EJ 1 sp. z o.o.

The First Polish Nuclear Power Plant

Environmental Scoping Report

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PGE EJ 1 sp. z o.o.

seated in Warsaw (00-542)
ul. Mokotowska 49
Poland

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Date:	01 09.2015
Author:	PGE EJ 1 sp. z o.o.
Contact details:	PGE EJ 1 sp. z o.o. ul. Mokotowska 49 00-542 Warsaw tel. (0048) 22 340 1053

Contents

Acronyms and names:

ECA	Export Credit Agency
BCE	Bounding Conditions Envelope
BWR	Boiling Water Reactor
CCS	Closed Cooling System
CCW	Component Cooling Water
EPM	Environmental Management Plan
CoC	Cycles of Concentration
Location Permit	Decision on determination of the site for investment in a nuclear power facility
Environmental Permit	Decision on Environmental Conditions
EnvP	Decision on Environmental Conditions
EIA Directive	Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (OJ L 26, 28.1.2012, p.1, as amended)
The Birds Directive	Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (OJ L 20, 26.01.2010, p.7-25, as amended)
The Habitats Directive	Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild flora and fauna (OJ L 206, 22.7.1992, p. 7–50, as amended)
NPP	Nuclear Power Plant
EPC	Engineering, Procurement and Construction contract in a “turn key” approach
ESWS	Essential Service Water System
GDOŚ	General Director for Environmental Protection
ICES	International Council for the Exploration of the Sea
IED	Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (OJ L 334 of 17.12.2010, explanatory memorandum OJ L 158 of 2012, p.25), Industrial Emissions Directive

Stakeholder	All persons, social groups and institutions within Poland and abroad who are necessary for the correct execution of the Project (first grade stakeholders, so-called direct stakeholders) and those who are likely to exert an impact on its execution (2nd grade stakeholders, so-called indirect stakeholders)
SWB	Surface Water Body
GWB	Groundwater Body
PIS/ESR	Project Information Sheet/Environmental Scoping Report
NPRWSFM	National Plan for Radioactive Waste and Spent Fuel Management
NPS	National Power System
IAEA	International Atomic Energy Agency
MCP	Draft Directive for Medium Combustion Plants
[MWe]	Megawatt electric
NRMM	Non-Road Mobile Machinery
OCS	Open cooling system
EIA	Environmental Impact Assessment
PAA	President of the Polish Atomic Agency
PGE EJ 1/Investor	PGE EJ 1 sp. z o.o.
PGE S.A.	PGE Polska Grupa Energetyczna S.A.
PHWR	Pressurized Heavy Water Reactor
PNPP	Polish Nuclear Power Program, Ministry of Economy, Warsaw 2014
Project	Investment consisting of the construction and operation of a nuclear power plant of up to 3750 MWe capacity subject to proceedings for the issuance of the decision on environmental conditions
PSA	Probabilistic Safety Assessment
PSEZ	Pomeranian Special Economic Zone
PWR	Pressurized Water Reactor
IP	Integrated Proceedings
PPL	Public Procurement Law act of 29 January 2004, J.o.L. of 2013, item 907, as amended
FRMP	Flood Risk Management Plans
EIA Report / Environmental	Environmental Impact Assessment Report

Impact Assessment Report	
Location Report	Report as specified in art.35b of the Atomic Law act of 29 November 2000
EIA Regulation	Regulation of 9 November 2010 by the Council of Ministers on types of projects likely to have significant effects on the environment (Polish J.o.L. of 2010, issue 213, item 1397)
MSFD	Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) (J.o.L 164/19 of 2008)
WFD	Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of water policy (OJ L 327, p.1 of 2000, as amended) (EU Water Framework Directive)
Scoping	Definition of the scope for the Environmental Impact Assessment Report
Screening	Qualification stage in the environmental impact assessment procedure
ES	Electrical substation
SES	Słupsk electrical substation
Company	PGE EJ 1 sp. z o.o.
Investment Act	Act of 29 June 2011 on the development and execution of investments in a nuclear power facility and associated investments (Polish J.o.L. of 2011, issue 135, item 789, as amended)
Uooś	Act of 3 October 2008 on Providing Information on the Environment and Environmental Protection, Public Participation in Environmental Protection and Environmental Impact Assessment (consolidated text, Polish J.o.L. of 2013, item 1235, as amended)
IAEA guidelines	IAEA Nuclear Energy Series No. NG-T-3.11 Managing Environmental Impact Assessment for Construction and Operation in New Nuclear Power Programmes, 2014
ZES	Żarnowiec electrical substation

1 Introduction

This document is the Environmental Scoping Report ("ESR") for the investment consisting of the construction and operations of the First Nuclear Power Plant in Poland up to 3750 MWe of capacity (the "Project"), within the boundaries of the site as defined and specified in Section 6 and 7 of the ESR, on the territory of the following communes: Choczewo, or Gniewino and Krokowa in the Pomeranian voivodeship.

Environmental Scoping Report constitutes an attachment to the application for the decision on environmental conditions (EnvP) and to the application for definition of the scope of report for the Project as defined above.

PGE EJ 1 sp. z o.o. seated in Warsaw ("Investor") acts in the capacity of the applicant.

Environmental Scoping Report has been developed by the PGE EJ 1 sp. z o.o. team with technical support provided by AMEC Foster Wheeler.

2 Scope and objective of the Environmental Scoping Report

Environmental Scoping Report is developed within the framework of proceedings aiming at the receipt of the decision on environmental conditions, in accordance with Division V, Chapter 3 of the Act of 3 October 2008 on Providing Information on the Environment and Environmental Protection, Public Participation in Environmental Protection and Environmental Impact Assessment (hereinafter referred to as "Uooś").

In the light of article § 2, paragraph 1, point 4 of the Regulation of 9 November 2010 by the Council of Ministers on types of projects likely to have significant effects on the environment (hereinafter referred to as the "EIA Regulation), **the planned Project belongs to the category of projects that are always likely to exert a significant negative impact on the environment (the so-called Group I of projects). Execution of such projects must therefore be preceded by the environmental impact assessment procedure.** In the case of projects that are always likely to exert a significant negative impact on the environment, the investor may attach to the application for decision on environmental conditions an environmental scoping report, together with a request for definition of the scope of the EIA report, instead of the EIA report itself.

Definition of the scope for the EIA report is mandatory for projects that are likely to exert a transboundary impact on the environment.

In accordance with art. 3, paragraph 1, point 5 of the Uooś, the project information sheet covers basic information on the planned project, in particular, data pertaining to:

a) type, scale and location of the project,
b) area of the land to be occupied and of the building structure, the land use until present and the vegetation cover of the site;
c) type of technology,
d) possible project variants,
e) predicted consumption of water, raw materials, other materials, fuel and energy,

f) solutions for the protection of the environment,
g) types and estimated volumes of substances or energy released to the environment when environmental protection measures are applied,
h) possible transboundary environmental impact,
i) areas protected in accordance with the Nature Conservation Act of 16 April 2004 and located within the range of the project's significant impact.

It must be underlined that the Project under analysis falls into the category of projects that may always exert a significant negative impact on the environment (so called Group I projects) and therefore the role of the ESR differs from the role this document normally performs in projects classified as Group II projects, that is, such that may potentially exert a significant negative impact on the environment. In the case of Group II projects, the ESR must include all information on the project and its impacts that is required for the relevant authority to issue a decision on the necessity – or lack thereof – of conducting the environmental impact assessment proceedings under the screening procedure. The information required is specified in art. 63, paragraph 1 of Uooś.
In the case of projects classified as Group I projects, the authority does not conduct the screening procedure, as the requirement to run environmental impact assessment proceedings for these projects stems from the law. On the basis of the PIS, the authority is under obligation to specify within the framework of the scoping procedure the content and scope of the information on the environment, project and its impact to be submitted to the relevant authority and may also, [1}{2]in view of the location, nature and scale of the project's potential impact on the environment, indicate:

a) types of alternative variants that require investigation,
b) types of impacts and elements of the environment that require a detailed analysis,
c) scope and methods of surveys and investigations.

It must be underlined that in the case of projects consisting of the construction and operations of nuclear power plants, which is the case here, when defining the scope of information to be presented in the Project Information Sheet, the IAEA guidelines on the environmental impact assessment process for the nuclear power plants must be considered (the "Guidelines")[1]. These Guidelines define the objective for the environmental scoping report – which upon translation into the Polish legal reality corresponds to the project information sheet – as submission of a set of information that is available at a given stage and pertains to the project, environment and the identified need of filling the gaps in knowledge thus creating a special kind of guide for the environmental impact assessment procedure that allows for the correct and comprehensive development of the EIA report at the next stage of the proceedings. In accordance with the Guidelines, the scoping report should encompass:

1) introduction – defining the objective for the environmental scoping report (PIS) and presenting the basics of the project,
2) justification of the project – together with an indication of the political and economic setting,
3) description of the EIA procedure – together with an outline of schedule, stakeholders and rules of public participation,

[1]IAEA Nuclear Energy Series No. NG-T-3.11 Managing Environmental Impact Assessment for Construction and Operation in New Nuclear Power Programmes, 2014

4) project description – together with an indication of parameters and processes identified at a given stage of the project and with an indication of possible mutual impacts between the project and the environment,
5) alternative variants under consideration that will be subject of the impact assessment, including the so-called zero variant,
6) definition of the scope for the Environmental Impact Assessment Report – including an identification of the subject of assessment,
7) all available information on the environment in the area to be covered by the planned project
8) methodology for environmental data collection - laid down in the environmental survey program conducted for use in the environmental impact assessment proceedings,
9) environmental impact assessment methodology that will form the basis for the development of the environmental impact assessment report,
10) plan for public participation – together with an identification of direct and indirect stakeholders and rules for the dialogue to be conducted in the course of the EIA proceedings,

Project Information Sheet herein contains all elements listed in the national and international requirements, including the Appendix I to the Convention on Environmental Impact Assessment in a Transboundary Context (Espoo, 1991) and it seeks to present information that is known at the present stage and pertains to the following:

1) the planned project
2) environmental conditions of its execution,
3) lack of knowledge and gaps in knowledge on the environment and possible impact it might exert on the project that need to be filled so as to perform a correct and comprehensive environmental impact assessment,
4) scope and methodologies for the environmental studies to be completed before launch of the environmental impact assessment procedure,
5) scope and methodology for the performance of the environmental impact assessment and development of the environmental impact assessment report,
6) planned activities performed with the view to ensure transparency and participation of all interested parties in the impact assessment,

so as to define – in the course of the scoping process and with active involvement of relevant authorities and stakeholders – detailed requirements regarding the scope and methodology for the environmental impact assessment procedure for the first nuclear power plant in Poland.

It must also be stressed that the PIS plays an important role from the perspective of the social strategy dialogue implemented by the Investor. PIS is the first official document presenting all basic assumptions for the planned investment in a comprehensive manner and in a publicly available form accessible to all stakeholders. Stakeholders are all the persons, social groups and institutions in Poland and abroad that are necessary for the correct execution of the Project (first grade stakeholders, so-called direct stakeholders) and who are likely to exert an impact on its execution (second grade stakeholders, so-called indirect stakeholders).

Table1. Matrix of the national and international requirements accounted for in specific PIS sections

No.	Requirement	PIS Section
I.	**Requirements of Art. 3, paragraph 1, point 5 of the Uooś**	
1.	Type of project	4
2.	Scale and location of the project	6.1
3.	Area covered (in terms of the area of the land and the building itself)	6.3
4.	Land use to date	12.1
5.	Vegetation cover of the site until present	12.9
6.	Technology types	6.4
7.	Possible project variants	7
8.	Projected consumption of water, raw materials, other materials, fuel and energy	8
9.	Solutions for the protection of the environment	11
10.	Estimated volumes and types of substances or emissions released to the environment when environmental protection measures are applied	9
11.	Possible transboundary environmental impact	10
12.	Areas protected in accordance with the Nature Conservation Act of 16 April 2004 and located within the range of the project's significant impact	13
II.	NG-T-3.11 Managing Environmental Impact Assessment for Construction and Operation in New Nuclear Power Programmes	
1.	Objective of the scoping report	2
2.	Presentation of the project basics	4
3.	Justification of the project – together with an indication of the political and economic setting,	3
4.	Description of the EIA procedure – together with an outline of schedule, stakeholders and rules of public participation,	5
5.	Project description – together with an indication of parameters and processes identified at a given stage of the project and with an indication of possible mutual impacts between the project and the environment,	6, 8, 9, 11

6.	Alternative variants under consideration that will be the subject of the impact assessment,	7
7.	Zero variant or the effects of the non-execution of the Project	7
8.	Description of the scope of the Environmental Impact Assessment Report	15
9.	Identification of the subject of the impact assessment	5
10.	All available information on the environment in the area to be covered by the planned project	12
11.	Methodology for environmental data collection laid down in the form of an environmental survey program conducted for the use of environmental impact assessment proceedings	14
12.	Environmental impact assessment methodology that will form the basis for the development of the environmental impact assessment report	15
13.	Plan for public participation – together with an identification of direct and indirect stakeholders and rules for the dialogue to be conducted in the course of the EIA proceedings,	17

Source: In-house studies

3 Justification for the construction of a nuclear power plant in Poland

In accordance with the decision by the Council of Ministers of 13 January 2009 (no 4/2009) regarding the activities undertaken with the intention to develop nuclear energy in Poland, PGE S.A. was designated as the leading entity for the construction of nuclear power plants in Poland. At present, within PGE Capital Group there exist two entities involved in Project execution – the Nuclear Power Department as the unit coordinating work on behalf of PGE S.A. – and PGE EJ 1 as the unit responsible for execution of day to day project activities.

In January 2014, the Council of Ministers adopted the Polish Nuclear Power Program (PNPP), thus confirming the intention to construct the first nuclear power plant in Poland and designating PGE S.A. as the investor for the project. The Program is supported by analyses (compare: Evaluation of potential for the reduction of the greenhouse gas emissions in Poland until 2030) that conclude that the use of nuclear energy sources is the most advantageous and profitable solution for achieving a fuel mix that provides for the theoretically highest possible reduction of CO_2 emissions while generating electric power.

It must be stressed that the nuclear power plant build project is a key project that aims at achieving decarbonisation targets while assuring the country's energy security. These targets stem from a number of documents adopted both at the EU and national level.

The EU document that is crucial for the definition of decarbonisation targets for energy production is the Energy Roadmap 2050 (COM (2011) 885). The Energy Roadmap bears proof that the European Union is determined to lower its greenhouse gas emissions by 80-95% compared to emission levels

from the 1990s, all in the context of reductions required from the developed countries. In this context the document claims that "Nuclear energy will be needed to provide a significant contribution in the energy transformation process in those Member States [...]. It remains a key source of low carbon electricity generation." The Roadmap also states that "Nuclear energy is a decarbonisation option providing today most of the low-carbon electricity consumed in the EU."

Communication from the Commission, A policy framework for climate and energy in the period from 2020 to 2030 (COM(2014)15) outlines ambitious framework for the continuation of the climate policy after 2020 and proposes to set the decarbonisation target within the EU for the year 2030 as the reduction of emissions by 40% compared to the year 1990. These targets were confirmed by the European Council during the summit of 23 October 2014. (SN 79/14). In the document issued by the EC it has been clearly underlined that one of its aims is: "within this EU framework, providing flexibility for Member States to define a low-carbon transition appropriate to their specific circumstances, preferred energy mix and needs in terms of energy security and allowing them to keep costs to a minimum."

Targets that Poland has undertaken to achieve at the EU level are reflected in the national documents. Poland energy policy until 2030, the document in force adopted with the decision of the Council of Ministers no 202/2009, defines basic directions for actions and activities with regards to the energy sector. These encompass the following elements:

- increasing the energy efficiency;
- increasing the security of fuel and energy supplies;
- diversification of energy generation sources by introduction of nuclear into the fuel mix;
- developing the use of renewable energy sources, including biofuels;
- developing competitive fuel and energy markets;
- limiting the energy sector's impact on the environment.

The directions defined for energy policy are to a great extent interdependent and their common denominator is the projected increase in energy demand coupled with the simultaneous aging of the generating fleet. In the next few years, significant volumes of installed capacity will go offline within the framework of a larger process to decommission old generation sources or to take them off the grid in order to execute thorough refurbishment and modernization works. Polish generation capacity must be restored while taking into account the national and European requirements for environmental protection in its broad sense and which might, among others, translate into the necessity to limit greenhouse gas, including CO_2, emissions.

The elements identified above form a set of valid reasons for the modification of the Polish fuel mix, which is based in 90% on fossil fuels, and for the development of the renewable energy sources. Construction of the nuclear power plants is understood as crucial part of this process as the nuclear power plants might become an integral element of the baseload capacity to assure security of energy supply.

The assumptions for the National Plan for the Development of Low Emission Economy entail that an optimum fuel mix must be defined for Poland until 2050. Definition of fuel mix for Poland, a mix that on one hand is most effective with regards to meeting the decarbonisation targets and that on the other is most advantageous for the efficiency of the Polish economy, would provide the energy sector with information on directions to be taken with regards to investment policies, which in its

turn would facilitate transformation of the Polish economy into low carbon economy and introduction of the nuclear energy into the Polish fuel mix.

The strategy adopted on 15 April 2014 "Energy Security and the Environment – 2020 perspective'" provides for the preparations to introduce nuclear power by stating that: "... due to maintaining as well as attempts at tightening further the EU policy on counteracting climate change, there has been a natural surge of interest in the low carbon emission generation sources. Decision to start nuclear power plants in Poland will significantly limit greenhouse gas emissions. Nuclear power is able to provide an adequate amount of electric energy while allowing to meet the requirements for climate protection."

New draft of the Energy Policy until 2050 constitutes an implementation of guidelines outlined in the aforementioned documents. It states that nuclear power should become an important part of the energy sector after 2025, due to the projected increase in fossil fuel prices and further restrictions related to CO_2. Consequently, nuclear power is present in all scenarios analysed in the draft Energy Policy until 2050.

The construction of a nuclear power plant in the locations identified in this document is further justified by the provisions of the basic documents that define the assumptions for the land use and spatial development policy on the regional and national scale. National Spatial Development Concept until 2030 is the long-term document defining the spatial development policy on the national level where the strategic goal to be achieved by means of focusing on six interdependent spatial development policy goals has been formulated. One of these interim goals set for spatial development policy is to increase the spatial structure's resistance to natural threats and loss of energy security as well as to create spatial structures that boost the national defense capacity in relation to the development of the National Transmission Grid: "The following elements must be listed among improvements to quality: replacing the old 220 kV grid with a 400 kV one, closure of the 220 and 400 kV circuits will significantly boost the security of supply to end users, development of the grid allowing for power evacuation from the renewable energy generation units and NPPs – located mainly in the North of Poland..."

Also the regional spatial development policy is focused around issues related to effective energy management, as proven by the "Strategy for the development of the Pomeranian Voivodeship 2020". The document attempts to make projections for the region and, among others, underlines that: "Pomerania is a region heavily dependent on external supply of electricity from outside its borders; a region that has significantly fallen behind with regards to investments in the power sector and whose energy efficiency is two times lower than the EU average. This translates into the lower level of energy security, which limits the influx of new investments into the voivodeship. Also the pressure on the environment resulting from energy generation and locally occurring transgressions to air quality norms that stem from the so-called low-emissions and transport reaches significant levels. At the same time, the region is characterized by advantageous conditions for the development of various forms of renewable energy generation sources, conventional energy units and nuclear plants."

Moreover, "Plan for spatial development of the Pomeranian Voivodeship", among other things, states the following with regards to electric energy supply: "Construction of installations based on other energy generation sources, like a coal plant and/or cogeneration plant complying to all

requirements that pertain to environmental protection and in particular to emission levels and coal ash waste managements, or of gas plants and nuclear power plant."

The documents quoted above contain a number of analyses that confirm the need to introduce the nuclear into the Polish fuel mix, especially from the perspective of decarburization targets and energy security of Poland. The launch of the nuclear power plant build project by PGE EJ 1, which is an investment that best meets the outlined goals, is a result of the circumstances specified above.

Key documents that constitute justification for the construction of a nuclear power plant in Poland are listed below.

Table2. International, national and regional strategic documents that justify the execution of the Project.

International / European Union documents

a) Energy 2020 - A strategy for competitive, sustainable and secure energy, Communication from the Commission, Brussels, 10 November 2010, COM (2010) 639 final;
b) GREEN PAPER, A 2030 Framework for Climate and Energy Policies, Brussels, 27 March 2013, COM(2013) 169 final;
c) Energy Roadmap 2050, Communication from the Commission, Brussels, 15 December 2011, COM(2011) 885 final;
d) A policy framework for climate and energy in the period from 2020 to 2030, Communication from the Commission, Brussels, 04 February 2014, COM(2014) 15 final/2;
e) European Energy Security Strategy, Communication from the Commission, Brussels, 28 May 2014, COM(2014) 330 final;
f) Energy Efficiency and its contribution to energy security and the 2030 Framework for climate and energy policy, Communication from the Commission, Brussels, 23 July 2014, COM(2014) 520 final;
g) Progress towards completing the Internal Energy Market, Communication from the Commission, Brussels, 13 Oct. 2014, COM(2014) 634 final;
h) Conclusions of the European Council from 24 October 205 on 2030 Climate and Energy Policy Framework (EUCO 169/14)
i) Communication from the Commission, A Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy from 25 February 2015, COM (2015)80 final

National documents

a) Resolution No 4/2009 of the Council of Ministers of 13 January 2009 on activities undertaken with the view to develop the nuclear power in Poland, RM-111-12-09;
b) Energy Policy of Poland until 2030, Attachment to the Minister's of Economy Announcement of 21 December 2009 on the energy policy of the country until 2030. (M.P. 2010 No 2 item 11);
c) National Regional Development Strategy in Poland 2010-2020: Regions, Cities, Rural Areas, Resolution of the Council of Ministers of 13 July 2010, Official Gazette of the Government of the Republic of Poland – Monitor Polski (M.P.) of 2011, item 423;
d) National Development Strategy 2030, Attachment to the Resolution No 239 by the Council of Ministers of 13 December 2011 on adoption of the National Development Strategy 2030 (M.P. of 2012, item 252).

e) National Development Strategy 2020, Attachment to the Resolution No 157 of the Council of Ministers of 25 September 2012 on adopting National Development Strategy 2020 (M.P. of 2012, item 882).

f) Strategy for Innovation and Economic Efficiency "Dynamic Poland 2020", Attachment to the Resolution No 7 by the Council of Ministers of 15 January 2013 on adoption of the Strategy for Innovation and Economic Efficiency "Dynamic Poland 2020", (M.P. of 2013, item 73).

g) Long-term National Development Strategy. Poland 2030. Third Wave of Modernity, Attachment to the Resolution No 16 by the Council of Ministers of 5 February 2013 on adoption of the Long-term National Development Strategy. Poland 2030. Third Wave of Modernity (M.P. 2013 item. 121);

h) Strategy of development of the National Security System of the Republic of Poland 2022, Attachment to Resolution No 67 of the Council of Ministers of 9 April 2013 on the adoption of 'Strategy of development of the National Security System of the Republic of Poland 2022', (M.P. of 2013, item 377).

i) Polish Nuclear Power Program, attachment to the Resolution No 15/2014 by the Council of Ministers of 28 January 2014 on the long-term program entitled 'Polish Nuclear Power Programme' (M.P. of 2015, item 502);

j) Strategy for 'Energy Security and the Environment – 2020 perspective', Attachment to the Resolution No 58 by the Council of Ministers of 15 April 2014 on adopting Strategy for 'Energy Security and the Environment – 2020 perspective' (M.P. of 2014, item 469);

k) Assumptions for the National Plan for the Development of the Low-Emission Economy– resolution by the Council of Ministers of 16 August 2011.

Regional documents

a) Plan for spatial development of the Pomeranian Voivodeship, Attachment to the Resolution No 1004/XXIX/09 by the regional assembly of the Pomeranian Voivodeship of 26 October 2009. (Official Journal of the Pomeranian Voivodeship of 2009, No 172);

b) Pomeranian Voivodeship Development Strategy 2020, Attachment 1 to the Resolution No 458/XXII/12 of the Pomeranian regional assembly of 24 September 2012 on adopting Pomeranian Voivodeship Development Strategy 2020;

c) Pomeranian Voivodeship Development Masterplan, Attachment to the resolution by the Council of Ministers no 234 of 14 November 2014 on the adoption of the Pomeranian Voivodeship Development Masterplan (M.P. of 2014, item 1144);

Source: In-house studies

4 Type and scope of the project

The Environmental Scoping Report herein has been developed for the Project that is subject of application for the decision on environmental conditions and that consists of the construction and operations of a nuclear power plant of 3750 MWe capacity.

The objective defined for the execution of the Project is to generate electricity with use of nuclear power.

The project will be implemented in the area of the communes of Choczewo, or Gniewino and Krokowa communes, in the Pomeranian voivodship, at a location selected under the environmental impact assessment in the Pomeranian Voivodeship, in one of the three specified location variants selected and confirmed at the stage of application for the Location Permit. Borders and the characterization of the location variants under consideration have been identified in Section 7 of the document herein.

The following tasks must be executed within the framework of the Project:

1. **Preparing the site for the construction of a nuclear power plant**, that is execution of all preparatory works at the site, as specified in art. 17, para 1 of the Act of 29 June 2011 on the development and execution of investments in a nuclear power facility and associated investments. The preparatory works might consist of (depending on the location variant and technology selected) mostly the following:
   a) demolition of the existing constructions, structures, technical installations and infrastructure,
   b) removal of trees and shrubs present at the plots of land covered by the decision on determination of the site for investment in a nuclear power facility together with clearing and removal of the humus,
   c) earth works, levelling, also archaeological works and sweeping for explosives that includes removing potential duds and unexploded ordnance and other artefacts,
   d) preparing access roads, fence and securing the construction site together with appropriate marking and the monitoring system,
   e) connection to sewage, wastewater and water systems, telecommunication network (optional: also to gas and heat distribution networks) as well as to the electric grid connector of 110/15kV, including lighting and internal infrastructure for all the media (water, AC power etc.),
   f) water intake structure and water treatment facility to meet the needs of an NPP,
   g) installation of a ditch drainage system together with installation draining ground water,
   h) construction of a site office, accommodation and a storage facility,
   i) preparing the temporary lay down yards and storage areas for the construction materials as well as the area to deposit the humus,
   j) preparation of distribution stations for liquid and gas fuels,
   k) preparing the area for the construction of marine architecture elements (on the site, among others, for cooling water corridors),
   l) preparation of the sea embankment for the construction of flood-protection and erosion-protection structures.

2. **Construction of the nuclear power plant** that might be composed of, depending on the location variant and technology selected, the following elements interconnected both from technical and functional perspective:
    a. **Nuclear part of the power generation unit** (the so-called "nuclear island") – encompasses the reactor building together with the containment structure, building with ancillary installations for the reactor, building for the nuclear fuel, building where radioactive waste is handled, buildings that host security systems as well as other auxiliary structures and installations for the nuclear part of the facility.

       Nuclear steam generation system is located within the reactor building and the building that hosts ancillary installations for the reactor. Nuclear steam generation system is composed of: nuclear power reactor that contains a reactor core in which a controlled nuclear fission chain reaction takes place, reactor cooling circuit, systems attached to the reactor cooling circuit as well as the safety, security and safeguard system for the reactor.

       Nuclear part of the power generation unit also encompasses: executive safety systems (such as emergency core cooling system, containment structure systems) that get activated automatically upon receipt of signals generated by the reactor safety system, also the remaining measurement, instrumentation and control systems, electricity supply systems and appropriate HVAC systems.

    b. **Conventional part of the power generation unit** (the so-called "conventional island") encompasses the building that hosts the steam turbogenerator together with ancillary systems and installations, condensate and water system, power evacuation system together with the power transformer, appropriate measurement, instrumentation and control systems, HVAC systems as well as other installations, systems and auxiliary equipment.

    c. **Balance of Plant** - encompasses facilities, systems and installations that are not considered part of the nuclear or conventional island of the power generation unit, cooling water systems, turbine condensers, service water systems, emergency fire water systems, untreated water systems, water treatment facilities, effluent and sewage treatment installations, emergency AC power systems, temporary storage for spent nuclear fuel, physical security system for the plant, workshops and storehouses, training facilities, public information centre, welfare facilities and accommodation, centre for environmental monitoring as well as other ancillary facilities.

    d. **Cooling water intake and discharge structures** – encompass all systems related to cooling water intake and discharge.

3. **Nuclear power plant operations** to produce electric energy.

Basic parameters for specific elements of the project have been presented in the following chapters as bounding conditions envelopes of the Project for technologies under consideration.

Depending on the technology selected, it is projected that the facility will generate between 9 to 28 TWh of electric energy per year. Final installed capacity of the plant as well as an annual electric energy production volume will depend on the technology selected at a later stage of the Project development process, after the Environmental Permit has been issued.

It must be underlined that at present stage only the very basic parameters of the project are known, encompassing all technologies under consideration. At the next stages of Project development, within the framework of project works and to meet the requirements of the administrative procedures, the information on the Project, its parameters and impacts will be supplemented and detailed, as presented on a diagram below.

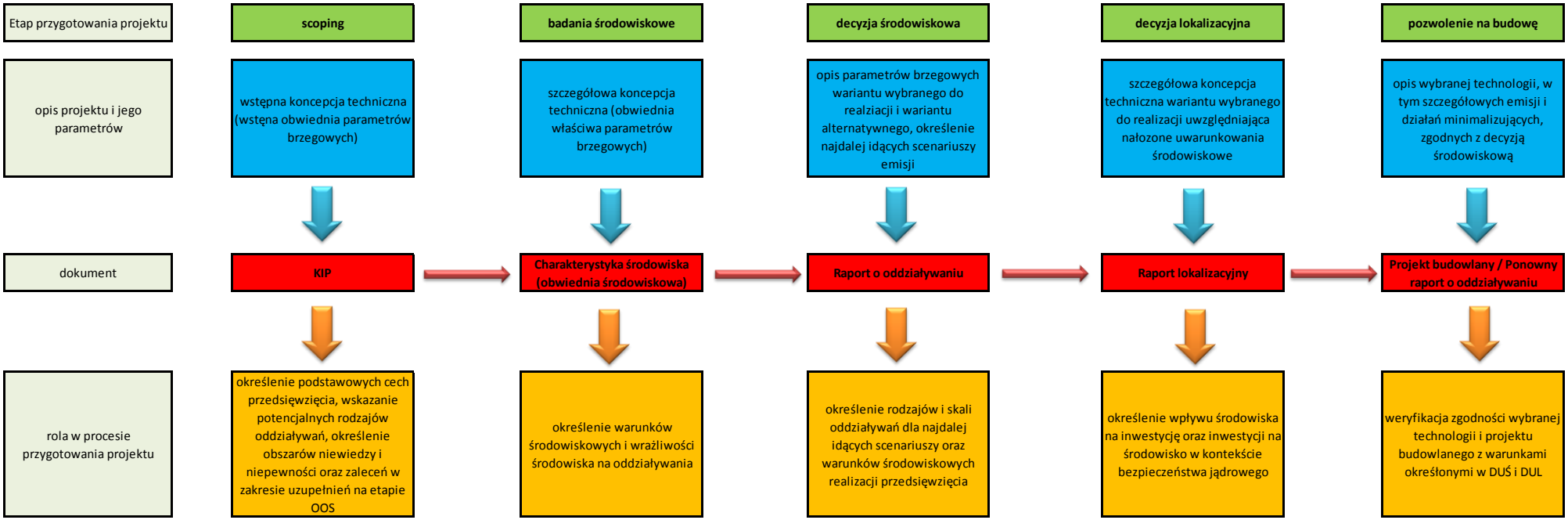


Figure 1. Provision of increasingly detailed information about the project at consecutive stages of its development

Source: In-house studies

Project Development	Scoping	Environmental Survey	Decision on Envirionmental Conditions	Location Decision	Construction Permit
Description of the Project and its parameters	Preliminary technical concept (preliminary bounding conditions envelope)	Detailed technical concept (bounding conditions envelope)	Description of the bounding conditions of the variant selected for execution and the alternative variant, description of the most intensive emission scenarios	Detailed technical concept of the variant selected for execution, including the pertaining environmental restrictions	Description of the selected technology, including detailed emissions and mitigation activities compliant with the Decision
Document	Environmental Scoping Report	Bounding envelope for environmental conditions	EIA Report	Location Report	Construction Design / Subsequent EIA Report
Role in the process of Project Development	Designating key characteristics of the Project, identifying potential impacts, identifying areas of uncertainty or lack of information, recommendations to complement the EIA	Identifying the environmental conditions and vulnerability of the environment to impacts	Determining the type and scale of impacts for the most intensive scenarios and the environmental conditions for project execution	Determining the impact of the environment on the program and impacts of the program on the environment in terms of nuclear safety.	Verifying the compliance of selected technology and construction design with the conditions set in the Decision on Environmental Conditions and Location Decision.

5 Environmental impact assessment procedure

Environmental impact assessment for the project is carried out, in particular, within the framework of the proceedings aiming at the issuance of Environmental Permit. The essential outcome of the environmental impact assessment for the planned investment is the evaluation of how and to what extent the project will affect the environment.

The main objective of the assessment is to provide the following entities with necessary information on the effects the planned project will have on the environment:

a) body in charge of issuing the Environmental Permit,
b) bodies that issue opinions and justification for the Environmental Permit,
c) and other entities included in the decision-making process, i.e. also the public opinion and counties whose territory might be affected by the planned project.

The objective for the assessment is to define conditions for execution of the planned project, including in particular technical, design, organizational and scheduling solutions that ensure absence of significant impacts, that is impacts that harm the environment in a durable and irreversible manner and that constitute a significant threat to public health and safety of people and animals. This objective can be reached through identification of the impact that the project, single-handedly or in conjunction with the existing and planned investments, will exert on the environment, including Natura 2000 sites, protected species, public health and living conditions of the residents as well as other elements; mitigating and compensatory actions to minimize harmful impact on the environment. Within the framework of this process, it is necessary to establish all environmental conditions and then to analyze them in order to eventually assess the type and scale of impact exerted by specific element of the project on the environment. This will allow all bodies and entities involved in the decision-making process to become informed on the consequences of the planned project.

5.1 Legal classification of the project

The classification has been performed on the basis of:

- Act of 3 October 2008 on Providing Information on the Environment and Environmental Protection, Public Participation in Environmental Protection and Environmental Impact Assessment (consolidated text, Polish J.o.L. of 2013, item 1235, as amended) („Uooś”);
- Regulation of the Council of Ministers of 9 November 2010 on investment projects which may significantly affect the environment (J.o.L. of 2010, No 213, item 1397 as amended).(EIA Regulation);
- Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (OJ L 26, 28.1.2012, p.1, as amended) (EIA Directive).

Specific elements of the project consisting of the construction of a nuclear power plant have been analyzed, together with their potential qualification to be embedded in the environmental impact assessment in accordance with the EIA Regulation and EIA Directive.

European regulations pertaining to EIA divide the projects that might exert a significant impact on the environment into 2 groups:

- Group I – project for which the EIA is mandatory,
- Group II – project for which the EIA is optional.

This classification has also been reflected in the Uooś:

- group I – projects that might **always** significantly impact the environment and for which the EIA is mandatory (art. 59, para 1, point 1 Uooś),
- group II – projects that might **potentially** significantly impact the environment and for which the EIA is optional (art. 59, para 1, point 2 Uooś).

EIA Regulation lists types of projects that belong to group I in § 2 and projects that belong to group II – in § 3. EIA Directive includes a similar classification of projects. Projects from Group I have been listed in Attachment I, while projects from Group II in Attachment II.

In the light of attachment I to the EIA Directive (point 2, letter b), nuclear power plants belong to group I of projects. Regulations embedded in the Polish legislation are analogous. In accordance with § 2, para 1, point 4 of the EIA Regulation, nuclear power plants belong to the category of projects that might always significantly impact the environment.

It is mentioned that if the planned Investment entails execution of elements that might be classified as projects that belong to categories specified in § 2 and § 3 of the EIA Regulation, then these projects should not be treated separately but as projects that might always exert a significant impact on the environment instead. Moreover, if the investment includes an element listed in either § 2 or § 3 as well as other elements that have not been specified in the Regulation, then it is fully justified to have the whole investment undergo a screening process and/or the environmental impact assessment.

When it comes to the planned Project that consists of the construction and operations of a nuclear power plant that is listed among projects that might always significantly impact the environment, construction site preparations as a set of tasks included in the planned project will also be subject to the environmental impact assessment.

5.2 Assessment of the need to perform the EIA for the project

Summing up the explanation laid down in point 5.1, it must be concluded that the project covered by the Environmental Scoping Report herein requires the mandatory environmental impact assessment be performed.

5.3 Scope of the project covered by the procedure

The procedure aiming at the issuance of the Environmental Permit covers all actions and activities listed in chapter 4 of the PIS, and which are: works related to preparing the construction site executed on the NPP site, including execution of internal infrastructure for the NPP as well as construction and operation of all elements of a nuclear power generation unit that is a nuclear power

plant. They encompass all actions and projects that are technically interrelated and that on specific stages of the development, construction, start-up and operations of a nuclear power plant ensure technical functionality and completeness of the project allowing for generation of electric energy as a result of a process that transforms heat released during nuclear fission (process that takes place in a nuclear reactor) into mechanic energy (with the use of steam turbine) and subsequently into electric power (generated by a generator propelled by the turbine).

5.4 NPP decommissioning

Life cycle of a nuclear power plant, as a life cycle of any investment of this kind, can be divided into three periods: construction, operation and decommissioning.

Decommissioning phase is a process that consists of lowering the radioactivity levels in the plant, disassembly and removal of installations and equipment, demolition of buildings upon their decontamination and phase out of their functions. Decommissioning is composed of the following three stages:

a) final retirement from operations,
b) partial decommissioning,
c) complete decommissioning.

Time required for execution and level of complexity of decommissioning works might vary depending on the type of work. Considering that the decommissioning of the nuclear power plant will take place a long time (over 70 years) from the moment the EIA procedure for the construction and operations of the said plant, it is not possible to provide accurate information on the technology and decommissioning procedures that might be subject to environmental impact assessment at the present stage. For this reason, the decommissioning process will be subject to a separate EIA procedure and covered by a separate Environmental Permit issued in compliance with regulations in force at that time and prior to the issuance of a decommissioning permit for the nuclear facility.

5.5 Associated Infrastructure – projects not covered by the procedure

Apart from the nuclear power plant itself, separate projects that might be executed in close relation to the execution of the first Polish NPP build Project have been identified. As provided for in the Investment Act, they might be classified, upon request by the Investor, as associated investments by the minister in charge of the economy. In accordance with the Investment Act, **associated investment is an investment in a construction and/or expansion of transmission system, as specified in Article 3, point 11a of Energy Law from April 10th, 1997, necessary to evacuate power from a nuclear power plant or any other investment necessary to construct or ensure proper operations of a nuclear power facility.**

The Investor might submit a request to have the projects listed below classified as associated investments (not all projects listed will be executed by PGE EJ 1 sp. z o.o). In case any specific project is granted the status of an associated investment, its execution will have to be preceded by issuance of an Environmental Permit in accordance with art. 72, para 1, point 18a Uooś.

In case the status of an associated investment is not granted to the specific project, this project will be subject to general classification applicable to the environmental impact assessment.

5.5.1 Construction and development of transmission lines

The Construction of nuclear power plants is closely interlinked with the need to construct and develop transmission lines that serve not only to evacuate power from a nuclear power plant but also to supply the NPP with AC power at the NPP construction stage and later, as reserve power supply during NPP operation.

The Investor has not yet obtained the definition of requirements that must be met to connect the construction site or the plant to the National Power System (NPS). At this stage it is impossible to define elements and parameters for the connection infrastructure. For this reason, the extra high voltage network (EHV) that constitutes external infrastructure allowing for plant connection will be subject to separate proceedings aiming at the issuance of the Environmental Permit.

Power evacuation from the plant will be executed with the use of 400 kV transmission line over 15 km in length. In accordance with the EIA Regulation "transmission stations or overhead transmission lines of no less than 220 kV maximum voltage and no less than 15 km in length" are classified as projects that might always significantly impact the environment, which entails that EIA procedure and development of EIA Report are in their case mandatory.

In the EIA Report for the proceedings in question all possible variants for connecting infrastructure corridors will be described, potential sites for NPS connection will be indicates and an analysis of a cumulative environmental impact for both investments in all listed variants will be included. In the Environmental Permit for the nuclear plant a specific connection variant must not be included as the connecting infrastructure for this NPP will be subject of a separate procedure aiming at the receipt of a separate Environmental Permit once the requirements for grid connection are defined.

As of today it is also impossible to define the final width for the infrastructure corridors since depending on the nuclear technology selected it might be necessary to use four, six or even eight power lines for the unit as well as from two up to eight AC supply power lines. Considering it is possible that double-circuit power lines will be used, the technical corridor might be between 250m to 400m wide. Regardless of the width, the impact from the electromagnetic field outside of the technical corridor will not exceed the accepted level. Electric field strength [2]will be less than 1 kv/m and magnetic field strength will be less than 60 A/m.

Once the grid connection requirements are defined, the Investor will apply for the Environmental Permit encompassing the entire external connector. The cumulative impact from the connection and the facility will be described and assessed in the EIA Report. Environmental Permit for the plant will be attached to the application for issuing this decision.

