESSMENT REPORT

for the Project involving the construction and operation of the First Nuclear Power Plant in Poland with a capacity of up to 3,750 MWe, in the territory of the following communes: Choczewo, or Gniewino and Krokowa

SUMMARY OF THE RESULTS OF THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE PLANNED PROJECT

May 2022

świadomie o atomie
energia jądrowa w Polsce

Polskie Elektrownie Jądrowe sp. z o.o.

Details of the Applicant (Investor)

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PRELIMINARY INFORMATION ON THE PLANNED PROJECT

INTRODUCTION

This document is a summary of the key results of the impact assessment carried out for the site variants and sub-variants in the phases and stages of the implementation of the planned Project.

The purpose of the information provided below is to acquaint the reader with an outline of the planned investment Project from the point of view of presenting basic information on the Project, taking into account, among other things, the type of construction and operation technology, employment, construction works schedule, their scope and sequence, as well as, most importantly, the results of the assessment of the potential impact on the biotic and abiotic elements of the environment subject to direct and indirect impact from the Project.

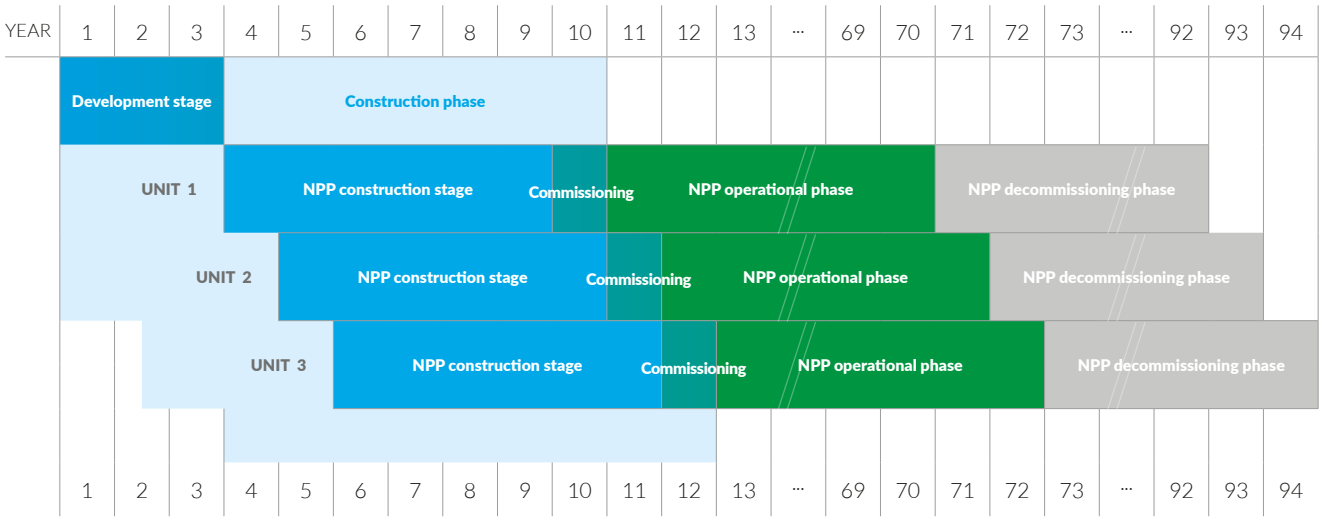
The information presented in this document by no means exhausts the issue of the assessment of the environmental impact of the nuclear facility, conducted as part of the procedure leading to the issuance of the decision on environmental conditions.

PROJECT SCHEDULE

The schedule for Variant 1 – Lubiatowo-Kopalino site [Figure 1] assumes that the duration of the construction phase will be approximately 10 years: development stage – 3 years, construction stage – 6 years, commissioning stage – 1 year. It is assumed that the first unit will be handed over 10 years after the start of the development stage. The next nuclear units will be put into operation with a one-year interval, so the entire construction phase for all units will be completed after about 12 years. Once the commissioning is complete, the operational phase will begin. The adopted generation III+ technology allows for 60 years of operation from the commissioning of each nuclear unit, regardless of the analysed site variants and sub-variants of the Project.

FIGURE1.

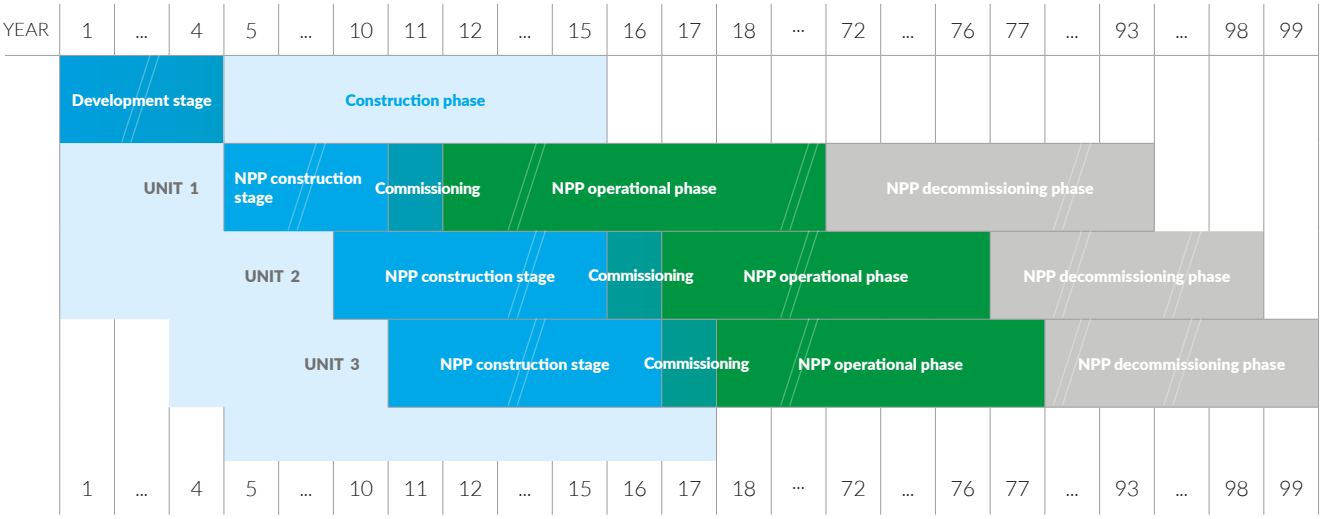
Planned Project schedule for Variant 1



Source: In-house study.

FIGURE 2.

Planned Project schedule for Variant 2



Source: In-house study.

For Variant 2 – Żarnowiec site [Figure 2] – the duration of the development stage will be similar to the implementation times assumed for Variant 1. Owing to the specificities of the arrangement of facilities in Variant 2, the construction works are estimated to last 5 years longer. The construction of the last nuclear unit will be postponed in relation to the construction of Unit No. 2 by 1 year. As in the case of Variant 1, the duration of the commissioning stage for a single nuclear unit will be 1 year. In the case of Variant 2 – Żarnowiec site, the construction phase of the entire power plant will last approximately 17 years.

CURRENT STAGE OF THE ADMINISTRATIVE PROCEDURE

In connection with the decision on the need to build a nuclear power plant as a strategic element of Poland's power system, making it possible for both economic needs (reduction of electricity prices and guaranteed security of supply) and environmental needs (CO_{2eq} emissions and related fees) to be addressed, on 5 August 2015, the Investor, as the entity responsible for the construction and operation of the power plant, appointed by the Council of Ministers, submitted an application for the issuance of a decision on environmental conditions for the planned Project involving the construction and operation of a Nuclear Power Plant with a capacity of up to 3,750 MWe, in the territory of the following communes: Choczewo, or Gniewino and Krokowa.

On 22 September 2015, the Director General for Environmental Protection (GDOŚ), as the competent authority under the procedure concerned, issued a decision on the need to conduct proceedings regarding the transboundary impact of the Project on the environment and on 2 December 2015 the decision was sent to the following countries: Germany, Czechia, the Netherlands, Hungary, Slovakia, Ukraine, Belarus, Lithuania, Russia, Latvia, Estonia, Finland, Sweden, Denmark and Austria. In addition, information on the initiation of the proceedings was sent to all countries within 1,000 km of the potential power plant sites. Then, on 25 May 2016, GDOŚ issued a Decision which specified the expectations regarding the scope of the EIA Report.

The submission of the EIA Report, of which this document is a summary providing a general presentation of information on the Project, in March 2022 resumes the procedure aimed at obtaining the Environmental Decision.

The entity responsible for the direct preparation of the investment process (i.e. for the conduct of site investigations and environmental surveys and for obtaining the necessary administrative permits for the operation of the Project) and the future operator of the nuclear power plant (NPP) is the special-purpose vehicle Polskie Elektrownie Jądrowe sp. z o.o.

RATIONALE FOR THE IMPLEMENTATION OF THE PROJECT

The Energy Policy of Poland until 2040 (PEP2040) provides for a deep energy transition of the country, with about 80% of the expenditures forecasted in PEP2040 in the electricity generation sector planned for renewable energy sources (RES) and nuclear power. The "zero-emission energy system" is one of the main pillars of the Policy, with the development of energy from renewable sources, the implementation of nuclear power and the implementation of the governmental Polish Nuclear Power Programme (PNPP) adopted in 2014 and updated in 2020 as the specific objectives enabling the energy transition. PEP2040 provides for the implementation of nuclear power and offshore wind power as activities of the same rank, aimed at achieving the same strategic goal by 2040. Nuclear power plants will have a 16% share and offshore wind power a 19% share in total electricity generation in Poland.

PEP2040 ASSUMES THAT IN 2040 NUCLEAR POWER PLANTS WILL GENERATE 16% OF ELECTRICITY IN POLAND.

In the justification of the Polish Nuclear Power Programme adopted by the Council of Ministers on 28 January 2014 and updated on 2 October 2020 with respect to energy security, it was indicated that the **construction and operation of nuclear power plants would result in a diversification of both the fuel base in the energy sector, and of the directions of supply of primary energy carriers**, which, in the present geopolitical situation, is an additional argument for the need to implement the Project.

In addition, with regard to the environment and climate, PEP2040 indicated that the use of nuclear technology is a rational low-carbon option for Poland, with its greenhouse gas emissions being at a level comparable to renewable energy, while also addressing the baseload needs of the energy system. Greenhouse gas emissions in the Project's life cycle are lower by two orders of magnitude than the emissions in the life cycle of a similar project that utilises gas or coal. From the point of view of the stability of electricity prices and improvement of the competitiveness of the national economy, PEP2040 assumes that the **implementation of nuclear power can contribute to halting the increase of energy costs for end users**.

From the point of view of technology, in accordance with the provisions of the PNPP, "*one of the main factors that affect the amount of capital expenditure and the level of risk involved in construction is the maturity of technology and experience in the construction and operation of units of a particular type*." This statement is the basis for the recommendation of the Council of Ministers, which, when adopting an update to the PNPP in 2020, recommended the selection of technology, indicating Pressurised Water Reactors (PWRs) as the preferred solution.

The overriding criterion for the choice of the technology from among the solutions available on the market and taken into consideration at the decision-making stage in this respect was to ensure the highest level of nuclear safety and radiological protection of the environment and the population. The reactor technology taken into account in the Environmental Impact Assessment Report represents Generation III/III+ and it is the reactor generation typically used in all implemented and planned nuclear power plant construction projects, ensuring the highest safety level currently available.

NPP IMPLEMENTATION

IMPROVED ENERGY SECURITY

Diversification of fuel base and directions of supply

LOWER ENERGY PRICES

Halting the increase of energy costs for end users

CLEAN AIR

Reduction of greenhouse gas emissions

CONSIDERED PROJECT VARIANTS

As part of the analysed Project, two potential sites for the construction of the Nuclear Power Plant were analysed along with the respective sub-variants, which differ depending on the cooling system used by the power plant:

Variant 1: Lubiatowo-Kopalino site		
Sub-variant 1A **open cooling system – direct cooling by seawater, no cooling towers (preferred variant)**	**Sub-variant 1B** **closed cooling system – cooling with the use of evaporative cooling towers with natural draught, operating on seawater**	**Sub-variant 1C** **closed cooling system – cooling with the use of evaporative cooling towers with natural draught, operating on fresh water (desalinated seawater)**
Variant 2: Żarnowiec site		
Sub-variant 2A **closed cooling system – cooling with the use of evaporative cooling towers with natural draught, operating on seawater**	**Sub-variant 2B** **closed cooling system – cooling with the use of evaporative cooling towers with natural draught, operating on fresh water (desalinated seawater)**	

In the site selection process, a number of criteria were taken into consideration, including those the application of which allowed for the development of a ranking in accordance with the guidelines of the International Atomic Energy Agency (IAEA), and for the identification of potential sites to be further analysed. A multi-annual site investigation and environmental survey programme was carried out for the identified sites.

In the years 2011-2015, the first stage of site investigations and environmental surveys was carried out, in particular for the Żarnowiec, Choczewo and Lubiatowo-Kopalino sites and the preliminary results were verified with regard to the occurrence of a "fundamental defect". Additional analyses carried out at the beginning of 2015 showed a risk of significant impacts on the Natura 2000 site, and therefore, in 2015, the Investor launched activities aimed at reliable and independent verification of this risk. At the same time, in view of the possibility of losing the Choczewo site, the Investor began to analyse the possibility of changing the coastal site. The internal analysis covered the area adjacent to the current Choczewo site. On 11 January 2016, the Investor submitted to GDOŚ an application to change the content of the application for the issuance of a decision on environmental conditions for the Project and the application to determine the scope of the Environmental Impact Report for the Project, by removing one site variant, i.e. "Choczewo".

Meeting the requirements of the EIA Act and the GDOŚ Decision, the Investor carried out a two-stage analysis aimed at indicating the investment variant, an alternative variant and the variant most favourable environmentally, in accordance with the requirements of the abovementioned documents.

In the first stage of the analysis, the sites were also compared with regard to a number of siting criteria aimed at identifying the preferred site – comparative analysis – followed by a multi-criteria analysis oriented at identifying the final sub-variant proposed for implementation, the variant most favourable environmentally, and the rational alternative variant, as well as the so-called "zero variant", i.e. one in which the Project would not be implemented.

As a result of the comparative and multi-criteria analyses, in which the considered sites and cooling system technologies were subject to surveys and studies, it was concluded that the variant proposed by the Applicant would be Variant 1 – Lubiatowo-Kopalino site, sub-variant 1A, with variant 1B as the alternative and, at the same time, most environmentally favourable variant.

CHARACTERISTICS OF THE PLANNED PROJECT

PROJECT AREA

The Project Area (PA), in which all the construction works related to the implementation of the Project and its subsequent operation for Variant 1 – Lubiatowo-Kopalino site and Variant 2 – Żarnowiec site will be carried out is presented in Figures 3 and 4.