5.5.2 Other associated investments

Associated investments are required to appropriately service the subsequent stages of the NPP construction and operations. However, they do not influence directly execution of the plant's

[2]Regulation of the Minister of the Environment of 30 October on acceptable levels of electromagnetic fields in the environment and methods of maintaining these levels (J.o.L.of 2003, issue 192, item 1883).

technical function, which is generation of electrical power. They are, undoubtedly, related to the NPP construction and operations but can be developed separately, in a different time frame, by different entities. For this reason they are not subject of this Environmental Scoping Report. Depending on the location and technology selected, the associated infrastructure can be composed of the following elements taking place outside of the NPP site (external infrastructure):

a. Marine transport infrastructure

This kind of infrastructure is required to transport large volumes of bulk materials, large size and heavy load equipment elements that cannot be transported via roads or railway due to limitations binding land transportation routes.

b. Road and rail transport infrastructure

Road and railroad transport infrastructure will be a basic way to transport construction materials, equipment and employees onto the NPP site. Some elements of infrastructure will have to be built from scratch, some will require refurbishment and some modernization.

c. Air transport infrastructure

There might be the need to construct an airfield to be used by helicopters or a need to modernize one of the airfields that already exist in the voivodeship may arise, among others, to meet the needs of paramedics.

d. Water supply, effluent and sewage infrastructure

Depending on the location, supplying water for general use to the site at the construction and operations stage might require new water intake structures be constructed, the existing ones – refurbished and water pipe network established. The Investment might also require that water treatment infrastructure in the given commune be modernised.

e. Welfare and accommodation facilities for the permanent staff and temporary workers, training facilities and offices, together with electricity, heat, water supply and sewage systems

Large number of employees contributing to the construction and operations of the nuclear power plant will translate into the need to organise welfare and accommodation facilities for them. Also the construction of training and education facilities will be necessary. Size, location and form of this infrastructure will depend, among others, on the occupancy rate in the existing accommodation facilities and centers as well as on the location and technology selected. Execution of the investment might require construction of additional office space, outside of the location itself. Size, location and form of this infrastructure will depend, among others, on the occupancy rate in the office facilities and buildings already present in the region and the selected location.

f. Cable and wireless connections

Execution of the investment will require development of the telecommunications infrastructure so as to enable access to broadband connection and services at the construction and operations stage and to meet the needs of the emergency and general communications.

Apart from the technical infrastructure elements listed above, activities related to the development of the organization as such must also be undertaken. This will translate into the development of appropriate procedures, plans, process flowcharts as well as conclusion of relevant agreements with the stakeholders. Organization development will encompass, among others:

a) development of the safety and physical security system,
b) development of fire protection system and organizing the medical assistance system;
c) development of public transportation system,
d) development of the system for early detection of radioactive releases,
e) development of fuel and technical gases supply system.

All of the elements listed above, constituting the associated infrastructure that will be considered a project in the light of the Uooś and the EIA Regulation will be subject of separate proceedings aiming at the receipt of relevant environmental permits once the final decision on location variant for the nuclear power plant is made and upon technology selection. These two factors will allow to define the scope of necessary works and their parameters.

5.5.3 External infrastructure for radioactive waste management

In the course of NPP operations radioactive waste will be produced. It will be low- and intermediate-level radioactive waste, but also high-level waste in the form of spent nuclear fuel.

Radioactive waste management for waste produced in the course of NPP operations will be performed in compliance with the recommendations of the International Commission on Radiation Protection (ICRP), Basic Safety Standards (BSS) issued by the EU (Directive 2013/59/Euratom[3]) and the International Atomic Energy Agency, Directive 2011/70/Euratom [4], in accordance with the principles outlined in the National Plan for Radioactive Waste and Spent Fuel Management (NpfRWaSFM) that is being developed by the minister in charge of economy and in accordance with the law in force in Poland (the Atomic Law act and relevant secondary legislation attached thereto).

During NPP operations, nuclear waste produced in the course of energy generation process will be temporarily stored and gradually recycled in the facility. In the course of NPP operations and after the facility goes offline, the waste will be sent to the National Radioactive Waste Repository (the case of llw and ilw) and to the geological repository where high-level waste that is the spent nuclear fuel will be stored. The construction of these repositories is not covered by the scope of the first Polish NPP build project. They are treated as separate projects. The plans, projections and guidelines pertaining to their construction have been included in the NpfRWaSFM that the Ministry of Economy is responsible for.

[3]Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom (OJ of EU L.2014.13.1){3]

[4]Council Directive 2011/70/Euratom of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste (OJ L 199, 2.8.2011, p. 48–56)

NpfRWaSFM has been subject of the Strategic Environmental Impact Assessment of its own. The plan outlines actions and activities that allow for responsible and safe management of radioactive waste and spent nuclear fuel, including activities to be undertaken by the first Polish NPP.

Other activities related to the nuclear waste management are executed with the use of and within the framework of facilities and infrastructure developed under the NPP build project.

In accordance with § 2, para 1, point 8 of the EIA Regulation, projects that might always significantly impact the environment include installations related to dealing with nuclear fuel or radioactive waste:

(…),
b) to recycle spent nuclear or high level radioactive waste,
(...),
e) exclusively for the storage of the spent nuclear fuel or radioactive waste in a place different than the facility where they were produced and for a period longer than 10 years.

In accordance with § 3, para 1, point 9 of the EIA Regulation, installations related to radioactive waste processing or storage other than listed in § 2 para. 1, point 8, letter b) and e) belong to the category of projects that might significantly impact the environment.

5.6 Body in charge of issuing the decision on environmental conditions

In line with art.75, para 1a Uooś, General Director for Environmental Protection (GDOŚ) is the authority responsible for issuing the environmental permits for the construction of a nuclear facility and associated investments executed on the basis of the Investment Act.

5.7 EIA proceedings

Environmental impact assessment procedure encompasses, in particular, the following:
- verification of the Environmental Impact Assessment Report,
- obtaining all opinions and decisions required,
- ensuring public participation in the proceedings.

Environmental impact assessment constitutes part of proceedings aiming at the issuance of Environmental Permit and is carried out by the authority in charge of issuing this decision. In line with the Investment Act, the Investor is required to receive Environmental Permit before the decision on determination of the site for the investment in a construction of a nuclear power plant is issued.

The proceedings aiming at the issuance of the decision on environmental conditions are launched upon request by the entity planning to execute the investment. In the case of projects that are always likely to exert a transboundary environmental impact, the investor may attach to the application for decision on environmental conditions an environmental scoping report, together with a request for definition of the scope of the EIA report, instead of the EIA report itself. Proceedings related to transboundary environmental impact assessment are run by GDOŚ when they confirm the possibility for a significant transboundary environmental impact coming from the territory of the Republic of Poland and resulting from the execution of the planned investment.

In the light of the Espoo Convention on environmental impact assessments in the transboundary context, for the purpose of ensuring adequate and effective consultations under Article 5, the Party of origin[5]shall notify any Party which it considers may be an affected Party[6] as early as possible and no later than when informing its own public about the proposed activity. Documentation of the environmental impact assessment to be submitted to the relevant authority of the Party of origin, should contain at least the information listed in the Appendix II to the Convention. In compliance with the Convention, final decision on the planned activity should take into consideration the results of the environmental impact assessment, together with the documentation of the environmental impact assessment, as well as comments by the public opinion of the Party that may be affected from the territory that may be affected and regarding, among others, potential transboundary impact from the planned activity and methods for mitigation and elimination of this adverse impact.

General Director for Environmental Protection defines the scope for the report by issuing a decision. Decision is issued upon consulting with the relevant organ of Państwowa Inspekcja Sanitarna (National Sanitary Inspectorate) (in case of a nuclear power plant this relevant organ is Państwowy Wojewódzki Inspektor Sanitarny – the National Sanitary Inspector for the Voivodeship), while in the case of projects executed offshore, upon consulting with the Director of the Maritime Office.

The decision mentioned above cannot be appealed.

Until submission of the EIA Report by the applicant, the proceedings related to issuance of the Environmental Permit are suspended. Upon submission of the Environmental Impact Assessment Report by the applicant, the proceedings are launched.

It is the duty of the relevant authority responsible for the issuance of the Environmental Permit to ensure general public has the possibility to participate in the proceedings. Public participation is ensured by the release of public information on the proceedings, public consultations related thereto and possibility to have the relevant body organize an administrative session that is open to the public.

Before the Environmental Permit for project to be executed offshore is issued, GDOŚ agrees on the requirements for project execution with the Director of the Maritime Office. GDOŚ also consults with Państwowy Wojewódzki Inspektor Sanitarny (the National Sanitary Inspector for the Voivodeship) as well as with the President of the Polish Atomic Agency by sending them draft decision and application for the permit with all documents attached thereto.

GDOŚ issues the Environmental Permit, taking into consideration:

1. results of consultations and opinions by relevant authorities, in compliance with art. 77 Uooś;
2. conclusions included in the EIA Report for the project;

[5]"Party of origin" means the Contracting Party or Parties to this Convention under whose jurisdiction a proposed activity is envisaged to take place

[6]"Affected Party" means the Contracting Party or Parties to this Convention likely to be affected by the transboundary impact of a proposed activity.

3. results of the proceedings run with public participation;
4. results of the transboundary environmental impact proceedings, if relevant.

GDOŚ announces publicly the issuance of the Environmental Permit and informs of the possibility to get acquainted with its content and documentation of the proceedings.

Under the Environmental Permit issued upon closure of the EIA proceedings, the relevant authority imposes, among other things, the requirements to run the environmental impact assessment procedure within the framework of process aiming at issuance of the construction permit for a nuclear facility or an associated investment in compliance with the Investment Act. Additionally, the authority may impose the requirement to run the EIA procedure within the framework of the process aiming at issuance of the permit to conduct preparatory work issued in compliance with the Investment Act. Subsequent EIA encompasses:

- - verification of the Environmental Impact Assessment Report,
- receipt of opinions (by the Director of the Maritime Office for an offshore project and of the National Sanitary Inspectorate) required by laws in force,
- running the public consultations procedure,
- running the transboundary environmental impact proceedings.

Upon conclusion of the subsequent EIA procedure, GDOŚ issues the decision regarding the requirements for project execution. The authority that issues the construction permit for a nuclear power plant takes into account the requirements for project execution embedded in the Environmental Permit and decision issued by GDOŚ mentioned above.

5.8 Schedule of the EIA proceedings

The flowchart presented below illustrated the schedule of the EIA proceedings as planned at the present stage of the project. Those stages of the EIA process where public consultations are planned are marked with the color red. It must be remembered that at the following stages:

- development of the Environmental Scoping Report,
- environmental characterisation executed on the basis of environmental surveys,
- development of the detailed concept for the Project

the consultations will be informal in nature and organized within the framework of the public dialogue conducted by the Investor.

Public consultations in the EIA Report, before the EnvP is issued, will however be formal and they will be run by the authority in charge of issuing the permit.

The dates indicated below are only an approximate and can be modified due to circumstances not attributable to the Investor. Dates for all public consultations conducted under the EIA procedure will be announced by the Investor on their website www.swiadomieoatomie.pl.

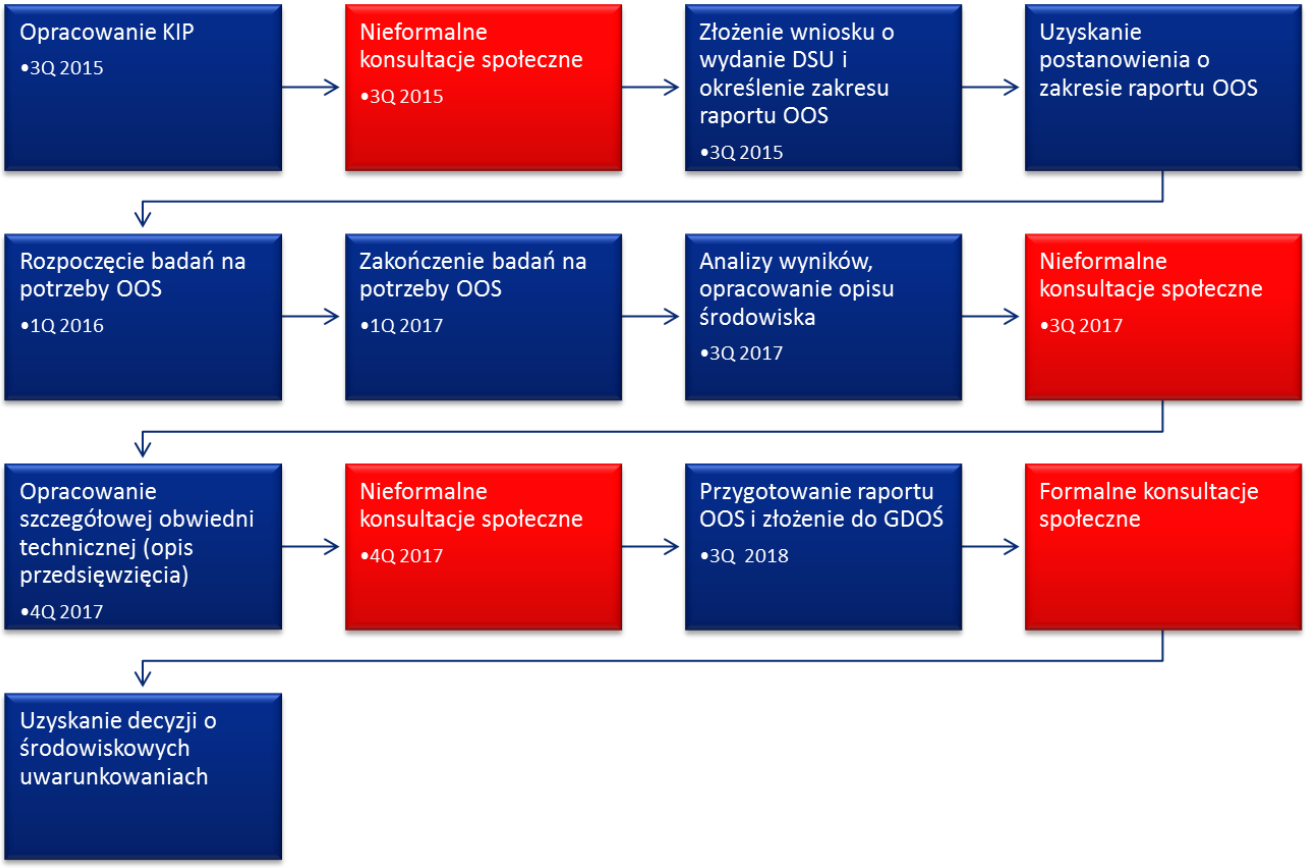


Figure 2. Schedule of the EIA proceedings

Source: In-house studies

Development of the Scoping Report 3Q 2015	Informal public consultation 3Q2015	Submitting the application for Environmental Decision, defining the scope of EIA Report 3Q2015	Decision received regarding the scope of EIA Report
EIA studies commence 1Q 2016	EIA studies completed 1Q 2017	Analysis of results, description of environmental conditions 3Q 2017	Informal public consultations 3Q 2017
Detailed technical bounding conditions developed (Project scope) 4Q 2017	Informal public consultations 4Q 2017	EIA Report developed and submitted with GDOŚ 3Q 2018	Formal public consultations
Issue of the Decision on Environmental Conditions			

6 Project description

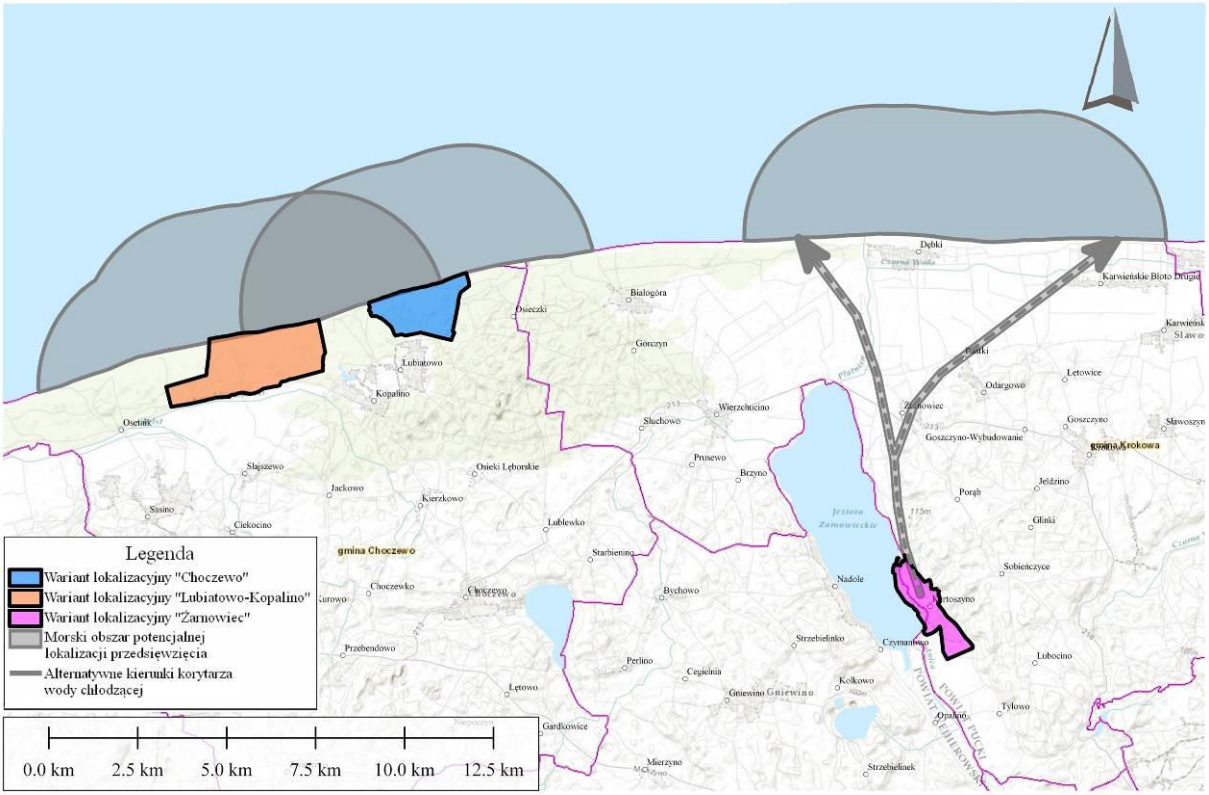
6.1 Scale and location of the project

Project consists in the construction and operation of a nuclear power plant of up to 3750 MWe capacity.

The project will be implemented in the area of the communes of Choczewo, or Gniewino and Krokowa communes, in the Pomeranian voivodship, at a location selected under the environmental impact assessment. In the said communes, at this stage, 3 location variants for the NPP are being considered that are subject to the EIA:

1) ‘Żarnowiec’,
2) ‘Choczewo’,
3) ‘Lubiatowo-Kopalino’.

The situation of the locations of the nuclear power plant in each of the variants is illustrated by Drawing 6. All the 3 locations are located in the northernmost parts of the Pomeranian voivodeship. Żarnowiec location is situated within ca 10 km from the Baltic Sea, whereas Choczewo and Lubiatowo-Kopalino are contiguous with the sea shore line. Attachments contain maps presenting the situation of each location.



Key
“Choczewo” location variant
“Lubiatowo-Kopalino” location variant
“Żarnowiec” location variant
Marine area of potential location
Alternative course of cooling water corridors

Figure 3. Situation of the considered first Polish nuclear power plant location variants

Source: In-house studies with use made of Esri data and OpenStreetMap data.

At this stage each of the locations under consideration as presented hereinabove is treated by the Investor equally. Indicating the variant selected for implementation shall take place during the procedure of project environmental impact assessment. The investor, after finalizing the analysis of environmental conditions, including the type and scale of Project impact on the environment and the community in the locations considered, and upon taking account of the technical, economic and organizational factors, will name the variant selected for realization in the EIA Report. The remaining locations currently under consideration may be included in the EIA Report as alternatives, provided the environmental impact assessment confirms they are rational options, with confirmed technical, economic, environmental and legal feasibility.

In the EIA Report there will be detailed boundaries of each location that may be subject to modifications following site characterization finalization through disclosing their geographic coordinates.

All the locations under consideration were subject to a multi-criteria analysis assessing the technical, environmental, social and economic possibilities of locating the nuclear power plant, as performed by the Company in the year 2011. All the locations were also indicated in the governmental document 'Nuclear Power Program for Poland' and thus were subject to the strategic environmental impact assessment.

6.2 Stages of the investment

The project may be delivered in stages, that said it has not been finally stipulated thus far how many reactors and with the use of what technology will be built at first stage and how many at the second stage and what the break period between the stages will be.

It needs underlining however that in the framework of the proceedings, the environmental decision application encompasses the Project of parameters encompassing all the would-be stages jointly, and the project parameters as described in ESR encompass the scenario of complete delivery of all would-be stages.

The consequences of the would-be stages of the Project will be subject to EIA and will be described in EIA Report. Particular stages will be specifically defined and characterized at the stage of construction design preparation, account taken of parameters as determined for the whole of the Project in the environmental decision issued and the decisions regarding construction permits for the subsequent stages will be obtained during its validity. Compliance of parameters and conditions of subsequent stages of the Project will be subject to verification within subsequent environmental impact assessment.

6.3 The required area

At this stage of Project preparation a farthest reaching scenario may be defined in the scope of area, which will be covered by the NPP in the event of applying a technological variant, which requires the largest area.

On the basis of analysis of the information about the technologies considered obtained from suppliers it has been established that in the farthest reaching scenario the following area is requisite for the Project to be implemented:

- up to 1.2 km^2 (120 ha) – a power plant, including all the plant's buildings, cold stores, office buildings, parking lots, temporary spent fuel storage facility – situated inside the nuclear power plant area,
- up to 1.5 km^2 (150 ha) – the area of the Baltic Sea where, potentially, cooling water intake and discharge structures will be built,
- up to 0.6 km^2 (60 ha) – additional ground for the construction facilities,
- up to 0.9 km^2 (90 ha) for Żarnowiec location or 0.1 km^2 (10 ha) for Choczewo location and the Lubiatowo-Kopalino location variant – area for the infrastructure associated with intake
  and discharge of cooling water.

Currently, in particular location variants the following areas have been determined for realization of the Project:

1) Żarnowiec location – 2.12 km^2 (212 ha),
2) Choczewo location – 3.02 km^2 (302 ha),
3) Lubiatowo-Kopalino location – 5.90 km^2 (590 ha).

6.4 Technology types

Nuclear power plant generate electrical energy in a technological process wherein heat generated as a result of nuclear fission reaction is used to generate electrical energy resulting from energy transformations.

The heat generated in a reactor heats water causing it to boil in the reactor or outside it (in a steam generator) and transforms it into steam of defined enthalpy. Steam enthalpy is transformed into mechanical energy of circular motion in a turbine. Through a shaft the turbine transmits mechanical energy of circular motion to the generator, which the latter transforms into electrical energy. As a result, electrical energy is transmitted through a transformer augmenting voltage located on the plot of land of the power plant to national grid (KSE).

At this stage the Investor cannot indicate particular technology of nuclear reactors, which will be applied in the Project. The technology will be selected under the Integrated Proceedings which, in a single tendering procedure, will lead to the selection of the plant vendor, EPC contractor, fuel provider, provider of O&M services, a potential strategic partner or business partners providing equity as well as support in obtaining debt financing from export credit agencies as well as commercial banks.

The concept of Integrated Proceedings adopted by the Company in 2012 provides for 2 main phases:

- preliminary dialogue;
- competitive proceedings.

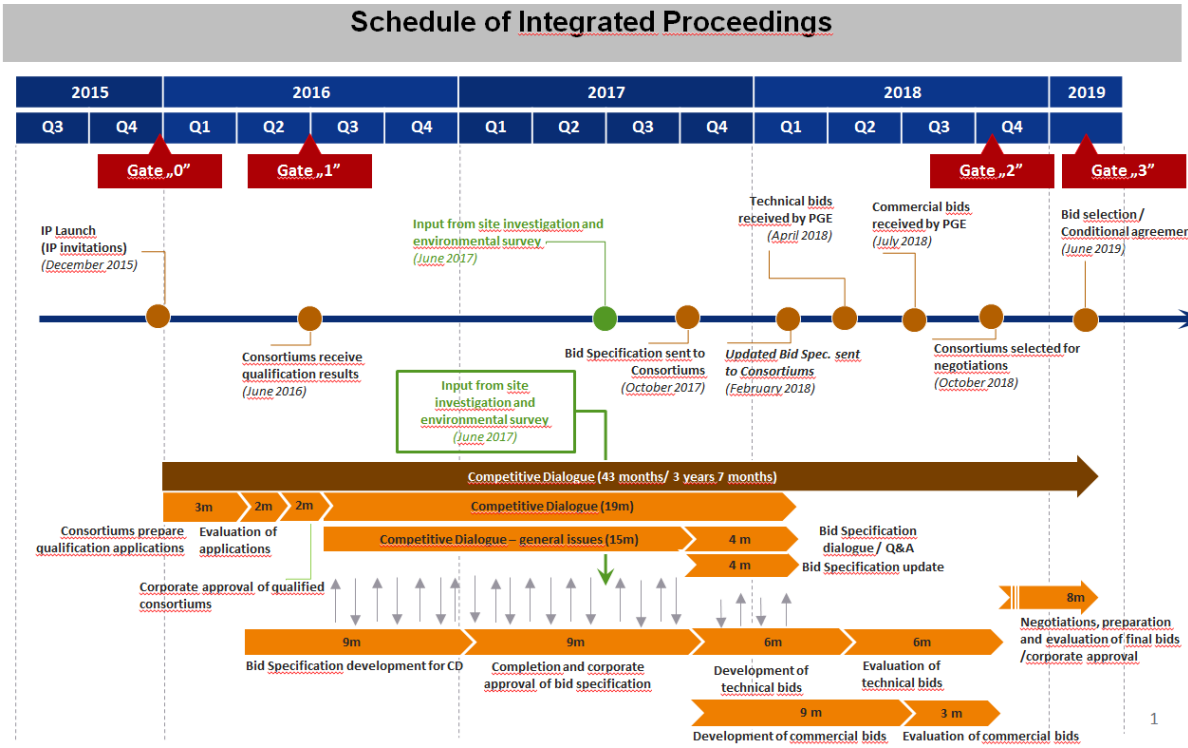
In 2013 there has been held a part of the meetings from preliminary dialogue phase with potential consortia – future participants of the integrated proceedings. Thematic scope of the meetings encompassed the issues related to reactor technology and EPC services, supplies of nuclear fuel, O&M of the NPP and regulatory matters pertaining to the formula of proceedings and agreements' structure. Experience of consortia in the scope of capital investment and project financing of the NPPs builds has also been discussed. Due to major significance of the last area in the overall proceedings, further sessions have been planned in that area for a discussion of the preliminary assumptions and expectations of PGE S.A.

Works also continued in 2014 on analyses and preliminary assumptions and expectations of PGE S.A. regarding capital engaged by the consortium and the related business, management and energy trading models. The materials prepared were presented to and discussed with potential consortia pending supplementary preliminary dialogue sessions held in February and March 2015. Ending preliminary dialogue meetings will enable drawing up a comprehensive summary and making a decision regarding the final shape, scope, approach and formula of the Integrated Proceedings, and by extension, constitutes a prerequisite for the later IP launch.

The launch of the competitive phase of the Integrated Proceedings is planned for the Q4 2015 and Q1 of 2016.

Integrated Proceedings will be conducted in compliance with the Code of Proceedings as developed by the Investor.

The key milestones within the framework of the IP have been presented in the Drawing below.



*Schedule is subject to further analysis and development in cooperation with Technical Advisor.

Figure 4. Integrated Proceedings Schedule and milestones.
Source: In-house studies

It should be underlined that an important input element to define detailed bid invitation specification for NPP vendors will constitute results of EIA as determined on the basis of environment study and potential impact analyses of particular technologies under consideration on the environment – the so-called 'environment envelope'.

In connection with the necessity to observe impartiality in the whole of the IP process, at this stage the Investor cannot indicate or describe in detail particular technological solutions which could point to specific suppliers' preferences. Therefore, the individual technologies are not regarded as technology variants where one is to be selected for execution and the others serve as alternatives, but the technologies are regarded as a set and a foundation of the envelope of bounding technical conditions. BCE, describing the parameters of the farthest reaching technological scenarios, namely such that may cause the most significant impact on specific environment elements, will be subject of the EIA. Conclusions from the assessment performed will, in turn, indicate thresholds of the environmental sensitivity for particular kinds of impacts and define on their basis permissible specific parameters and/or emissions or disruptions that the planned Project may cause in the locations assessed.

At this stage the Investor takes into consideration 3 main nuclear reactor technology types, which were described in greater detail below.

6.4.1 Nuclear reactor types

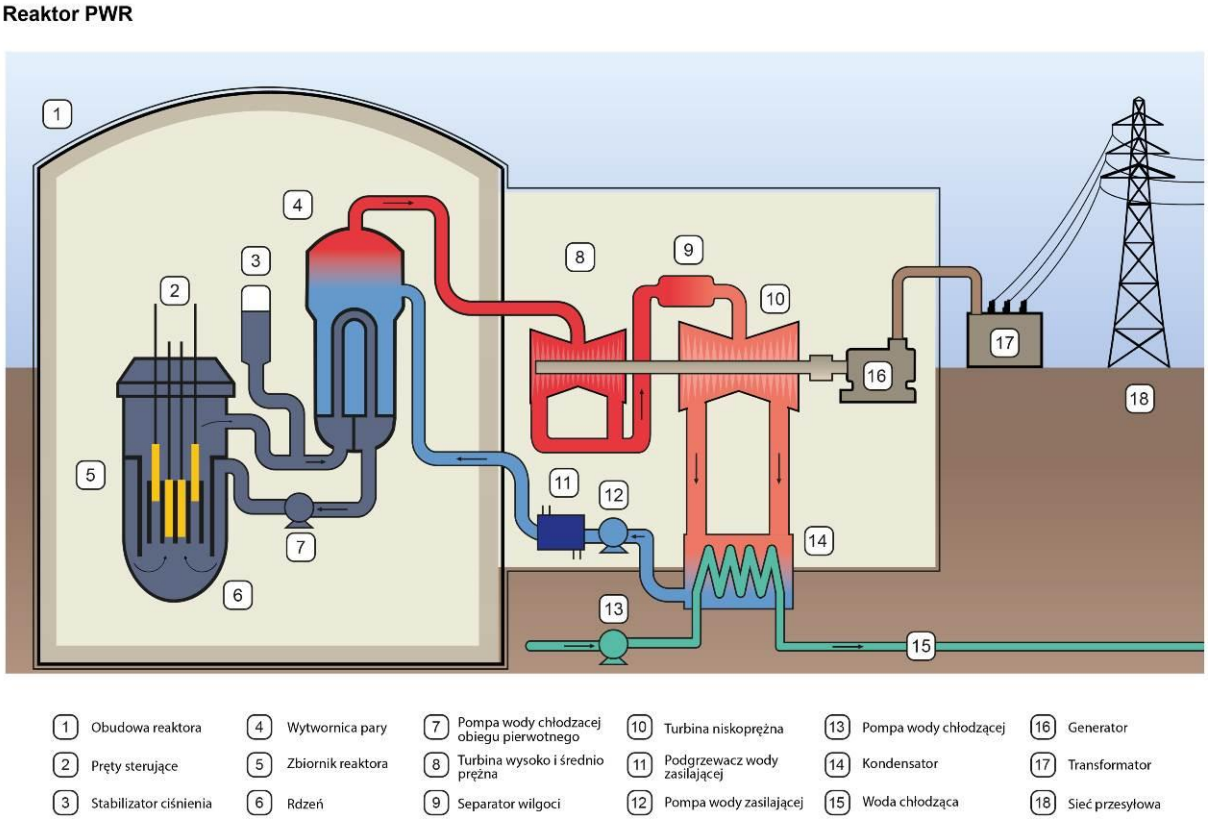
Currently, there are a couple of main nuclear reactor types available on the market and a dozen or so of reactor models offered by various suppliers. On the basis of the conducted market analyses and results of the preliminary dialogue conducted within the framework of the IP, the Investor is considering applying one of the technological variants presented below (nuclear reactors' technology types).

6.4.1.1 PWR (Pressurized Water Reactor)

A tank-type reactor, cooled and moderated with light water and using low-enriched fuel (3-5% U-235), which heats water to 300 - 330 degrees Celsius but prevents it from boiling by maintaining high pressure (over 15 MPa). The steam needed to power the turbines is produced in steam generators, on the border of two water cycles – primary (water under high pressure circulates through the reactor core receiving heat) and secondary (water turns to steam inside the steam generator and the steam is used to power the turbines). The steam generator allows for heat exchange between the primary and secondary cycle.

Three to four loops are typically installed for the primary and secondary cycle (i.e. each loop is a set of piping comprising primary cycle and secondary cycle). Units with PWR reactors installed also use pressurisers, which allow for the pressure in the primary cycle to be maintained at a desired, pre-set level. A single pressuriser serves the entire primary cycle. Contaminated water only circulates inside

the primary cycle and never leaves the reactor building. Nuclear fuel is replaced during reactor shutdowns. Safety and control rods used for start-up and shutdown of the reactor as well as for controlling power levels are inserted from above.



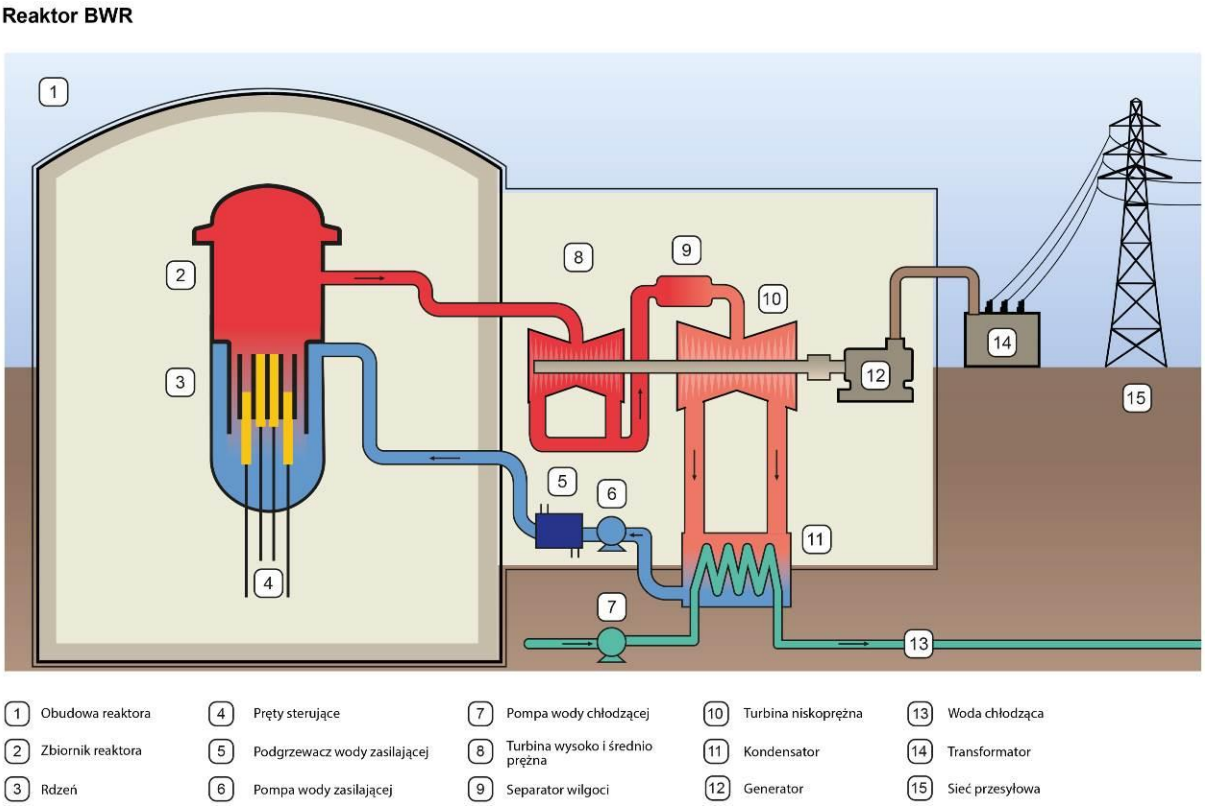
PWR Reactor				
1 Containment structure	5 Reactor vessel	9 Moisture separator	13 Tertiary water pump	17 Transformer
2 Control rods	6 Reactor core	10 LP turbine	14 Condenser	18 Grid
3 Pressurizer	7 Primary circuit pump	11 Secondary pre-warmer	15 Tertiary cooling water	
4 Steam generator	8 HP and IP turbine	12 Secondary pump	16 Generator	

Figure 5. Diagram of a PWR reactor
Source: In-house studies

6.4.1.2 BWR (Boiling Water Reactor)

A tank-type reactor, cooled and moderated with light water and using low-enriched fuel (3-5% U-235). Water evaporates inside the reactor (not in a steam generator, as in a pressurised water reactor). Steam then passes to the turbine directly.

For this reason there only is one cooling cycle (except for the cooling system of the turbine condenser). Nuclear fuel is replaced during reactor shutdowns. Safety and control rods are inserted from the bottom of the reactor vessel.



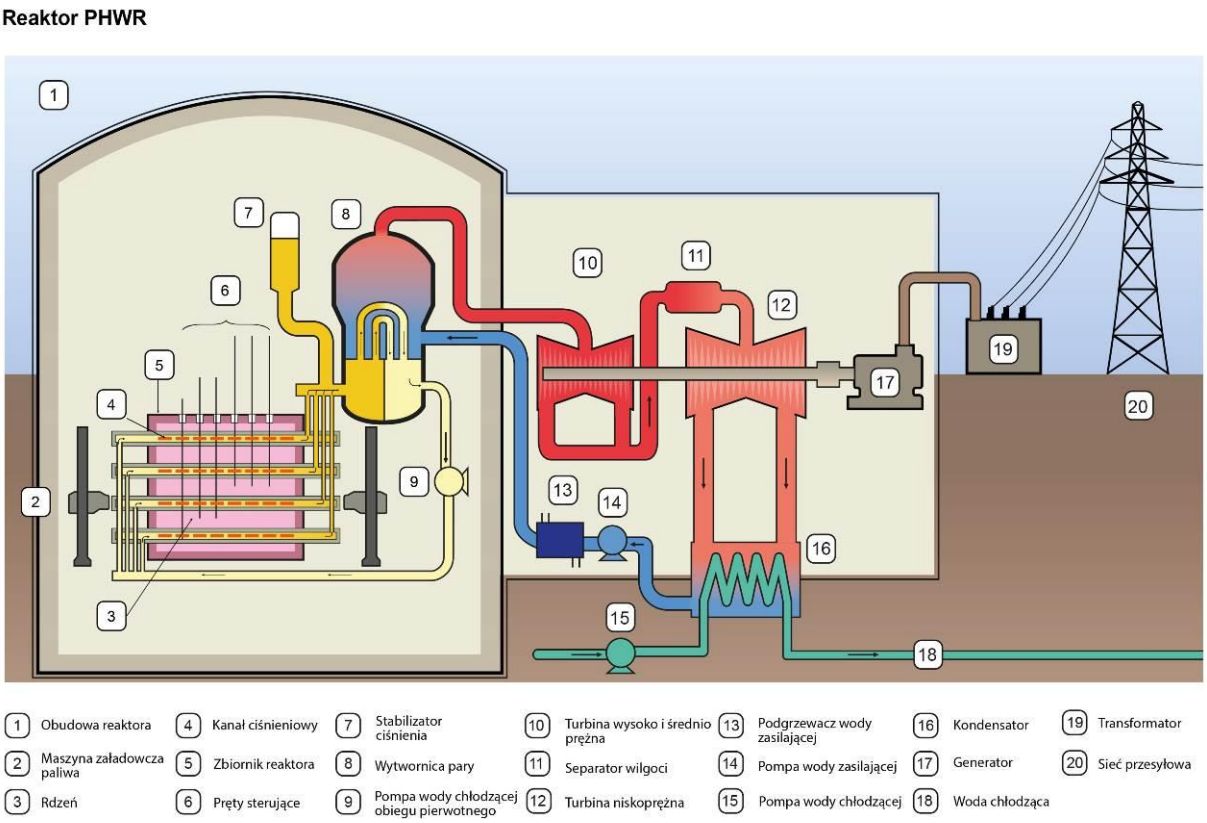
BWR Reactor				
1 Containment structure	4 Control rods	7 Secondary pump	10 LP turbine	13 Cooling water
2 Reactor vessel	5 Primary pre-warmer	8 HP and IP turbine	11 Condenser	14 Transformer
3 Reactor core	6 Primary pump	9 Moisture separator	12 Generator	15 Grid

Figure 6. Diagram of a BWR reactor
Source: In-house studies

6.4.1.3 PHWR (Pressurized Heavy Water Reactor)

A tank-type channel reactor, cooled and moderated with heavy water (D_2O), and using fuel based on natural uranium (0.7% U-235) or low-enriched uranium. As in PWR the water circulates in two cycles – primary (heavy water) and secondary (light water). Steam generators function as heat exchangers.

Heavy water is a better moderator than light water, therefore there is no need for enriched uranium and the fuel can be based on natural or low-enriched uranium. Fuel assemblies are situated in horizontal channels inside the vessel. Fuel assemblies can be replaced in the channels while the reactor is in operation.



PHWR Reactor				
1 Containment structure	5 Calandria	9 Primary pump	13 Secondary pre-warmer	17 Generator
2 Fuel loading drive	6 Control rods	10 HP and IP turbine	14 Secondary pump	18 Cooling water
3 Reactor core	7 Pressurizer	11 Moisture separator	15 Tertiary pump	19 Transformer
4 Pressure tube	8 Steam generator	12 LP turbine	16 Condenser	20 Grid

Figure 7. Diagram of a PHWR reactor
Source: In-house studies

6.4.2 Cooling systems technology

The power plant will be cooled with water. Two cooling systems are under consideration: a direct 'open' system and an indirect 'recirculating' system, discussed in more detail in Section 7.2. Cooling water is necessary to regulate the temperature of the reactor and ensure a difference in temperature required for the condenser. ESR does not present requirements related to cooling water for any given location or reactor technology since such issues will be the subject of a separate, expert analysis at the EIA stage and its results will be included in the EIA Report. Values stated in ESR [7]are estimated only and may be subject to major deviations.

Dry-cooling systems or systems using air and other gases are not taken into consideration.

[7]Figures and data presented in this section are based on http://www.world-nuclear.org/info/Current-and-Future-Generation/Cooling-Power-Plants/

During normal operation as well as emergency conditions additional heat load comes from components related to safety features that need to be cooled. Heat from such components is received by water from the indirect component cooling cycle (CCW) and/or essential service water system (ESWS). The components include:

- residual heat removal heat exchangers – used for cooling the reactor during shutdown or following an emergency,
- heat exchangers for cooling system of the spent fuel storage pool – used for transferring the heat from the spent fuel pool to the heat sink during normal operation and following an emergency,
- cooling of key components, e.g. main circulation pumps during normal operation and following emergencies; cooling technical components of safety systems, coolant injection systems and emergency injection systems in emergency conditions,
- cooling units and ventilation radiators servicing key locations, e.g. main control room, containment and other areas with key safety components, especially electric devices, which must remain in operation to keep the temperatures in such areas within the range required by the components working in such locations.

Requirements in terms of cooling the key safety components differ in relation to operation parameters of the power plant. Based on the data available from the vendors, heat load in normal operations can be set in the approximate range of 30 to 40 MWt per unit. Such heat load increases significantly during shutdown or cooling of a unit. In accordance with the reactor technology data presented to US NCR in the design control documentation (DCD), the heat load during reactor shutdown and cooling ranges from 60 to 120 MWt per unit depending on the number of multiple safety lines (channels) and the availability of external power supply.

Generation III/III+ nuclear plants use more passive cooling systems for design basis accidents and design extension conditions. Based on standard documentation of the vendors it is assumed herein that the maximum heat load of the safety components is observed during standard shutdown and is lower than or equal to the heat load during design basis accidents or design extension conditions in Gen III/III+ reactor technologies.

6.4.3 Emergency cooling systems

For simplicity all cooling requirements related to safety and discussed in this document, serviced by the CCW system or the ESWS system, are referred to as emergency cooling.

Emergency cooling may be provided by an open cooling system (OCS) or a closed cooling system (CCS). CCS may be configured with a cooling tower or a cooling lake as the ultimate heat sink.

Demand for emergency cooling water is regarded in this document separately from the demand for standard cooling water (Table 5). In actual operation of a nuclear power plant the volumes of standard cooling and emergency cooling are not added. As an example standard cooling systems in normal operation of a power plant are typically used early in the process of cooling the plant, before transferring residual heat to emergency cooling systems at a later stage. The conceptual design of emergency cooling assumes maximum intake of cooling water, discharge and consumption of water

as conservative assumptions to establish the demand for cooling water, the dimensions of components, to assess various options of emergency cooling and their costs.

In the assessment of the total intake, discharge and consumption of cooling water from emergency cooling systems a conservative assumption is made that all units require cooling simultaneously. Such assumptions give the maximum demand for water from emergency cooling systems. Such scenario is possible for example in the case of extreme natural threats requiring a shutdown of the plant, a complete loss of power from external sources or by decision of supervisory bodies.

In the course of normal operation of the plant emergency cooling is provided for basic components which are normally required to remain in operation. As was already mentioned, in the case of the considered reactors and in normal operating conditions the received heat falls between 30 and 40 MWt. Heat load increases significantly during shutdown and cooling mode and may reach from 60 to 120 MWt per unit.

Therefore, to ensure proper cooling the emergency cooling system requires the supply of 1 m^3/s to 2,5 m^3/s per unit in normal operation. When in cooling mode the flow to the unit will be increased up to 1,5–4 m^3/s, depending on the type of reactor and the use of OCS or CCS.

6.4.4 Spent nuclear fuel storage and other internal infrastructure for radioactive waste management

On the basis of data from other NPP operators it is assumed that in the foreseen period of operation i.e. 60 years for a plant of 3 500 MWe the volume of

- spent fuel will reach around 4 350 m^3,
- around 31 150 m^3 of short lived, low- and mid-level waste (including 25 900 m^3 low- and 5 250 m^3 mid-level waste).

The actual volume of low- and mid-level waste and spent nuclear fuel will be known upon selection of the technology and submission by the future plant vendor of data regarding the volume of radioactive waste and spent fuel generated during operation of the plant.

Once a specific nuclear technology is selected, detailed solutions related to management of radioactive waste will be designed in line with applicable regulations, standards and best international practice.

The Investor and future operator of the nuclear power plant will be responsible for the design and operation of the nuclear plant in a manner accounting for possible reduction of the volume of generated radioactive waste, the methods of its storage, processing and transportation as well as qualification of waste into categories in line with criteria set in appropriate regulations. Radioactive waste generated by the nuclear power plant will be stored in compliance with provisions of the law and in a manner ensuring the protection of the public and the environment from ionizing radiation in normal conditions as well as in hazardous situations, preventing the waste from release, spillage or leaks.

The storage tank or facility for medium and low-activity materials, located within the plant area, has sufficient capacity to store processed and non-processed radioactive waste generated in the operation of the plant over a period of time sufficient for their processing and arrangements for transportation.

The spent fuel storage created as part of the plant will serve as temporary storage of spent nuclear fuel until its future removal for deep storage in a repository or for reprocessing. Spent fuel – unless processed otherwise, spent fuel is moved to temporary storage where it may stay for a period of 40-60 years. Depending on the selected technology both wet and dry storage is possible. Temporary storage is planned with a capacity sufficient for the fuel spent over the entire operation period of the plant, i.e. 60 years.

The EIA Report will include detailed description and assessment of the radioactive waste management system in terms of environmental impact and effects of human health.

Further handling of spent fuel will by conducted in compliance with the National Plan for Radioactive Waste and Spent Fuel Management.

7 Project variants under consideration

Variants of the Project refer mainly to the selection of one of the three possible locations of a nuclear power plant. The choice is preceded by studies and analyses of environmental impact relevant to a number of technological solutions for the plant, including the type of cooling as well as selection of variants for associated infrastructure.

Under the environmental protection law (Uooś), the assessment also covers the 'zero variant'. The analysis of the zero variant aims at showing the environmental consequences in case of non-execution of the project. Therefore, it offers a baseline for the assessment of potential major impacts related to the execution of the project in the considered variants.

The assessment of environmental impact of non-execution of the project covers the effects present in both the micro and macro scale.

Non-execution of the project, i.e. the above zero variant, will bring no change to the environment at local and regional level, with the assumption there is no other alternative development for the energy sector and no social or economic development in the analyzed area.

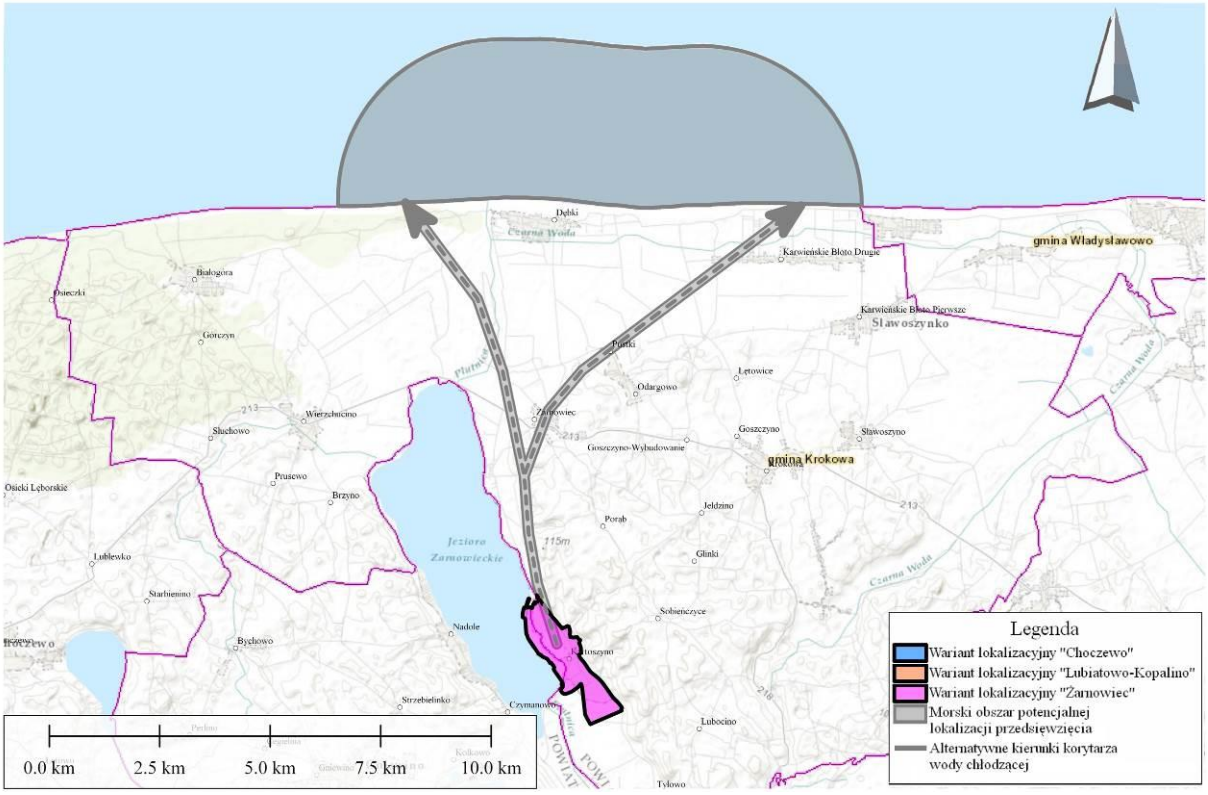
In terms of macro-scale effects, non-execution of the project will have adverse effect on curbing the emission of green-house gases in Poland, which – together with other Member States, is bound to reduce the emissions under climate policy of the EU (the issue is discussed further in Section 3).

7.1 NPP location variants

As indicated in section 6.1 above, there are currently three location variants under consideration:

1) Żarnowiec Location

Żarnowiec location is situated at the bank of Żarnowiec Lake, a lake within a deep glacial tunnel valley. The site belongs to two local communes: Gniewino (Wejherowo poviat) and Krokowa (Puck poviat). A detailed map of the Żarnowiec location is presented in Attachment 2, with a detailed description in section 12.

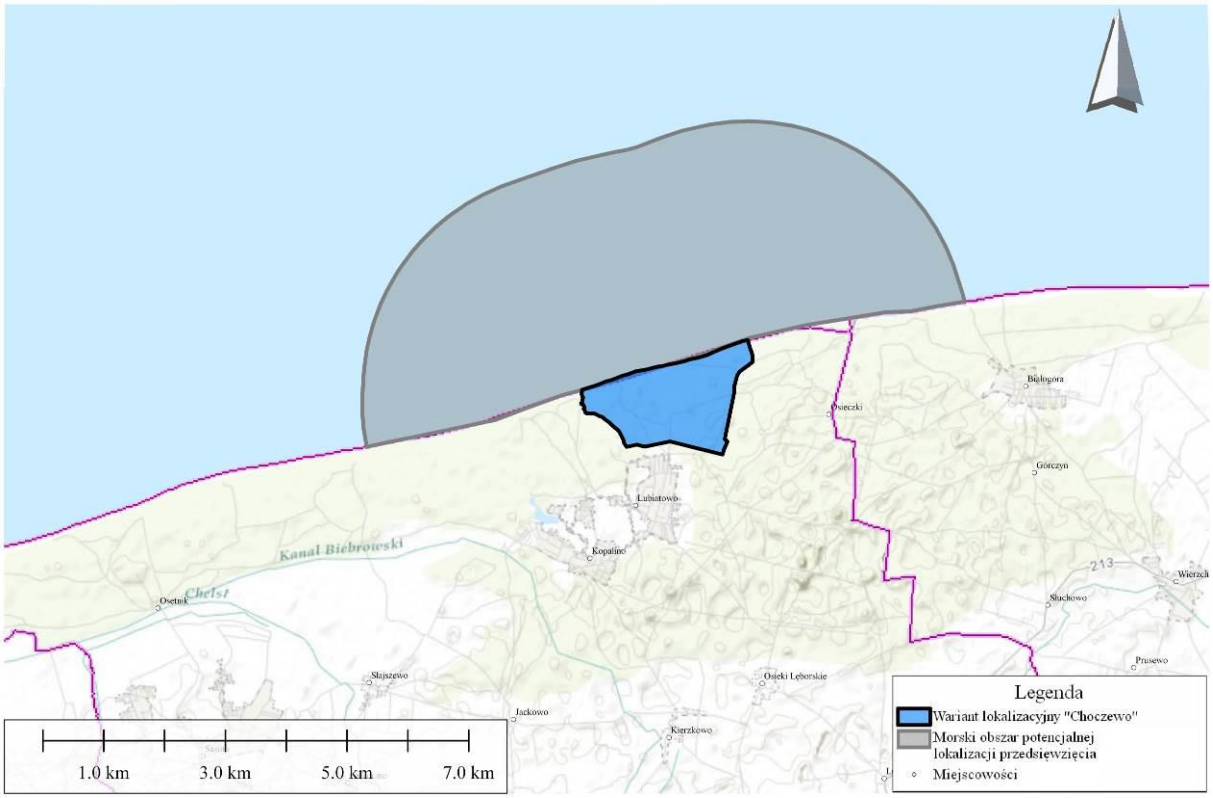


Key
“Choczewo” location variant
“Lubiatowo-Kopalino” location variant
“Żarnowiec” location variant
Marine area of potential location
Alternative course of cooling water corridors

Figure 8. Żarnowiec Location
Source: In-house studies with use made of Esri data and OpenStreetMap data.

2) Choczewo Location

The Choczewo location is situated directly on the Baltic coast, within a belt of coastline dunes. The area is located in the north-east of the Choczewo commune. A detailed map of the Choczewo location is presented in Attachment 3, with a detailed description in section 12.



Key
“Choczewo” location variant
Marine area of potential location
Villages

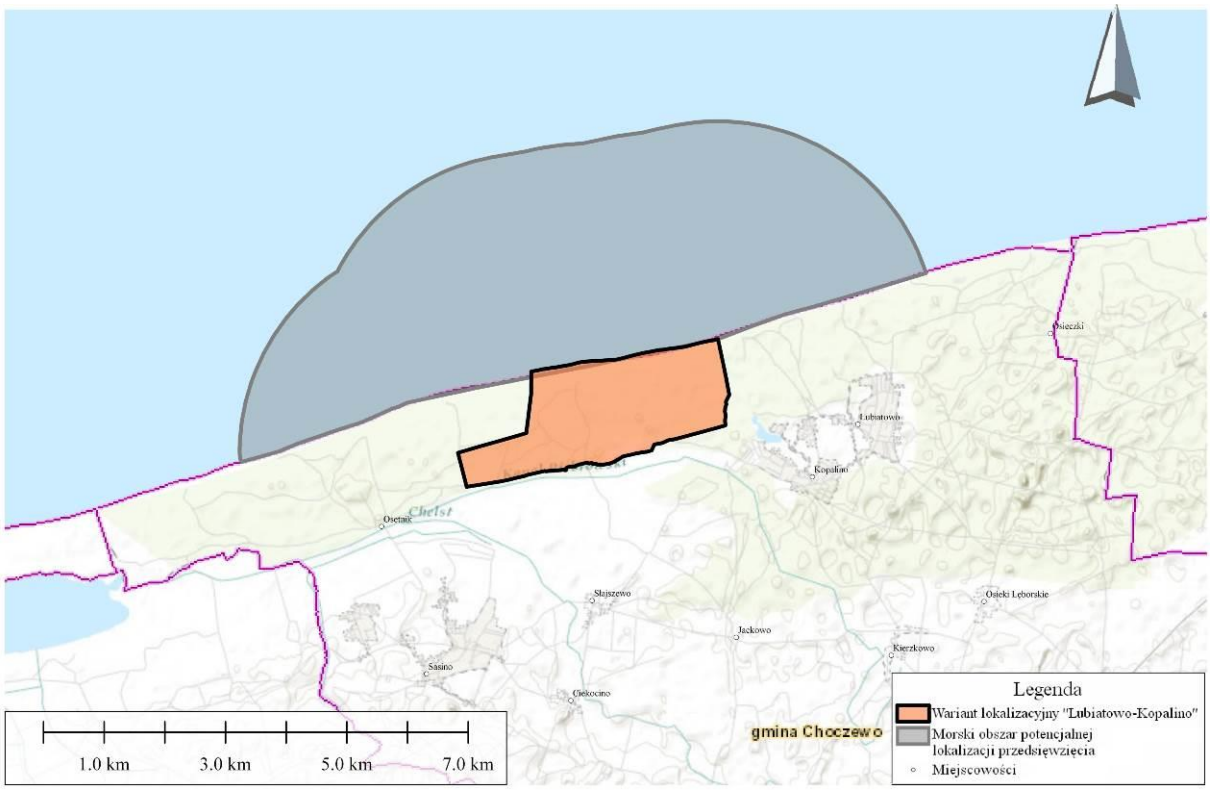
Figure 9. Choczewo Location
Source: In-house studies with use made of Esri data and OpenStreetMap data.

3) ‘Lubiatowo-Kopalino’.

The Lubiatowo-Kopalino location, similarly to Choczewo, is situated directly on the Baltic coast, at the northern end of the Choczewo commune, within a belt of coastline dunes. A detailed map of the Żarnowiec location is presented in Attachment 4, with a detailed description in section 12.

The final decision on the location of the nuclear power plant will largely depend on the potential environmental impacts, which will be verified and assessed in detail during this procedure on the environmental decision issue. In the assessment of individual variants of the Project, their technical and economic aspects will also be considered.

The preferred location of the NPP will be recommended in the EIA Report as the variant selected for execution, while detailed rationale will include the results of comparison of impacts of the individual location variants on the environment. The remaining variants may be included in the EIA Report as alternatives, unless a fatal flaw is identified excluding the execution of the project in a given location.



Key
“Lubiatowo-Kopalino” location variant
Marine area of potential location
Villages

Figure 10. Lubiatowo-Kopalino Location

Source: In-house studies with use made of Esri data and OpenStreetMap data.

As indicated in section 7, the choice of location for the Project will have a significant influence on the selection of reactor technology solutions, therefore its construction in the analysed location variants may result in a variety of environmental impacts.

In the case of the Choczewo and Lubiatowo-Kopalino locations directly adjoining the sea as a source of cooling water for the nuclear plant, the preferred solution is a once-through cooling system. In the case of the Żarnowiec location the distance from the sea (ca. 10 km) implies the need to construct a channel for intake and discharge of cooling water between the location and the Baltic sea, which in turn leads to the need of a closed cooling system.

In comparison to the closed system, a once-through cooling system may result in potentially higher impact on marine environment. This relates mainly to the significantly higher demand of cooling water and discharge of heated water back to the same basin. The operation of a once-through cooling system may therefore lead to such phenomena as impingement of small aquatic organisms in the cooling system or changes in their habitat resulting from local increase in water temperature. On the other hand it should also be noted that the operation of a once-through cooling system improves the energy efficiency of the power plant and thus reduces the use of nuclear fuel.

For the sake of comparison, the use of a closed cooling system requiring cooling towers will have a greater impact on the skyline of the area. On account of their size the cooling towers dominate over their surroundings and are visible from a considerable distance.

The impact on vegetation and landscape stemming from the construction of a nuclear power plant in Choczewo or Lubiatowo-Kopalino will differ from the same impact in Żarnowiec. The first two locations will require clearing of the local forest and levelling a considerable area of land. The location in Żarnowiec, although already largely altered by development, requires major demolition, which will intensify and prolong the construction works and lead to a greater impact of the Project on the environment during the construction stage. It is difficult to establish the environmental impact on the ecosystem of Żarnowieckie Lake cuased by major intrusion into the hydrogeological and geotechnical conditions existing since 1990s which would now be largely affected by the demolition of structures erected in the course of the former NPP build project.

Each of the variants may also affect the integrity and object of protection and object of protection of Natura 2000 sites. The location in the immediate vicinity, directly adjoining a Natura 2000 site is the Choczewo location (Białogóra Natura 2000 site). The Lubiatowo-Kopalino location is slightly farther, around 2-4 km from Natura 2000 site. The Żarnowiec location is the farthest from Natura 2000 sites (around 4-7 km), however the areas may be adjoining or lying directly in the path of cooling water corridors.

At present the possibility also exists that not all of the three locations listed in section 6.1 will be subjected to the full scope of analysis and environmental impact assessment. In the case a fatal flaw is discovered, a location may no longer be regarded as a rational alternative. In such case the EIA Report will include the result of such analysis as a rationale for withdrawal from full assessment of the environmental impact of such location variant.

The differences in the impact of the planned nuclear power plant is terms of selected locations listed above are only an example. A detailed impact assessment of the Project in the considered location variants will be conducted at the EIA stage.

The preferred location will be selected once a full set of studies is completed together with environmental impact assessment of each of the considered locations, that is during the preparation of the EIA Report and the first stage of analysis for the location permit. A proposed methodology for the environmental impact assessment is presented in detail in section 14.

7.2 Cooling technology options

Two basic cooling systems are currently considered: an open cooling system (OCS) and a closed cooling system (CCS), which may be operated with the reactor technologies under consideration, including PWR, BWR and PHWR. The choice of a given type of cooling system depends largely on the choice of location. Both systems are characterised below.

The choice of the cooling system will be discussed in detail together with the choice of reactor technology, as the topic of a separate study covering the location variants.

Cooling water is used in order to maintain sufficiently low temperature within turbine condensers, which is a key aspect of efficient generation of electricity.

7.2.1 Open cooling system

In an open cooling system the cooling water is obtained through an underground structure (channels) from a sufficiently large reservoir (lake or sea), pumped into the cooling system and discharged back into the same reservoir. Since the water leaving the installation is heated, it must be discharged at a sufficient distance from the intake point so that it may mix with the ambient waters in the area and so that heated water does not return at at the intake point.

Requirements towards an open cooling system limit the increase of temperature in the main condenser to 10^{o}C. The restriction is related to economic goals, as higher intake of water allowing for lower temperature and pressure in the condenser, increasing the overall efficiency of the plant. The 10°C restriction is also deemed appropriate to meet the condition related to maximum temperature of cooling water at discharge, which enables preventing efficiency loss due to high temperature of water taken in, which is common in the summer. A summary of needs regarding heat removal from the main condenser and intake of cooling water for open cooling system is provided below.

The use of seawater for cooling is beneficial due to its lower temperature (allowing for lower pressure in turbine condensers and higher efficiency of energy generation) as well as practical absence of: limits on cooling water and hydrothermal restrictions.

In the case of the Baltic sea the design of an open cooling system includes underground structures for water intake reaching 2-3,5 km into the sea, 10-15 m below the surface of the sea and with low velocity of water at intake to avoid impingement of fish and other marine organisms.

The pipeline discharging water may also reach 2-3,5 km into the sea, with discharge openings evenly spaced in a manner ensuring that water temperature and velocity at discharge comply with applicable regulations.

In the case of a nuclear power plant with total capacity of 3750 MWe the estimated consumption of cooling water at temperature increase of 10^{o}C falls between 124 m^{3}/s and 187 m^{3}/s.

In addition to the cooling of condensers cooling water is also required for components not related to safety, e.g. service water for TSW turbines (Turbine Service Water). The required flow was calculated on the basis of typical values for units of similar size and estimated as 5% of the required flow of the main condenser. Adding that value to the volume of water required for cooling the condensers, the total intake of cooling water by the plant can be estimated between 130 and 196 m^{3}/s.

7.2.2 Closed cooling system

The technologies of closed cooling systems fall in two categories:

- natural draft cooling system,
- forced draft cooling system,
- hybrid dry-wet cooling towers with fan-assisted draft.

The use of cooling towers allows for greater increase of temperature in the main condenser, set on the basis of efficiency of the cooling tower and the working range. Greater increase in temperature reduces the required flow of water, but also increases the working temperature and pressure of the condenser, leading to reduced overall efficiency of the plant compared to an open cooling system (OCS). The temperature of cooling water entering the main condenser, and consequently overall efficiency of the installation, is established on the basis of meteorological conditions for the specific location, efficiency of the cooling towers and difference of inlet/outlet temperature of the condenser.

The use of cooling towers to remove heat was assessed based on parameters of representative types of cooling towers in similar climate and environmental conditions. In order to estimate the use of cooling water it was assumed that the cooling tower operates at a typical range of 14.4^{o}C. Based on data provided from suppliers and available literature it was also assumed that in modern cooling towers with drift eliminators drift loss can be restricted to a negligible level of <0.001% of water volume in a tower. Drift loss of such scale is negligible when compared to evaporation loss and can be achieved by adding the drift eliminator at design stage of the cooling tower. Evaporation loss depends on the volume of removed heat. Water discharge is based on concentration cycles (CoC). CoC during operation will depend on the use of desalination, optimisation of make-up and discharge from the cooling tower as well as compliance with suspended solids requirements for air leaving the tower.

For a closed cooling system of a nuclear power plant of 3750 MWe:

- the estimated use of cooling water (loss and desalination) is in the range of 3.2 m^3/s to 4.2 m^3/s – depending on the exact configuration of the plant.

7.2.3 Emergency cooling through an open cooling system

Based on data provided by vendors the required water use for emergency cooling is estimated at 3.0 m^3/s to 8.0 m^3/s.

Water consumption in an open cooling system may be negligible, as water consumption may only be linked with possible evaporation loss in transfer between the source of water and the plant.

7.2.4 Emergency cooling through a closed cooling system

Evaporation loss from cooling towers or a cooling pond in closed emergency cooling systems is estimated based on the heat load. Conservative assumptions of discharge and make-up in CCS are estimated on the basis of concentration cycle (CoC) 1.5 as assumed for the main cooling system. During certain operations, e.g. cooling down the plant, the CoC cycle may change, which would lead to a reduction of the estimated flow requirements. Evaporation loss is estimated at 50 m^3/h (0.014 m^3/s) during normal operation and up to 200 m^3/h (0.056 m^3/s) during the initial stage of emergency cooling. Water consumption for a plant with closed emergency cooling system CCS is 100 m^3/h (0.03 m^3/s) up to 400 m^3/h (0.11 m^3/s). Therefore water use for CCS emergency cooling of the plant falls in the range of 400 m^3/h (0.11 m^3/s) during normal operation up to 1200 m^3/h (0.33 m^3/s) during emergency cooling.

7.3 Infrastructure corridors location variants

As indicated in section 5.1 the procedure does not cover activities related to the construction of power lines connecting the nuclear power plant with the grid. Such activities will be covered by separate procedures on obtaining a decision on environmental conditions. However, in order to accurately assess the accumulated impact of the nuclear power plant and its associated connecting infrastructure the EIA Report will include the considered variants of infrastructure corridors together with technical parameters of the connection line as known today.

The applicant is currently not able to indicate the exact positioning of the corridors for infrastructure connecting the nuclear power plant with the grid. An initial analysis of possible connections of the plant with the grid indicates, that the NPP may be connected with the national grid via a new-built substation (SEE) in the vicinity of the existing SEE in Żarnowiec (code: ZRC) or a new substation built along the 400kV line between Żarnowiec (ZRC) and Słupsk (SLK). Due to the capacity of the NPP connected to the national grid, it is necessary to upgrade the grid by constructing additional lines.

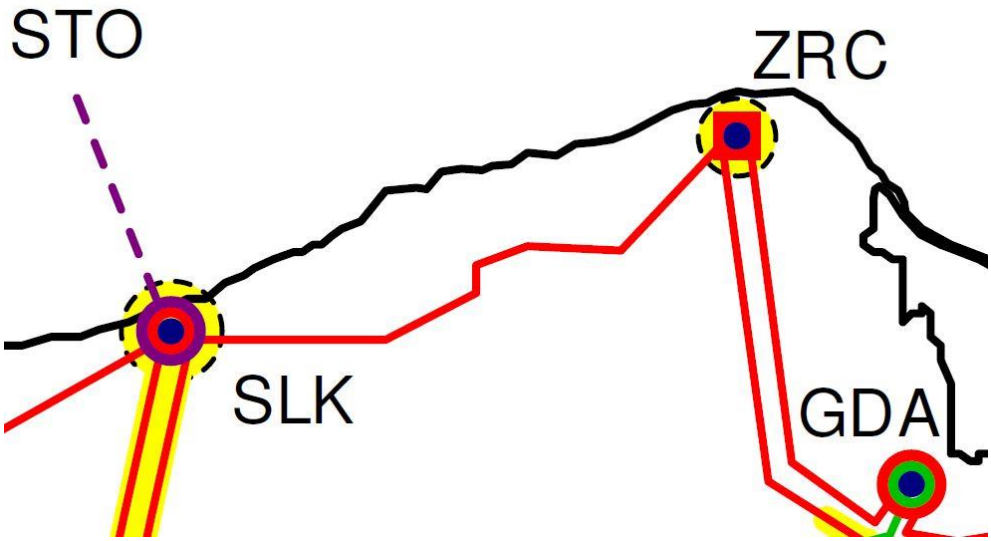
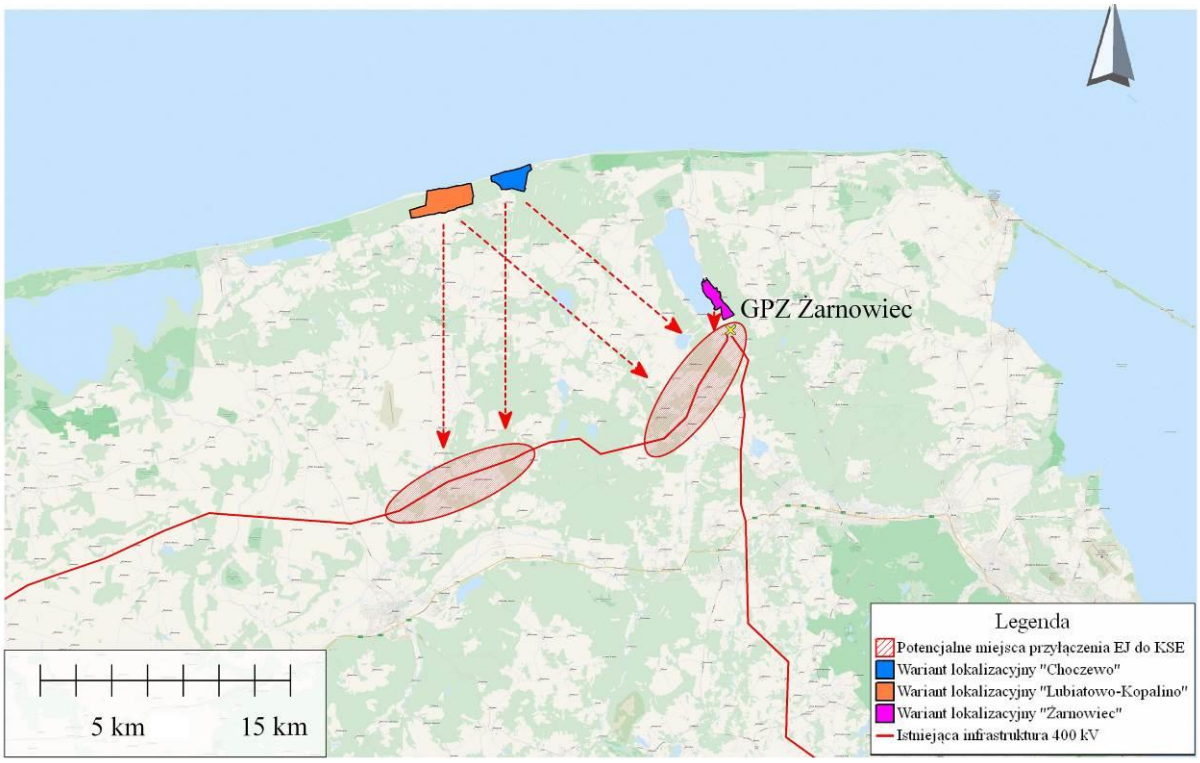


Figure 11. Northern section of the national grid (KSE)
Source: Own materials and data provided by PSE.

Detailed proposals for infrastructure corridors will be included in the EIA Report, after completion of the site characterisation activities and the planned local and regional consultations. The final situation of the infrastructure corridors can be specified once the investor receives the conditions for connection with the grid.



Key
Potential grid connection points of the NPP
“Choczewo” location variant
“Lubiatowo-Kopalino” location variant
“Żarnowiec” location variant
Existing 400 kV infrastructure

Figure 12. Potential connection points of the NPP with the national grid.
Source: Own materials and OpenStreetMap data.

8 Predicted consumption of water, raw materials, other materials, fuel and energy

This section presents the types and volumes of basic materials, water, fuel and energy required for the construction, operation and decommissioning of the nuclear power plant. Due to the specific nature of the facility and the current stage of the project (reactor technology and location to be selected at the next stage) it is not possible to indicate actual volumes of materials, water, fuel and energy required for each technology and each stage in the life of the nuclear power plant.

Since publications containing data on the use of materials, water, fuel and energy are scarce for the new, advanced technologies (Gen III/III+), the information found in this section is to be treated as assumptions and estimates only.

This section contains information for such stages of the investment, as:

- construction site preparation,
- construction,

- operation,
- decommissioning.

8.1 Construction site preparation stage

At the stage of construction site preparation work elements can be identified which may need to be executed at the NPP location:

- demolition of existing structures, installations and infrastructure,
- clearing of trees and bushes, removing of topsoil,
- earth works, including levelling, archaeological survey and sweeping for explosives, including the removal of possible unexploded ordnance, duds and other artefacts,
- construction of access roads, side railway track, fences, securing of the construction site including signage and a monitoring system,
- construction of water, sewage and telecommunication lines (possibly also gas and heating), as well as the main power access point 110/15kV, including lighting and media distribution points (internal infrastructure),
- construction of a water well and a wastewater treatment facility for construction and operation of the NPP (alternatively, if not possible to connect to the existing media),
- installation of a ditch drainage system together with installation draining ground water,
- construction of a site office, accommodation and a storage facility,
- preparation of temporary open storage yards for construction materials and technical equipment as well as a site for storage of topsoil,
- preparation of distribution stations for liquid and gas fuels,
- terrain preparation for the construction of off-shore infrastructure (within the boundaries of NPP location),
- preparation of the sea embankment for the construction of flood-protection and erosion-protection structures.

8.1.1 Consumption of materials and raw materials at the construction site preparation stage

Preparation of the construction site will require the use of materials including:

- concrete mix,
- cement,
- road slabs,
- construction aggregate,
- bitumen-aggregate mix
- timber,
- sand,
- variety of metals (structural elements, reinforcement rods, welding materials etc.).

In the case the materials scavenged from demolition are found useful and free of contamination, such materials may also be reused. The volumes of different materials to be used depend on a variety of factors, including the selected location and reactor technology. It is currently not possible to estimate actual volumes of materials necessary for site preparation for specific reactor technologies.

8.1.2 Consumption of water at the construction site preparation stage

Water consumption will be limited to preparation of concrete mix and sanitation.

8.1.3 Consumption of fuels at the construction site preparation stage

Machinery used in removial the trees and shrubs, earth works, road works and transportation will use liquid fuels – gasoline or diesel. Some construction equipment will use compressed air supplied from electric or diesel compressors.

8.1.4 Consumption of electric energy at the construction site preparation stage

At this stage electricity will be used to power site facilities, construction and drainage equipment as well as parallel works related to demolition of existing structures.

8.2 Construction stage

Works conducted at construction stage include:

- preparatory works, office and storage works,
- earth works related to construction of facilities, installations and infrastructure,
- assembly of tower cranes servicing the construction-assembly works,
- construction of temporary structures, facilities, installations and infrastructure, including: mixing plant, drainage, roads, culverts, parking lots.
- installation and assembly of underground networks, technological pipelines and related facilities and structures, including channels of cooling water (in case of open cooling circuit),
- construction, assembly and installation works of the reactor and equipment (e.g. reactor vessel, cooling system piping, steam generator, pumps, auxiliary systems) and other components of nuclear island and conventional island (e.g. turbines, generators, pumps, heat exchangers, pipelines),
- construction, assembly and installation works of cooling system with water treatment and desalination, cooling towers or hybrid cooling towers (in the case of closed cooling system),
- assembly and installation works of substation, electrical switchboards, transformers, power cables, wires, optical fibres and equipment for measurements, steering and monitoring, including monitoring of radioactive contamination,
- dredging works connected with preparation of area for construction of marine infrastructure, e.g. cooling water channels (in the case of open cooling system),
- construction of internal roads and parking lots, target access roads connecting the power plant with existing local roads,
- construction of permanent fences, signs, monitoring system and access control system,

- tests and inspections of completed structures, installations and equipment,
- start-up and acceptance of structures, systems, equipment and infrastructure.

8.2.1 Consumption of materials and raw materials at the construction stage

The construction of a nuclear power plant involves a large number of raw materials, including construction materials, installation components, technical equipment, testing and control equipment.

Types of materials used during construction include:

- water, cement, sand, construction aggregate, bitumen-aggregate mix with additives for production of concrete mix,
- timber for construction and installation works and other industrial use,
- metal in the form of: reinforcement rods, sheet metal, steel structures, components of equipment and security systems for the facilities, pipelines etc.,
- industrial gases used in construction and welding, including: acetylene, oxygen, argon, carbon dioxide, butane, propane etc.,
- chemical agents used in construction, including: glues, epoxy resin, sealants, lubricants, silicon, sorbents, plasticizers, solvents, paints and varnishes etc.,
- plastics, watertight membranes, insulation materials for construction.

Table3. Estimated quantities of concrete mix and metal (basic materials) used in construction of an NPP unit.

Reactor type	Plant capacity [MWe]	Number of units	Concrete mix, [m³]	Metal [tons]
PWR[8]	3750	2 or 3	410,000	142,000
BWR[9]	3,200	2	383,000	137,000
PHWR	3,000	4	no data	no data
Typical reactor	**3,750**	**2 – 4**	**410,000**	**142,000**

Source: Source: own work based on data from Estimated Quantities of Materials contained in a 1000 MWe PWR Power Plant by Bryan and Dudley [Ref: ORNL-TM-4515 June 1974] and Metal and Concrete Inputs for several Nuclear Power Plants by Peterson et al. Ref: UCBTH-05-001 February 2005 [Ref: Peterson 2005 UCBTH-05-001].

[8] Estimated Quantities of Materials contained in a 1000 MWe PWR Power Plant by Bryan and Dudley [Ref: ORNL-TM-4515 June 1974].

[9] Metal and Concrete Inputs for several Nuclear Power Plants by Peterson et al. Ref: UCBTH-05-001 February 2005 [Ref: Peterson 2005 UCBTH-05-001].

8.2.2 Consumption of water at the construction stage

The volume of water consumed for sanitation purposes will change in proportion to the size of workforce, which may peak at 7500. The estimated daily maximum consumption of water for human use during construction is 1200 m^3/day and varies with stages of construction works.

In the case of concrete mixing plant located on the site, water consumption will increase significantly for production of concrete mix. Water will also be used in tests and trial runs of individual technological systems and components. The estimated daily maximum consumption of water for production of concrete mix is 7100 m^3/day.

Table4. Estimated quantities of water used in construction of NPP units.

Reactor type	Plant capacity [MWe]	Number of units	Water for human use [m^3/d]	Water for production of concrete mix [m^3/d]
PWR[10]	3750	2 or 3	1,200	7,100
BWR[11]	3,200	2	1,200	4,700
PHWR	3,000	4	1,200	6,100
Typical reactor	**3,750**	**2 – 4**	**1,200**	**7,100**

Source: Source: own work based on data from Estimated Quantities of Materials contained in a 1000 MWe PWR Power Plant by Bryan and Dudley [Ref: ORNL-TM-4515 June 1974] and Metal and Concrete Inputs for several Nuclear Power Plants by Peterson et al. Ref: UCBTH-05-001 February 2005 [Ref: Peterson 2005 UCBTH-05-001].

8.2.3 Consumption of fuels at the construction stage

Machinery, construction equipment and vessels used in construction are usually powered by liquid fuels – gasoline or diesel oil. Estimated consumption of diesel oil (basic fuel) at present stage is from 5,000 to 10,000 liters per day.

8.2.4 Consumption of electric energy at the construction stage

Some construction equipment will use compressed air or electricity. Electric power will be provided on site both from a connector built for the needs of the NPP construction and from portable electric power generators. Estimated consumption of electricity at this stage will be 50 to 100 MWh/day.