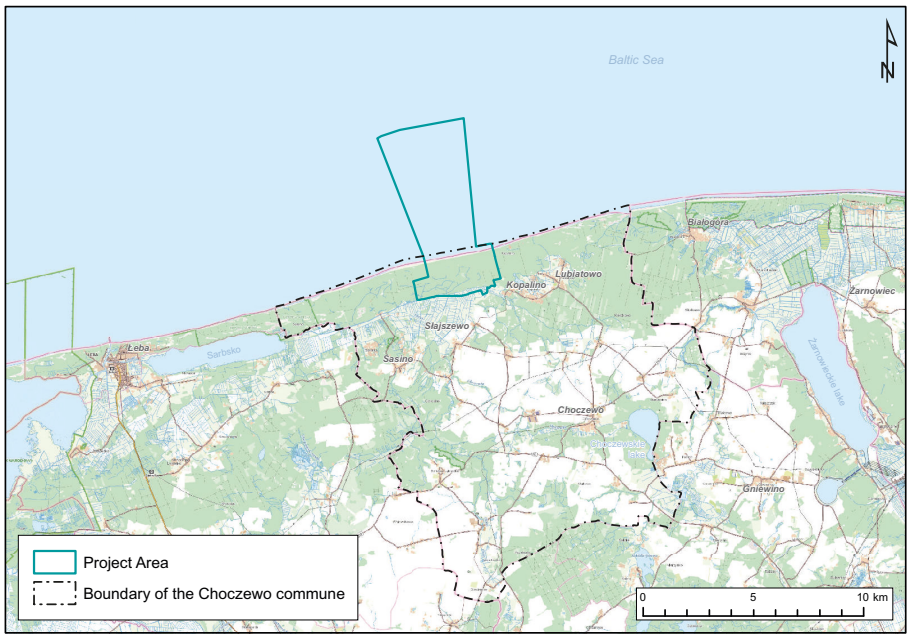


FIGURE 3.

Project Area in Variant 1 — Lubiatowo-Kopalino site

Source: In-house study.

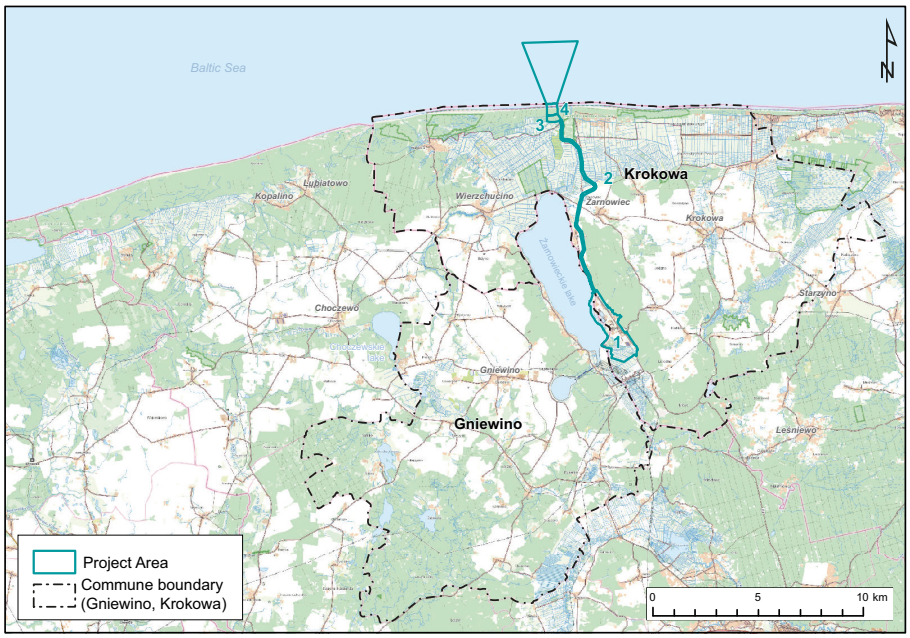


FIGURE 4.

Project Area in Variant 2 — Żarnowiec site

Source: In-house study.

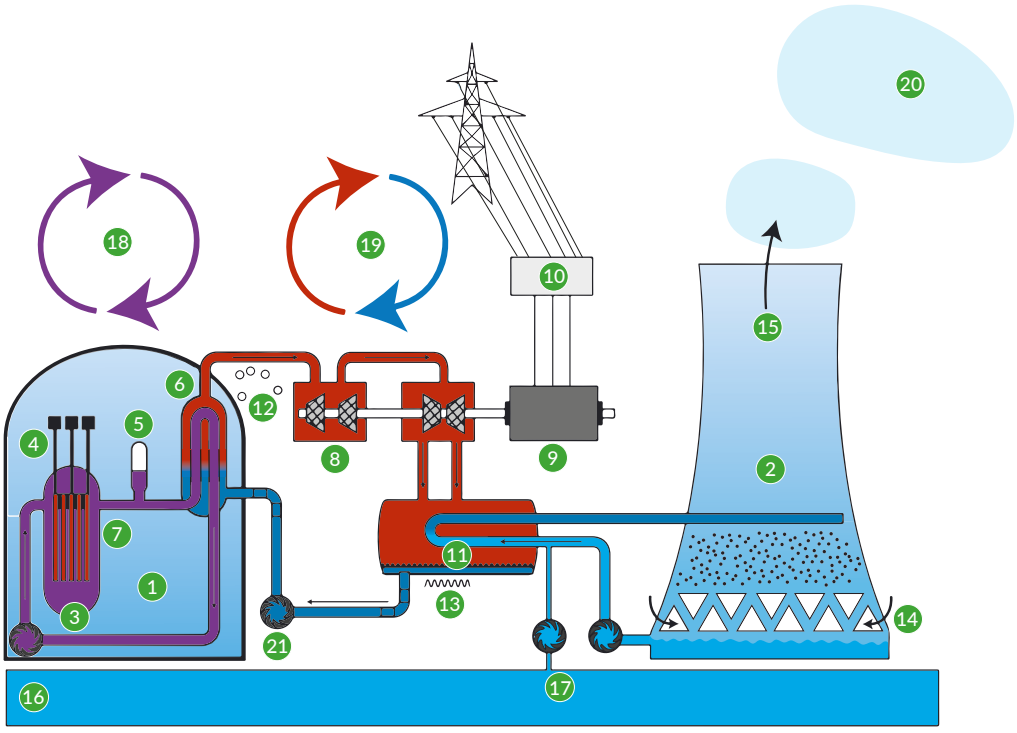
DESCRIPTION OF THE PRESSURISED WATER REACTOR

The environmental impact assessment as part of the EIA Report was carried out for a Nuclear Power Plant with a Pressurised Water Reactor (PWR).

The technological process of electricity generation in a nuclear power unit with a pressurised water reactor is schematically shown in Figure 5.

FIGURE 5.

Block diagram of a PWR nuclear power plant with a closed cooling system



1. Reactor cooling system
2. Cooling tower (closed system) / Baltic Sea (open system)
3. Reactor
4. Control rods
5. Pressuriser
6. Steam generator
7. Reactor core
8. Steam turbine
9. Generator
10. Unit transformer
11. Turbine condenser
12. Main steam
13. Condensate
14. Air
15. Humid air
16. Baltic Sea
17. Make-up of water losses in a closed cooling system
18. Primary circuit
19. Secondary circuit
20. Steam
21. Feedwater pump

Source: Wikimedia Commons: http://commons.wikimedia.org (accessed 28-09-2021).

The Project includes the construction and operation of a Nuclear Power Plant with three nuclear power units equipped with innovative Generation III/III+ reactors with passive safety systems, along with balance of plant for the entire Nuclear Power Plant.

PROJECTED TYPES AND VOLUMES OF EMISSIONS, INCLUDING WASTE, RESULTING FROM THE OPERATION OF THE PROJECT

EMISSIONS OF NON-RADIOACTIVE POLLUTANTS INTO THE AIR

In connection with the implementation of the Project, emissions into the air from conventional sources – fugitive emissions, including emissions from surface sources, will basically take place only at the construction stage. The direct sources of these pollutants will include concrete batching plants located at the NPP construction site, construction plant and machinery, point energy sources powering the equipment, and sources of fugitive emissions from the NPP area, which will include nitrogen oxides (NO_x), carbon monoxide (CO), sulphur dioxide (SO_2), and dust generated during excavation, movement of construction plant, or in the course of concreting works. The emission of pollutants from conventional sources into the air during the operational phase will be negligible compared to the construction stage.

EMISSIONS OF RADIOACTIVE POLLUTANTS INTO THE AIR

In operational states, emissions of substances into the air will take place from the shield building and (in small amounts) from the turbine building. These emissions will mainly include the most volatile radioactive substances in a gaseous form (radioactive noble gases) or aerosol form, produced in the nuclear reactor and in its cooling circuit. The types of those substances together with their total annual activities for the Nuclear Power Plant are presented in Table 1. **These substances pose no radiological hazard for the population or for the plant personnel.**

TABLE 1.

Emissions of radioactive substances into the air in operational states from a Nuclear Power Plant with the analysed PWRs (summary)

Isotopes	TBq/year	
	1 unit	3 units
Total iodine[1]	5.60E-04	1.68E-03
Noble gases (excluding argon)[2]	6.70E+00	2.01E+01
Co-57, Fe-59, Ru-103, Ru-106, Sb-125, Cs-136, Ce-141	negligible*)	negligible
Total beta-radioactive (particles)[3]	1.70E-05	5.10E-05
Sum excluding noble gases and Ar-41	3.65E+00	1.10E+01

**) negligible means less than 3.7E-8 TBq/year*

[1] Includes I-131 and I-133

[2] Include Kr-85m, Kr-85, Kr-87, Kr-88, Kr-85, Xe-131m, Xe-133m, Xe-133, Xe-135m, Xe-135, Xe-137, Xe-138

[3] Include the molecular form of Co-60 + Sr-90 + Cs-137 + others

Source: In-house study.

EMISSION OF NON-RADIOACTIVE WASTEWATER

For the development stage, it is assumed that the maximum volume of domestic and process wastewater, regardless of the variant, will amount to approximately 565 m^3 per day, and to approximately 1,785 m^3 per day for the construction stage. It is assumed that in the operational phase, a new wastewater treatment plant with treated wastewater discharge into the sea will be in operation in the NPP area.

EMISSION OF WASTEWATER CONTAINING RADIOACTIVE SUBSTANCES

The main emissions, albeit in insignificant quantities, containing radioactive substances will occur in the operational phase of the planned Project. For the operational phase, it is assumed that the quantity of treated industrial wastewater containing radioactive substances in the case of all sub-variants will be similar and will amount to approximately 1.68E-02 [Tbq/year] for three units; mainly (99.98%) tritium and carbon-14 – emitters of low-energy (local range) beta radiation. The discharge of the said wastewater into the environment will pose no radiological hazard for the marine environment or for animals and people.

WASTE (NON-RADIOACTIVE)

As regards conventional waste, the largest quantities of waste will be generated at the construction stage. It has been estimated that during the development stage – regardless of the chosen sub-variant – approximately 37,000 tonnes of conventional waste will be generated for Variant 1 and approximately 825,000 tonnes of conventional waste will be generated for Variant 2, of which approximately 785,000 tonnes is waste generated during demolition works. As a result of the construction works, it is expected that large masses of soil (approximately 7 – 10 million tonnes) will be produced, most of which will be used in the NPP area after the completion of the construction works.

At the construction stage for both NPP sites works related to the construction of channels/pipelines for cooling water intake and discharge along with treated industrial sewage will be carried out in the marine part. It is assumed that the spoil from dredging works at sea in the form of non-cohesive sediments (sands, gravels) will be re-used, e.g. to backfill the cooling system channels/pipelines. On the other hand, the remaining part of the spoil – cohesive sediments (clays, sandy clays, silts), will be deposited on a deposit site located at sea (in the event that the open-cut trenching method is used).

RADIOACTIVE WASTE AND SPENT NUCLEAR FUEL

All radioactive waste, generated irrespective of the phase of Project implementation,, will undergo different treatment processes depending on its form, eventually resulting in, among other things: the release of treated radioactive substances with reduced activity into the environment (into the air and marine waters); as well as solid (including solidified) radioactive waste placed in containers suitable for temporary storage at the NPP site and, subsequently, for being transferred for disposal at the National Radioactive Waste Repository.

Finally, high level radioactive waste, such as spent fuel, will be transported to a deep geological radioactive waste repository in accordance with the "National Plan for radioactive waste and spent fuel management" adopted on 21 October 2020. The repository will be a separate project carried out in accordance with Polish law by the Radioactive Waste Management Plant (RWMP).

The estimated annual amount of spent fuel produced in an NPP consisting of three units will be approximately 27 m^3/year.

NOISE AND VIBRATIONS

The implementation of the Project, as is the case with any investment, will involve temporary emission of noise and vibrations. The most noxious operations carried out during the construction stage are piling and the related vibrations, driving of sheet piles for the stabilisation of embankments, foundation works, construction of the reactor building and construction of the seawater desalination plant, as well as transport-related vibrations. The corrected values of the sound power level L_W [dB(A)] may reach as high as 129 dB(A).

As regards vibrations in Variant 2 – Żarnowiec site, emissions of significant vibrations associated with the demolition of facilities of the unfinished Żarnowiec nuclear power plant may occur, including mainly those related to the crushing of concrete.

During the commissioning of the first nuclear unit, noise with a power level of 80 to 114 dB(A) will be generated. During the operational phase, in addition to the main systems of the NPP, the noise sources in the case of sub-variant 1A will be pumps and desalination plant facilities, generating noise with a power level of 80 dB(A) to 87 dB(A), while in the case of the other sub-variants, the noise sources will include cooling towers, pumps and desalination plant facilities which will generate noise with a sound power level of 80 dB(A) to 119 dB(A).

For the commissioning and operational phases, regardless of the site variant, no vibrations of a significant range are expected to be generated.

ELECTROMAGNETIC FIELD

The sources of electromagnetic fields in the construction phase, in the low-frequency range (50 Hz) will include: 0.4 kV power generators, two cable lines at 110 kV, a 110/15 kV electrical substations, several to a dozen or so 15/0.4 kV electrical substations, 15 kV cable lines, 0.4 kV cable lines and electrical loads. Apart from the abovementioned sources, additional sources at the commissioning stage and during the operational phase will include the 400 kV extra-high voltage lines used for the evacuation of power from the NPP to the Polish National Power System.