8.3 Operation stage

Main activities at the NPP operation stage include:

- standard daily operation of the plant,
- inspections and monitoring of technical condition, tests, measurements of structures, systems and equipment,
- shut down, fuel load, ongoing maintenance and repairs,
- storage of spent fuel and radioactive materials in repositories and temporary storage,
- repair and service works of facilities, equipment, systems and infrastructure, including regular dredging works,
- management of radioactive waste, dangerous waste and other waste,
- water and wastewater management.

8.3.1 Consumption of materials and raw materials at the operation stage

Sample materials used during operation include:

- chemical agents used in the reactor cooling system and safety systems: boric acid, hydrazine, lithium hydroxide,
- chemical agents used in the water-steam cycle and other systems: hydrazine for improving the water chemistry and detecting leaks in the turbine condenser, addition of chlorates to condenser in open cooling circuits in order to limit the growth of aquatic organisms, hydrochloric acid and sodium hydroxide in the water desalination and treatment plant and ammonia in the feedwater systems,
- gases for reactor systems: nitrogen and hydrogen for secondary circuit; reactor cooling: carbon dioxide, nitrogen and hydrogen.

8.3.2 Consumption of water at the operation stage

Main uses of water:

- cooling water,
- process water (includes water for fire protection systems),
- water for human use

Maximum use of cooling water was estimated based on information received from plant vendors. The demand for cooling water will depend on the selection of reactor technology and type of cooling system. Maximum (within boundary of the assumed maximum capacity of 3750 MWe) demand for an open cooling system is between 124 m^3/s to 187 m^3/s, while for a closed system it is 3.2 m^3/s do 4.2 m^3/s (water loss and desalination discharge).

Maximum consumption of raw water (process water) for filling and make-up of technological systems is around 0.2 m^3/s.

The table below presents estimated quantities of water used in operating a nuclear power plant.

Table5. Estimated quantities of water used in operating a nuclear power plant.

Reactor type	Plant capacity [MWe]	Number of units	Total consumption of raw water [m^3/year]	Water for filling and make-up of technical systems (demineralised) [m^3/year]	Water for filling and make-up of technical systems (not demineralised) [m^3/year]	Potable water (for human use) [m^3/year]	Filtered water necessary for demineralisation process [m^3/year]
PWR	3,750	2 or 3	710,600	321,500	246,500	65,600	77,200
BWR	3,200	2	606,400	274,300	210,300	56,000	65,900
PHWR	3,000	4	568,500	257,150	197,200	52,500	61,800
Typical reactor	**3,750**	**2 – 4**	**710,600**	**321,500**	**246,500**	65,600	77,200

Source: In-house studies

Consumption of fuel at the operation stage

Fuel consumed during plant operation is the nuclear fuel, the basis of the technological processes of energy generation, as well as all other fuels used in operation of a nuclear power plant, including diesel oil used for power generators.

Without a decision on the type of reactor technology it is now difficult to foresee the composition of nuclear fuel for the first Polish nuclear power plant. Depending on the fuel strategy, this may be fuel in the form of uranium dioxide (UO_2) containing low-enriched uranium (U235 isotope at concentrations not higher than 5%). A Gen III/III+ nuclear power plant of 3750 MWe capacity will consume no more than 80 tons of nuclear fuel per year (metallic uranium).

In the case of diesel oil, used mainly to power emergency generators the consumption can be assumed at 150m^3 per day, while annual consumption should not be higher than 150t/year (mainly for regular tests of the generators).

Other petroleum products used in operation of the nuclear power plant include turbine oil (max. 35 tons per year), transformer oil (max. 35 t/y), motor oil (max. 25 t/y), synthetic oil (max. 20 t/y), oil for power generators (max. 120 t/y) and other oils (max. 5 t/y).

8.3.3 Consumption of electrical energy at the operation stage

A nuclear power plant of 3750 MWe capacity is estimated to consume up to 280 MWe for operation purposes.

8.4 Decommissioning stage

As indicated in section 5.4, the process of decommissioning the nuclear power plant will be the subject of a separate EIA procedure and covered by a separate decision on environmental conditions

obtained in compliance with legal provisions then in force and prior to the nuclear facility decommissioning permit.

At the present stage of project execution the following activities can be defined for the NPP decommissioning phase:

- dismantling reactor components and other elements of the nuclear steam supply system, auxiliary systems and equipment and the nuclear material and waste storage,
- removal, dismantling and demolition of facilities, systems, equipment and infrastructure, both internal and external,
- cleaning and decontamination, including decontamination of radioactive liquids and elements of the reactor plant, including the cooling system, desalination unit and sea water treatment unit,
- preparation and transport of radioactive waste to a repository,
- recycling and utilisation of waste,
- preparation and transport of non-radioactive waste to landfill sites,
- site restoration.

Materials used in decommissioning and materials used for decontamination of reactor components include:

- water, resins, activated carbon, explosives, concrete mix, temporary pumps and pipelines,
- diesel oil used to power construction machines and equipment in demolition works and in the process of neutralisation and transport of disassembled equipment and materials,
- electricity.

Waste generated during treatment of contaminated structures, installations and equipment includes:

- radioactive waste (of high, medium and low activity): spent nuclear fuel, liquids and sediments, stainless steel structures, ion exchange resins, activated carbon (gaseous treatment of radioactive waste), reactor vessel and components of cooling system, auxiliary equipment, pumps, pipelines, tanks, lines, lubricants, tools,
- non-radioactive waste: steel structures, equipment elements, steam turbines, condenser, generator, tanks, electric equipment, switchboards, lubricants, gases, wiring, pipelines.

Considering the fact that decommissioning of the NPP will not begin for 70 years from first operation of the first unit, it is, at this stage, difficult to estimate in detail the quantity of generated waste.

9 Estimated volumes and types of substances or forms of energy released to the environment when environmental protection measures are applied

The section presents the main types of emissions released to the environment during construction and operation of a nuclear power plant. At the present stage of project execution, where it proved feasible, there were estimated volumes of emissions characteristic of technology types under consideration. Such estimates are to help establish possible volume of emissions but do not constitute maximum values.

Detailed estimates of the highest possible emission releases and their impact on the environment will be discussed in the EIA Report, encompassing:

- estimated emissions from marine traffic, road and railway transportation (including NO_2, SO_2 and suspended solids) related to the construction and operation of the plant,
- assessment of sedimentation;
- assessment of carbon dioxide emissions;
- assessment of radioactive discharges to air and water;
- assessment of noise emissions.

Estimates presented in ESR are based on the information of impacts from operating nuclear power plants and information received from potential plant vendors. The exact volumes depend on a variety of factors, including the selected technology, methods of work and the size and location of the project. The data will be received as the studies progress.

9.1 Bounding conditions envelope

Bounding conditions envelope (BCE) has been developed in order to identify the maximum design parameters in a situation where more than one technology is considered. In compliance with IAEA Recommendations (page 8)

"To address the specific issue of uncertainty in the final design of the plant technology, including that the vendor may not be identified at the time of the EIA report preparation, the plant parameter envelope (PPE) concept was developed. The PPE addresses all technologies under consideration and attributes a value for each technology for the aspects identified to lead to a potential environmental impact. The PPE includes the important physical and chemical parameters that may affect the environment (e.g. water requirements, land use and emissions) for the considered plants, and identifies the parameters with the highest impact value or range of values for each parameter. These 'bounding parameters' which are included in the PPE are then used for environmental analysis in the EIA process. When the final design is known, a comparison is made between the actual value for each aspect and the bounding value initially identified. If the ranges of actual values for the parameter are lower than, or equal to, values on which the environmental analysis is based, then further environmental assessment is not required. Otherwise, a new environmental assessment will be required."

The table below presents data on occupied area, number of personnel and estimated noise emissions.

Table 6. Occupied area, number of personnel and noise levels for three technologies at NPP capacity of 3750 MWe

Reactor type	Pressurized Water Reactor (PWR)	Boiling Water Reactor (BWR)	Pressurised Heavy Water Reactor (PHWR)
Estimated area occupied by a single unit (m^2)	155,000	145,000	100,000
Estimated total area required for construction works (km^2)	0.60	0.12	0.20
Estimated total number of personnel required for NPP construction	7,500	3,200	4,800
Estimated total number of personnel required for NPP operation	1,200	1,000	2,000
Estimated maximum noise level in dB(A) at a distance of 15m	120	100	100
Attention: Above information is based on plant vendor information Area occupied by the unit includes: containment/reactor, fuel, control room, turbine room, auxiliary structures.			

Source: In-house studies

Many other emissions to the environment take place. They are listed and described below.

9.2 Carbon dioxide emissions

Nuclear power plants are low emission sources of energy since during operation they only release low quantities of carbon dioxide (CO_2). Analysis of carbon dioxide emissions is part of the EIA and emission levels will be established for construction, operation and decommissioning stages. The main source of emissions is fossil fuel burned during construction and decommissioning. The source of emissions will be construction machines and equipment as well as heating equipment. The main emission sources during NPP operation will be emergency diesel generators, switched on regularly to confirm their readiness and performance. All planned equipment requiring combustion of fuels and emission of carbon dioxide will be modern types, compliant with pertaining energy directives and minimising carbon dioxide emissions.

9.3 Radioactive effluents during normal operation

Emissions of radioactive substances from the power plant into the atmosphere and water environment during normal operation will remain at admissible levels compliant with pertaining regulations.

The table below presents maximum emission levels set as boundary conditions for the technologies in question (technologies are named in brackets, together with emission parameters constituting the boundary).

Table 7. Maximum annual emissions of radioactive substances to the environment during normal operation of the nuclear power plant.

Type of radioactive isotopes	Emission of radioactive substances
to atmosphere	
Radioactive noble gases (BWR) [TBq/year]	306.0
Tritium (PHWR) [TBq/year]	100.0
C-14 Carbon (BWR) [TBq/year]	3.0
Iodine (BWR) [TBq/year]	58.0
Other products of fission and activation (BWR) [TBq/year]	9.2
to waters	
Tritium (PHWR) [TBq/year]	240.0
C-14 Carbon (PWR) [TBq/year]	190.0
Iodine (BWR) [TBq/year]	3.2
Other products of fission and activation (BWR) [TBq/year]	6.4

Source: (1) Forecast environmental impact of PNPP. Final version (after trans-border consultations). Section 7.1.1. Radioactive effluents during normal operation Ministry of Economy, Warsaw, June 2013; (2) UK EPR. Pre-Construction Environmental Report - Sub-Chapter 6.2 – Details of the effluent management process. UK EPR-0003-062 Issue 05. AREVA NP & EDF. 2012 (3) UK-EPR Fundamental Safety Overview. Volume 1: Head Document. Chapter G: Environmental Impact – Sub-Chapter G.3; (4) AP1000 European Design Control Document. 11. Radioactive Waste Management. EPS-GW-GL-700. Revision 1. Westinghouse Electric Company LLC. 2015; (5) UK AP1000 Environment Report. 3.3 Gaseous Radioactive Waste. 3.4 Liquid Radioactive Waste. UKP-GW-GL-790, Revision 3. Westinghouse Electric Company LLC. 2010; (6) ESBWR Design Control Document/Tier 2. 26A6642BJ Rev. 10. Chapter 12. Radiation protection. 26A6642BJ. Revision 10. GE Hitachi Nuclear Energy. April 2014; (7) ESBWR Design Control Document/Tier 2. 26A6642BJ Rev. 10. Chapter 15. Safety Analyses. 26A6642BP. Revision 4. GE Hitachi Nuclear Energy. September 2007; (8) UK ABWR Generic Design Assessment. Quantification of Discharges and Limits. Hitachi-GE Nuclear Energy, Ltd. 2014; (9) Study of historical nuclear reactor discharge data. Better Regulation Science. Programme Science report: SC070015/SR1. UK Environment Agency – September, 2009.

In accordance with Polish regulations (the Atomic Law act, art. 36f item 1 pt.1), in operating conditions of the nuclear facility including normal operations and anticipated operational occurrences the annual effective dose from all exposure pathways may not exceed 0.3 mSv.

The results from calculations performed with **conservative assumptions** indicate, that for the technologies in question the condition will be met with a broad safety margin. Specific values for maximum doses were received as follows[12]**:**

- for PWR technology: 0.025 mSv (EPR) at 500 m from the reactor, 0.121 mSv (AP1000) at 800 m from the reactor,
- for BWR technology (ESBWR): 0.012 mSv at 800 m from the reactor,

[12] **European Utility Requirements for LWR Nuclear Power Plants. Revision D. October 2012.**

Practical experience from operation of nuclear power plants using PWR, BWR and PHWR reactors around the world shows that doses of radiation related to radioactive emissions to the environment are in fact far smaller (by two orders of magnitude) and remain at the level of several μSv.

9.4 Dust emissions and air quality

Emissions containing suspended solids (dust) and gases including: sulphur dioxide, carbon monoxide and nitrogen oxides, are created by traffic and point sources (e.g. power generators, compressors, boilers etc.) during construction, operation and decommissioning.

Assessment of suspended solids and air quality will be conducted under the EIA and measures aiming at prevention, reduction and compensation of impact will be discussed in the Environmental Management Plan (EMP).

A detailed list of sources of main air pollutants (including suspended solids) will be developed together with EIA and will include among others:

- emissions from non-road mobile machinery (NRMM) – necessary during construction,
- daily vehicle traffic flow (passenger and cargo) – during construction and operation,
- vehicles property of personnel – during construction and operation,
- ships and other marine traffic – mainly during construction,
- power generators – during construction and decommissioning as well as back-up and emergency sources of power during operation (piston engines or gas turbines),
- steam generation boiler – during operation
- non-radioactive emissions from reactor ventilation – unit start-ups during operation

The EIA Report will include a list of equipment for each type of technology, stating: nominal capacity, type of fuel, operational profiles and emissions etc.

Machines and equipment typically required during construction:

- excavators,
- cranes,
- earth work machinery,
- mixing plant,
- compressors,
- diesel fueled power generators,
- trucks,
- pile drivers,
- concrete pumps,
- crushers and air hammers,
- drainage pumps,
- boilers and air heaters.

European directives 2002/88/WE[13] and 2004/26/WE[14]establish limits to control gas and solid emissions for the above types of machinery (NRMM). The directives introduce a number of emission limits, including maximum admissible levels of NO_X, suspended solids, hydrocarbons and carbon monoxide. All NRMM planned for the project will, at least, comply with the highest emission standards presented in Table 8 or later regulations. They will be applied to specify detailed emissions under the EIA process once detailed information on the construction is available.

Table 8. Admissible emission levels for NRMM

Net power (kW)	CO	HC + NOx	NOx	Particulate matter (PM)
	g/kWh			
130 ≤ P ≤ 560	3.50		0.40	0.025
56 ≤ P < 130	5.00		0.40	0.025
37 ≤ P < 56	5.00	4.70		0.025

Source: In-house studies

The NRMM emission limits apply to all engines in non-road machinery, including barges, train engines etc.

Power generators comply with admissible emission requirements specified in the Industrial Emissions Directive (IED) 2010/75/UE or Medium Combustion Plant (MCP) Directive, provided such directive is passed, respective to the installed capacity of the plant. Provided that total installed capacity of reserve generators during the construction will not exceed 50 MW_{th}, the admissible levels of emission the generators will need to comply with are listed in Table 9.

Table9. Admissible emissions by MCP

Pollutants	Type of installation	Admissible emission level for liquid fuels (mg/Nm^3 at 15%	Admissible emission level for gas fuels (mg/Nm^3 at 15%

[13] Directive 2002/88/WE of the European Parliament and Council, of 09.12.2002, amending directive 97/68/WE on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery (OJ.L.2003.35.28).

[14] Directive 2002/88/WE of the European Parliament and Council, of 21.04.2004, amending directive 97/68/WE on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery (OJ.L.2004.146.1).

		oxygen content with dry gas)	oxygen content with dry gas)
SO_2	engine and gas turbine	60	-
NO_X	engine	190	95
	gas turbine	75	50
solids	engine and gas turbine	10	-

Source: In-house studies

The emission levels will apply to installations operating more than 500 h per year with nominal power between 1 MW and 50 MW. IED limits apply for installations over 50 MW.

A nuclear power plant may also release pollutants which are non-radioactive and not related to combustion. These may include:

- formaldehyde (H_2CO), which in turn may release CO through thermal decomposition of insulation materials during commissioning of the plant or start-up of a unit after maintenance (approx. every 18 months), as well as
- ammonia (NH_3) released in the event of temperature increase in steam generators during start-up..

9.5 Contaminating releases to surface and ground waters

During the operation of an NPP liquid waste is released due to the technical nature of the process (power generation) and other activities related to operation and maintenance. The exact quantity of such waste can be established once technology is selected for specific technical elements of the NPP. The types of liquid waste include:

- radioactive liquid waste containing chemical agents from technological processes in the nuclear island (reactor and auxiliary systems); this type of waste is processed, stored and monitored before discharge,
- non-radioactive liquid waste from the conventional island, including wastewater:
    - from demineralisation of raw water and treatment of potable water,
    - from chlorination of cooling water and production of sodium hypochlorite,
    - products from chlorination of cooling water (chlorinated organic compounds)
    - drainage water and treated water from wastewater treatment facility,
    - technical waste water and oil-polluted water from machine room,

Maximum annual levels of substances produced during demineralisation of water for a PWR nuclear plant of 3750 MWe capacity, estimated on the basis of data for two EPR units are:

- suspended solids: 1,010 kg/year
- ferrum: 1,000 kg/year
- chlorides: 5,000 kg/year,
- sulfates: 15,000 kg/year,
- sodium: 17,000 kg/year,

- detergents: 400 kg/year.

9.6 Emissions during periodic testing of diesel generators

Maximum emission levels for a nuclear power plant of 3750 MWe capacity were estimated on the basis of data for two EPR units equipped with 8 emergency diesel generators, 7,5 MWe each, and 4 additional Ultimate emergency diesel generators (in case of loss of external power) 2,5 MWe each.

Total annual time of testing each generator is estimated at less than 20 hours. Estimated emissions of sulphur and nitrogen oxides are:

- sulphur dioxide: annual emission – 1,800 kg/year, emission intensity – 93.8 g/h,
- nitrogen oxides: annual emission – 16,000 kg/year, emission intensity – 980 g/h,

9.7 Heat emissions

At present stage of the project it is difficult to estimate the impact on local thermal and meteorological conditions, as both depend on the type of technology, installed capacity, size, layout and location of the NPP. Once these are clear it will become possible to apply the thermal column modelling to assess the impacts.

Cooling water is used to transport the condensation heat of steam exiting the turbine. A lower temperature of cooling water allows the maintenance of lower pressure inside the turbine condenser, a more efficient use of steam enthalpy and maintenance of high efficiency of the power generation process.

9.7.1 Heat emissions associated with the open cooling system

In the case of plant equipped with an open cooling system, during normal operation of the unit water is typically heated by ca. 10 ° C. In such an arrangement the discharged water is gradually cooled by mixing with the water body acting as heat sink. The heat is then transfered to the atmosphere through three main processes: evaporation (25% to 45% of released energy), heat emitted by the surface (25% to 35%) and transfer to the air (20% to 30%).

The quantity of energy transfered through evaporation corresponds to 20 kg/s of steam per 100 MWt of transfered heat. The only atmospheric phenomenon which may be created in the vicinity of the water discharge point is persisting fog. It results from differences in temperature, but its range is local.

9.7.2 Emissions associated with the closed cooling system

In the case of power plants using closed cooling systems with wet cooling towers, heat is transferred directly to the atmosphere. Heat transfer in such cases is concentrated over a small area.

The cooling towers transfer 70% of heat in the form of latent heat (saturated steam) and 30% in the form of sensible heat. This implies that the quantity of steam released to the atmosphere is

approximately twice as high as in the case of open systems. The air released to the atmosphere is humid and its temperature is 10 - 20 ° C higher than the surrounding mass of air. The rate of outflow in a natural draft tower is 3 - 5 m/s, in a forced draft tower it is twice as high. The humid air mixed with a colder mass of ambient air may produce a cloud of vapor. The shape and volume of visible cloud depends on the temperature and humidity of ambient air and on wind speed. The colder and more humid the ambient air, the longer the vapor remains visible. The problem may be more persistent in winter.

The risk of fog forming at ground level from settling vapor in cold, humid, windless conditions may materialise in the case of forced draft towers, since such towers are lower structures and do not exceed 40-50 m in height. The use of combined dry-wet towers usually allows for avoiding the problem of fog. The higher the tower, the less likely the phenomenon to appear. It may be assumed that, depending on local conditions, for towers located on plains and measuring 50 to 75m fog formation becomes exceptional. In the case of nuclear power plants the wet cooling towers are in fact far higher (over 160m) – practically eliminating the risk.

In winter hoar frost may also form when settling vapor or water spray at the bottom of the tower contacts the ground. The phenomenon is only present in direct vicinity, within tens of meters from the tower. Formation of large quantity of vapor and condensation in extreme weather conditions may also lead to formation of black ice on roads.

Thermal emissions from machinery and equipment operating inside the plant (transferred via ventilation or walls) are negligible compared to emissions from the cooling systems.

9.8 Noise emissions

The level of noise present within a nuclear power plant during its construction, operation and decommissioning may potentially impact areas outside the facility.

During construction increased noise levels originate from moving machinery, construction works and construction equipment. During operation increased noise levels originate from cooling towers, turbines and transformers. The level of noise at the indicated locations must comply with pertaining Polish regulations. Table 10 below presents levels of noise generated by plant equipment on the basis of typical data for equipment presumed to be used during construction and decommissioning.

Table10. Noise levels for plant equipment during construction/ decommissioning

	Noise emission by type of equipment	
	dB (A) at distance of 10m	**LWA**
long reach caterpillar excavator	78	106
caterpillar crusher	90	118
bulldozer	79	107

Mixing plant,	80	108
mobile concrete pump	80	108
diesel generator	74	102
road milling machine	82	110
roller	80	108
asphalt spreader	75	103
diesel powered water pump	81	109
caterpillar excavator	78	106
mobile drilling rig	90	118
dump truck	81	109
powered hammer	80	108
crusher	90	118
compressor	72	100
angle grinder (steel)	80	108
tower crane	76	104
CFA piling rig	79	107

Source: In-house studies

Table 6 presents typical noise levels for nuclear power plants during operation, which is 101 dB(A) at a distance of 15m. In the case of power shortage from external sources and in emergency it is necessary to use reserve generators: these are expected to be large piston engines installed in buildings. Tests of the generators will be performed regularly (once per month). Based on data provided by manufacturers, a typical diesel engine has the spectrum profile as presented in Table 11.

Table 11. Levels of suppressed noise outside the generator building (emergency generator)

Frequency (Hz)	63	125	250	500	1,000	2,000	4,000	8,000	Total
Suppressed noise level (dB)	64	66	56	57	61	62	61	69	dB (A) at distance of 1m

Source: In-house studies

Based on manufacturer data, total level of noise of mechanical sources for each generator unit has been suppressed to 75 dB(A) at a distance of 1m.

A typical spectrum profile for exhaust muffler in resented in Table 12 in accordance with manufacturer data. Total level of noise from exhaust mufflers has been suppressed to 81 dB(A) for each engine.

Table 12. Levels of suppressed noise at exit of exhaust mufflers

Frequency (Hz)	63	125	250	500	1,000	2,000	4,000	8,000	Total

Frequency (Hz)	63	125	250	500	1,000	2,000	4,000	8,000	Total
Suppressed noise level (dB)	86	84	74	70	67	60	57	54	81 dB(A) at a distance of 1m and 90° C exhaust flow

Source: In-house studies

The noise levels presented above may change in accordance with the final plant design and equipment, and final data will be included in the EIA section related to noise and environmental impact.

Operating cooling towers also cause noise at the location. In the case of forced draft cooling towers and fan-assisted natural draft towers the levels of noise typically fall within the following range (based on manufacturer data as submitted for large cooling towers in other power plant tenders):

- wet inlet dB(A) ~ 115,
- dry inlet dB(A) ~ 115,
- outlet dB(A) ~ 118.

In the case of natural draft wet cooling towers the level of noise within a 100m radius may reach 60 dB(A), and in the case of combined cooling towers the level of 70 dB(A) at the same distance.

Quiet fans and other devices may also be considered upon the stage of detailed planning and specification of equipment for the cooling system of the first Polish NPP.

10 Potential environmental impacts

At present stage of project execution potential environmental impacts may only be analysed on the basis of other, similar investments already in operation. A description and analysis of possible impacts together with the evaluation of the scale of impacts on the environment, human and animal health will be conducted and presented in the EIA Report in accordance with the methodology presented herein, Section 15.

10.1 Standard environmental impacts of a nuclear power plant

The table below presents a summary of key impacts of an NPP during normal operation, as analysed in the EIA Report.

Table 13Summary of key impacts of an NPP during normal operation.

Area	Potential impact	Stage	Range[15]

[15]Potential impact zones are defined in section 10.4. Detailed impact of the project on particular elements of the environment will be specified in EIA Report in accordance with the methodology presented in section 15.4.7. KIP.

Area	Potential impact	Stage	Range[15]
Air quality and emissions	Air pollutants, including suspended solids, sulphur dioxide, carbon dioxide and nitrogen oxides	• Construction, • Operation, • Decommissioning.	• Local
	Radiation	• Operation, • Decommissioning.	• Local
Biodiversity and ecosystems	Destruction of habitats at construction site Change of habitats Displacement and disturbance of animals Obstruction to migrations Change of hydro-geological conditions	• Construction, • Operation, • Decommissioning.	• Local
	Risk of accidental contamination of water, soil (e.g. fuel leak)	• Construction, • Decommissioning.	• Local
	Impact on marine ecosystems from water intake and discharge	• Operation,	• Local
Climate change	Release of greenhouse gases Release of steam Reduction of CO_2 emissions and other air pollution during operation	• Construction, • Operation, • Decommissioning.	• Local • Regional • National
Communities	Economic and social changes (demography, income, employment and education opportunities, community benefit investments)	• Construction, • Operation, • Decommissioning.	• Local • Regional
Human health and wellness	Noise, vibration, air quality	• Construction, • Decommissioning.	• Local
Cultural heritage	Loss of material artefacts / surroundings of valuable structures	• Construction, • Operation,	• Local • Regional
Landscape	Landscape disrupted on location and in area	• Construction, • Decommissioning.	• Local • Regional
	Landscape disrupted by power transfer infrastructure	• Construction,	• Local
Soil, geology and land use	Loss of soil / arable land	• Construction,	• Local
Water quality and water resources	Impacts related to water consumption, discharge of cooling water on ecology and leisure	• Operation,	• Local
	Changes to levels of local ground waters	• Construction, • Operation,	• Local
Transportation and traffic	Load to roads, railroads and ports	• Construction, • Operation, • Decommissioning.	• Local • Regional
	Transport of hazardous waste	• Operation,	• Local

Area	Potential impact	Stage	Range[15]
Change to coast line	Coastline processes (erosion and accretion), hydrodynamics and transport of sediments	• Construction, • Operation,	• Local
Waste management	Removal of hazardous waste and other waste	• Construction, • Decommissioning.	• Local
	Safe storage and transportation of hazardous materials	• Operation,	• Local

Source: In-house studies

10.2 Potential environmental impact of the cooling systems

10.2.1 Heat emissions to the atmosphere

In a typical power plant with an open cooling system, in normal operation the cooling water is heated in the main condenser by 7 to 12^{o}C. In the case of a nuclear power plant the concept design assumes an increase of temperature in the condenser by 10°C in an open cooling system and by 14°C in a closed cooling system.

In the case of power plants using wet cooling towers there is a risk of fog forming at ground level from settling vapor in cold, humid, windless conditions, especially in the case of forced draft towers which are lower structures and do not exceed 40-50 m in height. The fog may form within 500m from the source. The use of combined dry-wet towers usually allows for avoiding the problem of fog. Water consumption (i.e. need of make-up water) is 20% lower than in the case of wet towers.

In the case of the Żarnowiec location, fog will not be a problem in the vicinity of the plant, including Żarnowieckie lake and the industrial area within 500m radius. Drift eliminators and/or combined cooling towers eliminate a majority of fog related problems. At the Żarnowiec location there are no transportation routes within 500m from the towers, which would be at risk due to fog.

Formation of hoar frost is generally restricted to direct vicinity of the cooling tower or tens of meters from its base.

Drift, or droplets of water lifted with the air flowing out of the tower, may be reduced by installation of drift eliminators. Drift eliminators are devices similar to deflectors, installed in the path of air flowing out of the cavity and condensation zone within the tower. Drift eliminators used in cooling towers rely on inertial separation induced by change in the direction of flow of water droplets as they pass through the eliminators. Eliminators are recommended for cooling towers as means to reduce formation of vapor clouds exiting the tower.

10.2.2 Temperature increase of the cooling water bodies

The discharge of cooling waters impacts two areas – in direct vicinity of the collector and distanced from it. Area in direct vicinity of the discharge collector is the area where heated water does not completely mix with ambient water. Area distanced from the collector is the area where waters are fully mixed at all depths and constitute background for further emissions. Increase in temperatures in areas distanced from the collector is gradually corrected by inflow of external waters.

The proposed concept design does not plan the NPP with an open channel discharging heated water into the Baltic sea, but deep discharge instead. The deep discharge system will have multiple exit points allowing for sea currents to mix the waters.

In the case of a nuclear power plant it is also necessary to analyse the layout of intake and discharge points to avoid recirculation. Thermal analyses of discharge will be carried out as part of the EIA process to establish the geographical characteristics of the heat trail of discharge water.

10.2.3 Impingement of living organisms into the cooling system

While water is pumped for cooling the plant, microorganisms and other organisms are sucked in (mainly algae and plankton, possible crustaceans and fish). Plankton passes through the rotating screens with grids of 1 to 5 mm.

Activities limiting impingement of organisms include:

- locating water intake away threatened areas like spawning grounds, shoaling pools near banks or migration routes e.g. of eel larvae,
- designing intake channels in a way ensuring low water velocity to eliminate the risk of sucking organisms in,
- fitting the water intake apertures with repelling elements which will cause the organisms to return to their habitats without harm,
- fitting the water intake apertures with systems returning the organisms to their habitat without harm.

In the case of a nuclear power plant the concept design of an open cooling system includes:

- water intake point located deep under the surface, ca. 10m, where activity of organisms is generally low,
- design of intake allowing for low water velocity to minimise impingement and allow fish to swim away,
- fitting the rotating screens with a system allowing for fish to return to the sea.

10.2.4 Changes to the water environment caused by chemical pollution

Chemical treatment of water collected for cooling may lead to chemical agents being discharged into the environment. These may include:

- agents protecting cooling systems with cooling towers from formation of limescale;
- agents preventing the growth of microbial life and products of their reactions;
- ferric sulfate used to protect condensers with copper alloys from corrosion;
- products of corrosion of heat exchangers and piping.

In the case of marine systems biocides are used to keep the systems clean and ensure their proper operation. In the case of cooling systems using sea water it is imperative to prevent the growth of mollusks (oysters, mules etc.)

In the case of a nuclear power plant the concept design should reduce the use of agents to a minimum. This is achieved through:

- recommended use of condenser and heat exchanger made of titanium and stainless steel,
- recommended construction of the interior of cooling towers with the use of thermoplastic materials resistant to limescale formation,
- mechanical cleaning techniques,
- considering regular treatment with low doses of biocides, e.g. chlorine injections into OCS water intakes preventing the growth of mollusks within the cooling system (quantities compliant with pertaining regulations) or use of other biocides.
- recommended optimisation of the cooling tower,
- cycles of concentration (concentration factor),
- chemical treatment.
- and/or desalination of make-up water for cooling towers.

10.2.5 Other potential, harmful impacts of some cooling systems

The use of cooling towers with natural or forced draft as well, hybrid towers or dry condensers and cooling towers allows for considerable restriction of the required flow of water in the power plant, thus also limiting its impact on the environment. However, the presence of cooling systems may lead to other issues, related mainly to aesthetics and noise from the towers.

There are three types of cooling towers which may be used with a closed cooling system: natural draft, forced draft and hybrid towers. Natural draft cooling towers allow for greater efficiency than the alternative, lower towers using mechanical, fan-induced draft or hybrid towers. Forced draft towers and hybrid towers only reach 1/3 of the height of natural draft towers. Forced draft towers and hybrid towers are approximately the same height as some of the other buildings of the plant in the considered reactor technologies.

All of the potential environmental impacts from cooling systems as described above will be characterised in detail and assessed in the EIA Report.

10.3 Radiation impact during accident conditions

During the operation of a nuclear power plant (as in the case of any other large industrial facility) it is not possible to eliminate the possibility of an accident or incident.

The specific nature of nuclear power plant involves technological processes generating radioactive substances. During accident conditions there is a risk of uncontrolled release of such radioactive substances to the environment.

Accident conditions include design basis accidents and design extension conditions.

For design basis accidents and design extension conditions the following objectives for **restrictions of radiation impact of the nuclear power plant on the environment:**

I. In the case of a design basis accident:
    1) no intervention necessary > 800m from the reactor,

2) limited economic impact,

II. In the case of a design extension conditions:
   1) no need of early intervention (evacuation within first 7 days) > 800m from the reactor,
   2) no need of mid-term intervention (evacuation for up to 1 month) > 3km from the reactor,
   3) no long-term intervention necessary (resettlement) > 800m from the reactor,
   4) limited economic impact,

Therefore, even in the case of a severe accident involving reactor meltdown – which is highly unlikely (once in 10 million years of operation) – major radiation impact is limited to an area within 800m from the reactor, while an area within 3km from the reactor requires temporary intervention (requirement to remain indoors, thyroid prophylaxis, forbidden consumption and ongoing monitoring of water and food from local sources).

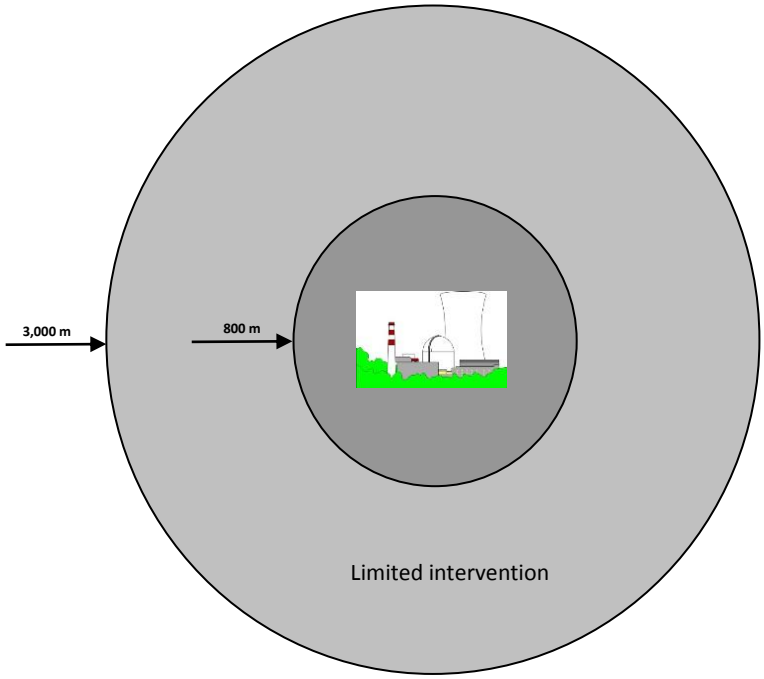


Figure 13. Illustration of limited radiation impact from a heavy accident in a gen. III reactor.
Source: In-house studies

In order to ensure that the objectives are met in compliance with the "EUR" document, the following radiation impact criteria must be fulfilled:

1. for design basis accidents – the limited impact criterion is calculated with the following formula:

$$\sum_{i=1}^{3} R_{ig} \cdot C_{ig} + \sum_{i=1}^{3} R_{ie} \cdot C_{ie} < criterion$$

where:

R_{ig} and R_{ie} are total release at ground level and at ventilation stack level for three reference isotopes (Xe-133, I-131, Cs-137) during the entire period of release from the containment structure, as specified in the design of the plant.

C_{ig} and C_{ie} are factors defined in the ”EUR” document, related to impact of the releases on the environment.

“Criterion’ is a numerical value set in the “EUR” document for design basis accident of a given category.

2. For design basis accidents – the limited impact criterion is calculated with the following formula:

$$\sum_{i=1}^{9} R_{ig} \cdot C_{ig} + \sum_{i=1}^{9} R_{ie} \cdot C_{ie} < criterion$$

where:

R_{ig} and R_{ie} are total release at ground level and at ventilation stack level for 9 reference isotopes (Xe-133, I-131, Cs-137, Te-131m, Sr-90, La-140, Ce-141, Ba-140), as specified in the design of the plant.

C_{ig} and C_{ie} are factors defined in the ”EUR” document, related to impact of the releases on the environment.

“Criterion’ is a numerical value set in the “EUR” document for the specific design objective of limiting radiation impacts.

A nuclear power plant will comply with Polish regulations requiring that in the case of a severe accident with reactor meltdown there will be no need of early or long-term intervention, including evacuation or permanent resettlement – outside the restricted use area of ca. 800m from the reactor, depending on local meteorological conditions and the reactor type. Limited, mid-term intervention may be necessary after a severe accident, in the form of e.g. issue of stabilised iodine tablets as long as it is limited to a low-population area measuring, under EUR requirements, 3 km in diameter or similar, depending on local meteorological conditions and the reactor type.

In accordance with Polish regulations (the Atomic Law act, art.36 f par. 1 pt.2), on the border of the restricted area the annual effective dose from all routes of exposure shall not exceed 10 millisieverts (mSv) in emergencies during which the reactor core remains safe.

Moreover, on terms of the so called “design regulation”, secondary legislation to the Atomic Law (§ 9): in case of accident conditions the design features of a nuclear facility will limit radioactive releases outside the containment structure in such manner, that in the case of:

1. design basis accident no intervention is necessary outside the restricted use area,
2. design extension conditions there is no need to:
   a. perform early intervention activities outside the restricted area of the nuclear facility during the radioactive release,

b. perform mid-term intervention in any locations outside the emergency planning area,
c. perform long-term intervention activities outside the restricted area of the nuclear facility.

Table 14 below presents parameters of radiation impact on population and environment from the nuclear power plant planned in Poland, in the form of a bounding conditions envelope for a gen. III reactor compliant with regulations proposed in Poland.

Table 14. Parameters of radiation impact on population and environment in accident conditions.

Parameter		Value in analysis of			Accepted for NPP in Poland
		EPR (PWR)	AP1000 (PWR)	ESBWR (BWR)	
Atmospheric dispersion factor χ/Q assumed for 800m from reactor and time of 2h, s/m^3		$1*10^{-3}$	$5.1*10^{-4}$	$2*10^{-3}$	$2.5*10^{-4}$
Assumed radius of restricted use area, m		800	800	800	800
Dose in case of accident without reactor meltdown[16], 800 m from NPP, mSv	For χ/Q based on plant vendor data	0.5	22	126	10
	For χ/Q accepted for NPP in Poland	1.4	10.8	15.8	
Dose in case of severe accident with reactor meltdown, within 2 hours, for the assumed χ/Q, mSv	For χ/Q based on plant vendor data	122	246	130	100
	For χ/Q accepted for NPP in Poland	30.5	120.6	16.3	
Atmospheric dispersion factor χ/Q assumed for 2400m from reactor s/m^3					
0-2 h		$1.75*10^{-4}$	$2.2*10^{-4}$	$1.9*10^{-4}$	Data must be specified for a particular location on the basis of a 1-year cycle of meteorological measurements
2-8 h		$1.35*10^{-4}$	$2.2*10^{-4}$	$1.9*10^{-4}$	
8-24 h		$1.00*10^{-4}$	$1.6*10^{-4}$	$1.4*10^{-4}$	
24-96 h		$0.54*10^{-4}$	$1.0*10^{-4}$	$0.75*10^{-4}$	
96-720 h		$0.22*10^{-4}$	$0.8*10^{-4}$	$0.3*10^{-4}$	
χ/Q on the border of low population zone s/m3, arithmetic average for 30 days		$2.63*10^{-5}$	$8.53*10^{-5}$	$3.87*10^{-5}$	
Dose in case of severe accident with reactor meltdown, within 30 hours, for χ/Q at 2400m from reactor, mSv		111	234	353	
Frequency of severe accidents with containment bypass and major radioactive release		Less than 10^{-6} /reactor-year	$6 * 10^{-8}$ /reactor-year	Less than 10^{-8} /reactor-year	Less than 10^{-6} /reactor-year

Source: (1) Forecast environmental impact of PNPP. Final version (after trans-border consultations). Section 7.1.2. Releases in accident conditions and transient state Section 7.1.3. Releases in severe accidents. Ministry of Economy, Warsaw, June 2013; (2) UK EPR. Pre-Construction Safety Report. Sub-chapter 14.6 – Radiation consequences of design basis accidents (UKEPR-0002-146 Issue 06). Sub-chapter 16.2 – Severe accident analysis (UKEPR-0002-162 Issue 05). AREVA NP & EDF. 2012 (3) AP1000 Pre-Construction Safety Report. UKP-GW-GL-732. Revision 2. Westinghouse Electric Company LLC. 2009 (4) ABWR Design Control Document / Tier 2. Chapter 15. Accident and analysis. Rev. 0. GE Hitachi Nuclear Energy. 5) ESBWR Design Control Document / Tier 2. Chapter 12 Radiation Protection. 26A6642BJ. Revision 10. GE Hitachi Nuclear Energy. April 2014; (6) European Utility Requirements for LWR Nuclear Power Plants. Revision D. October 2012.