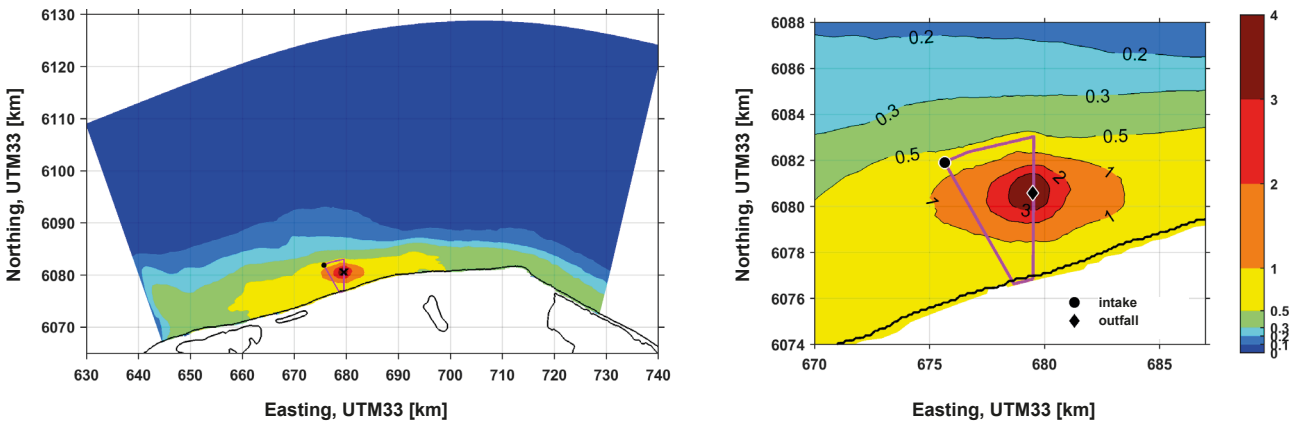
HEAT EMISSION TO THE ENVIRONMENT

At the commissioning stage and during the operational phase, the largest heat emissions will be related to the cooling of the nuclear reactor. Depending on the sub-variant of the power unit cooling system, the heat dissipated from the condenser and the turbine building equipment will be released into the environment via the cooling system channels/pipelines into the Baltic Sea (sub-variant 1A) or through cooling towers into the air (sub-variants 1B, 1C, 2A and 2B). Regardless of the sub-variant, the maximum thermal capacity of the condenser and the turbine building equipment will occur at the maximum NPP load and will amount to approximately 2,400 MW per nuclear power unit, i.e. approximately 7,200 MW for the entire NPP.

A graphical interpretation of the modelling results for sub-variant 1A is presented in Figure 6 showing the extent of the 2°C temperature rise (ΔT) contour at the sea surface in summer conditions.

FIGURE 6.

Temperature anomaly (°C) on the sea surface, 98th percentile – summer



Source: Marine Hydrodynamics and Water Quality, Jacobs Clean Energy Limited (2021).

LIGHT POLLUTION

During construction, particularly intense lighting will be present during night work, e.g. concreting works, which cannot be interrupted for technological reasons.

Regardless of the NPP site variant, the light from the illumination of the construction site will be visible from nearby towns, but its intensity will not be burdensome for their residents.

It is assumed that the selection of light intensity and sources for the illumination of the NPP area during operation will be made in such a way as to result in as little light pollution of the night sky and landscape as possible while meeting the safety and security requirements of the NPP.

HAZARDS AND SEVERE ACCIDENTS

In the context of the analysis of the safety of nuclear power plants, an analysis was carried out with regard to external events as events originating from outside the fenced area of the power plant, but which may become an initiating event that may have serious consequences for nuclear safety, e.g.: natural hazards (such as floods, extreme weather conditions and phenomena), and human-induced external hazards (such as aircraft impact, fires and explosions, release of toxic gases). In addition, external events occurring on the site of the power plant, the source of which is located onsite, but outside of buildings related to nuclear safety, were distinguished.

Examples of such events include onsite transport accidents, as well as fires originating from neighbouring buildings. External events can occur as a single event or as a combination of two or more external events. During the analyses, combined events that could negatively affect the safety of the nuclear power plant were identified. Safety analyses will be continued and their full scope, as an obligatory requirement for obtaining further administrative decisions, will be presented in the Preliminary Safety Analysis Report to be approved by the Polish National Atomic Energy Agency.

For the purposes of preparing the EIA Report, potential external events were identified. As a result of those analyses, a list of 40 possible events was drawn up, for which relevant quantitative (deterministic and statistical) analyses were performed.

Presented below are selected safety issues for the nuclear facility from the point of view of the impact of the facility on the environment and the impact of the environment (external factors) on the facility.

RISK OF AN ACCIDENT RESULTING IN ENVIRONMENTAL CONTAMINATION

Risk of a severe industrial accident

Irrespective of the sub-variant, the Project falls within the category of plants at high risk of a severe industrial accident according to the classification under the Environmental Protection Law Act of 27 April 2001 [consolidated text, Journal of Laws of 2021, item 1973] (EPL Act).

Risk of a severe accident in a nuclear context

The probability of a severe accident related to the degradation of the reactor core, including its meltdown, occurring in a Generation III/III+ NPP is less than one in a million years and the probability of a severe accident is less than one in 10 million years. In other words, an event of this type might occur in one of 166,667 reactors of the type concerned (PWR) operating for the assumed 60 years each. Currently, there are approximately 440 operational reactors of this type in the world.

The probability of an initiating event leading to an accident without core melt is approximately 7.8×10^{-7} per reactor/year, while the probability of an accident involving core melt is 1.7×10^{-7} per reactor/year.

Risk of a natural disaster

There are no tectonic zones in the Site Regions of both site variants, and there are no risks associated with river floods. As a result of the analysis of the maximum expected sea level, the foundation level of the nuclear power plant was determined at no lower than: site 9.5 m above sea level (AMSL) for nuclear facilities (nuclear island) and 8.3 m AMSL for other facilities for Variant 1 – Lubiatowo–Kopalino and 9.0 m AMSL for nuclear facilities (nuclear island), and an average of 5.75 m AMSL for other NPP facilities for Variant 2 – Żarnowiec site.

Geological hazards such as filtration deformations, erosion and accumulation phenomena, weak-bearing soils, landslides and karst phenomena will be taken into account at the NPP design stage so as to ensure that they do not pose a threat to the nuclear facility. The impact of extreme weather phenomena will also be taken into account.

At the stage of preparing this report, no serious hazards which would prevent the construction of the NPP in the considered site variant were identified.

Risk of a construction disaster

Nuclear power plant facilities are designed with the use of high safety factors. They are characterised by high quality of workmanship and control regime during operation, preventing them from being damaged, from failing, and hence from construction disasters; thus Generation III/III+ facilities are resilient to extreme hazards or external events.

Preventing the occurrence of emergencies

Measures preventing the occurrence of emergencies will be taken in all phases of Project implementation. These countermeasures are meant to cover both the occurrence of an industrial accident and an accident in a nuclear context. The measures to be implemented include, inter alia, appropriate procedures and ensuring that they are complied with, proper organisation of the construction site, appropriate design of the reactor, its safety systems and NPP facilities (in particular: the reactor and turbine buildings, as well as buildings and auxiliary facilities important to nuclear safety and radiological protection).

ENVIRONMENTAL CHARACTERISTICS

AREA ADOPTED FOR ENVIRONMENTAL SURVEYS

In accordance with the EIA Act and the GDOŚ Decision, the scope and extent of the detailed surveys of the natural elements of the environment carried out for the purposes of preparing this EIA Report covered the expected impact of the planned project on the environment.

The preparation of the EIA Report involved surveys of the existing status of the individual environmental components subject to potential impact. The surveys were carried out at the same time and at the same level of detail for the two considered site variants. The scope of the surveys covered the following issues: biota (natural inventory, land and marine parts), climate and weather conditions, geology (including seabed geomorphology and geology, as well as seismic and tectonic conditions), soil quality, hydrogeology (quantitative and qualitative assessment), hydrology (land and marine part, quantitative and qualitative part), ambient air quality, acoustic environment, electromagnetic field, ionising radiation background, landscape, location of archaeological sites and historic monuments, and socio-economic conditions (including the current land development status and health of the population).

The surveys were unprecedented in the history of infrastructure projects in Poland in terms of the thematic scope (21 research areas) and territorial coverage (a radius of 30 km from the PA boundaries). In addition, more than 40 research units and contractors from across Poland were involved in the performance of such an extensive scope of surveys.

MULTI-ANNUAL ENVIRONMENTAL AND SITING SURVEYS WERE CONDUCTED ON A SCALE UNPRECEDENTED IN POLAND.

The environmental investigations and site surveys were conducted for a period of 4 years (depending on survey area), and for selected elements, including meteorology, seismology, hydrology (both inland and marine) the surveys are being continued in accordance with the requirements of the Siting Regulation as an element of safety analyses with regard to external hazards for the purposes of preparing the Site Evaluation Report. The Site Evaluation Report is yet another element of the administrative procedure leading to the issuance of the building permit.

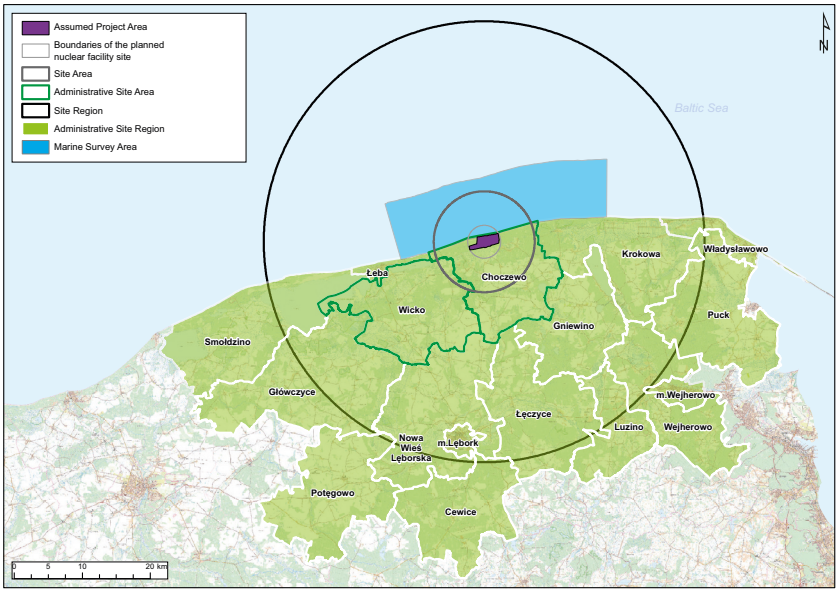
In territorial terms, the coverage of the surveys was a hybrid of two legislative regimes, namely:

1. the EIA Act – spatial coverage corresponding to the potential range of significant impact for the purposes of preparing the Environmental Impact Assessment Report and obtaining the decision on environmental conditions on its basis,
2. the implementing measure to the Atomic Law Act of 29 August 2000 [consolidated text, Journal of Laws of 2021, item 1941] (Atomic Law Act), the Siting Regulation – spatial coverage corresponding to the range delimited by the boundaries of the Site Region and the Site Area. The definitions of region (30 km) and area (5 km) determining the range of environmental investigations and site surveys are provided in the aforementioned Regulation.

The largest survey area was adopted for the surveys associated with the assessment of the area with regard to the seismic and tectonic conditions. The surveys were carried out in accordance with the recommendations of the International Atomic Energy Agency [IAEA Nuclear Energy Series No. NG-T-3.11, IAEA, Vienna (2014)] in the area within 300 km of the considered site variant, i.e. in the Macroregion.

FIGURE 7.

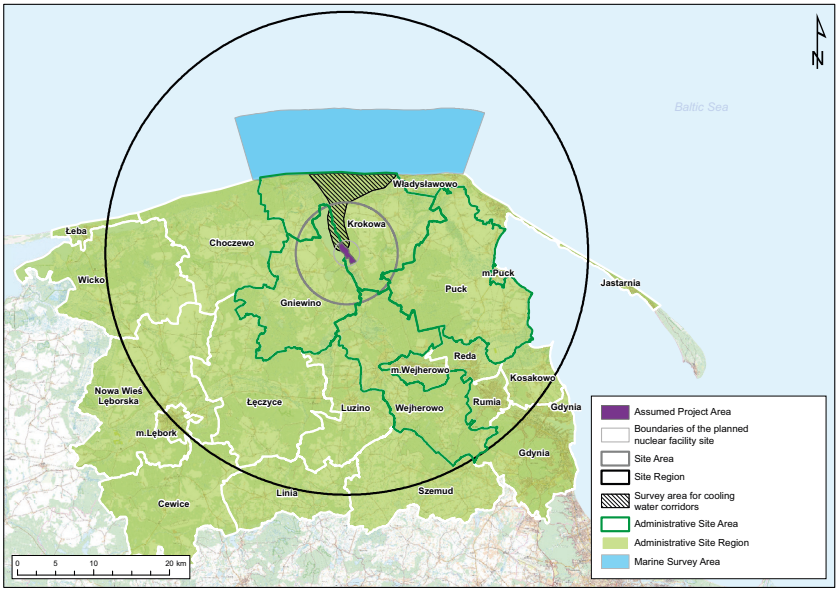
Areas adopted for environmental survey purposes: Variant 1 — Lubiatowo-Kopalino site



Source: In-house study.

FIGURE 8.

Areas adopted for environmental survey purposes: Variant 2 — Żarnowiec site



Source: In-house study.

IMPACT ASSESSMENT OF THE PROJECT

IMPACTS ON PROTECTED SITES AND FEATURES – LAND ENVIRONMENT

The works conducted included an assessment of impacts of the site variants and sub-variants on legal forms of nature conservation [Figure 9] and [Figure 10], referred to in Article 6(1) of the Nature Conservation Act of 16 April 2004 [consolidated text, Journal of Laws of 2021, item 1098, as amended], including impacts on the objectives and qualifying features of Natura 2000 sites and the continuity of wildlife corridors connecting them, in accordance with Article 66(1)(6a) of the EIA Act. The assessment was carried out in relation to the potential impact of the Project on the abovementioned protected areas located in the land part of the Project's area of impact, in particular on the Natura 2000 sites, Sites of Community Importance, and the integrity of those sites and natural habitats.