[16]Accidents without reactor meltdown include all design basis accidents and the so called "complex sequences" belonging to the "design extension conditions" (especially accidents involving containment bypass sequences).

10.4 Potential impact areas of the Project

Defining the potential impact areas of the project at its early stage of preparation - the scoping procedure, is significant for 3 reasons:

1) it enables the authority conducting the proceedings related to issuing the Decision on Environmental Conditions to properly identify the parties to the proceedings in accordance with the provisions of the Code of administrative proceedings,

2) it allows for proper definition of the surveyed area of particular elements of the environment for the purposes of the environmental analyses under the EIA procedure, which should also be reflected in the decision on the scope of the EIA Report,

3) it enables the authority conducting the proceedings to properly inform the 'public concerned' about the possibility to take part in the decisions concerning the environment, in compliance with the Aarhus Convention.

Identification of the parties to proceedings regarding the Decision on Environmental Conditions should be conducted on the basis of the general principle set out in art. 28 of the Code of Administrative Proceedings, since no other provisions have been established specific to an NPP. Any person whose legal interests or obligations are covered by the proceedings or any person requesting action on the part of the authority due to an existing legal interest or obligation shall be deemed a party to the proceedings. Identification of the potential impact area of the Project, which may influence the substantive legal circumstances of a given entity, is of key importance since case law confirms that only such direct influence may offer justification for a given entity to be recognised as party to the administrative proceedings.

Various aspects of the project have been analyzed to determine its potential impact areas, with particular attention to: parameters of emissions and disruptions of the considered technologies, consequences of external events that may influence the safety of NPP operation as well as potential radioactive releases, characterization of the environment and its features together with the existing or potential processes, that provide information about possible avoidance and elimination of natural threats to the safety of NPP operation, development in the vicinity of the plant and population density in particular (possibility of effective actions in case of an incident, reduction of threats to the population caused by radioactive releases).

It should also be noted that the analyses carried out at this stage of the procedure and related to the Decision on Environmental Conditions (scoping) are only approximate and require the survey program to yield knowledge of specific environmental conditions. In addition, best available

practices of many countries operating NPPs and IAEA guidelines were taken into consideration when identifying the impacts.

Potential impacts of the NPP were described in section 10.1 – Standard impacts of NPPs and 10.3 – Radiation impacts in emergency conditions. Not all of the potential impacts of the NPP mentioned above may, however, directly influence the substantive legal situation of the potential parties. The number includes the following standard NPP impacts (i.e. during normal operation):

a. air pollution;
b. radioactive radiation;
c. influence on the value of real estate in the immediate vicinity of the investment, changes in real estate use related to setting up restricted use area;
d. noise, vibration at the stage of construction and decommissioning;
e. loss of soil and land;
f. impacts on the quality of water;
g. strain on the road infrastructure.

The above impacts may only have direct influence on the substantive legal situation of such communities which are located in the direct vicinity of the planned Project.

In relation to radiation impacts in emergency conditions, which undoubtedly may also have a direct influence on the substantive legal situation of the potential parties, the adopted objectives are of key importance for determining the potential range of the impacts as far as restricting the radiation impact of the NPP on the environment is concerned, as described in section 10.3. The objectives derive from technology guidelines which may be applied when building an NPP in Poland, as adopted in national (Atomic Law act, Nuclear Power Program for Poland) and international documents (EUR). It should be emphasized that failure to meet the requirements by a given technology, and ultimately the NPP project, will prevent it from obtaining the necessary permits and approvals for its implementation. These objectives assume that even in the case of a severe accident with reactor meltdown – which is highly unlikely (once in 10 million years of operation) – major radiation impact is limited to an area within 800m from the reactor, while an area within 3km from the reactor requires temporary intervention (requirement to remain indoors, thyroid prophylaxis, forbidden consumption and ongoing monitoring of water and food from local sources).

In the light of the above, it should be stated that the impacts of the planned Project that may directly influence the legal and factual situation of a given entity, such that would give grounds for entities holding titles to property situated within impact areas to be recognized as parties to the proceedings, will not reach beyond the local area of impact.

Impacts of regional range connected with proper operation of an NPP as mentioned in the ESR: CO_2 emission, socio-economic changes in the form of higher employment, influence on important culture landmarks, impact on landscape in the area, strain on the railway and port infrastructure – will not have a direct influence on the substantive legal situation of the community and so do not give grounds for it to be recognized as a party to the proceedings. **In the regional impacts area, the impacts on the substantive legal situation of specific entities may not be excluded in individual instances but the entities should be recognized as a party to the proceedings upon an application**

of such party and after confirmation of an existing link between the planned investment and its impacts and the legal situation of a given entity.

The potential impact radii of the Project and by extension the areas where surveys will be conducted for the purposes of the EIA, were established in greater detail based on definitions provided in the Regulation of the Council of Ministers of 10 August 2012 on the detailed scope of assessment of the location intended for a nuclear facility, the cases where such location fails to meet the requirements for location of the nuclear facility and on requirements for a location report for the nuclear facility (J.o.L of 2012, item 1025).

Local impacts are impacts affecting:

- the planned placement of the nuclear facility, that is an area within the radius equal to the distance from the centre to the furthermost point on the plot of land where the facility is to be situated, drawn from the centre and enclosing the entire area of land where the facility is to be situated, and
- location area, that is an area within the radius of 5 km from the planned placement of the nuclear facility.

Regional impacts are impacts within the location region, that is the area within the radius of 30 km from the planned placement of the nuclear facility.

National impacts are impacts further than 30 km from the planned placement of the nuclear facility, but within the territory of Poland.

International impacts may have effects beyond Polish borders.

The areas of local and regional impact were designated based on the distances defined in the same systemic and legal environment i.e. the Act of 29 November 2000 – Atomic Law (J.o.L. of 2014, item 1512 as amended). The process of environmental impact assessment will be strictly related in both legal and factual terms with site characterization which should be carried out in the zone of potential impacts between the NPP and the environment and with the obligation to prepare on their basis an EIA report as referred to in art. 35 b. of the Act of 29 November 2000 Atomic Law (J o L of 2014, item 1512 as amended).

When identifying the parties to the proceedings it is important to differentiate between 2 areas of Project impacts:

a) local impacts area – 5 km from the boundaries of the NPP site indicated in the individual location variants – impacts that have direct influence on the legal situation of the entities holding titles to real estate within the boundaries of the area

b) regional impacts area – 30 km from the boundaries of the NPP locations indicated in individual location variants – impacts that may have indirect influence on the legal situation in individual cases.

Both areas cover all the potential NPP impacts under consideration, the standard described in 10.1 of the ESR and radiation impacts in emergency conditions that are set forth in section 10.1 herein. Both areas may serve as a basis to determine the scope of surveys.

The area of local impacts may serve as a basis to identify the parties to the proceedings.

The range of potential impact in marine areas for infrastructure of the cooling systems was defined in accordance with the character of its potential impact as a 5 km radius from points of discharge and intake of cooling water and 1 km distance from the cooling water corridors.

Consideration should also be given to the issue of designation of potential parties to the proceedings in marine areas on which the planned Project may exert impact. The owner of the marine areas is the State Treasury and the rights are exercised on its behalf by respective maritime administration bodies (minister for Maritime Economy, Directors of Maritime Offices) and other state administration bodies competent to manage particular uses of marine resources and marine space: minister for the environment, minister for administration, minister for transport, minister for fishery, minister for national defence, minister for national heritage). Entities that obtained permits for carrying out proper investment activities on specific marine areas (permits to erect artificial islands, structures and equipment in marine areas or a permit to lay undersea cables and pipelines) whose registers are kept by maritime administration are also holders of acquired rights. Therefore, the State Treasury should be a party to the proceedings regarding the Decision on Environmental Conditions for undertakings that may exert impacts on marine areas (through government administration units acting in the scope of their duties in the name and on behalf of the State Treasury) alongside entities authorized to use marine resources or set up a structure in marine areas within the potential impacts zone.

With respect to the obligation of ensuring public participation in the EIA procedure the authority conducting the proceedings shall, without undue delay, disclose to the general public and the information concerning:

- commencement of Environmental Impact Assessment;
- commencement of the proceedings;
- the object of the decision to be issued;
- the body competent to issue the decision and bodies competent to issue the opinion and make appropriate arrangements;
- opportunities to get acquainted with the necessary documentation on the matter, together with the location where it is available;
- the possibilities to submit comments and applications;
- the manner and place of submitting comments and applications, indicating that the term for such submissions is 21 days;
- the body competent to examine the comments and applications;
- the time and place of the open administrative hearing , provided such hearing is required;
- the course of transboundary environmental impact proceedings, if conducted.

The possibility to make comments and submit applications is open to all persons irrespective of actual or legal interest or place of residence, within the framework of public participation and in accordance with art. 29 of UOOŚ.

The requirement above is based on the provisions of the Convention on access to information, public participation in decision-making and access to justice in environmental matters made in Aarhus on 25 June 1998, the Aarhus Convention, while in relation to public participation in decisions concerning environmental protection it implements the Council Directive 2011/92/EU of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment.

Under art. 6 par. 2 of the Aarhus Convention 'the public concerned' which was defined as the public affected or likely to be affected by, or having an interest in, the environmental decision-making process should be informed in a manner that is appropriate, effective and timely either through public announcement or individually at an early stage of the decision-making procedure on matters concerning the environment. The scope of information released to the public through the Convention has been reflected in national provisions described above.

The Maastricht Recommendation on promoting effective public participation in decision-making in environmental matters of 2014, developed in a meeting of the parties to the Aarhus Convention as a best practice manual indicated that the adopted methods of informing the public should be tailored to the specifics of a given project so as to reach the maximum circle of 'the public concerned', in particular in the immediate vicinity of the project or within its environmental impact range.

In the context of potential impacts of the NPP on the environment as well as socio-economic life in the region, informing the public of the procedure under way should be considered in line with the principles as stipulated in art.3 par.1 subpar. 11 of UOOŚ, in the regional impact area i.e. within 30 km from the boundaries of the NPP in the individual variants.

The potential impact areas of the project that may influence directly the legal situation of entities (radius of 4 km around the location boundaries in individual variants) have been illustrated in Attachment 6 to ESR. Attachment 7 illustrates the boundaries of the communes situated in the potential regional impact area i.e. within the range where 'the public concerned' is to be informed directly about the possibility to participate in decisions on the environment.

Attachment 8 includes a table of precincts in the area of potential direct impacts of the project, listing precincts within the range of potential direct impacts of the project. Attachment 9 includes a table of communes where 'the public concerned' is to be directly informed about the possibility to participate in decisions on the environment (territorial range of announcements).

10.5 Possible transboundary environmental impact

The definition of transboundary impact was presented in art. 1 pt. VIII of the Espoo Convention of 25 February 1991 on Environmental Impact Assessment in a Transboundary Context. According to the definition:

"....transboundary impact means any impact, not exclusively of a global nature, within an area under the jurisdiction of a Party caused by a proposed activity the physical origin of which is situated wholly or in part within the area under the jurisdiction of another Party;

An NPP has a transboundary environmental impact when adverse effect to the environment may reach outside the territory of Poland.

As shown in this section, the project will not cause impacts greater than local or regional, either during construction, operation, design basis accidents or design extension conditions. Considering the position of the considered NPP locations with respect to national borders, as presented on the map enclosed as Attachment 5 to ESR, none of the potential impacts of the Project described in this section may reach beyond the territory of Poland.

In the case of nuclear power plants it is important to consider very low probability events, including design extension conditions accident, the probability of which is $1x10^{-6}$ per year. Although such events are highly unlikely, they will be included and analysed in the EIA Report due to the magnitude of their potential consequences.

An assumed event following the most severe scenario, as defined in the International Nuclear and Radiation Event Scale (highest level 7), " leading to the release of large quantities of radioactive substances collected in a large facility, could have severe health impact over a large area, also across national borders." Impact of this sort may under certain circumstances reach the territory of countries neighboring Poland and the Baltic region. Factors analysed under the EIA Report process include the identification of low probability events and their potential consequences.

The effects of such events will be determined in the probabilistic safety analysis (PSA). The PSA, conducted during preparation of the EIA Report, may be employed to calculate the probability of core damage accidents.

Considering current practices regarding participation in transboundary consultations for NPPs in Europe as well as the course of transboundary consultations of the Polish Nuclear Power Program it is safe to assume that countries at risk of impact from design extension conditions accident are countries as far as 1000km from Polish borders.

11 Solutions for the protection of the environment

Solutions serving greater protection of the environment may be applied at every stage of the Project: from construction to operation and decommissioning. The solutions may be divided in the following groups:

- Optimisation of spatial arrangements on the site
- Selection of technological solutions

- Environmental Management Plan
- Management of operation
- Supply chain management

Basic activities planned for execution in each group and serving greater protection of the environment against impacts from the planned Project are described below.

Detailed scope of activities limiting possible major environmental impacts from the Project will be analysed during preparation of the EIA Report and after careful survey of the environmental elements in need of protection and of the scale of impacts from the planned Project. The selection of mitigating actions will take place in two stages:

- at EIA Report stage – when general mitigation activities are defined on the basis of environmental surveys and ecosystem vulnerability thresholds, for each of the considered technologies,
- upon construction design – when detailed technical solutions are defined for the selected technology and analysed for compliance with conditions set in the environmental decision, as part of the subsequent environmental impact assessment.

11.1 Optimisation of spatial arrangements on the site

Proper situation of the plant and its elements may be a key factor in the environmental impact assessment. A decision in this respect requires prior analysis and assessment of environmental conditions. Proper selection of the location may largely decrease the impact on habitats, marine ecosystem, landscape, cultural heritage and Natura 2000 sites.
The bounding envelope for environmental conditions, developed on the basis of environmental surveys will be used in planning the layout of individual elements of the Project at the location to ensure the optimum potential impact on the environment in terms of acoustics, landscape etc.

11.2 Selection of technological solutions

One of major factors in the selection of technology under the Integrated Proceedings, as described in section 6.4, is the so called bounding environmental conditions envelope. The envelope is a set of environmental conditions specified in a program of tests and analyses to allow for determination of boundary environmental conditions influencing aspects of the technology, and in particular the levels of emissions and disruption caused by the given technology. Environmental safety of the individual technical solutions will be a major factor in the assessment and selection of technology, including variants of the cooling system which may lead to various environmental impacts specially affecting hydrological conditions, marine ecosystems and climate.

Key criteria in the selection of technology also include radiation safety. It is also important to remember, that under Polish regulations on radiation safety and the terms of PNPP, Polish nuclear power plants may only use generation III/III+ reactor technologies. The nuclear power plant will be fitted with a set of solutions minimising the risk of design basis accidents and design extension conditions which may lead to radioactive releases into the environment. Solutions of this type constitute a pre-requisite of nuclear safety for plant vendors. Together with the selection of reactor

technology other technical features will be selected to minimise environmental impacts, as each of the technologies may cause different environmental impacts requiring different mitigation activities.

11.2.1 "Defense in-depth" strategy

"Defense in-depth" strategy is the foundation of safety in nuclear power plants. The principle of defence-in-depth is to ensure the compensation of possible technical failures and human error. The main assumption in establishing a system of defence-in-depth is that no single element may be fully trusted during design, operation and maintenance of a nuclear power plant. In the case of failure of one sub-system, other sub-systems can continue the necessary safety functions. Defence-in-depth is not limited to applying redundant systems. It includes the following five levels of safety ("defence"):

I. **Level one** – involving prevention of abnormal operation and failures of NPP systems. This is achieved through a solid and conservative design (large safety margins, proper choice of materials), including redundancy, independence and variety of critical safety systems and equipment as well as high quality of construction, maintenance and operation of the NPP, with special emphasis on safety culture, i.e. practical application of the safety first principle.
II. **Level two** – involving detection of failures and control of abnormal conditions to prevent deterioration of operational incidents into emergency conditions. This level requires the use of appropriate systems specified in the safety analyses (normal plant systems including power reduction and reactor shutdown) and appropriate operational procedures preventing or limiting damage from operational incidents.
III. **Level three –** involving control of design basis accidents, in the unlikely case where operational incidents are not contained at safety level two and deteriorate into a more serious event. This is achieved through the use of inherent safety features of the NPP and design safety systems, which bring the facility back to a controlled state and then to a safe shutdown state and through ensuring that at least one barrier isolating the radioactive products of nuclear fission remains intact. The means serving the purpose include in particular:
    - Safety systems (e.g. scram system);
    - Safety systems, including: emergency cooling system of reactor core with automation functions ensuring its automatic function in case of emergency, with no intervention from operator;
    - Containment structure protecting from radiation release;
    - Emergency procedures of the operator.

IV. **Level four** – involving mitigation of severe accident consequences to control radioactive releases at the lowest possible level. The key objective of this level is to maintain the highest possible efficiency of the containment structure in limiting the radioactive releases. This level uses systems and activities to contain severe accidents and minimise their consequences, e.g. by controlled evacuation of gas from inside the containment structure through a system of filters to

protect the containment from damage caused by excessive internal pressure, by prevention of uncontrolled combustion or explosion of hydrogen inside the containment.

V. **Level five** – involving mitigation of radiation consequences of significant releases of radioactive materials which may result from an accident. Activities at this level require most of all a properly equipped emergency control centre and the use of emergency plans on-site as well as off-site. To reduce risks to the population this level of protection involves actions taken outside the NPP site, including: administration of iodine pills, instructions to remain indoors, temporary restriction on grazing in the case of contaminated pastures, temporary evacuation from direct vicinity of the NPP.

11.2.2 System of protective barriers isolating radioactive materials from the environment

The principle of "defence-in-depth" is implemented through the use of a sequence of physical barriers allowing for the containment of radioactive substances within designated areas of the facility and preventing their uncontrolled release to the environment. The barriers include (Drawing 17):

- 1 - nuclear fuel material,
- 2 - cladding of fuel element,
- 3 - reactor coolant pressure boundary, and
- 4 - containment structure.

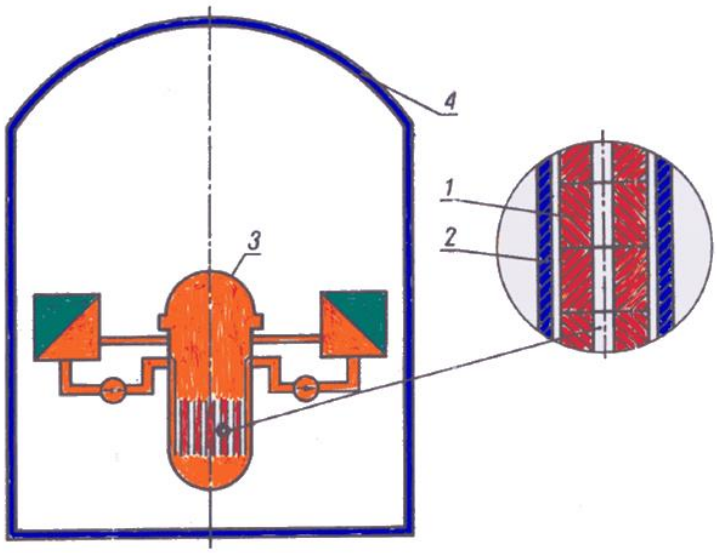


Figure 14. Outline of safety barriers
Source: In-house studies

A vast majority of radioactive isotopes (~99%) remain contained within the fuel pellets inside the fuel rods. Gaseous fission products (radioactive noble gases and aerosols) collect in the gap between fuel and cladding where they are retained by the cladding (negligible quantities reach the coolant).

Radioactivity of reactor coolant is partly caused by infiltration of gaseous fission products through micro-fissures of the nuclear fuel elements, and partly by activation of the coolant and its pollutants or chemical additives (irradiation with neutrons inside the reactor). The coolant is continuously filtered and radioactive substances are removed.

The reactor and the entire cooling system is locked within a tight containment structure, designed to withstand a surge in pressure from an emergency line break in the primary cooling cycle – which would release a large quantity of radioactive substances (mainly from fuel due to damaged cladding), but also to withstand external events (including seismic events, extreme weather conditions including a hurricane or a crash of a commercial airplane).

Large quantities of radioactive substances may be released from nuclear fuel if it is damaged (mechanical damage – from directly applied force or from overheating – caused by inadequate cooling – which may lead to damage of all fuel pellets, fragmentation or event meltdown of the fuel). In order to prevent damage to nuclear fuel in operational incidents or accidents it is necessary to ensure:

- fast and reliable reactor scram,
- fast and reliable evacuation of residual heat given out by the fuel after reactor is shut down.

In order to ensure safety of the population and of the environment in emergency conditions – to limit uncontrolled releases of radioactive substances from the NPP to the environment – it is of utmost importance to protect the integrity and tightness of the containment structure and its efficiency in removing the radionuclides released from the fuel and into the reactor cooling system.

Nuclear units with generation III reactors – in addition to superior operational parameters and economic characteristics, more efficient use of nuclear fuel and lower quantity of nuclear waste, this type of installations are far safer than earlier generations. This is achieved through a significant change in the design assumptions and more stringent safety criteria set for the generation III nuclear power plants.

Generation II power plants were designed for the so called **design basis accident (DBA)**, with the assumption that the probability of a more severe accident (causing major damage to the reactor core through failure of safety systems) is so low that the associated risk can be regarded as acceptable, and this safety systems were built to meet the DBA conditions without the assumption of degradation of reactor core – including core meltdown.

The design of generation III nuclear power plants accounts for the so called **design extension conditions**, which include the failure of safety systems required after an initiating event leading to a **design accident**, leading in turn to meltdown or the reactor core – a severe accident. The design of a generation III nuclear power plant is required to account for and limit the radiation impact of **severe accidents**. The above requirement is specified in a document developed by the European nuclear industry – 'Eur', entitled "European Utility Requirements for LWR Nuclear Power Plants. Revision D. October 2012"

In terms of the 'EUR' document, technical systems used in a nuclear power plant must ensure safety of the population and natural environment in the vicinity of the plant even in the event of a severe accident, minimising the radiation impact of radioactive releases caused by accidents. Moreover, thanks to the design solutions and improved reliability of equipment the probability of a severe accident with reactor meltdown is 100 times lower than in generation II reactors.

Severe accidents are low-probability accident conditions more serious than design basis accidents, resulting in major degradation of the reactor core – including its meltdown, which may lead to releases of large quantities of radioactive materials. In the case where a severe accident occurs despite the safety systems, then the radioactive substances released from the (overheated) nuclear fuel and the reactor cooling system must be retained within the containment structure.

One of key safety requirements of the new designs of nuclear power plants is practical elimination (deterministic, through appropriate design features) of such severe accidents with reactor meltdown, which could lead to early damage of the containment structure and to releases of large quantities of radioactive substances to the environment.

11.3 Environmental Management Plan

The concept of Environmental Management Plan (EMP) will be developed as part of the EIA process. The plan will include recommendations for the means of monitoring and minimising the impact of the NPP during its construction and operation. Concept of the Environmental management plan will be submitted together with the EIA Report. The final version of the Plan will be developed and approved at the stage of subsequent environmental impact assessment and construction permit. The Environmental Management Plan will serve as the basis for impact management during construction and operation of the NPP.

Key elements of the Plan, reflecting best practice recommended by the World Bank, are listed below. Environmental Management Plan may include:

- summary of potential environmental impacts;
- description of recommended mitigation measures;
- statement of compliance with pertaining norms and standards;
- allocation of resources and responsibility for implementation;
- implementation schedule;
- supervision, monitoring and audit plan;
- intervention plan for cases, where impacts are greater than foreseen.

Examples of mitigation measures which may be recommended in the Plan include:

- fencing off vulnerable areas during construction,
- protection of vulnerable areas against leaks,
- proper waste management on the construction site,
- use of ultra-low sulphur diesel fuel (in justified cases),
- ensuring that trucks carrying bulk materials are covered,
- requiring the subcontractors to submit transportation plans to minimise the volume of traffic,
- ensuring that diesel powered generators during the construction and operation use fuel with low sulphur content, minimising the level of SO_2 emissions,
- limiting the hours of work of machinery generating material emissions.

11.4 Management of operation

The organisation and management of the construction and operation of a nuclear power plant will comply with an integrated management system which is implemented, up-to-date and in accordance with the act of 29 November 2000, the Atomic Law (uniform text J.o.L. 2014.1512 as amended), subordinate regulations and IAEA requirements regarding integrated management systems as published in standard no. GS-R-3, 'The management System for Facilities and Activities'. Documentation of the Integrated Management System will be submitted for approval by the head of PAA, together with an application for the Nuclear facility construction license.

11.5 Supply chain management

Contractors and suppliers of systems and elements for structures, equipment and installations of the nuclear power plant as well as contractors executing works related to construction and equipping of the nuclear power plant will have implemented management systems suitable to the scope of supplies and type of works, compliant with terms of the integrated management system approved by the PAA, requirements specified in appropriate Polish regulations, terms of safety standards of the International Atomic Energy Agency, and in the detailed specifications and technical norms and standards appropriate for the structures, systems and installations of the nuclear power plant. Contractors and suppliers of systems and elements of the NPP will be controlled and supervised in accordance with the approved procedures, applicable norms and standards by qualified personnel holding appropriate licenses, permits, competence and experience in order to ensure nuclear safety, radiation protection, occupational health and safety and environmental protection.

Supervision and control will include the inspection of new systems and systems under construction, elements and equipment of the nuclear power plant as well as inspections on the construction site during the execution of the works. Should such inspections show that a given system, structural element, equipment or works conducted on the construction site of the nuclear power plant may have a negative impact on nuclear safety, radiation protection, environmental protection or OHS then such works will be suspended until the risk is removed and, if necessary, until new permits and licenses are obtained from appropriate authorities.

12 Description of the environment

At this stage, the description of the environment in the zone of potential impacts of the project was made on the basis of:

- data obtained from competent institutions and bodies,
- scientific publications specified in the list of references in Chapter 17,
- own research, including the habitat survey made in April-June 2015.

Information about the environment will be extended on the basis of a detailed environment survey, which is scheduled for 2016 and whose results will be the basis for preparing the characteristics of

environment in the EIA Report. The scope and methodology of the environmental survey program is presented in chapter 13.

12.1 Land use to date

Locations of the planned nuclear power plants are situated in the territory of three communes: Choczewo and Gniewino belonging to the Wejherowo poviat and Krokowa, Puck poviat. The land use in the communes is of forest and agricultural nature, with no large industrial plants or larger conventional power plants. Choczewo and Krokowa are the coastal communes, which involves additional functions fulfilled by these communes and presence of specific spatial development forms typical for coastal areas.

Most of the Choczewo commune area (183 km^2) is covered by forests located primarily in its northern part (along the Baltic Sea strip) and usable agricultural lands situated in the central and southern part. Meadows and pastures are present mostly in the river valleys. Developed and urbanized areas cover only app. 4% of the commune area.[17]Well-developed tourist infrastructure is present in the northern, coastal part of the commune. Numerous guest-houses, holiday centres and agrotourism farms are accompanied by campsites and scout camps. Clean beaches (Stilo, Lubiatowo) and Stilo lighthouse are a strength of the commune in terms of tourism.[18] A wreck of Danish West Star ship is an additional attraction. The wreck is situated at the depth of app. 2.5m. Only the mast sticking out of the water surface is visible from the beach. The wreck is approved for diving. There are also other ship wrecks located in a distance of app. 5 km from the seashore, e.g. Margareta and Skawina.[19]

More than 40% of the Gniewnino commune (total area of 176 km^2) is covered by usable agricultural lands situated primarily in the northern and central part of the commune and nearly the same by the forests located for the most in the south-western part and in the strip along the Żarnowieckie lake. Water constitutes a large percentage of commune area due to the presence of several lakes (among others Żarnowieckie Lake). Pumped storage power plant and wind turbine grid are the key components of the commune's economy.[20]

Table 15. Land cover structure of the Choczewo, Gniewnino and Krokowa communes

Use/Commune	Choczewo	Gniewino	Krokowa	Poland
Usable agricultural lands	49%	42%	55%	60%
Forests and forest areas	43%	40%	35%	31%
Water	2%	11%	1%	2%

[17] The Choczewo commune, Environmental protection program for 2004 – 2011, [in:] Environmental protection program for the Wejherowo poviat and poviat communes for 2004 – 2011; Poviat Starosty in Wejherowo, Wejherowo
[18]http://www.umgdy.gov.pl/wpcontent/uploads/2015/04/INZ_Studium_Uwarunkowan_Zagospodarowania_Przestrzennego_POM_20032015.pdf
[19] http://www.balticwrecks.com/pl/wraki/
[20] http://www.gniewino.pl/PL/struktura_uzytkowania_terenow.html

Developed and urbanized areas	4%	7%	5%	5%
Wastelands	2%		4%	2%

Source: Own study with the use of data from http://www.regioset.pl, http://gniewino.pl, "Environmental protection program for the Choczewo commune for 2004 – 2011", "Statistical yearbook of agriculture 2014", "Draft study on the conditions and directions of local spatial development of the Krokowa commune".

The Krokowa commune (212 km^2) is the agricultural and tourist commune, with agricultural production area covering more than a half of its territory. Arable lands and usable green fields are located in the central part of the commune and in its northern part on the area of coastal swamps with numerous meadows and pastures. Forests cover one third of the commune area and are located primarily in the north-western and northern (a narrow strip along the coast) as well as in the southern part of the commune and east of the Żarnowieckie Lake. Industrial areas of the Pomeranian Special Economic Zone (PSEZ) and the abandoned construction site of the nuclear power plant and Żarnowiec power station constitute a minor part of the commune. These areas are located at the south-western shore of the Żarnowieckie Lake and south of the lake. Developed and urbanized areas cover only app. 5% of the commune territory. The Dębki fishing harbour established in 2008 basing on individual vessels (5 crafts) is located in the territory of the commune. The harbour operations involve direct trade with the consumers or agents. Moreover, the development of the coastal part of the commune is strictly connected with services for tourist traffic. Comprehensive accommodation offer is accompanied with sports centres and health resorts (Dębki, Białogóra). Numerous beaches, e.g. in Białogóra, Dębki and Karwieńskie Błota Drugie, operate in the territory of the commune.[21]As in the case of Choczewo, the ships wrecks – British General Carleton and German Arngast (located in a greater distance from the seashore and approved for diving) – are also among the greatest tourist attractions.[22] The tourists enjoy also canoeing rallies on the Piaśnica river with the finish on the beach in Dębki.

Fisheries management is conducted on the Baltic Sea in the direct vicinity of the potential location options of the nuclear power plants. There are two classifications of fishing areas in this region. The first classification follows the division of marine waters according to the International Council for the Exploration of the Sea (ICES). According to this nomenclature, the fishing areas in the studied region are classified as the ICES statistical subdivision 25 and 26. These subdivisions comprise of separate areas named after the traditional names of fishing areas. The second classification is the fishery square grid. The grid is used in radio communication, log-books, communication between the shipping companies and crews, etc. The grid comprises of parallels measured every 10 geographical minutes latitude by 20 geographical minutes meridians, creating the conventional "squares" of 10 x 11.5 Nm (nautical miles) area. The squares are marked by letters from A to Z from east to west and

[21]http://www.umgdy.gov.pl/wpcontent/uploads/2015/04/INZ_Studium_Uwarunkowan_Zagospodarowania_Przestrzennego_POM_20032015.pdf
[22] http://www.balticwrecks.com/pl/wraki/

by digits from 1 to 31 from south to north. The following fishery squares are outlined in the vicinity of the locations: O6, O7 and P7.[23]

12.1.1 Żarnowiec Location Variant

The location is situated in the Żarnowieckie Lake trough. It adjoins the south-eastern lakeside, where the moraine hills covered with beech and mixed forest grow away from it. The location covers the remains of the abandoned construction site of the nuclear power plant – the fragments of decaying buildings and structures partially flooded with water. The remaining area of the location is developed with buildings of the Żarnowiec subzone of the Pomeranian Special Economic Zone (PSEZ), which makes for the industrial nature of the landscape. The other, south-western side of the Żarnowieckie Lake, is developed with the Żarnowiec pumped storage power plant facilities. Apart from the southern part, the landscape of the Żarnowieckie Lake becomes more natural. The central parts of the lakesides are developed with buildings – primarily with recreational residential development – of Nadole (on the western side of the lake) and Lubkowo (on its eastern side).

12.1.2 Choczewo Location Variant

Choczewo 1 location adjoins the Baltic Sea within the coastal dune strip. This area is almost entirely covered with pine forest with prevailing Scots pine *Pinus silvestris* and artificially introduced dwarf mountain pine *Pinus mugo* in the stand. Due to land diversification (the area of Lubiatowska Dune) and poor environment (sands, probably low groundwater table), the pine forest is species-poor which translates into non-intensive forest management.

The dune strip situated towards east and west from the location boundaries is covered with pine forest. A small Lubiatówka river runs along the western boundaries of the location, whereas the Bezimienna watercourse runs along its eastern boundary. The areas of the former military training field adjoin the location from the east. The dunes in this area are characterized by poor vegetation cover and mobility. In addition, the eastern boundaries of the location adjoin the Natura 2000 site – "Białogóra" Special Areas of Conservation.

The facilities of the „Mimo wszystko" foundation are situated in direct vicinity of the southern boundary of the location. The buildings of the Lubiatowo village (usually holiday development) are located app. 1 km further.

12.1.3 Lubiatowo-Kopalino Location Variant

The Lubiatowo-Kopalino location is situated in the direct vicinity of the Baltic Sea. It covers a forested area of the coastal dune strip. The prevailing species in the stand include Scots pine *Pinus silvestris* and the artificially introduced dwarf mountain pine *Pinus mugo,* covering primarily the dunes. Intensive forest management is maintained in the location. The area of the location has well-developed forest road network, many roads are used as tourist routes – for trekking, cycling and horse riding.

[23] Chief Inspectorate for Environmental Protection, 2012, Initial environmental assessment of marine waters, CIEP, Warsaw

The area situated west of the location is a forested dune strip, with the lighthouse (Stilo) erected on the top of the highest dune. The areas east of the location are primarily forest areas with a small holiday camp. South of the Lubiatowo-Kopalino location there are Biebrowo wet meadows used for agriculture.

12.2 Land relief

According to the geophysical regionalisation of Poland by Kondracki (2014), the entire region of the potential power plant locations is a part of the Koszalin Coast macroregion, Southern Coast of the Baltic Sea subprovince in the Central European Lowlands province. Vast majority of the region belongs to the Wysoczyzna Żarnowiecka (Żarnowiecka Plain) mesoregion. The eastern and southern boundaries of the location region are situated in the Gdansk Coast macroregion and East Pomeranian Lake District macroregion.

The relief of the location region was formed by the alluvial activity of the last ice sheet (Vistula ice stream), fluvoglacial erosion processes and current (Holocene) alluvial and erosion processes[24].

From the north, the region adjoins the Baltic Sea, which contributes to the current character of the coast determining the littorial and eolial processes. The seashore is poorly diversified and smoothened by sea waves. The alluvial activity of the sea involves formation of numerous dunes. Sand accumulated on the beach is blown away towards the land. This led to the forming of the dune strip of up to 1.5 km width with maximum heights exceeding 40 m above sea level. At present, vast majority of the dunes is immobilized by the pine forest.

The western and southern boundaries of the region are crossed with well-formed Reda and Łeba rivers ice-marginal valley, formed during the recession of the last ice sheet due to outflow of glacial meltwater towards west. Width of this deeply incised valley is between 1.5 and 5.5 km. At present, the eastern part of the ice-marginal valley is drained by the Reda river, running towards east to the Puck Bay, whereas its central and western part by the Łeba river, flowing into the Łebsko lake and further to the sea.[25]

The Kashubian Lake Disctrict, the highest situated region from among all the Pomeranian lakelands, spreads towards south from the Reda – Łeba rivers ice-marginal valley. These areas are characterised by significant height differences (relative heights reach 160 m). Numerous drainless basins and deep subglacial channels are observed there.[26]

The eastern part of the region is surrounded by shallow Puck Bay separated from the open sea by the Hel Peninsula formed by alluvial activity of waves and wind. Land part of the eastern boundaries of the location are the plains crossed with valley formations.

The Żarnowiecka Plain is situated inside the location region. The surface of this moraine plain is separated by depressions or subglacial channels into multiple moraine uplands. The northern and southern parts of the mesoregion are characterized by two ranges of low moraine hills and the

[24] Migoń P., 2013, Geomorfologia, PWN, Warsaw
[25] Kondracki J., 2014, Geografia regionalna Polski, PWN, Warsaw
[26,22] Kondracki J., 2014, Geografia regionalna Polski, PWN, Warsaw

sandur (a sandy, smooth formation formed during the ice sheet regression) covered with Wierzchucińska Forest.[27]

12.2.1 Żarnowiec Location Variant

The Żarnowiec location is situated in the north-eastern part of the Żarnowiecka Plain mesoregion. The area within the location boundaries is mostly flat. Anthropogenic transformation of the region results from earthworks performed for the purposes of construction of the nuclear power plant – including lakeshore transformation (40 ha of embankments), area levelling, deep excavations and embankments related to the foundation of construction structures. The location is situated in the subglacial channel of the Żarnowieckie Lake at the height of app. 9 MASL. The area peaks along the eastern boundary of the location, forming the hills of the moraine plain reaching 102.8 MASL.

12.2.2 Choczewo Location Variant

The boundaries of the Choczewo location adjoin directly the Baltic Sea shore and are situated entirely in the so called dune strip. The area of the location is diversified, since it is situated entirely on the established (partially mobile) Lubiatowska Dune, including multiple sandy curves and hills of maximum heights exceeding 20 MASL[28]. The area of the location is surrounded by two watercourses (Lubiatówka river from west and Bezimienna river from east), small riverbeds of which incise deeply (several meters) into the sandy bed. The area adjoining the location from the south is diversified (continuation of sand strip), and flattens towards the Lubiatowo village.

12.2.3 Lubiatowo-Kopalino Location Variant

The Lubiatowo-Kopalino location is situated in the so called dune strip at the height of app. 7 MASL and its boundaries adjoin directly the Baltic Sea shore. The area of the location is relatively flat and forms a depression between two well-formed dune hills. A part of eastern dune hill is situated within the location boundaries at the level exceeding 20 MASL. The height of dunes situated west of the location reaches up to 40 MASL. The northern boundaries of the location adjoin a beach measuring several dozen meters in width. Mobile terminal dunes of height reaching several meters are also present locally. A flat area (Biebrowo meadows) of drained swamp spreads south of the location boundaries.

12.3 Geology

The following geological characteristics concern the area located on the Baltic Sea coast, covering the Choczewo, Gniewnino and Krokowa communes in the Pomeranian Voivodeship and their direct surroundings, which are three location variants proposed for the nuclear power plant.

[28] http://www.pomorskie.travel/Odkrywaj-Przyroda_i_Wypoczynek-Przyroda-Punkty_widokowe/345/Wydma_Lubiatowska [Accessed: July 2015]

The analysed area is situated within the Precambrian East European platform (East European craton) characterized by double-stratum structure[29].

The bottom stratum, formed as the crystalline basement, consists of magmatic and metamorphic rocks of the Archaic and Proterozoic, folded several times during the orogenic movements. The crystalline basement rocks are highly transformed. Metamorphic rocks are crossed with magmatic, deep-seated, eruptive, vein, acidic, basic and ultrabasic rock intrusions.

Sedimentary rocks overlie the foundation discordantly, forming the upper, platform stratum. The strata have different formation time and geotectonic development. Different vertical movements during sedimentation of the sedimentary cover in the Paleozoic resulted in formation of the foundation top as well as depressions and elevations (platform units).

The platform consists of several structural units, which are the basis for its division into the secondary units. Their origins involve the diversified surface of the crystalline basement and vertical movements of the Earth's crust. In some units, the tectonics stem from the presence of faults in the crystal bed, resulting in horst and graben structure of some of them[30].

The studied area is located within the Peri-Baltic Depression (Peri-Baltic Syneclise), bordered to the North by the Baltic Shield, and the Łeba river elevation (part of the Peri-Baltic Depression on Polish territory). The area has a block structure. With the exception of fault zones, the strata of the sedimentary cover are not discordant – they lie horizontally or are slightly inclined. The tectonic blocks are separated with the Białogóra-Żarnowiec fault zone of a latitude-like course (W-E).

Different formations of the Older Paleozoic Era shaping the platform underlie the discordant Permo-Mesozoic sediments of the structural complex which consists primarily of evaporites (salts, anhydrites and carbonates). The most intense, multi-stage erosion covered the entire Upper Paleozoic and Mesozoic complex, where almost across the entire area, Syluric is covered discordantly with Permian, and secondary sedimentary gaps and structural unconformities are present also in the thill and Cretaceous top. The sedimentary profile is significantly reduced due to changes in size of subsequent sedimentary basins and related extensive, long-term denudation processes[31].

Due to differences in geological structure and specificity of the Cenozoic formations for the individual location variants, the description of Paleogene and Neogene complex and the Quaternary Period formations was divided into two regions, described below.

12.3.1 Żarnowiec Location Variant

The Paleogene and Neogene complex formations present within the described area are highly diverse. In the Eocene and Oligocene, the glauconitic sands, mudstones with glauconite, and phosphorites were formed by marine sedimentation. As the sea regressed and the inland water reservoirs were formed (Lower Miocene), sands and sandy silts with carbon dusts and brown coal

[29] Dadlez R., 1990, Tektonika południowego Bałtyku. Geological Quarterly, volume 34, no. 1, pages 1-20
[30] Stupnicka E., 2008. Geologia regionalna Polski. Wydawnictwa Uniwersytetu Warszawskiego, Warsaw.
[31] Pokorski J. 2010. Geological section through the lower Paleozoic strata of the Polish part of the Baltic region. Geological Quarterly, volume 54 (2), pages 123-130.

impurities continued to deposit. In many cases, the Tertiary Period formations are present as heavily slitted *in situ* formations[32].

Deposition of the Quaternary sediments took place in continental conditions and entirely covers the analysed region. Quaternary formations are primarily the North-Polish glaciation sediments. The common absence of any older sediments (South-Polish glaciation era) demonstrates heavy erosion during the younger glaciations. The remains of Middle-Polish glaciation sediments are present as formations redeposited in the later period. The highest thickness of the Quartenary formations is observed at the moraine upland (exceeding 100 MASL). During the Holocene changes of the Baltic Sea level fluctuations, local depressions filled with lake silts and the valleys with gyttjas and lake marl. At present, these formations are covered with peats, spreading across extensive areas in the coastal depression strip in the valleys and in many depressions on the plain. The analyzed region is situated at the bottom of the deep glacial Żarnowiecka Channel which acted as the water outflow system in the terminal stage of the Baltic glaciation. The channel connects to the wide Reda – Łeba rivers ice-marginal valley in the South. Discontinuation of the erosion processes and increase in the water level of ice-marginal Baltic Sea at the end of the Pleistocene were followed by the period of intense accumulation of river and fluvioglacial sediments filling the bottoms of ice-marginal valleys with a thick sand and gravel bed. Upon further increase of the water level in the Littorina Sea period, i.e. 3 000 – 7 000 years ago in the Holocene, the water level of the Baltic Sea continued to rise. This resulted in accumulation of sediments aggregated by the Piaśnica River, covering the land with vegetation and forming shoreline swamp formations in the southern part of the Żarnowiecka Channel. In the past-Littorina Sea period, i.e. between 0 and app. 1000 years AD, the surface waters level was app. 1 m higher than nowadays, which contributed to formation of coastal peat lowlands in the Piaśnica river valley area, whereas the peat and mud strata with humous sand insertions formed at the Żarnowieckie Lake. In the area, the bed of the planned investment contains humous sands, peat sands and peat muds as well as delluvial sediments deposited by alluvial fans[33].

12.3.2 Choczewo and Lubiatowo-Kopalino Location Variant

The Paleogene and Neogene complex formations present within the described area are highly diverse. They are heavily reduced or absent in the areas of deep erosive incisions. The complex is represented by Eocene mudstones, siltstones and silts underlying the Oligocene sands, clays and mudstones with brown coal insertions.

Deposition of the Quaternary sediments took place in continental conditions and entirely covers the analysed region. Deep erosive incisions of bed are usually filled with South-Polish glaciation sediments. They are sandy, sand and gravel formations with an overlying boulder clays stratum. These formations underlie the Middle-Polish glaciation sediments, mainly mudstones and sandy mudstones, covered with boulder clays and fluvioglacial formations stratum (sands and sands with gravels). The North-Polish glaciation formations include primarily fluvioglacial sediments (sands and sands with gravels) underlying boulder clays. In the areas of coastal valleys and deep depressions, boulder clays have been entirely eroded. The youngest formations are the Holocene dune and beach

[32] Mojski E. 2006. Ziemie polskie w czwartorzędzie. State Geological Institute, Warsaw.
[33] Mojski E. 2006. Ziemie polskie w czwartorzędzie. State Geological Institute, Warsaw.

sands, gyttjas, peats as well as sands and aggregated muds of valley beds and drainless basins. Sands and gravels of the sandbars and shore banks are frequently covered with eolic sands. In the coastline zone, the eolic sands in the dunes and beach sea sands are observed. In the area of the projected research, the bed of the planned investments features eolic sands overlying the river sands of valley beds and terraces[34].

12.4 Hydrogeological conditions

According to the hydrogeological regionalization of Poland in line with the Hydro-geological Atlas of Poland[35] the area of the projected research is located within region V (Pomeranian), subregion V.1 (Coastal).

This region is characterized by normal groundwater in the Cenozoic aquifer, locally exposed to ascension of mineralized water from the deeper aquifers (Trias) and sea water ingression. Groundwaters in the Quaternary formations and in the Paleogene-Neogene complex are of functional importance and form a single, local, hydraulically connected water-bearing system. Deeper strata waters are highly mineralized and demonstrate no functional properties.

Groundwaters in the Paleozoic formations cover the Cambrian and Permian sediments (Zechstein) and form highly mineralized salt waters.

Mesozoic aquifers are bound up with the sandy sediments of Tumlin sandstone (Trias) and demonstrate high salinity and mineralization.

Aquifers or heterogeneous genesis, age and distribution are present within the Cenozoic formations. Groundwaters of the Paleogene-Neogene complex were identified within the sandy sediments of Oligocene and Miocene[36].

Due to differences in hydrogeological structure of the Cenozoic formations for the individual location variants, the description of the Quaternary Period aquifers complex was divided into two regions:

12.4.1 Żarnowiec Location Variant

The first aquifer consists of the intermoraine fluvioglacial sands of the North-Polish glaciations on the Żarnowiecka Plain and of sands, gravels of lake terraces and alluvial fans filling the bottom of the Żarnowieckie Lake trough. The surface aquifer is also formed of the sand and gravel sediments filling the subglacial channels incising the moraine upland.

The second aquifer comprises of the sandy deposits of the Middle-Polish glaciations and the Eemian interglacial period. It is present locally in the depressions of pre-Quaternary bed on the upland and in the fossil erosive channel. The second aquifer is present continuously only in the Żarnowieckie Lake trough. In the northern part of the Żarnowieckie Lake

[34] Mojski E. 2006. Ziemie polskie w czwartorzędzie. State Geological Institute, Warsaw.
[35] Atlas hydrogeologiczny Polski (*Hydrogeological Atlas of Poland)*, scale 1:500 000, Part II – Zasoby, jakość i ochrona zwykłych wód podziemnych *(Resources, quality and protection of normal groundwaters),* Paczyński B. et al., State Geological Institute, Warsaw, 1995.
[36] Pazdro Z., Kozerski P., 1990. Hydrogeologia ogólna. Wydawnictwa Geologiczne, Warsaw.

trough, waters of the second stratum are influenced by highly mineralized (chlorides) older bed waters. This refers primarily to a narrow meridian-oriented zone, spreading from Żarnowieckie Lake north to the Baltic Sea[37].

12.4.2 Choczewo and Lubiatowo-Kopalino Location Variant

The Quaternary aquifer waters are present in two aquifers: intermoraine and subclay.

The intermoraine waters of the aquifer are present in the fluvioglacial sediments of Middle-Polish and North-Polish glaciations, forming usually a single, joint water-bearing complex. Locally, this stratum is separated with a non-continuous boulder clay stratum. The coastal lowland is formed of river sediments with four river terraces and two dune strips within its area. The eroded river terraces are of non-continuous nature. The aquifer is formed of the Quaternary sands of various granularity with prevailing fine sands. The analyzed aquifer is supplied by direct infiltration, especially in the non-isolated areas. The intermoraine aquifer in this area acts as the primary aquifer.

Subclay aquifer is present within the extensive depression in the sub-Quaternary surface. It is observed in fluvioglacial formations from the South-Polish glaciation period. It underlies the boulder clay complex top and connects with the Oligocene stratum at the edges of the erosive valley. The subclay stratum is not currently being exploited and constitutes a secondary aquifer.

According to the Hydro-geological Map of Poland, First Aquifer, scale 1:50 000, Choczewo sheet, the area of the projected works is located within the unit 1 pd, p/r/zsP/Q [14]. This unit was marked out within the plain area (r). The unit area includes four river terraces and two dune strips. The unit covers almost the entire coastal area of the Choczewo sheet. The top of the first aquifer is located at the depth of app. 0.5 m to 15 m. Water table is of free nature and lies on the coordinates of the parameters from 1 MASL to app. 20 MASL. The first aquifers waters flow north to the Baltic Sea. Aquifer is formed of the Quaternary sands of various granularity with prevailing fine sands. The first aquifer is separated from the primary exploited aquifer with a Vistula river glaciation clay layer (North-Polish glaciation). Both strata are hydraulically connected. The first aquifer fails to meet the criteria for the primary aquifer.

12.4.3 Issues Related to Groundwater Protection

Within the analyzed locations or the range of the potential impact of the project, pursuant to the Regulation of the *Council of Ministers of 27 June 2006 on the course of boundaries of the river basins and water regions (Journal of Laws of 2006, No. 126, item 878 as amended),* the following is identified: MGB 108 – Salino intermoraine basin, 109 - Żarnowiec fossil valley and 110 – Kaszuby ice-marginal valley and Reda river included into the Vistula river basin.

The Main Groundwater Basin (MGB), as defined in Słownik Hydrogeologiczny (*Hydrogeological Dictionary*) [38], is the groundwater basin meeting the officially established quantitative and qualitative

[37] Paczyński B., Sadurski A., 2007. Wody słodkie [w:] Hydrogeologia regionalna Polski. State Geological Institute, Warsaw, volume I.
[38] Słownik Hydrogeologiczny (*Hydrogeological Dictionary*), Dowgiałło J., Kleczkowski A. S., Macioszczyk T., Różkowski A., et. al., State Geological Institute, 2002, Warsaw.

basic criteria: potential well capacity above 70 m^3/h, water intake capacity above 10 000 m^3/d, aquifer conductivity above 10 m^2/h, the highest water quality class. In the water-deficit areas, MGBs are determined using the individual quantitative criteria.

The issues related to MGBs and their protection constitute one of the key aspects in terms of water exploitation and protection, pursuant to the *Water Law* and *Environmental Protection Law* acts. The MGBs are water reservoirs intended primarily for securing high-quality water reserves, for the protection of which, pursuant to Art. 51 of the *Water Law* act, the protected areas for the inland water bodies are established. The protected area is established under the act of local law by the Regional Director for Water Management, on the basis of hydrogeological documentation containing the suggested prohibitions, orders and restrictions regarding land or water exploitation to protect these water resources against degradation. All identified MGBs are accompanied by hydrogeological documentation, however, as of today, in the Lower Vistula river water region no protected areas for the inland water bodies have been established.

The subject-matter of analyses with regard to the research execution shall also include prohibitions, orders and restrictions for the protected areas for surface and ground water intakes established under the Water Law act.

12.4.4 Groundwater bodies

Pursuant to the definition of Art. 2, par. 12 of the Water Framework Directive (WFD) and Art. 5, par. 5, clause 2 of the Water Law act (transposing the WFD provisions), the groundwater body means a distinct volume of groundwater within an aquifer or aquifers. Division into groundwater bodies was adopted for the purpose of water management in the sub-basin management system.

Pursuant to Art. 38e. par. 1 of the Act of 18 July 2001, Water Law (i.e. Journal of Laws of 2015, item 469), the environmental objective for groundwater bodies is:

1) preventing or mitigating the pollution entry into groundwater bodies;
2) preventing deterioration and improvement of the status of groundwater bodies;
3) protection and taking the corrective actions as well as ensuring a balance between abstraction and recharge of groundwater to ensure good status of groundwater.

The Water Law act, within the boundaries of the investigated locations, identifies the groundwater bodies no. 11, 12 and 13 (Figure 18). Table 16 presents the aggregated evaluation of water status (divided into 161 and 172 groundwater bodies).

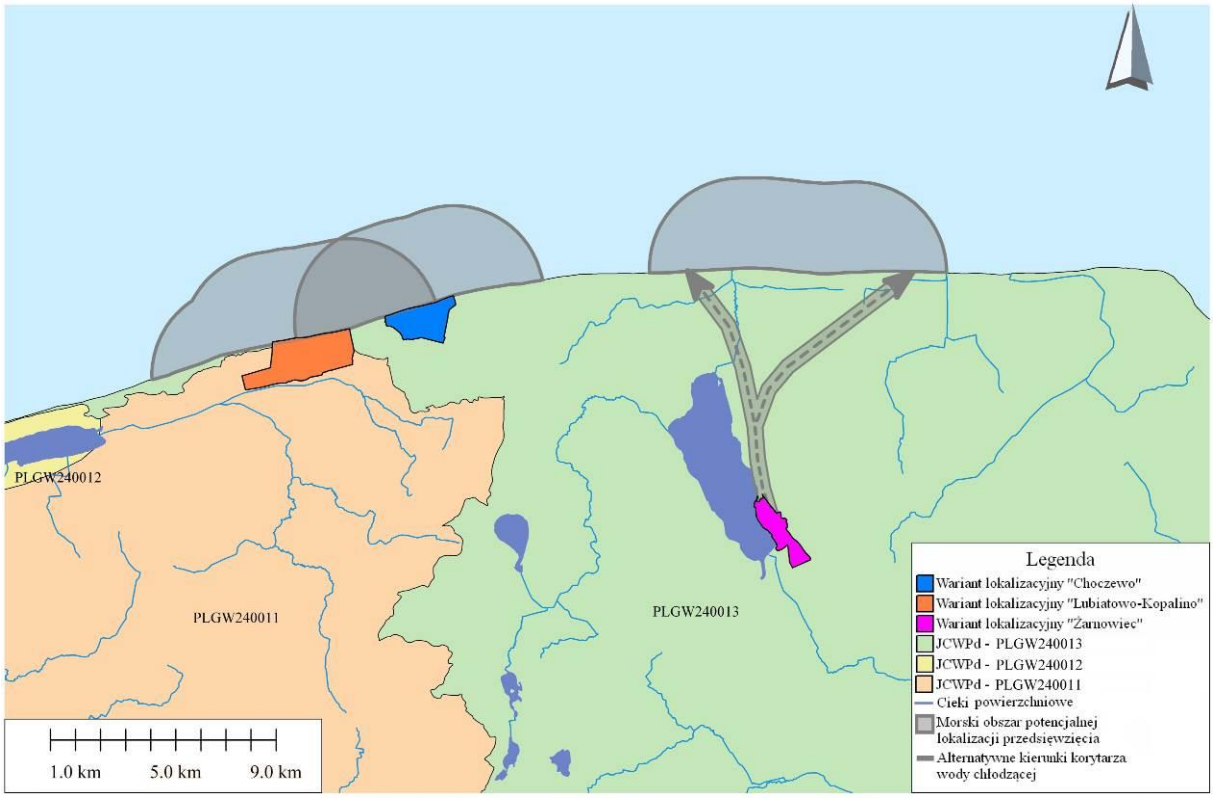
Table 16. Groundwater bodies within the boundaries of the planned project and its vicinity

		Groundwater body no.					
		11		12		13	
		acc. to the division into 161 GWB	acc. to the division into 172 GWB	acc. to the division into 161 GWB	acc. to the division into 172 GWB	acc. to the division into 161 GWB	acc. to the division into 172 GWB
Evaluation of quantitative status	according to WMP (Water Management Plan)	good	good	good	good	good	good
	according to CIEP data, 2012	good	good	good	good	good	good

Evaluation of chemical status	according to WMP	good	good	poor	good	good	good
	according to CIEP data, 2012	good	good	good	good	good	good
Evaluation of risk of failure to meet the environmental objectives (according to PGW)		not at risk	not at risk	not at risk	not at risk	not at risk	not at risk
Evaluation of risk of failure to meet the environmental objectives		not at risk	not at risk	not at risk	at risk	not at risk	not at risk

Source: http://mjwp.gios.gov.pl/; http://www.rdw.org.pl/; ** based on the studies: „Charakterystyka wód podziemnych zgodnie z zapisami załącznika II.2 Ramowej Dyrektywy Wodnej", („Specification of groundwater in accordance with Appendix II.2 of the Water Framework Directive", „Ustalenie celów środowiskowych dla jednolitych części wód powierzchniowych (JCWP), podziemnych (JCWPd) i obszarów chronionych" („Determination of the environmental objectives for surface water bodies (SWBs), groundwater bodies (GWBs) and protected areas").*

The results of the research and analyses performed with regard to execution of the research program under the delivery of this Project will be analyzed regarding assessment of risk of failing to meet the environmental objectives for such groundwater bodies specified in the Water management plan for the Vistula river basin district and with regard to the arrangements and actions included in the Water and Environment Programme [39].



Key
"Choczewo" location variant

[39] Plan gospodarowania wodami na obszarze dorzecza Wisły (*Water management plan for the Vistula river basin district*), Official Gazette of 2011, No. 49, item 549

"Lubiatowo – Kopalino" location variant
"Żarnowiec" location variant
GWB – PLGW240013
GWB – PLGW240012
GWB – PLGW240011
Surface water courses
Marine area of the potential project location
Alternative directions of cooling water canal

Figure 15. Groundwater bodies within the boundaries of the location
Source: Own study utilizing data from the Regional Water Management Authority in Gdansk.

12.5 Hydrological conditions

Hydrological conditions of the location region are specific for the early post-glacial area and were formed following the last (Vistula) glaciation. Its features include extensive river valleys formed on the beds of ice-marginal valleys (Reda – Łeba rivers ice-marginal valleys), drainless basins, deep post-glacial channels[40,41]. Due to absolute height and sea vicinity, relatively high slopes are a feature recorded for the vast majority of rivers.

The Baltic Sea is the largest hydrographic object of the region (South-Eastern Basin). The potential locations of nuclear power plants are situated in significant distances from the country's large rivers. The significant regional rivers include: Łeba river and its tributaries (river lenght of 117 km, river basin district of 1768 km^2), Reda river (51 km, 486 km^2) and Piaśnica river (30 km, 319 km^2). Lakes above 1 km^2 situated within the location region include Łebsko (70.4 km^2), Sarbsko (6.2 km^2), Żarnowieckie (14 km^2), Choczewskie (1.8 km^2) and Lubowidzkie (1.6 km^2).[42] The vast majority of lakes were formed in the post-glacial period (channel and kettle lakes). Łebsko and Sarbsko Lakes are examples of the coastal type – they were formed as a result of the separation of marine bays from the sea by sandbars or depressed areas filled with water due to increased groundwater level. The largest artificial object of the regional hydrography is the upper reservoir of the pumped storage power plant in Czymanowo (at the Żarnowieckie Lake) the surface of which is app. 1 km^2. Swamps at the river valley bottoms and the so-called coastal swamp strip are a significant component of the hydrographic structure.

The regional rivers are characterized by simple hydrological system, with a single minor spring lift. River supply system is of complex nature and involves soils, rainfalls and snowfalls.[43] The location region is classified as an area of high surface outflows and balanced flows, which is reflected by low

[40] Bajkiewicz-Grabowska E., Mikulski Z., 1999, Hydrologia Ogólna, PWN, Warsaw
[41] Migoń P., 2013, Geomorfologia, PWN, Warsaw
[42] KZGW, 2010, Mapa Podziału Hydrograficznego Polski (*Map of Hydrographic Division of Poland)*, Warsaw
[43] Fac-Beneda J., 2005, Komentarz do Mapy Hydrograficznej Polski w skali 1:50 000 *Commentary to the Hydrographic Map of Poland, scale 1:50 000)*, sheet N-34-37-C Gniewino, Główny Geodeta Kraju (Surveyor General of Poland), Geomat Poznan, Rzeszow

irregularity of the average annual flow rates, which for the Piaśnica river is below 1.8. Average annual unit flow rate is high and amounts to app. 10 $dm^3/s/km^2$ (average value for Poland is 5 $dm^3/s/km^2$).

According to the division used for water resources management, the location region is classified as the lower Vistula river water region. The basic units of water management system in the light of Polish law and in accordance with the Water Framework Directive are surface water bodies (and groundwater bodies), which will be considered further in the description.

According to the Flood Hazard Map[44] and Flood Risk Map[45] the areas of the potential locations of the nuclear power plants are not at risk of flood of a probability rate of 0.2%.

With regard to the situation of the potential locations of the nuclear power plants in different river basins, the remaining part of the description accounts separately for each river basin.

12.5.1 Żarnowiec Location Variant

The Żarnowiec location is situated in the Piaśnica river basin district (319 km^2) and directly adjoins the Żarnowieckie Lake. According to the Map of Hydrographic Division of Poland, the Piaśnica river basin district is the 4. grade river basin, constituting a part of the Przymorze rivers basin from Łeba river to Martwa Wisła river (grade 3). The Piaśnica river (30 km) crosses the Żarnowieckie Lake and drains it, flowing into the Baltic Sea at a distance of 10 km from the location centre.[46] The average annual river flow in the Warszkowski Młyn profile (app. 8 km south east of Żarnowieckie Lake) is 0.132 m^3/s, whereas at the mouth to the lake it is app. 0.75 m^3/s. The largest Piaśnica river tributary is the left-bank Bychowska Struga (21.5 km), flowing directly into the Żarnowieckie Lake.

The Żarnowieckie Lake (surface of 14 km^2, maximum depth of 19.4 m) was formed in the subglacial channel, i.e. deeply incised formation emerged as a result of fluvioglacial water erosion. The lake basin is a cryptodepression – the lake surface lies at the height of 1.5 MASL. The average inflow to the Żarnowieckie Lake is estimated to 2.2–2.3 m^3/s, of which app. 1.7 m^3/s is allocated to surface water supply and app. 0.5–0.6 m^3/s to groundwater supply.[47] The lakeshore and partially its bathymetry in the location site have been anthropogenically transformed in the course of construction of the abandoned nuclear power plant. There are several artificial water reservoirs and open channels within the boundaries of the location, of the total surface of 0.17 km^2.[48] These were formed as a result of flooding the foundations of the abandoned nuclear power plant construction site with water.

The location boundaries with regard to the division into surface water bodies are entirely contained within the river basin district JCWP PLRW200017477259 "Piaśnica do wypływu z Jeziora Żarnowieckiego" (Piaśnica to the outflow from the Żarnowieckie Lake) and in immediate vicinity of JCWP PLLW21049 "Jezioro Żarnowieckie" (*the Żarnowieckie Lake).* The variants of the cooling water canals course would be located within the river basin district: JCWP PLRW200023477289 "Piaśnica od

[44] KZGW, 2013, Mapa Zagrożenia Powodziowego (*Flood Hazard Map*), Warsaw
[45] KZGW, 2013, Mapa Ryzyka Powodziowego (*Flood Risk Map*), Warsaw
[46] KZGW, 2010, Mapa Podziału Hydrograficznego Polski (*Map of Hydrographic Division of Poland)*, Warsaw
[47] Atlas jezior Polski (*Atlas of the Polish lakes*), Jańczak J. et. al. 1997, Bogucki Wydawnictwo Naukowe, volume II, Poznan,
[48] Condition of the Żarnowieckie Lake after 10 years of the pumped storage power plant exploitation. Monography of the Water Management Committee of the Polish Academy of Sciences (PAN), Majewski W. et. al., PAN, Warsaw, 1996

wypływu z Jeziora Żarnowieckiego do Białogórskiej Strugi" *(Piaśnica from the outflow from Żarnowieckie Lake)*, JCWP PLRW200023477324 "Kanał Karwianka do dopływu z polderu Karwia z dopływem z polderu Karwia" *(Karwianka Channel to a tributary from the Karwia polder along with tributary from the Karwia polder)* and JCWP PLCWIIIWB5 "Jastrzębia Góra – Rowy".[49]

12.5.2 Choczewo Location Variant

The Choczewo location is situated in the immediate vicinity of the Baltic Sea. According to the Map of Hydrographic Division of Poland (KZGW, 2010), the location area contains in two 5. grade river basins – Lubiatowka river basin (8.64 km^2) and Przymorze river basin from Lubiatówka to Bezimienna rivers. Both river basins constitute a part of the 4. grade river basin – Przymorze river basin from Łeba to Piaśnica rivers.

There are no signs of surface water presence within the boundaries of the location. The key elements of the hydrographic network, situated in the immediate vicinity of the location include small rivers flowing directly into the Baltic Sea – Bezimienna river of a length of 4.05 km, situated east, and Lubiatówka, 3.45 km, situated west of the planned location of the nuclear power plant.

With regard to the division undertaken to meet the needs of the water resources management, the boundaries of the location along with the planned cooling water canals are contained within the CWDW1801 area – direct sea basin and JCWP PLCWIIIWB5 "Jastrzębia Góra – Rowy".

12.5.3 Lubiatowo-Kopalino Location Variant

The Lubiatowo-Kopalino location is situated in the immediate vicinity of the Baltic Sea and belongs to the two 5. grade river basins: Chełst river basin (194 km^2) and Przymorze basin from łeba to Lubiatówka rivers.[50]

There are no signs of surface water presence within the boundaries of the location. From the south, the location adjoins the area of wet Biebrowo meadows crossed with drainage ducts. The largest and draining the major part of the area is the Biebrowski Channel (12.2 km), flowing into the Chełst river (31.4 km), being the largest right-bank tributary of Łeba river.

With regard to the division undertaken to meet the needs of the water resources management, the boundaries of the location are contained within the direct sea basin – CWDW1801 and JCWP PLCWIIIWB5 "Jastrzębia Góra – Rowy" as well as JCWP PLRW200017476925.

12.5.4 Surface water bodies

Pursuant to the definition of Art. 2.12 of the Framework Water Directive (FWD) and Art. 5.5.1 and Art. 9.1.4c of the Water Law act (transposing the FWD provisions), a surface water body (SWB) means a discrete and significant element of surface water such as

a) a lake or any other natural water reservoir,
b) an artificial water body,

[49] http://www.geoportal.kzgw.gov.pl/imap/ [Accessed: July 2015]
[50] KZGW, 2010, Mapa Podziału Hydrograficznego Polski (*Map of Hydrographic Division of Poland)*, Warsaw

c) a stream, river or canal, part of a stream, river or canal,
d) an internal sea water, a transitional water or a stretch of coastal water.

Transitional waters are bodies of surface water in the vicinity of river mouths which are partly saline in character as a result of their proximity to coastal waters but which are substantially influenced by freshwater flows and internal sea waters of the Gdańsk Bay.

Coastal waters are a stretch of sea water of a breadth of one nautical mile on the landward side of a line, every point of which is at a distance of one nautical mile on the seaward side from the nearest point of the baseline from which the breadth of territorial waters is measured, excluding internal sea waters of the Gdańsk Bay and adjoining territorial sea waters, If the range of transitional waters exceeds one nautical mile, the outer limit of this range constitutes the outer limit of coastal waters.[51]

Pursuant to the provisions of Art. 38d.1 of the Water Law act, the environmental objective for surface water bodies not classified as artificial or heavy modified, is protection, improvement and restoration of the status of surface water bodies, as well as preventing deterioration of their status.

With regard to the division undertaken to meet the needs of the water resources management, pursuant to the Water Law act, within the area of the analysed locations, surface water bodies listed in Table 17 were identified. Figure 19 also presents a summary assessment of the surface water bodies status.

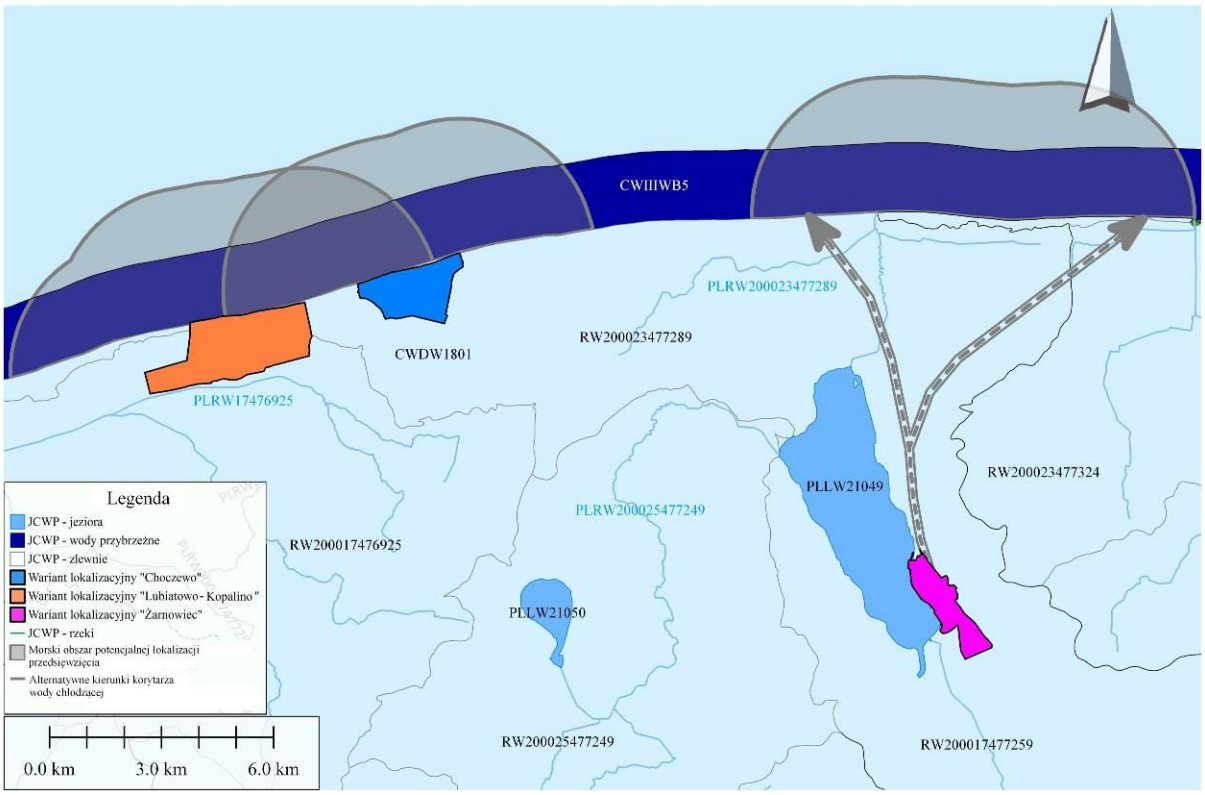
[51] Hobot A. et. al., 2013, Ustalenie celów środowiskowych dla jednolitych części wód powierzchniowych (JCWP), podziemnych (JCWPd) i obszarów chronionych, *(Determination of environmental objectives for surface water bodies (SWB), groundwater bodies (GWB) and protected areas),* Gliwice

Table 17. Surface water bodies in the area of the planned project and its vicinity

No.	SWB code	SWB name	SWB type	SWB area [km^2]	SWB status	SWB type	Evaluation of status/ecological potential according to PGW 2010-2015	Assessment of failure to achieve the FWD objectives according to PGW 2010-2015 [degradation]	Evaluation of status/ecological potential according to 2010-2012 assessment	Evaluation of chemical status according to 2010-2012 assessment	Current SWB status
1	PLCWIIIWB5	Jastrzębia Góra - Rowy	Coastal	141.00	NAT	WBIII	Good	Not at risk [-]	Bad	Good	Good
2	PLCWIIIWB4	Władysławowo - Jastrzębia Góra	Coastal	17.44	NAT	WBIII	Moderate	At risk [4(4)-3]	Bad	Good	Good
3	PLRW200017476152	Drainage duct	River	14.51	AWB	17	Bad	Not at risk [-]	Good and above good	Good	Good
4	PLRW20001747616	Tributary from Kaczkowo	River	15.11	HMWB	17	Bad	Not at risk [-]	Good and above good	Good	Good
5	PLRW200017476329	Kisewska Struga	River	136.09	HMWB	17	Bad	At risk [4(4)-1]	Good and above good	Good	Good
6	PLRW200017476569	Białogardzka Struga	River	56.76	HMWB	17	Good	At risk [4(4)-1]	Good and above good	Good	Good
7	PLRW20001747658	Charbrowska Struga	River	45.44	HMWB	17	Good	At risk [4(4)-1]	Good and above good	Good	Good
8	PLRW200017476925	Chełst river to the inflow to Sarbsko Lake	River	131.71	HMWB	17	Bad	At risk [4(4)-1]	Good and above good	Good	Good
9	PLRW2000174767259	Piaśnica river to inflow into Żarnowieckie Lake	River	136.63	HMWB	17	Bad	At risk [4(5)-1]	Good and above good	Good	Good
10	PLRW20001747839	Reda river to Bolszewka river	River	172.20	HMWB	18	Bad	At risk [4(5)-1]	Good and above good	Good	Good
11	PLRW20001947891	Reda river to Bolszewka river to the tributary from Rekowo polder	River	56.37	HMWB	19	Bad	At risk [4(4)-1]	Moderate	Good	Bad
12	PLRW200023477289	Piaśnica river from the outflow from Żarnowieckie Lake to Białogurska Struga	River	62.66	NAT	23	Bad	Not at risk [-]	Good	Good	Good
13	PLRW200023477324	Karwianka Channel to the tributary from Karwia polder along with tributary from Karwia	River	61.45	HMWB	23	Bad	At risk [4(4)-1/4(4)-3]	Poor	Good	Bad

		polder									
14	PLRW200023477342	Czarna Woda river to Struga river (inclusively)	River	67.01	HMWB	23	Bad	At risk [4(4)-1]	Poor	Good	Bad
15	PLRW20002247729	Piaśnica river from the tributary from Dębki Polder to the outflow	River	0.11	NAT	22	Bad	Not at risk [-]	Good	Good	Good
16	PLRW200023477329	Karwianka Channel to the tributary from Karwia polder to the outflow	River	0.03	NAT	22	Bad	At risk [4(4)-1/4(4)-3]	Poor	Good	Bad
17	PLRW200022477349	Czarna Woda river from Struga river to the outflow	River	20.81	NAT	22	Bad	At risk [4(4)-1/4(4)-3]	Poor	Good	Bad
18	PLRW200025477249	Bychowska Struga	River	119.51	HMWB	25	Bad	At risk [4(4)-1]	Good and above good	Good	Good
19	PLLW21049	Żarnowieckie	Lake	14.32	HMWB	3b	Bad	At risk [4(5)-1/4(4)-3]	Good	-	No evaluation
20	PLLW21050	Choczewskie (Choczewo)	Lake	1.76	NAT	1b	Good	Not at risk [-]	Very good	Good	Good
21	PLLW21051	Czarne	Lake	0.59	NAT	1a	Good	Not at risk [-]	Moderate	-	Bad
22	PLLW21052	Dąbrze	Lake	0.57	NAT	1b	Good	Not at risk [-]	Good	-	No evaluation
23	PLLW21053	Salińskie (Salino)	Lake	0,71	NAT	1a	Good	At risk [4(4)-3]	Good	-	No evaluation

Source: Own study with the use of data derived from http://geoportal.kzgw.gov.pl, http://www.rdw.org.pl, „Ustalenia celów środowiskowych dla jednolitych części wód powierzchniowych (JCWP), podziemnych (JCWPd) i obszarów chronionych" [Determination of environmental objectives for surface water bodies (SWB), groundwater bodies (GWB) and protected areas],



Key
SWB – lakes
SWB – coastal waters
SWB – river basins
“Choczewo” location variant
“Lubiatowo – Kopalino” location variant
“Żarnowiec” location variant
SWB – rivers
Surface water courses
Marine area of the potential project location
Alternative directions of cooling water canal

Figure 16. Surface water bodies in the vicinity of the location
Source: Own study with the use of data from the Regional Water Management Authority in Gdansk.

Results of research and analyses carried out with regard to the execution of the research program and the environmental impact assessment for the Project, the risks of failure to achieve the environmental objectives specified for these surface water bodies in the Water management plan for the Vistula river basin will be considered, subject to the arrangements and actions specified in the Water and Environmental Programme (2010).

12.6 Flood Risk Management Plans (FRMP)

The hydrological analyses carried out for the purpose of execution of the Project – the first nuclear power plant in Poland will include the arrangements specified in the Flood Risk Management Plans

(FRMPs), draft versions of which were drawn-up by the President of the National Water Management Authority in 2014. The drawing-up of FRMPs for the river basin districts and water regions follows from the Water Law act and constitutes the basic component of effective flood risk management in future, taking into account also the application of investment activities and support measures.

Under the FRMP, for each water region of Lower Vistula river and the Vistual river basin district the technical and non-technical activities were defined aiming at the achievement of the objectives for effective flood risk management. Based on FRMP drafts published as part of public consultations, non-technical and technical activities were prioritized to reflect the nature of hazard and issues of concern related to floods. Verification and justification of the assumed general and detailed objectives for each water region and river basin district were made by defining and assessment of the planning variants. The planning variants are prepared based on the selection of activities limiting the flood risk (which may mitigate, neutralize or postpone in time the diagnosed issues of concern) and assigning the activities to the objectives. The variants analysed under the FRMP include:

- zero variant, based on the scenario of refraining from actions for improvement of current status: it involves the maintenance of the current generic and spatial scope of flood infrastructure and controlling the flood volume under the provisions in force;
- maintenance variant, based on the identification of the desired amount of annual maintenance cost of the existing flood infrastructure; identification of the maintenance scenario requires maintaining the flood infrastructure through the on-going financing at the level required by the user to keep a certain standard of the infrastructure condition.

Due to the interdisciplinary nature of the Project and considering the potential impact on aquatic environment all planning and strategic documents in the field of water management specified under the Water Law act will be used for the specification of the type of impact range. The Water management plan for the Vistula river basin district is the base document concerning the sustainable water resources management in the analysed area, enhancing the process of achieving or maintaining the good water status and related ecosystems.

Moreover, under the environmental impact assessment procedure, the following document will be used: *Environmental Protection Programme of the Pomeranian Voivodship for 2013 – 2016 with 2020 perspective,* approved with the Resolution no. 1203/185/12 by the Board of the Pomeranian Voivodship on 9 October 2012. The Programme covers the years 2013 – 2016 with 2020 perspective. On the basis of goals intended for implementation in 2013 – 2020 stipulated in the Programme, the following priority activities were identified, including:

- achievement and maintenance of good condition of surface water, groundwater and coastal water,
- achievement and maintenance of natural environment quality standards,
- protection of inhabitants and their property against natural hazards and the effects of natural disasters,
- development of the pro-ecological awareness of the inhabitants,
- securing biodiversity,
- improving forest resources condition in the region,
- ensuring sustainable use of water resources,

- sustainable use of power, water and natural raw materials.

12.7 Characterisation of the marine environment in the Polish sector of the Baltic Sea from the perspective of the Marine Strategy Framework Directive

The principles of protection and objectives for sea water are described in the *Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy* (Marine Strategy Framework Directive, MSFD), under which the Member States take the necessary actions to achieve or maintain good ecological condition of the marine environment by 2020 at the latest.

The results of research and analyses carried out with regard to the execution of the research program under the delivery of the said Project will be reviewed with regard to assessment of sea water condition and in connection with the set of environmental objectives specified for them and for the national sea water protection programme (pursuant to Art. 61o, par. 1 and Art. 61s par. 1 of the Water Law act, the entity responsible for the delivery of the environmental objectives and of the national sea water protection programme is the President of the National Water Management Authority; at the moment the process of preparation of the a/m documents is pending). Under the research program for the planned NPP Project, research of physical and chemical conditions and observation of biological parameters of marine environment will be carried out, identical as for the scope of monitoring under the State Environmental Monitoring.

12.8 Climate

The region of the nuclear power plant location is situated in the Baltic Coast zone, forming a belt of a width ranging between several and several dozen kilometers along the southern coastline of the Baltic Sea. Apart from seaside-type landscapes with river estuaries, it covers the moraine uplands crossed with a network of small ice-marginal valleys situated below 100 MESL with few hills exceeding this height. This climatic region is strongly influenced by the Baltic Sea and Atlantic air masses. The region is characterized by mild winters and moderately warm summers. Relatively long transitional periods between summer and winter season and clearly colder spring comparing to autumn are also typical for this region. The range of sea influence depends on topography of the areas adjoining the coast and diminishes along with distance from the coastline. Wherever moraine elevations are present in the vicinity of the coastline, the Baltic Sea influence decreases, and the scope of its direct impact may be limited to several kilometres from the coastline[52].

Average annual air temperature in the region is 7-8^{o}C. Annual temperature flow is of regular nature throughout the area. Average annual air temperature amplitude throughout the entire area is below 19^{o}C. The lowest average annual air temperature amplitude is recorded in the narrow coastline zone with values reaching app. 17.5^{o}C. The coldest month is January with average air temperature in the range between 0^{o}C and -2^{o}C. The hottest month is July with average air temperature of 17 -18^{o}C. Number of frosty days i.e. with minimum temperature below 0^{o}C, does not exceed 30 and is the lowest in Poland.

[52] Woś A. 1993. Regiony klimatyczne Polski w świetle występowania różnych typów pogody, Booklet of IGiPZ PAN no. 20, Warsaw.

Average number of sunny days i.e. with cloudiness below 20% is 30 days. Number of days with average total daily cloudiness equal to or greater than 80% fluctuates between 120 and 140 days a year. Annual total insolation at this area is in the range of 1500-1600 hours. Average insolation in June and July may reach up to 9 hours per day. Average thermal summer duration is 60-70 days, whereas average thermal winter duration amounts to 50-80 days.

Average annual precipitation in the area is from 550 up to 700 mm. Majority of precipitation falls on warm half-year and amounts to 350-500 mm, whereas the lowest precipitation rate is recorded in the winter half-year and amounts to 200-250 mm. Snow cover duration ranges between 40 and 70 days[53].