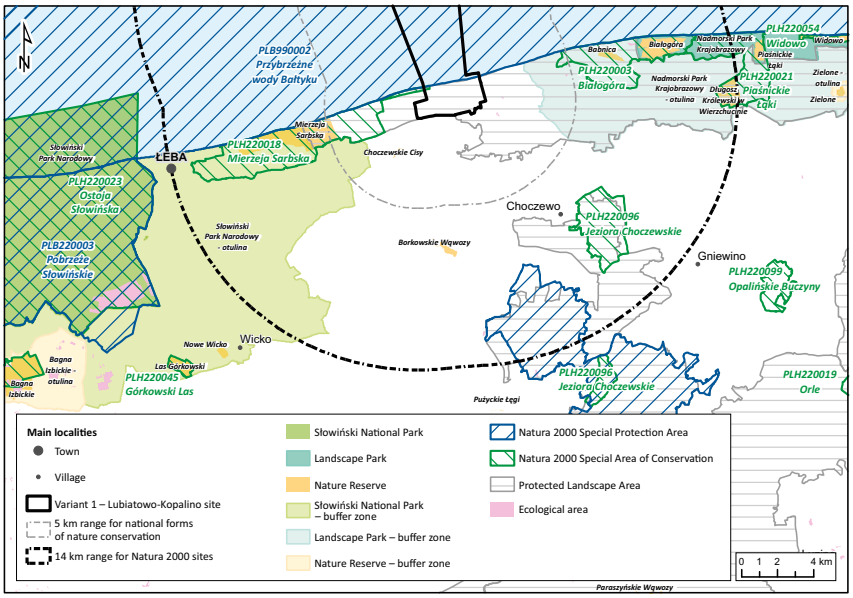


FIGURE 9.

Natura 2000 sites and other forms of nature conservation situated within the range of Variant 1 – Lubiatowo -Kopalino site, land area

Source: In-house study.

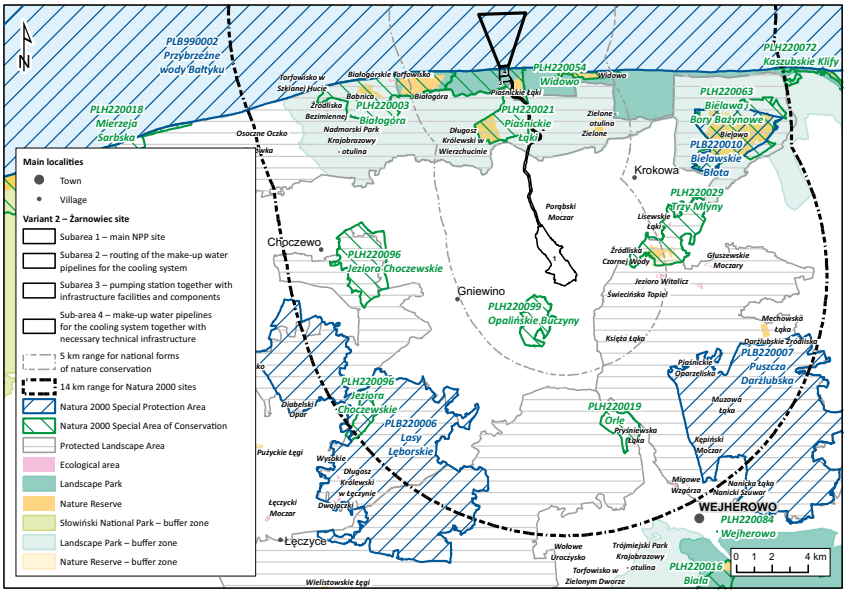


FIGURE 10.

Natura 2000 sites and other forms of nature conservation situated within the range of Variant 2 – Żarnowiec site, land area

Source: In-house study.

For the purposes of the assessment, an area within a radius of 5 km was adopted and covered by the inventory surveys carried out for the purposes of the EIA Report, the results of which enabled a full assessment to be made of the potential adverse impact on all forms of nature conservation (including refuges and habitats in the network of Natura 2000 sites as well as particularly valuable species of flora, fauna, and fungi) situated within the Project's range of impact.

In assessing the impact on Natura 2000 sites for the PA in Variant 1 – Lubiatowo-Kopalino site, direct interference was identified for four of the analysed habitats being the qualifying features of the Mierzeja Sarbska PLH220018 site. For one of them, Site 2170 – Dunes with Salix repens ssp. argentea (Salicion arenariae), impact mitigation measures were proposed (including the establishment of a meta-plantation of creeping willow Salix repens ssp. argentea).

No direct negative impacts on other forms of nature conservation in Variant 1 – Lubiatowo-Kopalino site were identified.

In assessing the impact on Natura 2000 sites for the PA in Variant 2 – Żarnowiec site, direct interference was identified for three of the analysed habitats being the qualifying features of the Piaśnickie łąki PLH220021 site. For one of them – Molinia meadows (Molinion), impact mitigation measures were proposed, including a proposed modification of the construction method for the service road and the cooling system make-up water pipeline.

No direct negative impacts on other forms of nature conservation in Variant 2 – Żarnowiec site were identified, with impacts identified only for the Piaśnickie łąki reserve, which is situated within the Natura 2000 site Piaśnickie łąki PLH220021 (the impacts will be the same for both forms of conservation).

Interference with natural land environment, which will take place in the course of Project implementation, unequivocally shows that Variant 1 – Lubiatowo-Kopalino site is the most advantageous variant for the reduction of impact on the features of the natural environment. The scope of impacts in this Variant has the least negative effects for various registered receptors in plant communities, fauna, and fungal biota. At the same time, a smaller number of other legal forms of nature conservation are situated in the zone of potential impact for that variant, such as Natura 2000 sites, nature reserves, ecological sites, or wildlife corridors important for undisturbed natural processes. In Variant 1 – Lubiatowo-Kopalino site, the implementation of sub-variant 1A (open system) will be the optimal solution. The adoption of this sub-variant as the most advantageous in terms of environmental impact is also supported by the scope of mitigation measures that have been proposed to reduce impacts, as well as their feasibility and possibility of delivering effective outcomes. The implementation of mitigation measures will also be an effective way of reducing adverse impacts expected to appear at each stage of Project implementation.

IMPACTS ON THE CLIMATE

The estimation of greenhouse gas emissions was made for all phases of the Project's life cycle. Greenhouse gas (GHG) emissions from all sources and in all processes were taken into account, e.g. emissions related to the production of steel, concrete, equipment, and transport emissions.

Regardless of the sub-variant, the NPP would generate electricity with much lower carbon intensity than the expected carbon intensity for the currently generated electricity. This significant favourable effect means that each kWh generated in this scenario would bring net savings in terms of carbon dioxide emissions by replacing more emission-intensive generation sources.

The results indicate that the analysed PWR technology would be a low-emission variant for Poland, as it emits greenhouse gases at a level comparable to or lower than the alternative renewable energy technologies, even taking into account the conservative assumptions of the Life Cycle Assessment (LCA) for the nuclear technology [Table 2].

As at the date of the analysis, the emission reduction commitments do not extend beyond 2045. Based on Poland's commitments to reduce emissions as at the date of this Report, the Project is expected to save approximately 386 million tonnes of CO_2 emissions, which is equivalent to almost 1 billion of oil barrels; the consumption of three main liquid fuels (engine petrol, diesel oil, LPG) reached 97.9 million barrels in Poland in the first half of 2021.

The analyses conducted have shown that the CO_2 emissions related to the implementation of the Project will be the largest in the initial phase of the NPP life cycle – at the development stage and those enabling the construction stage to commence (long-lead items) – and that they represent about 37% of its total greenhouse gas emissions. The life

TABLE 2.

Results of the comparative analysis of the carbon footprint of the nuclear technology considered by the Investor with alternative technologies

Energy technology	CO_2 emissions from electricity generation [gCO_2e/kWh]
Biomass	106.0
Hydropower	4.5
Wind	28.5
Solar power	81.7
Natural gas	402.0
Coal	764.0
NPP (value averaged for sub-variants)	6.4

Source: Life cycle and carbon footprint. Jacobs Clean Energy Limited, 2020.

cycle phase that contributes the second-largest CO_2 emissions (34% of total emissions) is construction. The lowest GHG emissions (about 3%) occur in the operational phase.

Greenhouse gas emissions in the Project life cycle would thus be two orders of magnitude (10^{-2}) lower than life cycle emissions of an analogous project using gas or coal. Hydropower (run-of-river hydroelectric power plants) is the only stable source of electricity in the decarbonisation analysis with GHG emissions life cycle comparable to nuclear power.

The Project would undoubtedly contribute to a significant reduction of greenhouse gas emissions within the territory of Poland, which would have a favourable effect on the climate.

IN THE FIRST FULL YEAR OF ITS OPERATION, THE PROJECT WOULD CONTRIBUTE EMISSION SAVINGS AT APPROXIMATELY 13 MILLION TONNES OF CO_2, WHICH IS EQUIVALENT TO ANNUAL CO_2 EMISSIONS FROM ABOUT 3 MILLION VEHICLES.

IMPACTS ON GROUNDWATER

The groundwater environment in the PA under consideration is particularly exposed to potential adverse impacts of the Project.

The modelling conducted for Variant 1 – Lubiatowo-Kopalino site, with specific assumptions, showed that the largest impacts on the groundwater of the first aquifer would be within the excavations themselves (for the QI layer), and the maximum surface area of the cone of depression would be approximately 500 m x 900 m [Figure 11]. Draining would not result in saline seawater infiltrating the land area.

No adverse impacts on Main Groundwater Basins (GZWP) are anticipated at this stage of works. The boundary of Main Groundwater Basin No. 108 "Zbiornik międzymorenowy Salino" [Salino Intermoraine Basin] is approximately 5.6 km away from the area where the projected works would take place.

The development and construction works would be confined to the Project Area. In that area, there are no existing wells intended for drawing groundwater that the construction works would impact.

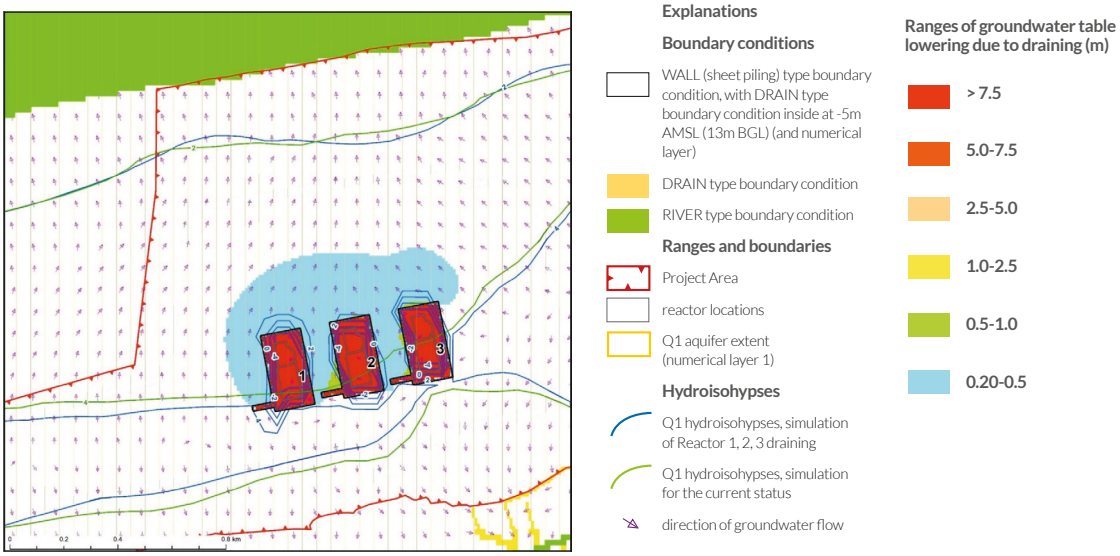
No significant impacts from the Project on environmental objectives are anticipated for Groundwater Bodies (GWBs). For all three Groundwater Bodies (No. 11, 12 and 13), environmental objectives under the Vistula River Basin Water Management Plan consist in achieving a good chemical status accompanied as well as good quantitative status. These objectives are not at risk in any phase of the Project, and any adverse impacts that could bring about changes within Groundwater Bodies would be limited to the necessary minimum by applying appropriate methods (e.g. diaphragm walls, jet grouting, etc.).

The modelling conducted for Variant 2 – Żarnowiec site showed that the cone of depression caused by draining of the construction excavations related to the reactors would be of a significant size despite the application of engineering measures such as anti-filtration vertical diaphragms driven into the ceiling of the first low-permeability layer.

As a result of the analysis, it was concluded that draining of construction excavations in Variant 1 – Lubiatowo-Kopalino site might prove to be both easier in engineering terms and more cost effective. It would also have a lower impact on groundwater. The geological structure of the area makes it possible to construct diaphragm walls and install them in a less permeable layer. Thus, the inflow of groundwater to the excavations would be small.

FIGURE 11.

Distribution of groundwater table depression in the first (Quaternary) aquifer caused by excavation draining, Variant 1



Source: PEJ. Dokumentacja hydrologiczna [Hydrological documentation] (...) BLS_BHY_BHY02_DG_10001_01, Rev 1A, September 2019.

IMPACTS ON SURFACE WATERS

IMPACTS ON INLAND SURFACE WATERS

The qualification process for Variant 1 – Lubiatowo-Kopalino site identified the need to conduct impact assessment in connection with potential impacts on water quality resulting from the implementation of the planned Project for the following SWBs: [Figure 12]: CWDW1801 Direct catchment area of the Baltic Sea, RW200017476925 Chełst River to the inflow to Lake Sarbsko, LW21047 Lake Sarbsko.

For Variant 2 – Żarnowiec site [Figure 13], the impact assessment was carried out for the following SWBs: RW200017477259 Piaśnica to the outflow from Lake Żarnowieckie, LW21049 Lake Żarnowieckie, RW200023477289 Piaśnica from the Lake Żarnowieckie outflow to Białogórska Struga, RW20002247729 Piaśnica from the tributary from the Dębki polder to the estuary.

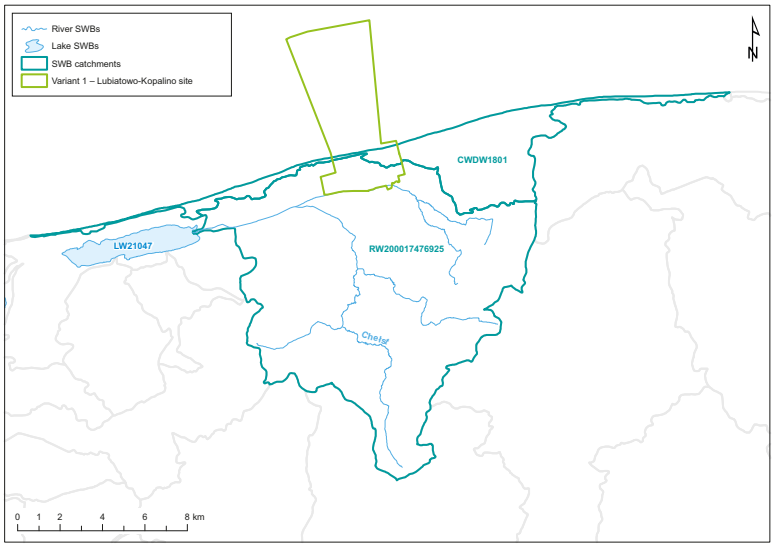
As a result of the assessment, it was found that the operational phase of the Project would involve the alimentation of runoffs from the catchment areas of the WBs (water bodies) subject to impact in order to preserve undisturbed conditions, taking into account the hydrobiological flow.

The modelling quantitatively demonstrated how significant an effect (impact significance) the proposed Project would have on the environment. When it comes to the operational phase, both in Variant 1 – Lubiatowo-Kopalino site and in Variant 2 – Żarnowiec site, it was concluded that the Project will not involve excessive impacts on any physico-chemical indicators analysed.

The assessment of the impacts of the planned Project, in its specific variants and sub-variants, found no significant adverse impacts on inland surface waters in any phase of Project implementation.

FIGURE 12.

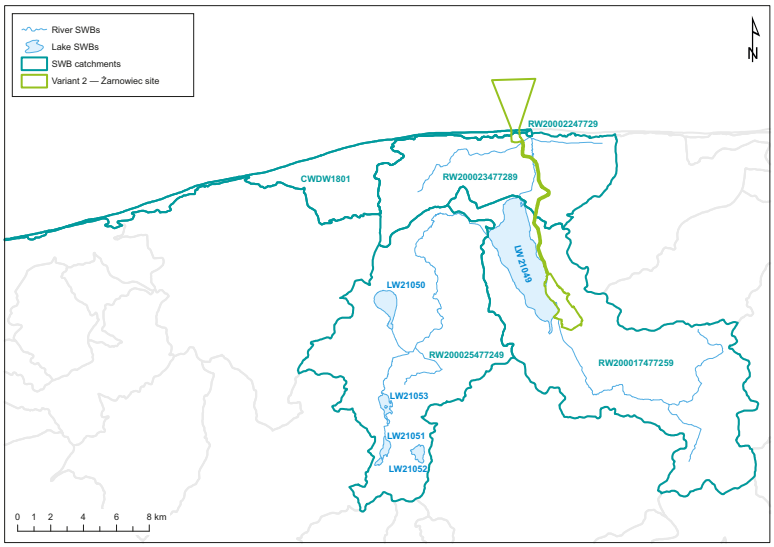
Variant 1 – Lubiatowo-Kopalino site broken down into river and lake SWBs



Source: In-house study.

FIGURE 13.

Variant 2 – Żarnowiec site broken down into river and lake SWBs



Source: In-house study.

IMPACTS ON MARINE SURFACE WATERS

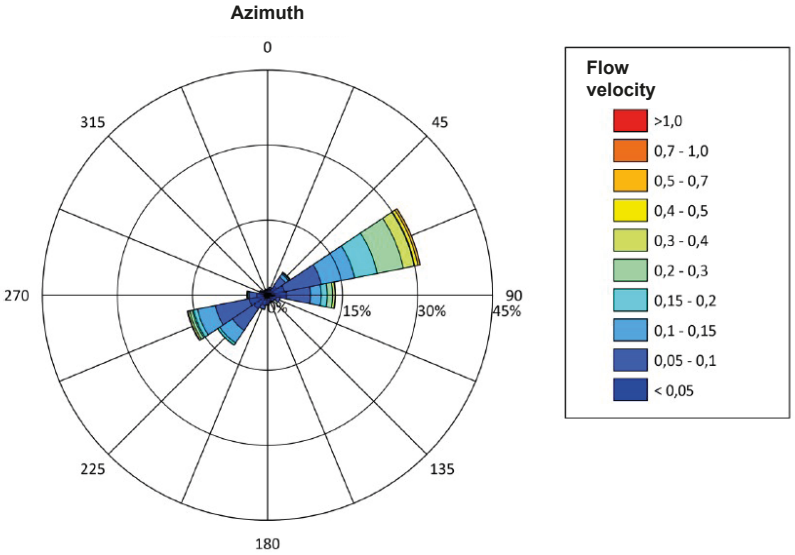
The analyses of the potential impacts on the marine surface water environment were based on multi-seasonal field work; observations and surveys covering biotic aspects (fish, birds, sea mammals, phytoplankton, macroplankton, zooplankton and benthic macroinvertebrates) and abiotic aspects (met-oceanic data [Figure 14], physico-chemical, hydromorphological aspects together with magnetometric surveys, sound and marince seismic surveys, surface tests, and geological boreholes to the depth of 60 m below sea level along with laboratory testing of geotechnical and chemical parameters for PAH, PCP or heavy metal concentrations), which were carried out in an area of approximately 8 x 40 km – water body 39a.I and 39b.I/SWB Przybrzeżne Wody Bałtyku [Baltic Coastal Waters] (PLB900002).

When it comes to the impact on the marine water environment, the implementation of the Project will be related mainly to the construction of the cooling system elements in the construction phase and their use in the operational phase, regardless of the site variant. The assessment of the impact on seawater was conducted based on conservative assumptions, i.e. for works representing the so-called most environmentally invasive scenario – the construction of the intake and discharge channels/pipelines (using the so-called "submersion method") with the use of the open-cut trenching method involving the installation of channels made of prefabricated reinforced-concrete elements. The modelling covering the construction of the abovementioned channels/pipelines using temporary sheet piling and the presence of the marine off-loading facility (MOLF) in the marine areas demonstrated that their impact on coastal bathymetry and the location of the coastline would be only temporary and local. The modelling also demonstrated that the process of returning to the baseline status should begin within one year from the completion of the construction of the abovementioned channels/pipelines. The changes were also demonstrated to be within the range of normal variability of the coastline in the Marine Survey Area for both site variants [Figure 15]. When it comes to impacts on marine physico-chemistry and biology, including habitat loss, the assessment showed negligible and insignificant impacts across the WB.

The largest effects on the marine environment during the operational phase would come from the discharge of heated cooling water and treated industrial process effluent. Their impact would apply mainly to the quality of the discharge water and the receiving water (sea), and their relative temperatures. The modelling, which was based on the assumption of a temperature rise near the outfall of the cooling water system by $\Delta T=10^{o}C$, and the temperature at the thermal plume boundary of $2^{o}C$, demonstrated potential moderate impacts on the marine environment. However, due to low sensitivity and large surface area of the impacted WB, the overall effect of impact on marine life is considered to be insignificant [Figure 6] and [Figure16].

FIGURE 14.

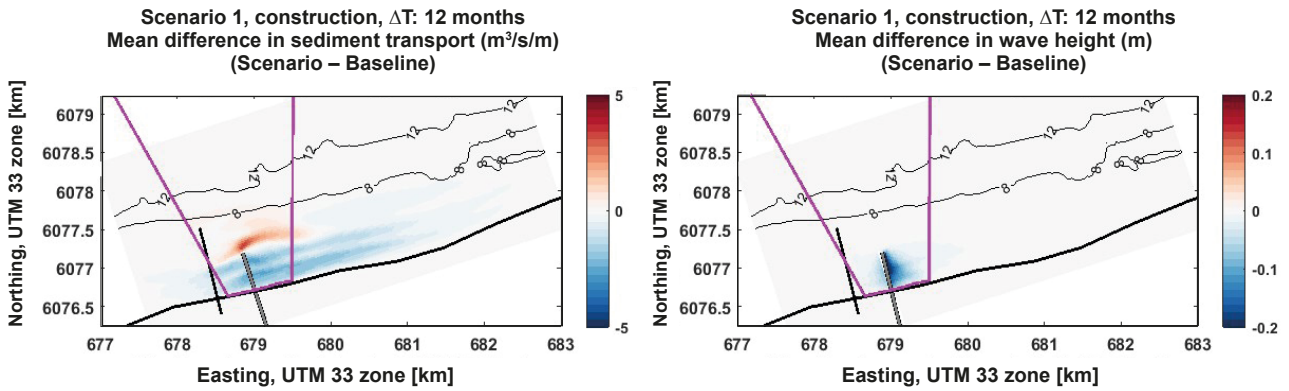
Example. Currents recorded at measurement point MHM_LK1 (measuring buoy), 4 m above seabed in the water column



Source: PEJ. Report on Environmental Characteristics and Valorisation (...) BLS_MHS_xxxxx_RY_10011_01_EN, June 2019.

FIGURE 15.

Example. Modelling results based on Scenario 1, open cooling system, presenting the effects of the presence of the cofferdam for the construction of the intake/fish recovery and return system [FRRS] and the marine off-loading facility [MOLF] (the first 12 months of construction) on the rate of sediment transport and wave height

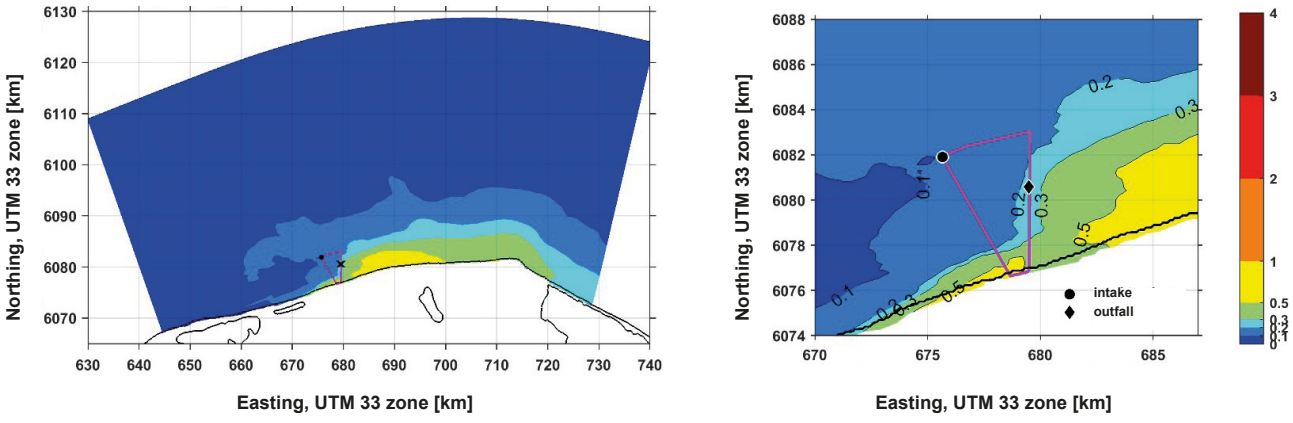


Source: Marine Hydrodynamics and Water Quality, Jacobs Clean Energy Limited (2021).

When it comes to the impact on the marine water environment, the implementation of the Project will be related mainly to the construction of the cooling system elements in the construction phase and their use in the operational phase, regardless of the site variant. The assessment of the impact on seawater was conducted based on conservative assumptions, i.e. for works representing the so-called most environmentally invasive scenario – the construction of the intake and discharge channels/pipelines (using the so-called "submersion method") with the use of the open-cut trenching method involving the installation of channels made of prefabricated reinforced-concrete elements. The modelling covering the construction of the abovementioned channels/pipelines using temporary sheet piling and the presence of the marine off-loading facility (MOLF) in the marine areas demonstrated that their impact on coastal bathymetry and the location of the coastline would be only temporary and local. The modelling also demonstrated that the process of returning to the baseline status should begin within one year from the completion of the construction of the abovementioned channels/pipelines. The changes were also demonstrated to be within the range of normal variability of the coastline in the Marine Survey Area for both site variants [Figure 15]. When it comes to impacts on marine physico-chemistry and biology, including habitat loss, the assessment showed negligible and insignificant impacts across the WB.

FIGURE 16.

Temperature anomaly (°C) on the sea surface, 98th percentile – winter



Source: Marine Hydrodynamics and Water Quality. Jacobs Clean Energy Limited (2021).

IMPACTS ON AMBIENT AIR QUALITY

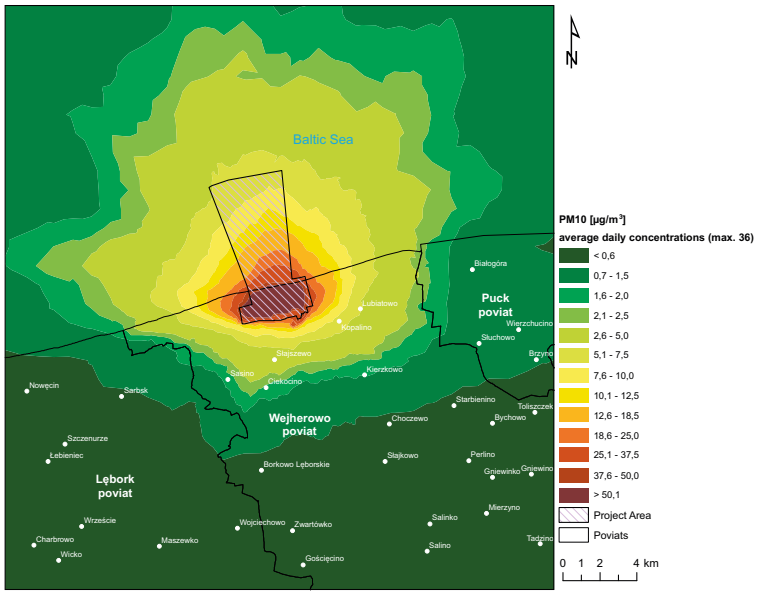
As a result of the environmental impact modelling for the construction stage in Variant 1, as the stage that involves the most significant emission levels of substances (NO_x, SO_x, CO, C_6H_6) and particulate matter ($PM_{2.5}$ and PM_{10}) into the air in the form of point source and fugitive emissions, it was found that the concentrations of the substances emitted would not exceed the reference levels for maximum one-hour emissions (limit) and mean annual emissions (load). Only the concentrations of the PM_{10} and $PM_{2.5}$ particulate matter would be high, but solely at the boundary of the Project Area (average daily concentrations of PM_{10} may approach approximately 74% of the permissible level). However, they would not exceed the permissible levels and would sharply drop with the distance from the Project development site [Figure 17].

For Variant 2, the analyses have shown [Figure 18] that concentrations of sulphur dioxide, carbon oxides and benzene will be negligible, with nitrogen dioxide concentrations reaching maximum concentrations outside the PA of up to 1.5% of the permissible level. The analysis has shown that concentrations of particulate matter PM_{10} and $PM_{2.5}$ will be high close to the PA boundary. Average annual concentration of $PM_{2.5}$ may be increased, but the maximum would reach 27% of the permissible level. Average daily concentrations of PM_{10} may exceed the permissible level and approach approximately 220% of the permissible level, while average annual concentrations - up to 134% of the permissible level. Such high concentrations of the particulate matter would be short-term and located in a woodland, just at the boundary of the Project Area (up to 1.2 km of the boundary of the Area).

According to analyses, emissions from conventional sources in the operational phase will be negligibly low in both site variants.

FIGURE 17.