Oceanic nature of the region's climate is strengthened by winds blowing in 60% from the sea or along the coastline. Throughout the year, the most common in the area are western wings i.e. blowing from NW, W and SW directions. The location region is also characterized by high wind speeds and large number of days per year (up to 70) with strong and very strong winds (above 15 m/s). Strong and very strong winds are recorded primarily in winter. The lowest number of days with strong and very strong winds at the coast is in summer. This is also when periods of lulls and weak winds are more common. At the meeting point between land and sea occurs a local wind – breeze – the direction of which tends to change throughout the day. Breeze appears on the Polish coast only in warm half-year at favourable synoptic conditions. Number of days with breeze in this period is estimated a several to 30–40. Breeze speed does not exceed 4 m/s and its range is highly limited. On the open areas it may reach several kilometres towards the land at the most[54].

The location region is among the ones with the lowest pressure values in Poland, which results from direct vicinity of low pressures tracks, highly active in the winter season.

12.8.1 Climate change adaptation

With regard to the fact that the power industry is classified as one of the sectors most vulnerable to climate changes, the EIA Report should take into account the impact of climate changes on the environment and economy, their effects and methods of mitigation as well as development of actions adapting to the new environmental conditions and key areas of economic operation, including the construction and exploitation of the nuclear power plant. Economic analyses of climate change impact demonstrate their most evident relation with the power production sector, subject to the prevailing role of two meteorological factors: temperature and humidity, changes of which translate directly into power consumption.

Within the KLIMAT and KLIMADA projects for the territory of Poland, climate scenarios were prepared for the selected meteorological components (air temperature, precipitations, cloudiness and air humidity). They describe trends and range of climate changes to be considered in the economic activities in the selected locations within the upcoming several dozen years. Climate changes and their impact on natural environment were estimated followed by identification of their economic effects. Detailed trends of the changes were estimated on the basis of results obtained

[53] Lorenc H. 2005, Atlas klimatu Polski *(Climatic Atlas of Poland)*, IMGW, Warsaw.
[54] Wibig J., Jakusik E. i in., 2012. Warunki klimatyczne i oceanograficzne w Polsce i na Bałtyku Południowym. IMGW PIB, Warsaw.

from two types of numerical models: numerical models using statistical and empirical downscaling and regional numerical models using statistical methods for parametrization as the description of meteorological processes in small scale[55][56].

Since the middle of the last century, the climate of Poland has changed significantly. Main changes included a rise in the average air temperature, cloudiness increase in summer and its drop in winter, spring and autumn seasons. We observed an increase in vapor volume in the air with simultaneous drop of relative humidity. Precipitations remained at the similar level. The climate change scenarios demonstrate that the average annual air temperature in Poland shall not change significantly by 2030, comparing to the values from the reference period. However, an increase in maximum temperature, in particular in winter season, is to be observed. One should also expect increased precipitations related to the intensification of cyclonic rotation in the Baltic Sea basin and/or over the eastern part of the continent. Climate changes result in a greater probability of consistent sea level rise. At the same time the frequency of storms shall increase. Climate warming will reduce the duration of ice phenomena, deteriorate water quality with regard to eutrophication of the environment, increase in the average Baltic Sea level and its extreme values. Change scenarios do not assume any changes in the wave climate.

In general, the change scenarios indicate continuous warming throughout the upcoming 20 years with unchanged precipitation values, which follows the trend observed since mid-20th century. Climate changes within the territory of Poland comply with the ones observed in other European countries. Climate change will primarily affect the power sector significantly impacting the demand. The issues of concern may include water deficits and repeated periods of low water levels.

One should remember however, that due to the uncertainty of the results presented by science, the course of the climate system changes requires monitoring. At the current stage, we are also not able to determine unambiguously, to what extent climate changes are caused by energy processes induced by human activity and to what by natural factors. The models used for climate change estimates, both in long- and in short-term perspective, present a number of limitations. Models analysis points, among other things, to their tendency to emphasize the oceanic nature of the local climate to a greater extent than it is actually the case.

The infrastructure has to be prepared for climate changes, in particular for extreme weather conditions, including strong winds, tornados or storms. To this end, adaptive actions are undertaken, adjusted both to the type of the infrastructure and the region concerned.

At the stage of the nuclear power plant construction, the directions of adaptations to the climate changes, recommended in the KLIMADA project and dedicated to the area of the Pomeranian Voivodeship, in particular Baltic Sea Cost, shall be taken into consideration. They will involve among other things:

[55] Wibig J., Jakusik E. i in., 2012. Warunki klimatyczne i oceanograficzne w Polsce i na Bałtyku Południowym. IMGW PIB, Warsaw.
[56] World Meteorological Organization, 2008, Guide to Meteorological Instruments and Methods of Observation, WMO-No. 8, WMO, Geneva

- protection of coastlines and port areas, flood protection, - flood protection of the areas identified at the preliminary flood risk assessment and the areas marked out at the flood hazard maps,
- implementation of forest and agricultural land protection against drought by means of soil protection against excessive drying and low water retention.

12.9 Vegetation cover

Information contained in this chapter pertains to the region of the planned investment, i.e. Choczewo, Gniewino and Krokowa communes where Żarnowiec, Choczewo and Lubiatowo-Kopalino location variants are located.

Most of the land in the aforementioned communes is covered by forests and arable land, then by meadows and pastures, heterogeneous agricultural areas, inland waters and wetlands. Share of land not covered by vegetation (e.g. urban fabric, industrial, comercial and transport units) is smaller.[57]

According to the map of potential natural vegetation of Poland, the potential plant communities for the area under analysis are, among others, South-Baltic coastal pine forest *Empetro nigri-Pinetum,* Subatlantic swamp birch forest *Vaccinio uliginosi-Betuletum,* Continental swamp pine forest *Vaccinio uliginosi-Pinetum,* Subatlantic acidophilous beech-oak forest (Pomerania-vicariant) *Fago-Quercetum,* lowland forb-rich beech forest *Melico-Fagetum,* lowland alder and ash-alder forest *Fraxino-Alnetum,* lowland ash-elm floodplain forest *Ficario-Ulmetum,* Continental mesotrophic oak-pine mixed forest *Querco-Pinetum,* lowland acidophilous beech forest *Luzulo pilosae-Fagetum,* Atlantic wet dwarf-scrub *Sphagno-Ericetalia,* Subatlantic beech-oak-hornbeam forest (Pomerania-vicariant) Stellario-Carpinetum.[58]

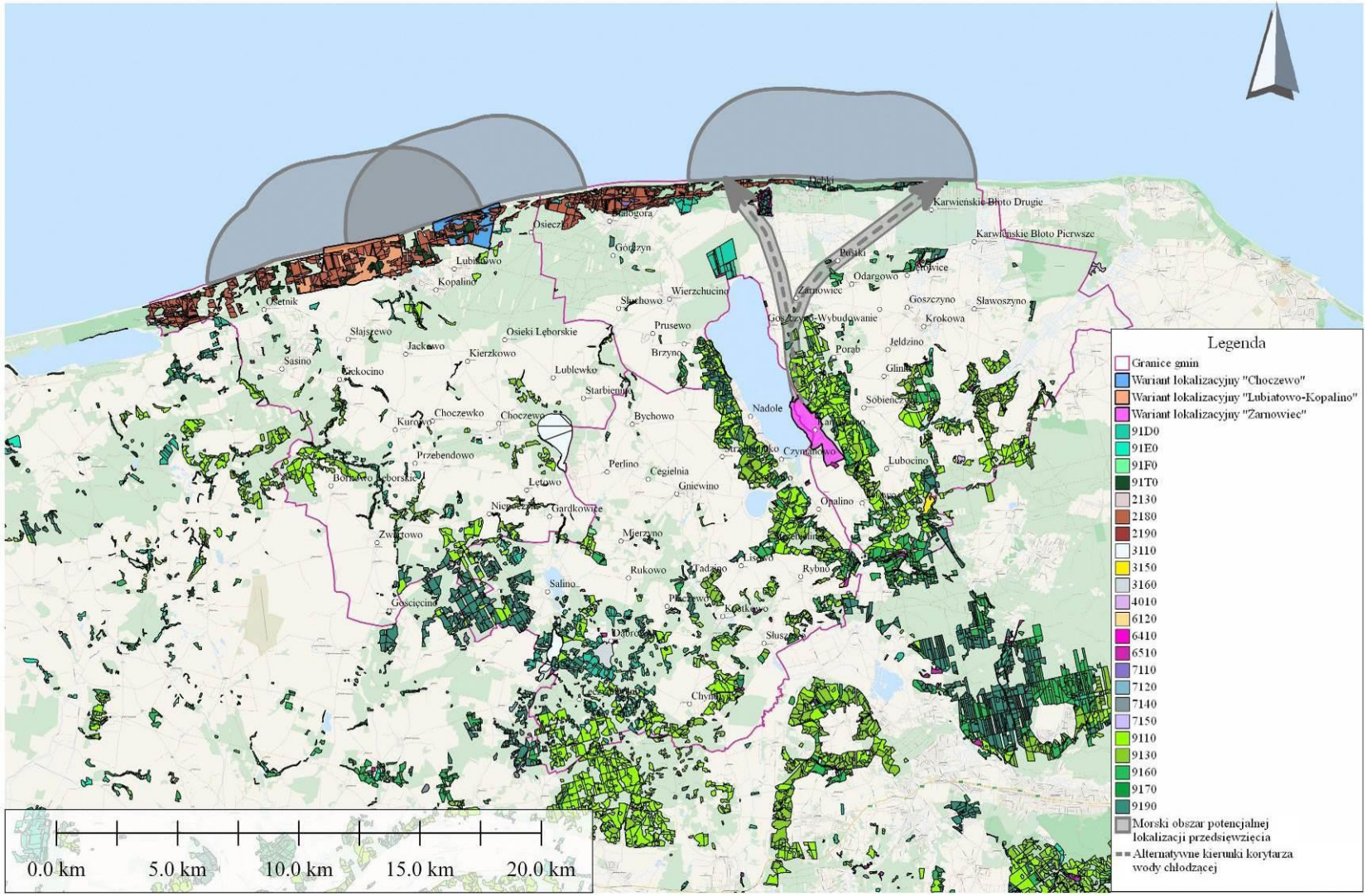
Presence of natural habitats listed in the Annex I to the Council Directive 92/43/EEC of 21 May 1992 on the on the conservation of natural habitats and of wild fauna and flora on the territory of Choczewo, Gniewino and Krokowa is shown on Figure.[59]

Location of Choczewo, Gniewino and Krokowa communes in relation to the division into natural and forest regions[60], geobotanical classification[61] and geophysical classification[62] is characterised as follows:

- Natural and forest regions:
  - Land: I Baltic
    - District: Coastal Strip
      - Mesoregion: Wybrzeże Słowińskie (Slowinskie Strip)
    - District: Pobrzeże Słowińskie (Slowinskie Coast)
      - Mesoregion: Wysoczyzna Żarnowiecka (Żarnowiecka Plain)
      - Mesoregion: Reda and Łaba urstromtal

[57] according to CORINE Land Cover 2006
[58] Matuszkiewicz J. M., 2008, Potencjalna roślinność naturalna Polski, IGiPZ PAN, Warsaw
[59] based on prior general habitats survey in the State Forests 2007.
[60] Zielony R., Kliczkowska A., 2010, Regionalizacja przyrodniczo-leśna Polski, CILP
[61] Matuszkiewicz J. M., 2008, Regionalizacja geobotaniczna Polski, IGiPZ PAN, Warsaw
[62] Kondracki J., 1994, Geografia Polski, Mezoregiony fizyczno-geograficzne, PWN, Warsaw

- Geobotanical regions:
  - Area: European broad-leaf and mixed forests
    - Province: Central Europe
      - Subprovince: South Baltic
        - Division: Pomeranian (A)
          - Area of the Southern Coast of the Baltic Sea (A.1)
            - Section of Wybrzeże Słowińskie (Slowinskie Strip) (A.1.2)
              - Subsection of Jastrzębia Góra (A.1.2.e)
          - Southern Coast of the Baltic Sea (A.2)
            - Section of Kashubian Coast (A.2.4)
              - Subsection of Lower Łeba Valley (A.2.4.a)
              - Choczewo Subsection (A.2.4.b)
              - Salina Subsection (A.2.4.c)
              - Puck Subsection (A.2.4.f)
- Geophysical regions:
  - Province: Central European Lowlands (31)
    - Subprovince: Southern Coast of the Baltic Sea (313)
      - Macroregion: Koszalin Coast (313.4)
        - Mesoregion: Wybrzeże Słowińskie (Slowinskie Strip) (313.41)
        - Mesoregion: Wysoczyzna Żarnowiecka (Żarnowiecka Plain) (313.45)
        - Mesoregion: Łeba and Reda Urstromtal (313.46)


Legenda
Granice gmin
Wariant lokalizacyjny "Choczewo"
Wariant lokalizacyjny "Lubiatowo-Kopalino"
Wariant lokalizacyjny "Żarnowiec"
91D0
91E0
91F0
91T0
2130
2180
2190
3110
3150
3160
4010
6120
6410
6510
7110
7120
7140
7150
9110
9130
9160
9170
9190
Morski obszar potencjalnej lokalizacji przedsięwzięcia
Alternatywne kierunki korytarza wody chłodzącej
0.0 km
5.0 km
10.0 km
15.0 km
20.0 km
Karwieńskie Błoto Drugie
Karwieńskie Błoto Pierwsze
Osieczna
Białogóra
Gorzyn
Lubiatowo
Kopalino
Ostrzyce
Odargowo
Żarnowiec
Wierzchucino
Sławoszyno
Goszczyno-Wybudowanie
Krokowa
Jeldzino
Prusewo
Brzyno
Osieki Lęborskie
Jackowo
Kierzkowo
Lublewko
Starbienino
Choczewko
Choczewo
Bychowo
Nadole
Przebendowo
Perlino
Cegielnia
Gniewino
Lubocino
Letowo
Gardkowice
Opalino
Mierzyno
Rukowo
Tadzino
Rybno
Salino
Gościęcino
Chwaszczyno

Key
Commune boundaries
“Choczewo” location variant
“Lubiatowo – Kopalino” location variant
“Żarnowiec” location variant
Marine area of the potential project location
Alternative directions of cooling water canal

Figure 17. Choczewo, Gniewino and Krokowa communes in reference to the general habitat survey in the State Forests

Source: Own study on the basis of OpenStreetMap data and data from General Directorate of State Forests – results of natural habitat survey in the State Forests in 2007.

12.9.1 Żarnowiec Location Variant

In this location variant most of the area with vegetation cover is occupied by meadows and pastures. Most of land in this site is not, however, covered by vegetation but is classified as Urban fabric, industrial, commercial and transport units [63].

In accordance to the map of potential natural vegetation of Poland, potential plant communities for this location variant are the Subatlantic beech-oak-hornbeam forest (Pomerania-vicariant) *Stellario-Carpinetum*[64]*,* while vegetation present on this site includes, among others: *Potametum natantis* and *Hydrocharitetum morsus-ranae* water plant communities, communities of usable green fields classified as *Molinio-Arrhenatheretea* and *Fago-Quercetum* occupying small share of land under consideration.

The following have been identified as present in the area under analyses:

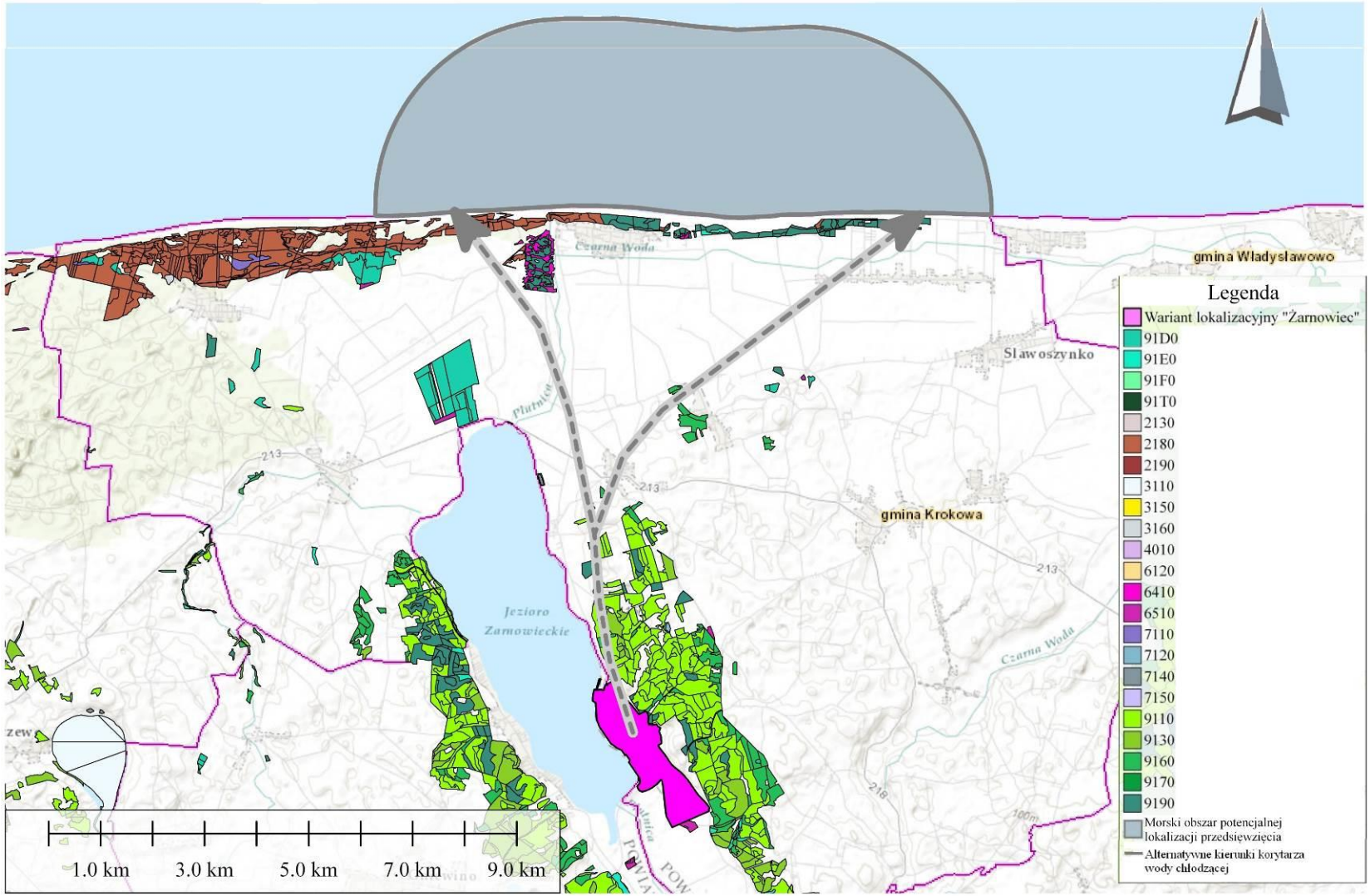
- natural habitats listed in the Annex I to the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora:[65]
  - 3150 Oxbow lakes and natural eutrophic lakes with communities of *Nympheion*, *Potamion*
    The whole Żarnowieckie Lake is a habitat. The location variant is situated at the south-eastern side of the lake. The lake is heavily transformed due to water impoundment, changes to shorelines, and daily water exchange with the neighbouring artificial lake.
  - 6510 Lowland hay meadows in intense use (*Arrhenatherion elatioris*)
    Part of the habitat is located in the southern part of the location variant.
  - 9190 Old acidophilous oak woods (*Quercion robori-petraeae*)
    Part of the habitat, being part of the forest growing on the slopes of Kępa Żarnowiecka hills, is located in the north-eastern part of the location variant.

- species of vascular plants listed in the Regulation the Minister of the Environment from 9 October 2014 regarding protection of plant species (Journal of Laws of 2014, item 1409):[66]
  - Immortelles *Helichrysum arenarium*
  - Sea buckthorn *Hippophae rhamnoides*

As for the elements of the cooling water intake and discharge systems for the Żarnowiec location, natural habitats potentially present in their area might include, among others:

- 2180 Wooded dunes of the Atlantic, Continental and Boreal region
- 9190 Old acidophilous oak woods (*Quercion robori-petraeae*)

[63] according to CORINE Land Cover 2006
[64] Matuszkiewicz J. M., 2008, Potencjalna roślinność naturalna Polski, IGiPZ PAN, Warsaw
[65] on the basis of information obtained from the State Forests and field inspection carried out in April and June 2015 for the Company's own purposes
on the basis of field inspection carried out in April 2015 for the Company's own purposes


Legenda
Wariant lokalizacyjny "Żarnowiec"
91D0
91E0
91F0
91T0
2130
2180
2190
3110
3150
3160
4010
6120
6410
6510
7110
7120
7140
7150
9110
9130
9160
9170
9190
Morski obszar potencjalnej lokalizacji przedsięwzięcia
Alternatywne kierunki korytarza wody chłodzącej
gmina Władysławowo
Sławoszynko
gmina Krokowa
Jezioro Żarnowieckie
Czarna Woda
Płutnica
1.0 km
3.0 km
5.0 km
7.0 km
9.0 km

Key
"Żarnowiec" location variant
Marine area of the potential project location
Alternative directions of cooling water canal

Figure 18. Żarnowiec location variant against the results of the general survey of natural habitats in the State Forests

Source: Own study with the use of Esri, OpenStreetMap and the Directorate General of the State Forests data – results of natural habitat survey in the State Forests in 2007.

12.9.2 Choczewo Location Variant

This location variant is covered mainly by forests, in small part by beaches, dunes and sands.[67]

The prevailing forest habitat is dry forest (Bs), followed by fresh forest (Bśw). Smaller parts are covered with mixed fresh forest (BMśw) and wet forests (Bw). The location is characterized by the highest share of stand at the age of ≤ 80, followed by the stand at the age of 80 – 120. Small areas are covered by stands of older age classes, exceeding 120 years.[68]

According to the map of potential natural vegetation of Poland, a potential plant community for this location variant is the coa South-Baltic coastal pine forest *Empetro nigri-pinetum*[69], while vegetation present on this site includes, among others: sea lyme grass and European beach grass *Elymo-Ammophiletum arenariae*, a community of immortelles and blue bonnets *Helichryso-Jasionetum litoralis* and *an Empetro nigri-Pinetum* community.

The following have been identified as present in the area under analyses:

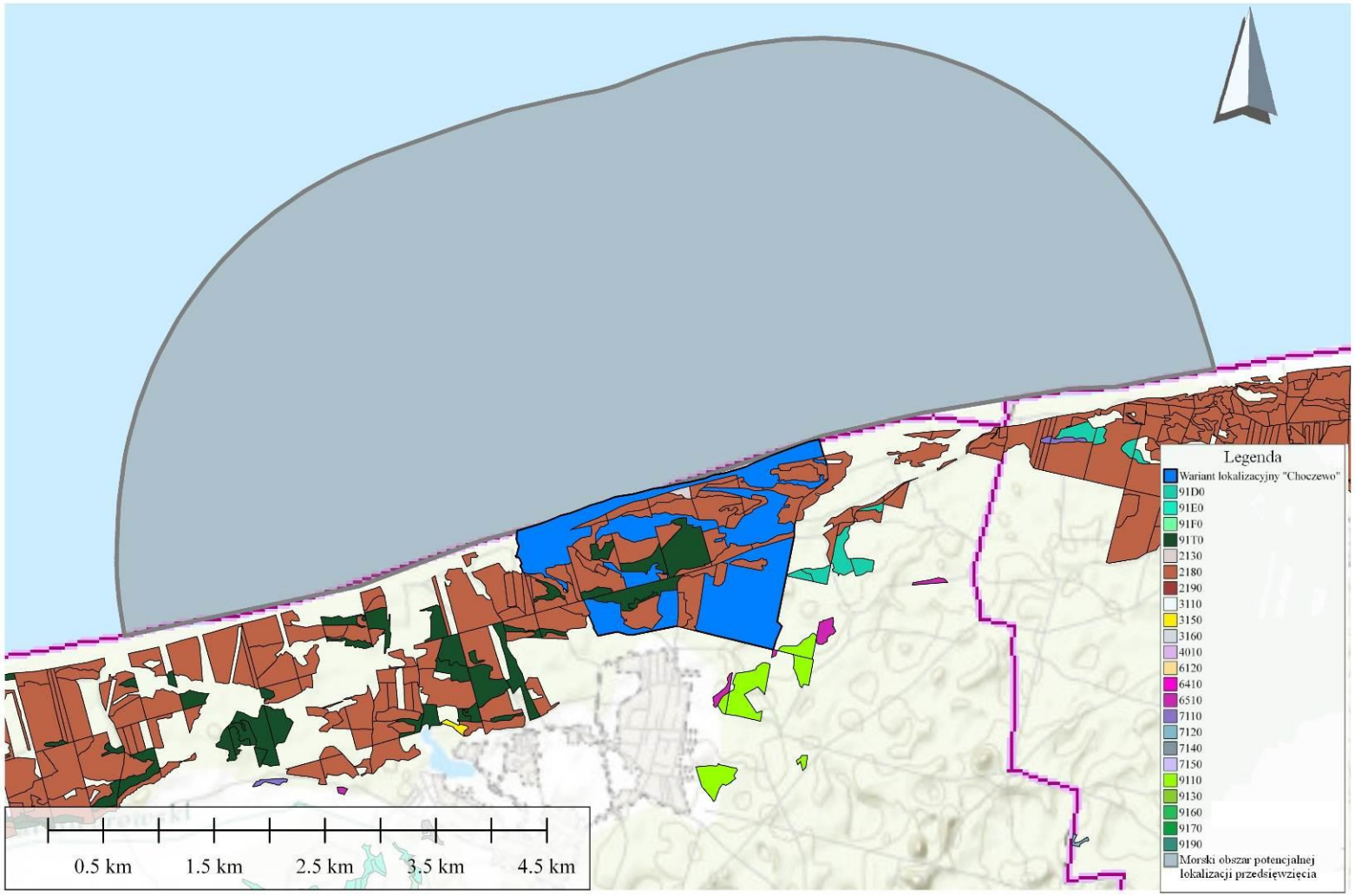
- natural habitats listed in the Annex I to the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora:[70]
  - 2120 Shifting dunes along the shoreline ('white dunes') (*Elymo-Ammophiletum*)
    Habitat is represented by the community of sea lyme grass and European beach grass *Elymo-Ammophiletum arenariae.* It stretches as a strip along the coast, most often neighbouring the *2130 grey dunes habitat to the south (inland).
  - *2130 Fixed coastal dunes with herbaceous vegetation ("grey dunes")
    Habitat is represented by the community of immortelles and blue bonnets *Helichryso-Jasionetum litoralis*. It stretches as a strip along the coast, adjoining from the sea with the 2120 Shifting dunes along the shoreline ('white dunes') (*Elymo-Ammophiletum*) habitat and from the land with the 2180 Wooded dunes of the Atlantic, Continental and Boreal region habitat. Moreover, in some spots, especially in the middle and in the northern part of the location variant, this habitat is present in conjunction with the South-Baltic coastal pine forest *Empetro nigri-Pinetum* habitat.
  - 2180 Wooded dunes of the Atlantic, Continental and Boreal region
    Habitat represented by the South-Baltic coastal pine forest *Empetro nigri-Pinetum* occupies most of the area covered by this location variant. Habitats identified under the general survey of natural habitats in the State Forests (2007) as 91T0 Cladonia-Scotch pine forest (*Cladonio-Pinetum* and cladonia form of *Peucedano-Pinetum*). Cladonia-

[67] according to CORINE Land Cover 2006
[68] on the basis of information obtained from the State Forests
[69] Matuszkiewicz J. M., 2008, Potencjalna roślinność naturalna Polski, IGiPZ PAN, Warsaw
[70] on the basis of information obtained from the State Forests, preliminary habitat survey carried out between 10 April 2015 and 19 August 2015 commissioned by the Investor and field inspection carried out in April and June 2015 for the Investor's own purposes

Scotch pine forests should be interpreted as dry (Cladonia) form of South-Baltic coastal pine forest (sub-community *Empetro nigri-Pinetum cladonietosum)*. In some spots this type of habitat is combined with grey dunes.

- species of vascular plants and bryophytes listed in the Regulation of the Minister of Environment of 9 October 2014 regarding the protection of plant species and lichen species listed in the Regulation of the Minister of Environment of 9 October 2014 regarding protection of fungi species (Journal of Laws of 2014, item 1408):[71]
  - Marsh Labrador tea *Ledum palustre*
  - Black crowberry *Empetrum nigrum*
  - Pincushion moss *Leucobryum glaucum*
  - Tree moss *Usnea sp.*
  - Neat Feather-moss *Pseudoscleropodium purum*
  - Lichens *Cladonia sp.*
  - Glittering wood-moss *Hylocomium splendens*
  - Dwarf mountains pine *Pinus mugo* (outside its natural range)
  - Red-stemmed Feather-moss *Pleurozium schreberi*
  - Creeping lady's-tresses *Goodyera repens*
  - Sand sedge *Carex arenaria*
  - Stiff clubmoss *Lycopodium annotinum*
  - Rugose Fork-moss *Dicranum polysetum*
  - Cross-leaved heath *Erica tetralix*
  - Sweet gale *Myrica gale*
  - Mosses *Sphagnum sp.*

[71] on the basis of information obtained from the State Forests and field inspection carried out in April and June 2015 for the Investor's own purposes


Legenda
Wariant lokalizacyjny "Choczewo"
91D0
91E0
91F0
91T0
2130
2180
2190
3110
3150
3160
4010
6120
6410
6510
7110
7120
7140
7150
9110
9130
9160
9170
9190
Morski obszar potencjalnej lokalizacji przedsięwzięcia
0.5 km
1.5 km
2.5 km
3.5 km
4.5 km

Key
“Choczewo” location variant
Marine area of the potential project location

Figure 19. Choczewo location variant against the results of the general survey of natural habitats in the State Forests

Source: Own study with the use of Esri, OpenStreetMap and the Directorate General of the State Forests data – results of natural habitat survey in the State Forests in 2007.

12.9.3 Lubiatowo-Kopalino Location Variant

Vegetation cover is similar to the Choczewo location variant.

This location variant is covered mainly by forests, in small part by beaches, dunes and sands.[72]

The prevailing forest habitat is dry forest (Bs), fresh forest (Bśw) and wet forest (Bw). Smaller parts are covered by mixed fresh forest (BMśw), mixed wet forest (BMw) and mixed wet deciduous forest (LMw). Forest stands aged 80 and below dominate this site variant, followed by stands aged 80 – 120.
Small areas are covered by stands of older age classes, exceeding 120[73].

According to the map of potential natural vegetation of Poland, potential plant communities for this location variant is the South-Baltic coastal pine forest *Empetro nigri-pinetum*,[74] Vegetation present on this site includes, among others according to the a/m information: the South-Baltic coastal pine forest *Empetro nigri-pinetum* and the community of sea lyme grass and European beach grass *Elymo-Ammophiletum Arenariae*, community of immortelles and blue bonnets *Helichryso-Jasionetum litoralis.*

The following, among others, have been identified as present on the area under analysis:

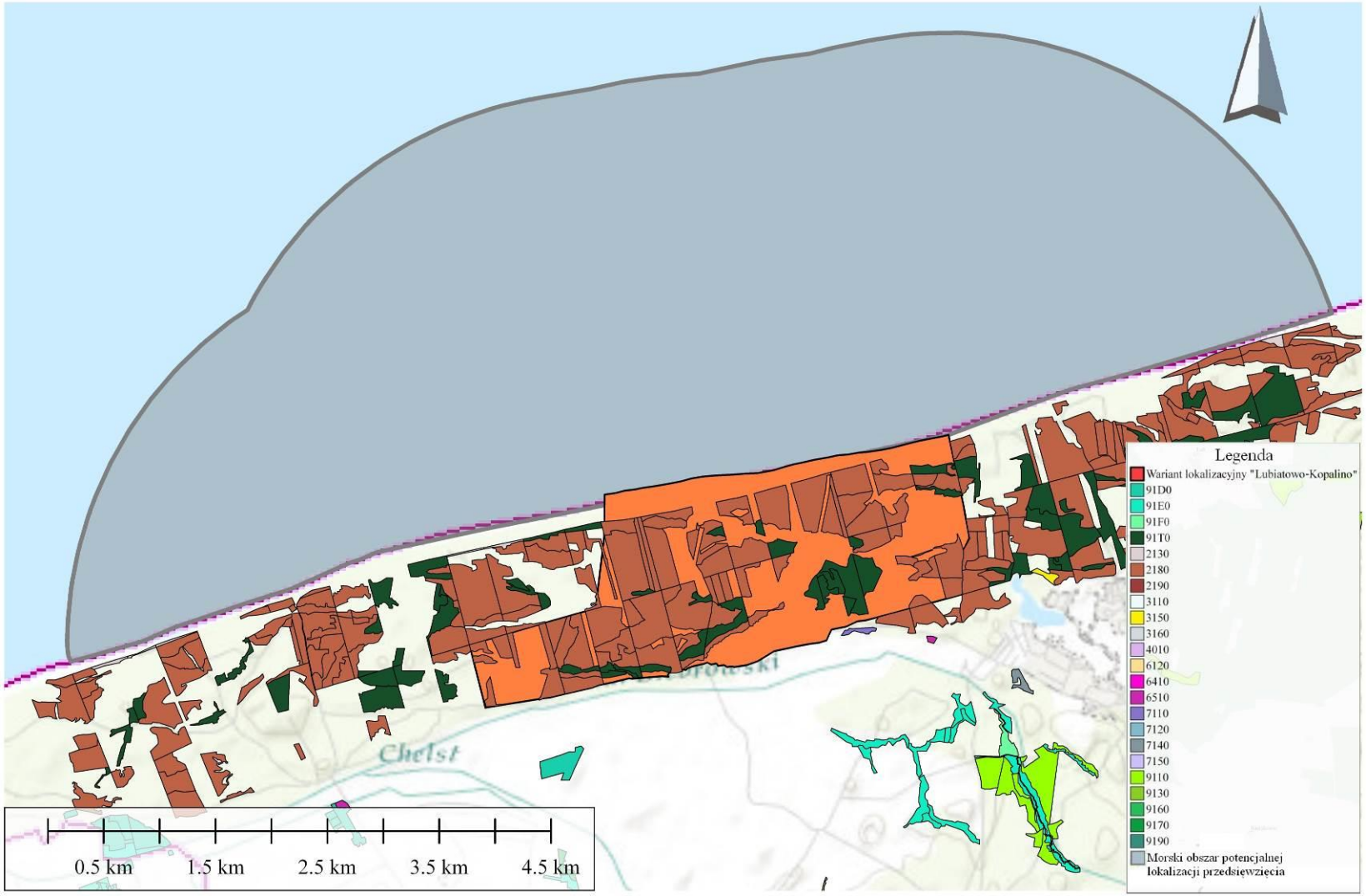
- natural habitats listed in the Annex I to the Council Directive 92/43/EEC of 21 May 1992 on the on the conservation of natural habitats and of wild fauna and flora:[75]
  - 2120 Shifting dunes along the shoreline (‘white dunes’) (*Elymo-Ammophiletum*)
    Habitat is represented by the community of sea lyme grass and European beach grass *Elymo-Ammophiletum arenariae.* It stretches as a strip along the coast, most often neighbouring the *2130 grey dunes habitat to the south (inland).
  - *2130 Fixed coastal dunes with herbaceous vegetation (“grey dunes”)
    Habitat is represented by the community of immortelles and blue bonnets *Helichryso-Jasionetum litoralis*. It stretches as a strip along the coast, adjoining from the sea with the 2120 Shifting dunes along the shoreline (‘white dunes’) (*Elymo-Ammophiletum*) habitat and from the land with the 2180 Wooded dunes of the Atlantic, Continental and Boreal region habitat.
  - 2180 Wooded dunes of the Atlantic, Continental and Boreal region
    Habitat represented by the South-Baltic coastal pine forest *Empetro nigri-Pinetum* occupies most of the area covered by this location variant. Habitats identified during general inventory of natural habitats in the State Forests (2007) as 91T0 Central

[72] according to CORINE Land Cover 2006
[73] on the basis of information obtained from the State Forests
[74] Matuszkiewicz J. M., 2008, Potencjalna roślinność naturalna Polski, IGiPZ PAN, Warsaw
[75] on the basis of information obtained from the State Forests, preliminary habitat survey carried out between 10 April 2015 and 19 August 2015 commissioned by the Investor and field inspection carried out in April and June 2015 for the Investor’s own purposes

European lichen pine forest (*Cladonio-Pinetum* and cladonia form of *Peucedano-Pinetum).* Central European lichen pine forests (Fig. 23) should be interpreted as dry variant of South-Baltic coastal pine forest (sub-community of *Empetro nigri-Pinetum cladonietosum)*.

- species of vascular plants and bryophytes listed in the Regulation of the Minister of Environment of 9 October 2014 regarding the protection of plant species and lichen species listed in the Regulation of the Minister of Environment of 9 October 2014 regarding the protection of fungi species (Journal of Laws of 2014, item 1408):[76]
  - Marsh Labrador tea *Ledum palustre*
  - Black crowberry *Empetrum nigrum*
  - Tree moss *Usnea sp.*
  - Neat Feather-moss *Pseudoscleropodium purum*
  - Lichens *Cladonia sp.*
  - Glittering wood-moss *Hylocomium splendens*
  - One-flowered Wintergreen *Moneses uniflora*
  - Dwarf mountains pine *Pinus mugo* (outside its natural range)
  - Red-stemmed Feather-moss *Pleurozium schreberi*
  - Sand sedge *Carex arenaria*
  - Mosses *Sphagnum sp.*
  - Ground pines *Lycopodium sp.*
  - Rugose Fork-moss *Dicranum polysetum*
  - Cross-leaved heath *Erica tetralix*
  - Sweet gale *Myrica gale*

[76] on the basis of information obtained from the State Forests and field inspection carried out in April and June 2015 for the Investor's own purposes


Legenda
Wariant lokalizacyjny "Lubiatowo-Kopalino"
91D0
91E0
91F0
91T0
2130
2180
2190
3110
3150
3160
4010
6120
6410
6510
7110
7120
7140
7150
9110
9130
9160
9170
9190
Morski obszar potencjalnej lokalizacji przedsięwzięcia
Chłst
0.5 km
1.5 km
2.5 km
3.5 km
4.5 km

Key
“Lubiatowo-Kopalino” location variant
Marine area of the potential project location

Figure 20. Lubiatowo-Kopalino location variant against the results of the general survey of natural habitats in the State Forests

Source: Own study with the use of Esri, OpenStreetMap and the Directorate General of the State Forests data – results of natural habitat survey in the State Forests in 2007.

13 Areas protected under the Act of 16 April 2004 *on Nature Conservation*, located within the area of significant impact of the project

According to Art. 6. par. 1. of the Act of 16 April 2004 on Nature Conservation (Journal of Laws of 2013, item 627, as amended) the following area-related forms of nature conservation are distinguished:

- national parks,
- nature reserves,
- landscape parks,
- protected landscape areas,
- Natura 2000 sites,
- ecological sites.

This following chapter presents the protected areas based on the Act of 16 April 2004 on Nature Conservation (consolidated text: Journal of Laws of 2013, item 627, as amended) located within such a distance from the considered location options of the planned project (Żarnowiec, Choczewo 1, Choczewo 2, and having regard to the elements of technological system of cooling water intake and discharge) for which it is impossible to completely rule out the occurrence of its significant impact on these areas. Potential range of the planned investment impact on the protected areas is determined in line with the methodology specified in Chapter 10.4 of the PIS. Considering the local nature of the potential impact of the investment on natural environment, a 5 km buffer from the boundaries of the nuclear power plant location and 1 km buffer from the individual elements of the technological system of cooling water intake and discharge was determined as the zone of potential impact on the protected areas.

In the case of Natura 2000 sites, when determining the potential impact of the project, the necessity of maintaining the cohesion of the Natura 2000 network was taken into account, including preserving the migration, dispersal and genetic exchange of species, which made the buffer of 5 km insufficient. Due to the above, having regard also to the results presented in the study prepared for the internal needs of the Owner called “Assessment of the impact on valuable nature habitats and the integrity, coherence and object of protection of Natura 2000 sites of the nuclear power plant build project with a capacity up to 3000 Mwe in the area of communes Choczewo and Krokowa. Part 1 – assessment of the impact on the Natura 2000 sites. The report on habitat screening assumes the zone within 14 km from the particular location options of the project.

However, it should be emphasized that the range of project’s impact on the protected areas will be further determined at the stage of preparing the Report on the environmental impact of the project based on, among others, the results of modelling regarding changes of the environmental factors, including e.g. ground water levels.

13.1 Żarnowiec Location Variant

Table 18. Area forms of nature protection within the impact range of the planned project in the Żarnowiec location.