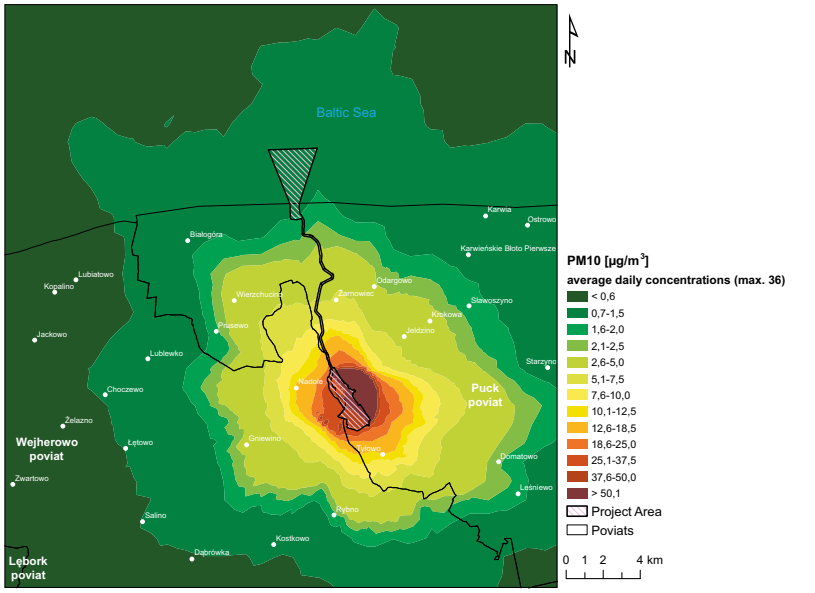
Distribution of PM_{10} 24h concentrations (36 max value) at the development stage (permissible level = 50 µg/m³), Variant 1 – Lubiatowo-Kopalino site



Source: Krajny, E., Ośródka, L., IMGW-PIB, BSiPP Ekometria Sp. z o.o., IPIŚ PAN. Opracowanie w zakresie oddziaływania Przedsięwzięcia na powietrze atmosferyczne, Tom I – Lubiatowo – – Kopalino [Study on the Project's Impact on Ambient Air, Volume I – Lubiatowo-Kopalino], 2021.

FIGURE 18.

Distribution of PM_{10} 24h concentrations (36 max value) at the development stage (permissible level = 50 µg/m³), Variant 2 – Żarnowiec site



Source: Krajny, E., Ośródka, L., IMGW-PIB, BSiPP Ekometria Sp. z o.o., IPIŚ PAN. Opracowanie w zakresie oddziaływania Przedsięwzięcia na powietrze atmosferyczne, Tom II – Żarnowiec [Study on the Project's Impact on Ambient Air, Volume II – Żarnowiec], 2021.

IMPACTS ON THE VIBRATION AND ACOUSTIC ENVIRONMENT

LAND AREA

The analyses carried out as part of impact assessment showed that the projected noise and vibration emissions in the construction phase (development, construction, commissioning) in the PA, including the construction of the open cooling system and the marine off-loading facility (MOLF), would not exceed the permissible levels owing to the distance of the facilities from residential areas [Figure 19].

Based on the results of impact analyses for Variant 1 it was concluded that noise emitted during the Project operational phase would be caused by the operation of the transformer substation. In the absence of mitigation measures, it might result in exceeding night-time noise limits in built-up areas situated closest to the site: in farm buildings in Biebrowo and in four buildings situated in the single-family residential area in Kopalino (Kopalino W receptor). The use of technical mitigation measures (including sound barriers, appropriate design of the substation so as to ensure sound diffraction) will allow environmental quality standards in this respect to be met [Figure 20].

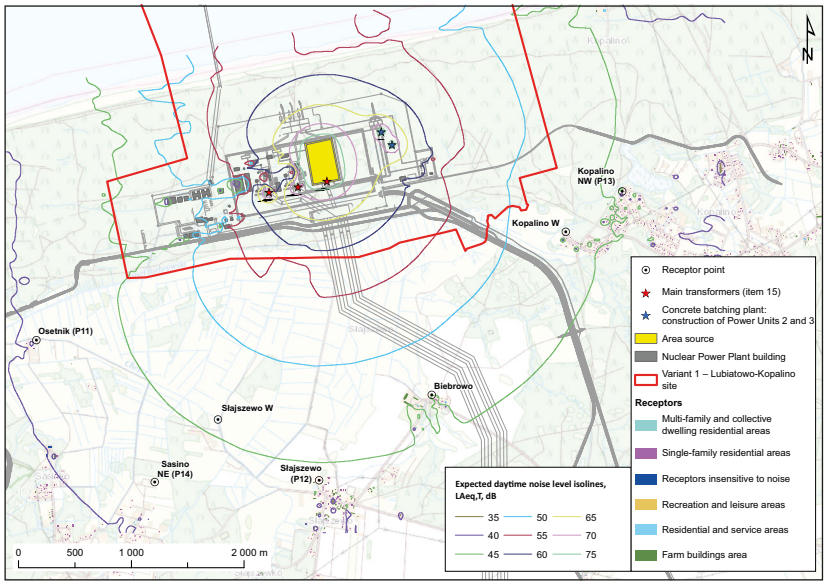


FIGURE 19.

Example. Noise level isolines. Commissioning stage, Sub-variant 1A

Source: Noise and Vibration Impact Assessment, Jacobs Clean Energy Limited. September 2021.

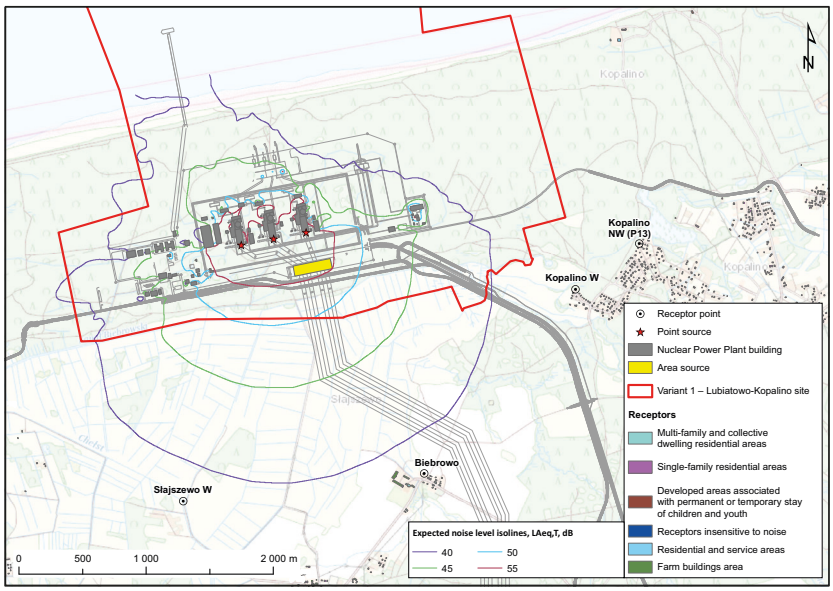


FIGURE 20.

Example. Noise level isolines taking into account mitigation measures. Operational phase, Sub-variant 1A

Source: Noise and Vibration Impact Assessment, Jacobs Clean Energy Limited. September 2021.

MARINE AREA

The analysis found that the dominant source of noise related to the Project implementation would be the construction stage; in the operational phase, the operation of the cooling systems and marine traffic showed no significant effect on the identified receptor groups. The analysis took into account the following groups of organisms considered to be potential impact receptors: the harbour porpoise (high-frequency cetaceans), seals (phocid pinnipeds), and fish, larvae and roe (species with or without swim bladder). The waterborne noise and vibration impact on the abovementioned noise-sensitive receptors was assessed for the construction, operation and decommissioning of the Project and its associated infrastructure.

The analysis shows that the levels of underwater noise due to construction works in Variant 1 would be below the sensitivity threshold for high-frequency cetaceans (sound-sensitive marine mammals) and fish (with swimming bladder). Following the cessation of impacts and effects related to the behavioural change, representatives of species subject to the impact, in particular the harbour porpoise, would return to the water body.

IMPACTS ON MONUMENTS AND ARCHAEOLOGICAL SITES (LAND AND SEA)

For all Site Variants, impacts on archaeological sites would be most pronounced at the development and construction stages due to extensive earthworks and construction works. Project impacts on architectural monuments may be the greatest at the construction stage due to the intensity of using transport routes (roads and railways) situated in the vicinity of the monuments.

Regardless of the sub-variant, implementation of the Project in Variant 2 – Żarnowiec site would be least favourable for cultural heritage, since a much larger number of archaeological sites (38) could be lost in the Project construction phase within the PA than in the case of the Project implemented in Variant 1 – Lubiatowo-Kopalino site (1). Indirect impacts on architectural monuments along roads and railways are considered to be a minor issue, because at the current stage of the Project it is impossible to conclusively confirm whether the monuments identified in the above analysis would be exposed to damage.

LANDSCAPE AND VISUAL IMPACTS

Based on the assessment of Project effects on landscape, sub-variants 1B and 1C with closed cooling systems (in Variant 1 – Lubiatowo-Kopalino site) and 2A and 2B (in Variant 2 – Żarnowiec site) proved to be most unfavourable in terms of landscape impacts. This is due to the fact that closed cooling systems require the construction of cooling towers which constitute a negative dominant landmark, which is absent from sub-variant 1A with an open cooling system.

IMPACTS RELATED TO EXCESSIVE LEVELS OF ELECTROMAGNETIC FIELDS

In none of the site variants and in none of the Project implementation phases would the nuclear facility cause the electromagnetic field emission limits to be exceeded, and therefore, in terms of the value of the electromagnetic field generated by devices installed at the NPP site, its environmental impact would be confined to the boundaries of the Project.

The NPP facilities that would produce electromagnetic radiation would be power lines and substations (frequency of 50 Hz) and radio communication and safety system equipment (frequency range of 100 MHz – 60 GHz).

IMPACTS RELATED TO IONISING RADIATION

The work on the Report included the assessment of the total annual effective doses from particular exposure pathways and the annual thyroid-absorbed dose for various age groups (adults, children and infants). In addition, possible build-up of radioactive substances in components of the environment (flora, fauna and human organisms: bones and thyroid) were analysed.

The assessments and analyses in question were conducted for two phases of the Project: the construction phase (with development, construction, and commissioning stages) and the operational phase. The assessment of radiological impacts on the environment in the decommissioning phase will be conducted in a separate safety report dedicated to decommissioning, taking into account the actual status of nuclear and radioactive materials accumulated and stored at the NPP site. However, radiological impacts on the surroundings in the NPP decommissioning phase are expected to be much lower than in the operational phase.

In the construction phase, first emissions of radioactive substances from the NPP would occur at the commissioning stage, after the reactor reaches the first critical state. They are estimated not to exceed a half of average emissions from a single NPP unit in the operational phase.

In the operational phase of the Project, the results of calculations and analyses of the NPP radiological impacts in operational states demonstrated that the annual effective dose limit (0.3 mSv/year) adopted as the criterion for analysis in accordance with the Atomic Law Act and the European Utility Requirements (EUR) would not be exceeded in any case in the NPP surroundings.

The calculated maximum annual effective doses associated with operational emissions of radioactive substances from the NPP to the environment (i.e. into the air and seawater) for the Lubiatowo-Kopalino site amount to 0.0048 mSv/year for infants, and 0.0035 mSv/year children and adults; while for the Żarnowiec site they amount to 0.00305 mSv/year for infants, and 0.0023 mSv/year for children and adults. Maximum annual effective doses in operational states that will occur at the NPP site will be almost 100 times lower than the limit of 0.3 mSv/year specified in the above legislation. The doses in the Żarnowiec site are lower than in the Lubiatowo-Kopalino site mainly because of a much higher stack, assumed at 150 m, i.e., about 50 m above the tops of the surrounding hills; while in the Lubiatowo-Kopalino site, the stack height was assumed at 75 m, which is a standard height in the generic design of AP1000. In addition, the assessment of doses related to emissions of liquid radioactive substances into the sea has demonstrated that radiological impacts resulting from those emissions are insignificant, since they contribute less than 1% to the cumulative effective dose.

Maximum annual (equivalent) iodine thyroid dose quantities in both proposed sites are also insignificant and cannot have any adverse impact on human health. The analysis of potential build-up of radioactive substances in environmental components also shows that the effect of radionuclides released to the environment on a change of their natural concentration in particular environmental components is negligible (at 0.000445 mSv/year).

THE RADIOLOGICAL IMPACTS OF THE NUCLEAR POWER PLANT ON THE ENVIRONMENT IN THE OPERATIONAL PHASE WILL BE 100 TIMES LOWER THAN THE NATURAL BACKGROUND LEVEL.

IMPACTS ON HUMAN HEALTH AND LIFE

Conventional emissions would be the potential sources of impact on human health and life (emissions of pollutants into the air, noise emissions, water pollution, or sewage disposal) that could physically affect human health. By contrast, the radiological impact of the NPP in operational states on the surrounding area will be negligibly low. The maximum annual effective dose in connection with the operation of the power plant would be 0.0048 mSv/year for infants and 0.0035 mSv/year for children and adults for the Lubiatowo-Kopalino site, and 0.00305 mSv/year for infants and 0.0023 mSv/year for children and adults for the Żarnowiec site, while the annual dose limit for infants, children and adults is 0.3 [mSv/year], which means that no adverse impacts on human health can occur, taking into account all exposure pathways (conservative approach). Additionally, it should be noted that the annual average effective dose arising from the background gamma radiation for a resident of the Region of the Lubiatowo-Kopalino site will be 0.71 mSv/year, while for the Region of the Żarnowiec site, it will be 0.72 mSv/year. The surveys conducted have confirmed that it is the exposure to the natural background gamma radiation.

The analyses show that conventional emissions will fall within standard limits, while the related nuisance will occur periodically and locally, and will cease upon completion of the construction phase.

IMPACTS RELATED TO CONVENTIONAL WASTE MANAGEMENT

Direct impacts related to conventional waste are assumed to occur primarily in the construction and decommissioning phases. It would be mainly construction waste, most of which could be recycled and recovered; thus, its quantities would be effectively minimised. Under the applicable regulations, all waste would be sent for management to licensed entities only. Due to the need to dismantle the facilities existing at the Variant 2 – Żarnowiec site, that site would generate significantly more construction waste, whereas for Variant 1 – Lubiatowo-Kopalino site the key issue would be the optimal management of soil masses.

Conventional waste generated in the operational phase of the Project would be processed in compliance with the applicable procedures to prevent the waste contamination with radioactive substances.

THE PRIORITY IS TO ENSURE THE HIGHEST SECURITY STANDARDS AT EACH STAGE OF THE PROJECT.

DETERMINATION OF AN ANTICIPATED IMPACT OF A SEVERE ACCIDENT; THE NEED TO ESTABLISH A RESTRICTED USE AREA

IMPACTS IN THE EVENT OF A SEVERE ACCIDENT

For the environmental impact assessment, potential radiological consequences outside the NPP site in the event of a severe accident were analysed for two event categories: an accident without core melt, and a severe accident with core melt, the latter being also the accident representative for emergency planning. Based on applicable national and international regulations, requirements and recommendations, criteria were established for determination of zones and areas surrounding the NPP where, in particular, specific protective activities (referred to as intervention activities) could be planned to minimise adverse effects of an accident on human health in the neighbourhood of the NPP. The results of analyses of Project impacts from a severe accident at a distance of more than 30 km show that, even for cities and voivodeships situated closest to the NPP (for both site variants), effective doses and dose rates would be at low levels. For dose rates, this means that they are less than the mean background radiation in Poland. For doses, this means that lifetime doses (over periods of 70 years for children and 50 years for adults) received as a result of an accident would not exceed annual limits for planned exposure situations, i.e. NPP operational states.

To summarise, even in the event of a severe accident, the measures needed for the protection of human health would be limited in space (no need for permanent resettlement or temporary relocation of the population outside the immediate neighbourhood of the power plant), and in time (i.e., there would be sufficient time for the implementation of necessary protective measures). This is consistent with recommendations of the West European Nuclear Regulators' Association (WENRA) for next-generation reactors, such as the reactor under consideration.

THE NEED TO ESTABLISH A RESTRICTED USE AREA

Contrary to conventional projects where a Restricted Use Area (RUA) is established under the EPL Act, the requirements for delimiting the RUA around the nuclear facility for the Project planned are set forth in the Atomic Law Act. According to the Act provisions, exposures by ingestion (annual dose: maximum of 0.3 mSv in operational states and 10 mSv for an accident without core melt) and the most adverse weather conditions were taken into account in determination of the RUA.

The above criteria were applied to define the Restricted Use Area (RUA) for Variant 1 – Lubiatowo-Kopalino site, the radius of which would potentially be approximately 3.8 km (conservative approach). This distance is calculated from the geometric centre of the line connecting the reactors, and takes into account the results of analyses of releases from each of the three reactors separately. The calculated value is an approximation which will be determined more precisely for the Preliminary Safety Analysis Report (PSAR) and for the final NPP, with the technology and arrangement of building facilities to comply with the laws and regulations in force at the time the abovementioned documents are being prepared.

IMPACT ON SOCIO-ECONOMIC ASPECTS

The NPP implementation will affect socio-economic aspects, and consequently there will be changes in land management and use, settlement network and infrastructure (transformations), spatial planning in communes, especially in the communes surrounding the NPP, management of marine areas and coastal areas, services, the economy, industry, agriculture, fisheries, forestry, tourism, human living standards, and quality of life.

PROJECTED TOTAL WORKFORCE

For both Site Variants, it is estimated that approximately 8,000 employees would be working at the construction stage. It is assumed that some workers can be sourced locally and regionally. For the analyses aimed at showing impacts related to the presence of incoming workforce, a scenario was adopted assuming that approximately 15% of workers would be sourced locally. Some 85% of the workforce would potentially live at the planned workforce accommodation base in Choczewo and at the container camp located near the construction site, while 15% of the workforce would be housed in the existing accommodation facilities (hotels, boarding houses, private lodgings, etc.).

For the analyses, a two-step approach was adopted to determine the ability of workers to use the currently available tourist accommodation facilities. The analysis provided for the accommodation of workers in 12 communes (in 42 different towns and villages).

Approximately 860 full-time employees would work during the NPP operation. Many of them would be specialists, qualified to work at the NPP. Most of these are expected to be the incoming workforce. Nevertheless, some of the workers are presumed to be recruited from the local/regional market. For the purposes of the analysis, the maximum impact was adopted, i.e. 860 incoming workforce. It was assumed that approximately 75% of these workers would live with their family members. The average family size was presumed to comprise 3.35 persons and thus the estimated number of permanent workers with families would be approximately 2,376 persons. It is projected that some of the workforce would choose to live in the neighbouring towns, i.e. Łeba, Puck, Wejherowo, Władysławowo and Reda. They are expected to prefer locations with access to more amenities, services, and infrastructure than in rural communes, including, for the sake of children, accessibility to schools, kindergartens and nurseries, and medical care.

It is expected that approximately 1,000 additional workers would come over to the site to perform tasks during the unit outage for refuelling and repairs. The duration of routine maintenance activities would be one month, and they are to be performed immediately prior to refuelling. The duration was assumed to be two months for medium overhauls and three months for major overhauls carried out every ten years. It is expected that some temporary staff may also be sourced locally or regionally. Incoming workforce are likely to be accommodated at the tourist facilities in the vicinity of the NPP or in a dedicated accommodation base in Choczewo.

At present, it is impossible to accurately estimate the total size of workforce required during the decommissioning phase because this will occur about 60 years after the NPP commissioning, and the NPP decommissioning techniques will have changed by that time. However, for the analysis, approximately 1,000 full-time employees are assumed to be needed during the decommissioning phase. The estimated duration of the decommissioning phase will be 20 to 25 years.

GUARANTEE OF NEW JOBS IN AN INDUSTRY OF THE FUTURE – UP TO 8,000 EMPLOYEES HIRED IN THE CONSTRUCTION PHASE AND APPROXIMATELY 860 IN THE OPERATIONAL PHASE.

CHANGES IN SPATIAL DEVELOPMENT

At the development stage, the use and development of land within the PA boundaries will change due to the Project implementation. The changes will primarily involve the exclusion of land from agricultural and forestry production, as well as deforestation and alteration of the character of the site to industrial use.

In the construction phase, changes can be expected in the vicinity of the Project site that consist in new functions of undeveloped areas (conversion of agricultural land into service areas), due to the anticipated increase in investment areas. Due to the planned number of incoming workforce and demand for new services, there may be new investments in commercial and industrial facilities.

THERE ARE FIVE INDIRECTLY INVOLVED WORKERS FROM DIFFERENT SECTORS PER ONE POWER PLANT WORKER.

The Project implementation will also affect land use in terms of visual impact. The Project will modify the landscape not only in the immediate vicinity of the NPP but, owing to the landform and type of sub-variant, it may also be visible from several kilometres away from the Project site. On the other hand, some land may be activated thanks to a better availability of both road and rail transport routes, which will be established to give access to the NPP site and accommodation facilities for the NPP construction workers.

Under the Regulation of the Council of Ministers of 14 April 2021 on the adoption of the maritime spatial plan of the Polish internal sea waters, territorial sea and exclusive economic zone (Journal of Laws of 2021, item 935, as amended), no new elements of port and marine infrastructure unrelated to the Project, including new bathing areas, can be implemented in the marine part of the PA, within the boundaries of the dedicated water body 39a.I or 39b.I.

SOCIAL ASPECTS AND THOSE RELATED TO THE QUALITY OF LIFE AND STANDARDS OF LIVING OF THE POPULATION

The Project implementation will lead to an increase in population. Consequently, the fabric of the local community will change, and new infrastructure and service requirements will emerge. Population growth will also cause increased vulnerability for certain groups in society. Factors that the extent of impact and rate of change will depend on will include the location of worker accommodation (in and outside the dedicated worker accommodation base in Choczewo), and worker age and gender.

Demographic changes – The construction phase is forecasted to see a significant influx of workers in connection with the NPP Project. At the development stage, there will be about 1,700 staff (from the local market), while at the peak of the NPP construction this figure will reach about 8,000 (85% incoming workforce and 15% local staff). The above actions will result in changes to the local population size and structure. In the long term, however, it is anticipated that the employees hired to work at the construction stage will not reside permanently in the region, which is typical of such projects.

Changes in housing – During the implementation of the Project, there will be a need for both short-term and long-term housing for workers, primarily within the location communities. The criteria for the selection of accommodation will primarily be the availability of housing infrastructure provided by the Investor (container camp at the construction site, accommodation base in Choczewo), and the available space in the existing tourist facilities (hotels, boarding houses, apartments/houses for rent, recreational buildings for rent, etc.), as well as the commute time to the place of work, rent levels, standard of accommodation, and access to commercial, sports, and recreational etc., facilities.

Changes in the schooling sector – It is assumed that most workers will not be accompanied by their families, so the demand for school seats will not change significantly from the projected baseline. At the development stage and then at the construction stage, a training programme is planned to be implemented to enable some of the workers to adjust their qualifications for the purposes of employment in the operational phase of the Project.

Effect on culture, sports and recreation – The influx of workers due to the construction of the NPP is likely to contribute to the increased use of sports, recreational, or cultural facilities. The demand for such facilities may attract new investments in the area.

Effect on unemployment and exclusion – Approximately 1,700 workers will be employed during the development stage, mainly from the local and regional market. This is expected to have a positive impact on the local community and improve the livelihood of many people. It is also possible that some of the workers will continue to work during the construction stage, or in the operational phase of the NPP, after acquiring appropriate qualifications, or in the sector of external services for the NPP.

IMPACT ON BUSINESS AND ECONOMIC ASPECTS

In both site variants, the NPP implementation necessitates hiring a large number of workers, especially from the construction and industrial sectors. It is assumed that the proposed Project will result in a significant increase in employment (direct and indirect impacts). The Project will have a significant impact on the site commune (Variant 1) / site communes (Variant 2) and their neighbouring communes due to the fact that the NPP implementation is associated with the generation of tax revenues: PIT, CIT and property tax. In addition, there will be impacts related to the economic sector within the Pomorskie voivodeship and nationwide, with the largest-scale impacts at the NPP site.

Labour market changes – Implementation of the NPP is likely to have a direct, significant impact on the size and structure of employment in the local labour market. In the peak construction period (in Year 8 of the Project), approximately 8,000 construction workers will be employed. It was assumed that approximately 15% of the workforce needed during the construction phase (i.e. approximately 1,200 people) would be local workers and the remainder would be the incoming workers. The majority of these will be staff members employed in the construction and industrial sectors. An increase in labour rates is possible throughout the entire Pomorskie voivodeship since additional demand attracts workers to the area. Labour rates are likely to increase in all sectors of the economy, although they are expected to be highest in the construction and industrial sectors. With the increase in both direct and indirect employment, the overall unemployment rate is expected to decline. In addition to the direct impact on worker employment, construction of a nuclear power plant will be associated with a number of indirect impacts. Construction works will also create demand for goods and services from local and regional businesses that supply materials and services, and this can also contribute to creation of new jobs.

Effect on the construction sector – A large stream of materials and equipment for the Project is projected to be sourced from the manufacturers throughout Poland. Where domestic production is not possible, the international market will be used. The major supply chain will primarily include materials, i.e. cement, aggregates, steel, as well as electrical and electronic equipment (standard supplies), but also specialised materials and equipment produced as part of the international supply chain for nuclear power (not part of standard supplies for the construction sector).

IMPACT ON TOURISM

Tourism is considered to be one of the crucial factors in the regional development of the Pomorskie voivodeship. The overall tourism sector, including domestic and foreign tourists, owners of tourist facilities, businesses associated with the sector (providers of products and services), as well as employees working in the sector, will be exposed to impacts generated by the Project. The changes that will occur as a result of Project implementation will affect the tourist offer, the level of services, as well as access to recreational and tourist areas. The direct and indirect impacts on the tourism sector were analysed taking into account the Project implementation phases, the characteristics of nuclear power and the related concerns, as well as the demographic changes caused mainly by the influx of workers required by the NPP.

It is predicted that during the construction phase there will be a change in the number of tourists visiting the region analysed in favour of the NPP construction workers, primarily in the coastal villages of the Choczewo commune. Undoubtedly, the Project implementation on such a scale will attract tourists interested in the construction of the first Polish Nuclear Power Plant. Similar interest will be aroused by the investment project among students and lecturers of technical universities nationwide, especially of the energy, construction, mechanical, and similar faculties. Additionally, new investment projects (associated infrastructure) will appear in the area, including the Local Information Centre, which will also serve as a hotel and conference facility and will foster the development of the "science/cognitive tourism" sector. In addition to its primary informational role, the Local Information Centre will host numerous training sessions, conferences, and workshops, including international ones, devoted to nuclear energy and the construction of the NPP itself, a nationally unique investment project.

THE NUCLEAR POWER PLANT AND ITS SURROUNDINGS MAY BECOME A TRIP DESTINATION AND CONTRIBUTE TO THE DEVELOPMENT OF THE "SCIENCE/ COGNITIVE TOURISM" SECTOR.

It is assumed that during the operational phase the existing (guarded) bathing area and public beach will be available for tourists. During the operational phase of the NPP, there will be restrictions on the siting of new port and marine infrastructure components. This includes the creation of new bathing areas. The area of the cooling water intake and discharge diffusers will be closed to all navigation and all operations unrelated to the nuclear power plant. International experience with nuclear power plants indicates that there has been no negative correlation between the number of tourists and the nuclear power plant site, which has suggested that tourists do not pay much attention to this issue. In reality, it has been observed that some of the power plants have had a positive impact on tourism, and scientific tours organised by the power plant authorities have attracted a new category of people who later visit the region as tourists.

IMPACT ON FISHERIES

As the Project will create an exclusion zone (PA/construction site), there will be a disruption of fishing activities near the littoral zone. Due to the fact that there are no fishing ports in the Choczewo Commune and the fishing intensity is low, the Project implementation should not have a major impact on this economy sector. The greatest impact will be noted in sub-variant 1A due to the routing of the cooling system pipelines up to approximately 5–6 km away from the coastline.

During the operational phase, the fishing industry could be affected by the Project due to restricted access to parts of the marine area. For sub-variant 1A, cooling water intake points will be located up to maximum 6 km from the coastline, and water discharge points at a distance of 3.7 km. For sub-variants 1B and 1C, the intake and discharge points will be located at a distance of 2.3 km and 1.2 km from the coastline, respectively. Restrictions on vessel traffic will be implemented in the water body adjacent to the nuclear power plant, whereas the area around the intake and discharge points/diffusers will be closed to all navigation.

During the operational phase in Variant 2, the marine and inland fisheries and aquaculture sectors may be affected by the Project. Impact associated with public concerns will be similar to those described for Variant 1 – Lubiatowo-Kopalino site, under the proviso that they will affect fishing operations both at sea and in Lake Żarnowieckie. In the marine area, the likelihood of interference with fisheries is low. Pipelines placed close to the shore and under the seabed will not cause any impacts to the location of potential open-sea fisheries. During the Project operation, the area where the intake and discharge points for cooling water will be located along with the discharge of treated industrial effluents will be taken out of service. However, the location of the NPP on Lake Żarnowieckie shores may fuel concerns about the quality and safety of fish caught in the lake.

IMPACT ON FOREST MANAGEMENT

At the development stage of the construction phase in Variant 1, there will be permanent conversion of forest land in the PA, i.e. approximately 542 ha. The deforestation area will result from the selected option of building channels/pipelines for the intake and discharge of cooling water, and treated industrial effluents in the marine area, i.e. Option 1 using TBM tunnelling technique or Option 2 using open cut trenching (land part). In the case of Variant 1 – Lubiatowo-Kopalino site, the greatest impact will occur under sub-variant 1C (with Option 2), where the forested area subject to felling is estimated at approximately 410 ha, which accounts for about 76% of the forested land situated in the PA. Sub-variants 1A and 1B (with Option 1) have the lowest impact at about 335 ha, which means that the area under deforestation is smaller by about 15%. Permanent loss of forested land resulting from the development of the nuclear power plant site, in the context of the current availability and use of forests in the Choczewo commune, natural variation level and wide availability of alternative forest land, will not represent a significant impact. In Variant 1 –Lubiatowo-Kopalino site, the maximum loss of forested area in the Choczewo commune would account for approximately 5.5%.

The percentage share of the pine (pinus sylvestris sp.) among other forest-forming species in the PA is 82%. The remaining 18% is the dwarf mountain pine, which represents artificial plantings that stabilise dunes in the coastal belt.

When analysing the extent of impact of sub-variants 2A and 2B, they were found to result in no significant differences in impacts on forestry. From the forestry perspective, the Project impact analysis was carried out jointly for two sub-variants (2A, 2B).

IMPACT ON THE REAL ESTATE MARKET

For the purposes of the Project implementation in Variant 1, the rights to use land will have to be obtained. No demolition of buildings will be required in the PA. The land designated for the Project will not be traded on the market from the moment rights to the real estate are acquired until the process of the Project decommissioning is completed. Given the current ownership structure of the PA, the acquisition of land for the Project will not result in a change in demand for real estate in the local market. Concerns are expected to be voiced by the public about the nuisance caused by works during the development stage.

The construction stage will see the largest changes caused by the incoming workforce. The estimated number of workers and the need to accommodate them (as well as the increased demand for services) will drive up demand for residential and tourist properties (the latter to be subsequently used for residential purposes). Investors who will want to increase the supply through development of new tourist facilities are also likely to appear. Growing demand will most likely drive prices up, especially the rent for accommodation and/or residential space. It should be noted that some workers will be housed at the Choczewo accommodation base (approximately 4,000

people) and at an on-site container camp (approximately 1,000 people). A change of the status and/or potential of the land adjacent to the PA will also be reflected in real estate market trends. It is assumed that in the initial period the Project implementation may translate into price (offer) hike expectations; however, it will not necessarily translate immediately into the level of actual transaction prices.

For the purposes of the Project implementation in Variant 2, demolition of buildings (approximately 180 buildings at most) will be required in the PA. The land designated for the Project will not be traded on the market from the moment rights to the real estate are acquired until the process of the Project decommissioning is completed. Given the current ownership structure of the PA and the need to demolish some structures, land acquisition for the purposes of the Project may trigger changes in demand for real estate in the local market.

The development stage will take 1 year longer compared to Variant 1 due to the need to demolish the existing facilities. There will be more workers in the area (approximately 1,000 in the demolition period and 1,700 at the development stage).

DESCRIPTION OF ANTICIPATED PROJECT IMPACT MITIGATION ACTIONS (AVOIDANCE, PREVENTION, REDUCTION OR COMPENSATION)

To maintain Environmental Quality Standards (EQS), the Project implementation will involve the need to apply mitigation measures and design solutions that enable Emission Limit Values (ELVs) to be achieved.

NATURAL ENVIRONMENT

Components of the natural environment that were considered in the analysis included macrofungi, lichens, bryophytes, vascular plants, natural habitats, terrestrial and freshwater invertebrates, ichthyofauna, herpetofauna, i.e. amphibians and reptiles, avifauna, chiropterofauna, and other mammal species, for which the risk of significant impacts from the Project was identified.

Methods to minimise the effects of the Project impact that will be applied to protect the natural environment include an artificial translocation of plants from a natural site to another newly established site in free nature environment, relocation to non-endangered sites, monitoring, carrying out works outside the period of activity and creating ecological niches, leaving wildlife corridors (e.g. in the form of a tree belt for bats), limiting the use of light to the necessary minimum and limiting the use of UV-emitting light, keeping canals clear (which is particularly important for migratory fish), using guidance bands and anthropogenic traps (which will be controlled by the qualified personnel) and hanging nesting boxes. Depending on the species of plants and animals, an appropriate method of counteracting the Project environmental impact will be selected.

GEOLOGY AND HYDROGEOLOGY

All earthworks and construction works will be carried out in compliance with the applicable standards, recommendations and legislation. The Project will be implemented in such a manner as to minimise the transformation of the topographic relief forms and restore them to the largest possible extent. Mitigation activities will be carried out to minimise land drainage, to adapt the discharge volume to the characteristics of the receiving body of water and to minimise the extent of earthworks, to optimise the use of excavated soil, and to manage the emergencies appropriately and in line with established procedures.

INLAND SURFACE WATERS

Examples of measures taken to protect inland waters would include installing an adequate drainage system, arranging for immediate removal of defects to the systems discharging sewage from the construction site, and, for instance, collection of waste from separators and performance of coagulation (sedimentation) at an appropriate frequency.

MARINE SURFACE WATERS

According to the assessment of the impact of the planned Project on marine surface waters, most activities during the construction and operational phases of the Project would not have a negative impact on marine hydrodynamics and geomorphology, marine water quality, or marine biology. However, mitigation measures will be required for some activities during the operational phase to avoid significant adverse environmental impacts. The mitigation measures will include the precise dosing of chemicals thanks to the use of modern concentration measurement methods, neutralisation of harmful substances, reduction of the quantity of chemicals by applying other methods (e.g. in the case of components on the surface of which a film of microorganisms may form, appropriate paints or mechanical cleaning can be used), sewage quality control and pre-treatment before discharge, appropriate distribution of spent cooling water in order to minimise thermal impacts.

AMBIENT AIR QUALITY

With respect to air protection, mitigation measures will mainly involve the operation of equipment that complies with emission standards, the use of appropriate low-sulphur fuel, taking care of the state of repair of vehicles, the application of dust removal and proper control of its efficiency in cement unloading installations, and the protection of slopes and embankments against erosion. In addition, tyre washing stations will be prepared and mechanical cleaning of roads around the construction site will be applied. Furthermore, fuel gases at the boiler room and power generators will be periodically measured.

VIBROACOUSTIC ENVIRONMENT

In order to reduce the impact of noise generated when implementing the Project, the following measures will be taken: an adequate work schedule to reduce the night work to the minimum, and planning work in such a way as to avoid an overlap of the most arduous work, the use of machinery only in good working order, as well as the appropriate management and control of the construction plant along with the ongoing monitoring of its state of repair, proper planning of the construction site layout, and the use of sound-absorbing enclosures and noise barriers where necessary.

Piling activities will represent a significant source of vibration. Their impact will be minimised by choosing an appropriate method depending on ground conditions.

In minimising vibrations, design solutions will be applied related to the foundation of plant and machinery representing vibration sources, so as to minimise the impact range. For transport, routes will be identified that run across areas with the lowest population density as a function of distance from the axis of the transport route (railway line, road).

CONVENTIONAL AND RADIOACTIVE WASTE MANAGEMENT

Mitigation actions for conventional waste will take place through management at source, proper waste management (e.g. waste minimisation or proper storage). Waste collection will be carried out, as a last resort, by specialised operators to ensure proper disposal and storage.

In the case of radioactive waste, the mitigation actions will consist of minimising the waste quantity, proper segregation, volume reduction, as well as solidifying and packaging radioactive waste so that it is chemically and physically stable. These actions will follow the optimisation principle, also known as the ALARA (as low as reasonably practicable) principle, and using the best available techniques (BATs). Waste storage will take place in areas with the appropriate geological structure and with the use of all possible technologies and barriers that effectively isolate the waste from the environment.

HISTORIC MONUMENTS, ARCHAEOLOGICAL SITES, WRECKS

The construction activities that will take place in close proximity to historic monuments will be carried out without the use of heavy equipment whenever possible. If this proves impossible, vibration impact studies will be carried out and, if necessary, measures will be taken to minimise the impact, e.g. isolation mats will be used.

In the event new heritage assets are discovered during construction works, the appropriate authority will be notified and rescue actions will be taken to protect them.

In the case of shipwrecks, protection will be based on the routing of watercraft so that they avoid the shipwreck site.

LANDSCAPE

Minimising the impact of the Project on the landscape will consist in analysing the spatial layout of buildings, restoration of vegetation where possible and planting vegetation in places where it can effectively obscure the Project site.

HUMAN HEALTH AND LIFE – IONISING RADIATION

Issues related to protection of human health and life involve both protection against operational effects such as emission of radioactive substances and those associated with the physical execution of the Project and its effect on the quality of life.

The impact of radioactive substances and ionising radiation on human life will be limited to a level as low as reasonably achievable, taking into account economic, social and health factors, by implementing the principle of optimisation, which is commonly referred to in the world as the ALARA principle mentioned before. In addition, radiation monitoring will be applied both on the NPP site and in the surrounding area.

A Health and Safety Plan will be implemented to protect the health of workers. They will have access to medical care, and radiological protection standards will be in place during the commissioning and in the operational phase.

Dedicated occupational health and medical services can also be provided in the area analysed, and at the workforce accommodation facilities (associated infrastructure), where a medical centre will be established, thus reducing the need for health care services delivered to the local community at large.

In order to ensure the quality of life of the local community at an appropriate level, a stakeholder outreach plan will be developed to increase their involvement in each phase of implementation and to improve the flow of information related to the implementation of the Project. In addition, actions will be undertaken to monitor public opinion regarding the Project, including the opportunity for the members of the public to file comments and lodge complaints.

Efforts will be made to improve and expand local cycling paths and traffic routes, and measures will be taken to ensure traffic safety.

POSSIBLE TRANSBOUNDARY ENVIRONMENTAL IMPACTS

IONISING RADIATION

The type of impact qualified as potentially having a transboundary effect is the radiological impact from the Project area in an accident situation. In analysing this impact, account was taken of countries directly bordering Poland, countries of the Baltic Sea basin, and countries not immediately adjacent to Poland which applied for the status of an Affected Party, or were recognised as such by the General Directorate for Environmental Protection.

The calculations made consisted in determining meteorological sequences that would cause the passage of a contaminated cloud from the NPP to the considered receiver (borders of the considered country) in the shortest possible time, subject to extremely conservative (adverse) conditions. Based on the determined sequence, meteorological data sets were prepared and simulations were performed on the air dispersion of radioactive substances. The results obtained were then used to calculate the amount of doses received via ingestion. This way, doses were determined taking into account all routes of exposure.

The resulting doses included effective doses: two-day, seven-day, annual, and lifetime, and analogous absorbed doses by the thyroid gland. The above doses were determined separately for adults and children.

The determined maximum dose rates for neighbouring countries are at least an order of magnitude lower (the highest determined rate was 2.43E-5 mSv/h and concerned the border with Germany) than the mean background radiation in Poland (2.74E-4 mSv/h). For the maximum doses from an external exposure, the highest dose determined (2.89E-4 mSv for the border with Slovakia and Germany) is four times lower than the annual dose from natural background radiation in Poland (2.4 mSv/year).

This means that a severe accident representative for emergency planning will not pose any risk to human health in areas remote from the site, particularly in countries directly bordering Poland, and that the transboundary impact of the Polish Nuclear Power Plant will be insignificant.

HELCOM

Detailed impact assessments resulting from the implementation of the Project were carried out for both site variants: Variant 1 – Lubiatowo- Kopalino site and Variant 2 – Żarnowiec site, taking into account all related variants and their potential impact on sea water hydrodynamics, sea water quality and biological diversity of the marine environment.

For some elements of the Project, potentially significant effects have been identified in both site variants, but if additional mitigation measures are introduced, they can be reduced to a level that avoids significant adverse effects on the marine environment. Therefore, it can be concluded that the implementation of the Project in either site under consideration will not have a negative impact on HELCOM objectives set out in the Baltic Sea Action Plan.

SUMMARY

On 29 March 2022, the Investor submitted relevant documentation to the competent body in charge of the environmental procedure (GDOŚ, Warsaw): the EIA Report resuming the suspended procedure for the issuance of the decision on environmental conditions for the Project in question, initiated at the request of PGE EJ1 Sp. z o.o., dated 5 August 2015. The submission of the EIA Report is the culmination of the multi-annual programme of environmental surveys and studies concerning the characteristics of the potential NPP sites, the scope of which, both in territorial and substantive terms, is unprecedented in the history of infrastructural projects in Poland. The rationale for such an approach is the need to ensure that safe operation of a nuclear facility will be possible at the designated site – Variant 1 – Lubiatowo-Kopalino site and sub-variant 1A — open cooling system.

The results of the environmental survey and site investigation programme, as inputs to a number of analyses and mathematical modelling operations subsequently performed on their basis for the quantification and assessment of the two-way interaction of nuclear facility with the environment (the assessment of impact of the nuclear facility on the environment and of the environment on the nuclear facility) have made it possible to select both the preferred Project site and the cooling system sub-variant. The Project will be implemented in the site variant preferred by the Investor – Variant 1 – Lubiatowo-Kopalino site and sub-variant 1A (open system) with the use of sea water from the Baltic Sea for the cooling systems, with no need to provide cooling towers. The preferred site selection process has been carried out in accordance with the requirements of the International Atomic Energy Agency as the last stage of the siting process which started in 2014 with the publication of a list of potential NPP sites – Resolution of the Council of Ministers No. 15/2014 on the multi-annual programme referred to as the "Polish Nuclear Power Programme".

The environmental impact assessment carried out for the planned Project under the procedure for issuance of the decision on environmental conditions, addressed (1) the aspects referred to in the EIA Act, and (2) the aspects indicated by the authority in its Decision dated 25 May 2016 (ref. no.: DOOŚ-OA.4205.1.2015.23) on the need to carry out the environmental impact assessment for the EIA Report, with a particular focus on organisational and technical measures the application of which will enable the environmental quality standards to be met, and with the identification of direct social benefits arising from the implementation of the Project.

In addition, the results of the analyses have made it possible to identify the directions of potential design solutions, the implementation of which at later stages will guarantee that environmental and health standards are met in all phases of the Project. Furthermore, the Project implementation will have a favourable impact not only on macroeconomic factors such as energy security (replacement of end-of-life conventional generating units) or economic security of Poland (guarantee of a stable price of 1 kWh of baseload energy produced, reduced fees for the emission of CO_{2eq} from power sources), but also on local ones (including the regional development, new jobs – hotel industry, food service, retail, development of the service sector, taxes remitted to the commune budget for the NPP operation).

As the analyses conducted for the development of the EIA Report have shown, nuclear power is a safe, low-emission and stable energy source (baseload power), which, according to the assumptions of PEP2040, will contribute to ensuring stable and undisturbed energy supply while meeting the growing demand for electricity in compliance with increasingly restrictive regulations on environmental protection, including climate protection.

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