I. Nature reserves	
I.1. Piaśnickie Łąki (Piaśnickie meadows)	
Legal basis	Order of the Ministry of Forestry and Wood Industry of 5 November 1959 on establishing a nature reserve (Official Gazette No. 97, item 525) Regulation No. 3/2002 of the Voivode of the Pomeranian Voivodeship of 11 February 2002 regarding the establishment of the protection plan for the "Piaśnickie Łąki" nature reserve (Journal of Laws of Pomeranian Voivodeship, No. 12, item 243).
Location	Krokowa commune
Area [ha]	56.23 ha
Protection objective	Preserving currently rare plant communities, which were typical in the past for the banks of a small river - variably wet Molinia meadows, nardo-juncetum squarrosi, calcareous fens, short sedge mire Caricetum davallianae, acidophilous birch-oak forest, oak forest and different stages of scrub encroachment of oxbow lakes with their characteristic vulnerable plants.
Distance from the planned project	The location of nuclear power facilities is approx. 7 km from the southern boundary of the reserve. At the current stage the determination of the distance of the reserve from the planned elements of the technological system of cooling water intake and discharge is impossible due to the lack of detailed information on their location.
I.2. Widowo	
Legal basis	Order No. 119/99 of the Voivode of the Pomeranian Voivodeship of 20 July 1999 on establishing the "Widowo" nature reserve (Journal of Laws of Pomeranian Voivoidship, No. 76, item 439).
Location	Krokowa commune
Area [ha]	97.10 ha
Protection objective	Preserving the interesting combination of dune forms (dune hills and banks, parabolic dunes, depression basins and gutters, dune slacks of various shapes), the sets of mixed oak and pine forests and crowberry coniferous forest and rare plant species.
Distance from the planned project	The location of nuclear power facilities is approx. 8 km from the southern boundary of the reserve. At the current stage the determination of the distance of the reserve from the planned elements of the technological system of cooling water intake and discharge is impossible due to the lack of detailed information on their location.

I.3. Długosz Królewski in Wierzchucin (Royal Fern in Wierzchucin)	
Legal basis	Regulation No. 11/2003 of the Voivode of the Pomeranian Voivodeship of 20 May 2003 on establishing the "Długosz Królewski w Wierzchucinie" nature reserve (Journal of Laws of Pomeranian Voivodeship, No. 71, item 1133).
Location	Krokowa commune
Area [ha]	148.19 ha
Protection objective	Retaining one of two largest sites of long-living fern – royal fern *Osmuda regalis* and the largest population of interrupted clubmoss *Lycopodium annotinum* in the Gdańsk region, preserving the residue of high and transitional peatbog together with species and plant communities that are characteristic for these ecosystems.
Distance from the planned project	The location of nuclear power facilities is approx. 5 km from the southern boundary of the reserve. At the current stage the determination of the distance of the reserve from the planned elements of the technological system of cooling water intake and discharge is impossible due to the lack of detailed information on their location.
I.4. Zielone	
Legal basis	Order of the Ministry of Forestry and Wood Industry of 24 November 1983 on establishing a nature reserve (Official Gazette No. 39, item 230)
Location	Krokowa commune
Area [ha]	17.09 ha
Protection objective	Preserving the woodbine honeysuckle site, the biggest in the Gdańsk region, near its eastern boundary range.
Distance from the planned project	The location of nuclear power facilities is approx. 6 km from the southern boundary of the reserve. At the current stage the determination of the distance of the reserve from the planned elements of the technological system of cooling water intake and discharge is impossible due to the lack of detailed information on their location.
I.5. Źródliska Czarnej Wody	
Legal basis	Order No. 139/99 of the Voivode of the Pomeranian Voivodeship of 16 September 1999 on establishing the "Źródliska Czarnej Wody" nature reserve (Journal of Laws of Pomeranian Voivodeship of 1999, No. 103, item 983).
Location	Krokowa commune
Area [ha]	50.58
Protection objective	Preserving the spring and rare regional soils similar to calcareous para-rendzinas, covered with forest and spring communities and rare and protected flora and fauna species in the unchanged form.

Distance from the planned project	The location of nuclear power facilities is approx. 4 km from the western boundary of the reserve.
I.6. Babnica	
Legal basis	Regulation No. 17/07 of the Voivode of the Pomeranian Voivodeship of 14 May 2007 on the "Babnica" nature reserve (Journal of Laws of Pomeranian Voivodeship, No. 103, item 1668). Order of Regional Director for Environmental Protection in Gdańsk of 31 March 2014 on determining the protection plan for the nature reserve "Babnica" (Journal of Laws of Pomeranian Voivodeship, item 1456).
Location	Krokowa commune
Area [ha]	55.99 ha
Protection objective	Preserving the spatial complex of dunes and interdune hollows together with characteristic biotopes, biocenoses and processes that are unique on the Polish coast.
Distance from the planned project	The location of nuclear power facilities is approx. 11 km from the southern boundary of this site. At the current stage the determination of the distance of the reserve from the planned elements of the technological system of cooling water intake and discharge is impossible due to the lack of detailed information on their location.
I.7. Białogóra	
Legal basis	Regulation No. 85/06 of the Voivode of the Pomeranian Voivodeship of 19 September 2006 on the "Białogóra" nature reserve (Journal of Laws of Pomeranian Voivodeship of 2006, No. 108, item 2229). Order of Regional Director for Environmental Protection in Gdańsk of 12 March 2014 on determining the protection plan for the nature reserve "Białogóra"
Location	Krokowa commune
Area [ha]	211.56 ha
Protection objective	Preserving the spatial complex of dunes and interdune hollows, continental peatbog plants with endangered and rare flora species at the boundary of their geographical range, phytocenoses of the coastal bog and crowberry woodlands and crane important bird area.
Distance from the planned project	The location of nuclear power facilities is approx. 10 km from the southern boundary of this site. At the current stage the determination of the distance of the reserve from the planned elements of the technological system of cooling water intake and discharge is impossible due to the lack of detailed information on their location.

II. Landscape Parks	
II.1. Nadmorski Park Krajobrazowy (Coastal Landscape Park)	
Legal basis	Resolution No. 142/VII/11 of the Local Government Assembly for the Pomeranian Voivodeship of 27 April 2011 on Nadmorski Landscape Park (Journal of Laws of Pomeranian Voivodeship, N. 66, item 1457)
Location	Krokowa, Władysławowo communes
Area [ha]	18 804 ha
Protection objectives	1. Preserving the natural character of seacoasts and rivers estuaries as well as the specific features of the sandbar forms, 2. Preserving the characteristic zonal system and spatial continuity of individual types of coastal ecosystems, 3. Protecting the floristic and phytocentric values of the park, in particular the valuable phytocenosis in the Bay of Puck and on its shores, dunes and cliffs communities, mid-forest peatbogs, bogs and small ponds with rare plant communities, including the Atlantic type of range, 4. Protecting the breeding, feeding and resting places of particular groups of animals, notably fish and marine mammals, and breeding sites, feeding and resting places important for birds during their migrations and winter, 5. Preserving historically diversified special types of fishing and farming villages, holiday settlements and the areas of key strategic and navigation importance, together with their architectural tradition, retaining the value of intangible culture, in particular ethnical specificity and traditional activities and customs of the Kashubian community. 6. Protecting characteristic landscapes of open sea coasts (dune and cliff type) bay coasts (dune, uplands and low ones) including the characteristic organogenic and mineral plains on the Hel Peninsula, scenically exposed high level plains and edge areas of the plateau hillocks and vast landscapes of coastal plains and proglacial stream valley flooring.
Distance from the planned project	The location of nuclear power facilities is approx. 7 km from the southern boundary of the park. Determination of the distance of the park from the planned elements of the of the technological system of cooling water intake and discharge is at the current stage impossible due to no detailed information on their location.
III. Protected landscape areas	
III.1. Nadmorski (Coastal)	

Legal basis	Resolution No. 1161/XLVII/10 of the Local Government Assembly for the Pomeranian Voivodeship of 28 April 2010 on areas of protected landscape in the Pomeranian Voivodeship (Journal of Laws of Pomeranian Voivodeship, No. 80, item 1455)
Location	Krokowa, Puck, Władysławowo, Choczewo communes
Area [ha]	14 940 ha
Description of the area	The area covers a seashore, forest and non-forest lane of dunes running along the cost, a part of the Bielawskie Błota complex, the Błota Przymorskie plain in the eastern part the and the northern fragments of Wysoczyzna Żarnowiecka adjacent to it.
Distance from the planned project	The location of nuclear power facilities is approx. 3 km from the southern boundary of this site. Determination of the distance of the area from the planned elements of the of the technological system of cooling water intake and discharge is at the current stage impossible due to no detailed information on their location.
III.2. Puszcza Darżlubska (Darżlubska forest)	
Legal basis	Resolution No. 1161/XLVII/10 of the Local Government Assembly for the Pomeranian Voivodeship of 28 April 2010 on areas of protected landscape in the Pomeranian Voivodeship (Journal of Laws of Pomeranian Voivodeship, No. 80, item 1455)
Location	Krokowa, Puck, Reda, Wejherowo communes
Area [ha]	15 908
Description of the area	The area protects a dense forest complex. The moraine upland is covered with fertile and acidic beech woods and oak-hornbeam forests, whereas the sandur plain is covered with pine forest.
Distance from the planned project	The location of nuclear power facilities is approx. 2 km from the western boundary of this site.
IV. Areas of Community importance	
IV.1. Białogóra PLH220003	
Legal basis	Commission Decision of 13 November 2007 adopting, pursuant to Council Directive 92/43/EEC, a first updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2007) 5403)

	Order of Regional Director for Environmental Protection in Gdańsk of 30 April 2014 on determining the plan for protection actions for the Natura 2000 site Białogóra PLH220003 (Journal of Laws of Pomeranian Voivodeship, item 1916).
Location	Choczewo and Krokowa communes
Area [ha]	1 132.8 ha
The object of protection	The habitats which are the objects of protection include: 2110 – embryonic shifting dunes, 2120 – coastal white dunes (*Elymo-Ammophiletum*), 2130 – coastal grey dunes, 2140 – coastal crowberry heaths (*Empetrion nigri),* 2180 – mixed forest and coniferous forest on coastal dunes, 2190 – humid interdune hollows, 4010 – humid heaths with bog heathers (*Ericion tetralix*), 7110 – high heaths with peat formation vegetation, 7150 – depression on peat substrates with the vegetation of *Rhynhosporion,* 91D0 – bog woodlands (*Vaccinio uliginiosi-Betuletum pubescentis, Vaccinio uliginosi-Pinetum, Pino mugo-Sphagnetum, Sphagno girgensohnii-Piceetum* and birch-pine bog borealen forests.
Distance from the planned project	The location of nuclear power facilities is approx. 9 km from the southern boundary of this site. Determination of the distance of the area from the planned elements of the of the technological system of cooling water intake and discharge is at the current stage impossible due to no detailed information on their location.
IV.2. Piaśnickie Łąki PLH220021 (Piaśnickie meadows)	
Legal basis	Commission Decision of 13 November 2007 adopting, pursuant to Council Directive 92/43/EEC, a first updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2007) 5403) Order of Regional Director for Environmental Protection in Gdańsk of 17 April 2014 on determining the plan for protection actions for the Natura 2000 site Piaśnickie Łąki PLH220021 (Journal of Laws of Pomeranian Voivodeship, item 1816).
Location	Krokowa commune
Area [ha]	1 085.0 ha
The object of protection	The following natural habitats are the objects of protection: 1130 – estuaries, 2120 – coastal white dunes (Elymo-Ammophiletum), 2130 – coastal grey dunes, 2180 – mixed forest and coniferous forest on coastal dunes, 6410 – Molinia meadows on calcareous, 7120 – degraded raised bogs still capable of natural or stimulated regeneration, 9190 – near-natural birch-oak woodlands (Betulo-Quercetum), 91D0 – bog woodlands (Vaccinio uliginiosi-Betuletum

	pubescentis, Vaccinio uliginosi-Pinetum, Pino mugo-Sphagnetum, Sphagno girgensohnii-Piceetum and birch-pine bog boreal forests.
Distance from the planned project	The location of nuclear power facilities is approx. 5 km from the southern boundary of this site. Determination of the distance of the area from the planned elements of the of the technological system of cooling water intake and discharge is at the current stage impossible due to no detailed information on their location.
IV.3. Opalińskie Buczyny PLH220099 (Opalińskie beech forest)	
Legal basis	Commission Decision of 10 November 2011 adopting, pursuant to Council Directive 92/43/EEC, a fourth updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2010) 9669)
Location	Gniewino commune
Area [ha]	355.7 ha
The object of protection	The following natural habitats are the objects of protection: 9110 – beech forests (*Luzulo – Fagetum*), 9130 - fertile beech forests (*Dentario glandulosae-Fageion*, *Galio odorati – Fagenion,* 9160 - Sub-Atlantic oak-hornbeam forest (*Stellario – Caripnetum),* 9190 - near-natural birch-oak woodlands *(Betulo-Quercetum),* 91E0 - willow-poplar gallery forest, poplar, alder and ash *(Salicetum albo-fragilis*, *Populetum albae*, *Alneion glutinoso-incanae*), and alder forests on percolating mires, 91F0 - Riparian mixed forests of Quercus robur, Ulmus laevis and Ulmus minor, Fraxinus excelsior or Fraxinus angustifolia (*Ficario-Ulemetum*).
Distance from the planned project	The location of nuclear power facilities is approx. 2 km from the northern and eastern boundary of this site.
IV.4. Widowo PLH220054	
Legal basis	Commission Decision of 12 December 2008 adopting, pursuant to Council Directive 92/43/EEC, a second updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2008) 8039)
Location	Krokowa commune
Area [ha]	99.14 ha
The object of protection	The following natural habitats are the objects of protection: 2120 – coastal white dunes (Elymo-Ammophiletum), 2180 – mixed forest and coniferous forest on coastal dunes, 9190 – near-natural birch-oak woodlands (Betulo-Quercetum).

Distance from the planned project	The location of nuclear power facilities is approx. 9 km from the southern boundary of this site. Determination of the distance of the area from the planned elements of the of the technological system of cooling water intake and discharge is at the current stage impossible due to no detailed information on their location.
IV.5. Jeziora Choczewskie PLH220096 (Choczewskie lakes)	
Legal basis	Commission Decision of 10 November 2011 adopting, pursuant to Council Directive 92/43/EEC, a fourth updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2010) 9669)
Location	Choczewo, Gniewino, Łęczyce communes
Area [ha]	1 120.03
The object of protection	The following natural habitats are the objects of protection: 3110 – Lobelia lakes, 3160 – natural dystrophic lakes and ponds
Distance from the planned project	The location of nuclear power facilities is approx. 9 km from the western boundary of this site.
IV.6. Orle PLH220019	
Legal basis	Commission Decision of 10 November 2011 adopting, pursuant to Council Directive 92/43/EEC, a fourth updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2010) 9669) Order of the Regional Director for Environmental Protection in Gdańsk of 19 September 2014 No. 34/2013 on determining the plan for protection actions for the Natura 2000 site Orle PLH220019 (Journal of Laws of Pomeranian Voivodeship, item 3405).
Location	Wejherowo commune
Area [ha]	269.92 ha
The object of protection	The objects of protection are the following nature habitats: 7230 - alkaline fens of the Caricion davallianae with mostly low-growing sedge and rush communities and helophilous mosses (Caricetalia davallianae) and the species: *Drepanocladus vernicosus* and *Liparis loeseli*.
Distance from the planned project	The location of nuclear power facilities is approx. 8 km from the northern boundary of this area.
IV.7. Trzy Młyny PLH220029	

Legal basis	Commission Decision of 10 November 2011 adopting, pursuant to Council Directive 92/43/EEC, a fourth updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2010) 9669) Order of the Regional Director for Environmental Protection in Gdańsk of 19 May 2014 on determining the plan for protection actions for the Natura 2000 site Trzy Młyny PLH220029 (Journal of Laws of Pomeranian Voivodeship, item 2090).
Location	Krokowa commune
Area [ha]	765.8776
The object of protection	The following natural habitats are the objects of protection: 7230 – alkaline fens of the Caricion davallianae with mostly low-growing sedge and rush communities and helophilous mosses (Caricetalia davallianae), 9110 – beech forests (*Luzulo – Fagetum*), 9160 – Sub-Atlantic oak-hornbeam forest (*Stellario – Caripnetum),* 91E0 – willow-poplar gallery forest, poplar, alder and ash *(Salicetum albo-fragilis*, *Populetum albae*, *Alneion glutinoso-incanae*), and alder forests on percolating mires.
Distance from the planned project	The location of nuclear power facilities is approx. 4 km from the southern and eastern boundary of this site.
IV.8. Lasy Lęborskie PLB220006 (Lęborskie forest)	
Legal basis	Regulation of the Ministry of Environment of 21 July 2004 on the Natura 2000 special birds protection areas (Journal of Laws No. 229, item 2313). Order of the Regional Director for Environmental Protection in Gdańsk of 19 May 2014 on determining the plan for protection actions for the Natura 2000 site Lasy Lęborskie PLB220006 (Journal of Laws of Pomeranian Voivodeship, item 2089).
Location	Choczewo, Gniewino, Luzino, Łęczyce communes
Area [ha]	8 565.3 ha
The object of protection	The boreal owl *Aegolius funereus* is the object of protection.
Distance from the planned project	The location of nuclear power facilities is approx. 9 km from the northern and eastern boundary of this site.
V. Special birds protection areas	
V.1. Przybrzeżne wody Bałtyku PLB990002 (Baltic coastal waters)	

Legal basis	Regulation of the Ministry of Environment of 21 July 2004 on the Natura 2000 special birds protection areas (Journal of Laws No. 229, item 2313).
Location	Baltic sea/Territorial sea of the Republic of Poland
Area [ha]	194 626.73 ha
The object of protection	The following species are the object of protection: alca *Alca torda,* black guillemot *Ceppus grylle,* European herring gull *Larus argentatus,* velvet scoter *Melanita fusca,* common scoter *Melanita nigra*. Two bird species from the Annex I of the Council Directive 79/409/EEC stay for winter on this area: black-throated loon and red-throated loon (C7). During winter, more than 1% of the migratory routes population of long-tailed duck (C3) and at least 1% of black guillemot and velvet scoter are present there.
Distance from the planned project	The components of technological system of cooling water intake and discharge are located within the boundaries of this site.
VI. Ecological sites	
VI.1. Porąbski Moczar (Porąbski swamp)	
Legal basis	Order No. 163/99 of the Voivode of the Pomeranian Voivodeship of 16 November 1999 (Journal of Laws of Pomeranian Voivodeship, No. 121, item 1073).
Location	Krokowa commune
Area [ha]	1.19
Description of the area	Transitional peatbog with typical flora, including protected species.
Distance from the planned project	The location of nuclear power facilities is approx. 1.5 km from the western boundary of this site.
VI.2. Świecińska Topiel	
Legal basis	Order No. 163/99 of the Voivode of the Pomeranian Voivodeship of 16 November 1999 (Journal of Laws of Pomeranian Voivodeship, No. 121, item 1073).
Location	Krokowa commune
Area [ha]	1.25
Description of the area	Sedge sward and embryonic alder forests complex

Distance from the planned project	The location of nuclear power facilities is approx. 4 km from the western boundary of this site.
VI.3. Jezioro Witalicz (Witalicz lake)	
Legal basis	Order No. 163/99 of the Voivode of the Pomeranian Voivodeship of 16 November 1999 (Journal of Laws of Pomeranian Voivodeship, No. 121, item 1073).
Location	Krokowa commune
Area [ha]	8.51
Description of the area	Shallow eutrophic lake
Distance from the planned project	The location of nuclear power facilities is approx. 5 km from the northern boundary of this site.
VI.4. Księża Łąka (Księża meadow)	
Legal basis	Order No. 163/99 of the Voivode of the Pomeranian Voivodeship of 16 November 1999 on considering certain areas as ecological sites (Journal of Laws of Pomeranian Voivodeship, No. 121, item 1073)
Location	Krokowa commune
Area [ha]	3.8
Description of the area	Damp meadow and transition peatbog complex
Distance from the planned project	The location of nuclear power facilities is approx. 4 km from the northern boundary of this site.

Source: own study

13.2 Choczewo Location Variant

Table 19. Area forms of nature protection within the impact range of the planned project in the Choczewo location.

I. Nature reserves	
I.1. Babnica	
Legal basis	Regulation No. 17/07 of the Voivode of the Pomeranian Voivodeship of 14 May 2007 on the "Babnica" nature reserve (Journal of Laws of Pomeranian Voivodeship, No. 103, item 1668). Order of Regional Director for Environmental Protection in Gdańsk of 31 March 2014 on determining the protection plan for the nature reserve "Babnica" (Journal of Laws of Pomeranian Voivodeship, item 1456).
Location	Krokowa commune
Area [ha]	55.99 ha
Protection objective	Preserving the spatial complex of dunes and interdune hollows together with characteristic biotopes, biocenoses and processes that are unique on the Polish coast.
Distance from the planned project	The location of nuclear power facilities is approx. 2 km from the western boundary of this site.
I.2. Białogóra	
Legal basis	Regulation No. 85/06 of the Voivode of the Pomeranian Voivodeship of 19 September 2006 on the "Białogóra" nature reserve (Journal of Laws of Pomeranian Voivodeship of 2006, No. 108, item 2229). Order of Regional Director for Environmental Protection in Gdańsk of 12 March 2014 on determining the protection plan for the nature reserve "Białogóra"
Location	Krokowa commune
Area [ha]	211.56 ha
Protection objective	Preserving the spatial complex of dunes and interdune hollows, continental peatbog plants with endangered and rare flora species at the boundary of their geographical range, phytocenoses of the coastal bog and crowberry woodlands and crane important bird area.
Distance from the planned project	The location of nuclear power facilities is approx. 10 km from the southern boundary of this site. At the current stage the determination of the distance of the reserve from the planned elements of the technological system of cooling

	water intake and discharge is impossible due to the lack of detailed information on their location.
II. Protected landscape areas	
II.1. Nadmorski (Coastal)	
Legal basis	Resolution No. 1161/XLVII/10 of the Local Government Assembly for the Pomeranian Voivodeship of 28 April 2010 on areas of protected landscape in the Pomeranian Voivodeship (Journal of Laws of Pomeranian Voivodeship, No. 80, item 1455)
Location	Krokowa, Puck, Władysławowo, Choczewo communes
Area [ha]	14 940 ha
Description of the area	The area covers a seashore, forest and non-forest lane of dunes running along the cost, a part of the Bielawskie Błota complex, the Błota Przymorskie plain in the eastern part the and the northern fragments of Wysoczyzna Żarnowiecka adjacent to it.
Distance from the planned project	The location of nuclear power facilities is within this area.
III. Areas of Community importance	
III.1. Białogóra PLH220003	
Legal basis	Commission Decision of 13 November 2007 adopting, pursuant to Council Directive 92/43/EEC, a first updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2007) 5403) Order of Regional Director for Environmental Protection in Gdańsk of 30 April 2014 on determining the plan for protection actions for the Natura 2000 site Białogóra PLH220003 (Journal of Laws of Pomeranian Voivodeship, item 1916).
Location	Choczewo and Krokowa communes
Area [ha]	1 132.8 ha
The object of protection	The habitats which are the objects of protection include: 2110 – embryonic shifting dunes, 2120 – coastal white dunes (*Elymo-Ammophiletum*), 2130 – coastal grey dunes, 2140 – coastal crowberry heaths (*Empetrion nigri),* 2180 – mixed forest and coniferous forest on coastal dunes, 2190 – humid interdune hollows, 4010 – humid heaths with bog heathers (*Ericion tetralix*), 7110 – high heaths with peat formation vegetation, 7150 – depression on peat substrates with the vegetation of *Rhynhosporion,* 91D0 – bog woodlands (*Vaccinio uliginiosi-Betuletum pubescentis, Vaccinio*

	uliginosi-Pinetum, Pino mugo-Sphagnetum, Sphagno girgensohnii-Piceetum and birch-pine bog borealen forests.
Distance from the planned project	The location of nuclear power facilities is within the direct vicinity of the western boundary of the site.
III.2. Mierzeja Sarbska PLH220018 (Sarbska sandbar)	
Legal basis	Commission Decision of 10 November 2011 adopting, pursuant to Council Directive 92/43/EEC, a fourth updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2010) 9669) Order of the Regional Director for Environmental Protection in Gdańsk of 8 April 2014 on determining the plan for protection actions for the Natura 2000 site Mierzeja Sarbska PLH220018 (Journal of Laws of Pomeranian Voivodeship, item 1715).
Location	Łeba commune, Wicko commune
Area [ha]	1 882.9 ha
The object of protection	The habitats which are the objects of protection include: 1150 – coastal lagoons, 2110 – embryonic shifting dunes, 2120 – coastal white dunes (*Elymo-Ammophiletum*), 2130 – coastal grey dunes, 2140 – coastal crowberry heaths (*Empetrion nigri),* 2170 – coastal dunes with Salix repens ssp argentea 2180 – mixed forest and coniferous forest on coastal dunes, 2190 – humid interdune hollows, 4010 – humid heaths with bog heathers (*Ericion tetralix*), 9190 – near-natural birch-oak woodlands (*Betulo-Quercetum*) 91D0 – bog woodlands (*Vaccinio uliginiosi-Betuletum pubescentis, Vaccinio uliginosi-Pinetum, Pino mugo-Sphagnetum, Sphagno girgensohnii-Piceetum* and birch-pine bog borealen forests.
Distance from the planned project	The location of nuclear power facilities is approx. 7,5 km from the eastern boundary of this site.
III.3. Piaśnickie Łąki PLH220021 (Piaśnickie meadows)	
Legal basis	Commission Decision of 13 November 2007 adopting, pursuant to Council Directive 92/43/EEC, a first updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2007) 5403) Order of Regional Director for Environmental Protection in Gdańsk of 17 April 2014 on determining the plan for protection actions for the Natura 2000 site Piaśnickie Łąki PLH220021 (Journal of Laws of Pomeranian Voivodeship, item 1816).

Location	Krokowa commune
Area [ha]	1 085.0 ha
The object of protection	The following natural habitats are the objects of protection: 1130 – estuaries, 2120 – coastal white dunes (*Elymo-Ammophiletum*), 2130 – coastal grey dunes, 2180 – mixed forest and coniferous forest on coastal dunes, 6410 – Molinia meadows on calcareous, 7120 – degraded raised bogs still capable of natural or stimulated regeneration, 9190 – near-natural birch-oak woodlands (*Betulo-Quercetum*), 91D0 – bog woodlands (*Vaccinio uliginiosi-Betuletum pubescentis, Vaccinio uliginosi-Pinetum, Pino mugo-Sphagnetum, Sphagno girgensohnii-Piceetum* and birch-pine bog boreal forests.
Distance from the planned project	The location of nuclear power facilities is approx. 7.5 km from the western boundary of this site.
III.4. Widowo PLH220054	
Legal basis	Commission Decision of 12 December 2008 adopting, pursuant to Council Directive 92/43/EEC, a second updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2008) 8039)
Location	Krokowa commune
Area [ha]	99.14 ha
The object of protection	The following natural habitats are the objects of protection: 2120 – coastal white dunes (*Elymo-Ammophiletum*), 2180 – mixed forest and coniferous forest on coastal dunes, 9190 – near-natural birch-oak woodlands (*Betulo-Quercetum*).
Distance from the planned project	The location of nuclear power facilities is approx. 14 km from the western boundary of this site.
III.5. Jeziora Choczewskie PLH220096 (Choczewskie lakes)	
Legal basis	Commission Decision of 10 November 2011 adopting, pursuant to Council Directive 92/43/EEC, a fourth updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2010) 9669)
Location	Choczewo, Gniewino, Łęczyce communes
Area [ha]	1 120.03
The object of protection	The following natural habitats are the objects of protection: 3110 – Lobelia lakes, 3160 – natural dystrophic lakes and ponds

Distance from the planned project	The location of nuclear power facilities is approx. 7 km from the southern boundary of this site.
III.6. Lasy Lęborskie PLB220006 (Lęborskie forest)	
Legal basis	Regulation of the Ministry of Environment of 21 July 2004 on the Natura 2000 special birds protection areas (Journal of Laws No. 229, item 2313). Order of the Regional Director for Environmental Protection in Gdańsk of 19 May 2014 on determining the plan for protection actions for the Natura 2000 site Lasy Lęborskie PLB220006 (Journal of Laws of Pomeranian Voivodeship, item 2089).
Location	Choczewo, Gniewino, Luzino, Łęczyce communes
Area [ha]	8 565.3 ha
The object of protection	The boreal owl *Aegolius funereus* is the object of protection.
Distance from the planned project	The location of nuclear power facilities is approx. 10 km from the northern boundary of this area.
IV. Special birds protection areas	
IV.1. Przybrzeżne wody Bałtyku PLB990002 (Baltic coastal waters)	
Legal basis	Regulation of the Ministry of Environment of 21 July 2004 on the Natura 2000 special birds protection areas (Journal of Laws No. 229, item 2313).
Location	Baltic sea/Territorial sea of the Republic of Poland
Area [ha]	194 626.73 ha
The object of protection	The following species are the object of protection: alca *Alca torda,* black guillemot *Ceppus grylle,* European herring gull *Larus argentatus,* velvet scoter *Melanita fusca,* common scoter *Melanita nigra*. Two bird species from the Annex I of the Council Directive 79/409/EEC stay for winter on this area: black-throated loon and red-throated loon (C7). During winter, more than 1% of the migratory routes population of long-tailed duck (C3) and at least 1% of black guillemot and velvet scoter are present there.
Distance from the planned project	The location of nuclear power facilities is within the direct vicinity to the southern boundary of this site.
V. Ecological sites	
V.1. Osoczne oczko	

Legal basis	Order No. 183/00 of the Voivode of the Pomeranian Voivodeship of 28 November 2000 (Journal of Laws of Pomeranian Voivodeship, No. 115, item 738).
Location	Choczewo commune, forest district Choczewo; sub-dist. Choczewo; Szklana Huta forest, sec. 120o; sub-dist. Kopalino, plot 120/1
Area [ha]	1.36 ha
Description of the area	Water reservoir with statiotes aloides
Distance from the planned project	The location of nuclear power facilities is approx. 1.5 km from the boundary of this site.
V.2. Torfowisko in Szklana Huta (Peatbogs in Szklana Huta)	
Legal basis	Order No. 183/00 of the Voivode of the Pomeranian Voivodeship of 28 November 2000 (Journal of Laws of Pomeranian Voivodeship, No. 115, item 738).
Location	Choczewo commune, Forest district Choczewo, sub-dist. Choczewo, Biała Góra forest, sect. 42c, 43b; precinct 42LP, 43/2LP
Area [ha]	0.86 ha
Description of the area	The area of transition peatbogs, important for protection of local genetic resources and unique types of environment.
Distance from the planned project	The location of nuclear power facilities is approx. 0.5 km from the boundaries of this site.
V.3. Źródliska Bezimiennej (Bezimmienna river springs)	
Legal basis	Order No. 183/00 of the Voivode of the Pomeranian Voivodeship of 28 November 2000 (Journal of Laws of Pomeranian Voivodeship, No. 115, item 738).
Location	Choczewo commune, Forest district Choczewo; sub-distr. Choczewo, Biała Góra forest, sect. 94m, 111c; precinct Kierzkowo; plot 94LP, 111LP
Area [ha]	1.3 ha
Description of the area	This site covers numerous seepage spring areas important for the protection of local genetic and unique types of environment.
Distance from the planned project	The location of nuclear power facilities is approx. 0.5 km from the boundaries of this site.
V.3. Białogórskie torfowisko (Białogóra peatbog)	

Legal basis	Order No. 183/00 of the Voivode of the Pomeranian Voivodeship of 28 November 2000 (Journal of Laws of Pomeranian Voivodeship, No. 115, item 738).
Location	Krokowa commune
Area [ha]	2.58
Description of the area	Transitional peatbog
Distance from the planned project	The location of nuclear power facilities is approx. 12 km from the southern boundary of this site. At the current stage the determination of the distance of the reserve from the planned elements of the technological system of cooling water intake and discharge is impossible due to the lack of detailed information on their location.

Source: own study

13.3 Lubiatowo-Kopalino Location Variant

Table 20. Area forms of nature protection within the impact range of the planned project in the Lubiatowo – Kopalino location.

I. National parks	
I.1. Słowiński National Park (buffer zone)	
Legal basis	Regulation of the Council of Ministers of 2 March 2014 on the Słowiński National Park (Journal of Laws of 2004, No. 43, item 390).
Location	Ustka, Smołdzino, Główczyce (Słupsk Poviat) communes, Wicko, Łeba (Lębork Poviat) communes
Area [ha]	32 744
Protection objective	Preserving biodiversity, resources, formations and abiotic components as well as landscape values, re-establishment of favourable status of resources and natural components and restoration of transformed natural habitats, flora, fauna or fungi habitats.
Distance from the planned project	The location of the nuclear power plant facility is situated at a distance of app. 3 km from the eastern border of the park buffer zone.
II. Nature reserves	
II.1. Choczewskie Cisy (Choczewskie yew trees)	
Legal basis	Order of the Ministry of Agricultural and Wood Industry of 12 December 1961 on establishing a nature reserve (Official Gazette of 1962, No. 14, item 58)

Location	Choczewo commune
Area [ha]	9.19 ha
Protection objective	Preserving the natural site of yew trees in the multi-species mixed forest due to scientific and didactic reasons.
Distance from the planned project	The location of nuclear power facilities is approx. 2 km from the northern boundaries of this site.
II.2. Mierzeja Sarbska (Sarbska sandbar)	
Legal basis	Order of the Ministry of Forestry and Wood Industry of 10 November 1976 (Official Gazette No. 42, item 206)
Location	Choczewo, Łeba, Wicko communes
Area [ha]	546.95
Protection objective	Preserving the natural dune and bog plant communities, formed in specific conditions of a narrow coastal sandbar.
Distance from the planned project	The location of nuclear power facilities is approx. 5 km from the eastern boundary of the reserve.
III. Protected landscape areas	
III.1. Nadmorski (Coastal)	
Legal basis	Resolution No. 1161/XLVII/10 of the Local Government Assembly for the Pomeranian Voivodeship of 28 April 2010 on areas of protected landscape in the Pomeranian Voivodeship (Journal of Laws of Pomeranian Voivodeship, No. 80, item 1455)
Location	Krokowa, Puck, Władysławowo, Choczewo communes
Area [ha]	14 940 ha
Description of the area	The area covers a seashore, forest and non-forest lane of dunes running along the cost, a part of the Bielawskie Błota complex, the Błota Przymorskie plain in the eastern part the and the northern fragments of Wysoczyzna Żarnowiecka adjacent to it.
Distance from the planned project	The location of nuclear power facilities is within this area.
IV. Areas of Community importance	
IV.1. Białogóra PLH220003	
Legal basis	Commission Decision of 13 November 2007 adopting, pursuant to Council Directive 92/43/EEC, a first updated list of

	sites of Community importance for the Continental biogeographic region (notified under document number C(2007) 5403) Order of Regional Director for Environmental Protection in Gdańsk of 30 April 2014 on determining the plan for protection actions for the Natura 2000 site Białogóra PLH220003 (Journal of Laws of Pomeranian Voivodeship, item 1916).
Location	Choczewo and Krokowa communes
Area [ha]	1 132.8 ha
The object of protection	The habitats which are the objects of protection include: 2110 – embryonic shifting dunes, 2120 – coastal white dunes (*Elymo-Ammophiletum*), 2130 – coastal grey dunes, 2140 – coastal crowberry heaths (*Empetrion nigri),* 2180 – mixed forest and coniferous forest on coastal dunes, 2190 – humid interdune hollows, 4010 – humid heaths with bog heathers (*Ericion tetralix*), 7110 – high heaths with peat formation vegetation, 7150 – depression on peat substrates with the vegetation of *Rhynhosporion,* 91D0 – bog woodlands (*Vaccinio uliginiosi-Betuletum pubescentis, Vaccinio uliginosi-Pinetum, Pino mugo-Sphagnetum, Sphagno girgensohnii-Piceetum* and birch-pine bog borealen forests.
Distance from the planned project	The location of nuclear power facilities is approx. 4 km from the western boundary of this site.
IV.2. Mierzeja Sarbska PLH220018 (Sarbska sandbar)	
Legal basis	Commission Decision of 10 November 2011 adopting, pursuant to Council Directive 92/43/EEC, a fourth updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2010) 9669) Order of the Regional Director for Environmental Protection in Gdańsk of 8 April 2014 on determining the plan for protection actions for the Natura 2000 site Mierzeja Sarbska PLH220018 (Journal of Laws of Pomeranian Voivodeship, item 1715).
Location	Łeba commune, Wicko commune
Area [ha]	1 882.9 ha
The object of protection	The habitats which are the objects of protection include: 1150 – coastal lagoons, 2110 – embryonic shifting dunes, 2120 – coastal white dunes (*Elymo-Ammophiletum*), 2130 – coastal grey dunes, 2140 – coastal crowberry heaths (*Empetrion nigri),* 2170 – coastal dunes with Salix repens ssp argentea 2180 – mixed forest and coniferous forest on coastal dunes, 2190 – humid interdune hollows, 4010 – humid heaths with bog heathers (*Ericion tetralix*), 9190 – near-natural birch-oak woodlands (*Betulo-Quercetum*) 91D0 – bog woodlands (*Vaccinio uliginiosi-Betuletum*

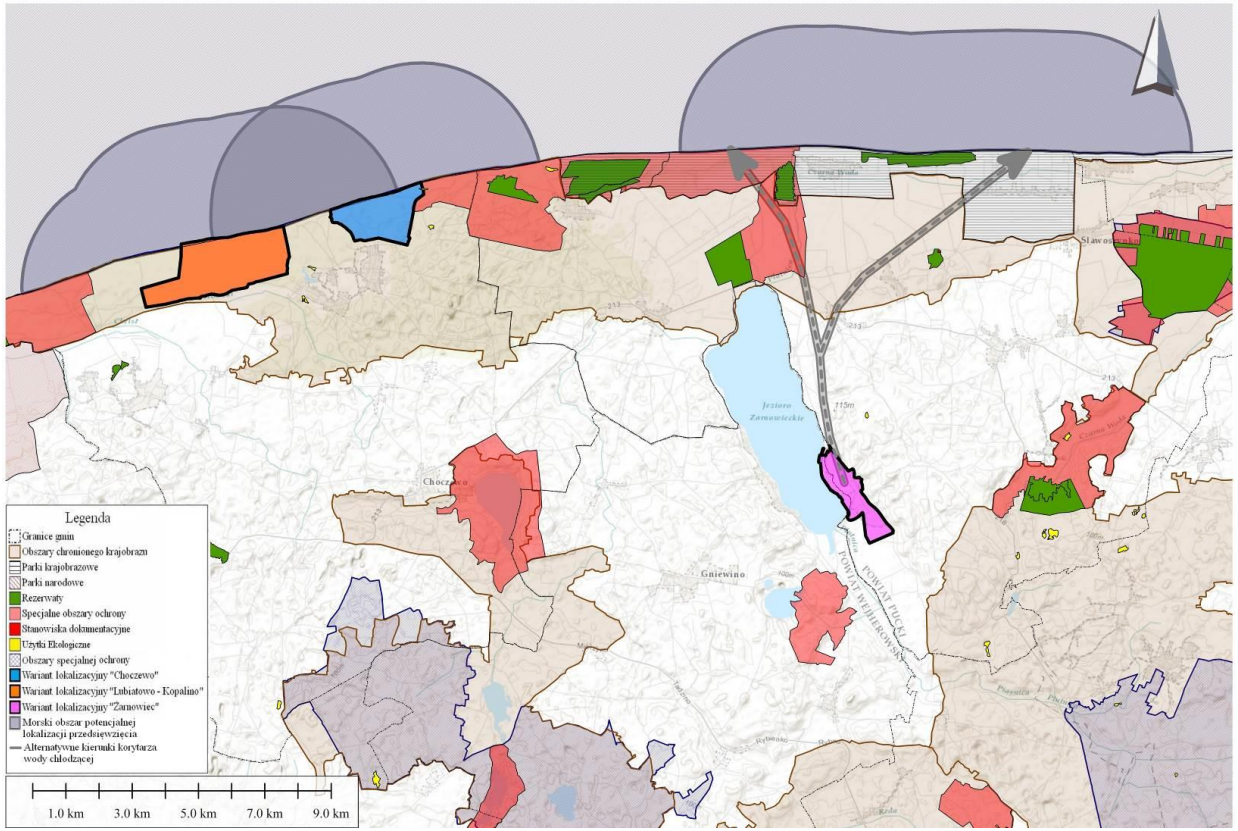
	pubescentis, Vaccinio uliginosi-Pinetum, Pino mugo-Sphagnetum, Sphagno girgensohnii-Piceetum and birch-pine bog borealen forests.
Distance from the planned project	The location of nuclear power facilities is approx. 2 km from the eastern boundary of this site.
IV.3. Lasy Lęborskie PLB220006 (Lęborskie forest)	
Legal basis	Regulation of the Ministry of Environment of 21 July 2004 on the Natura 2000 special birds protection areas (Journal of Laws No. 229, item 2313). Order of the Regional Director for Environmental Protection in Gdańsk of 19 May 2014 on determining the plan for protection actions for the Natura 2000 site Lasy Lęborskie PLB220006 (Journal of Laws of Pomeranian Voivodeship, item 2089).
Location	Choczewo, Gniewino, Luzino, Łęczyce communes
Area [ha]	8 565.3 ha
The object of protection	The boreal owl *Aegolius funereus* is the object of protection.
Distance from the planned project	The location of nuclear power facilities is approx. 10 km from the northern boundary of this area.
IV.4. Piaśnickie Łąki PLH220021 (Piaśnickie meadows)	
Legal basis	Commission Decision of 13 November 2007 adopting, pursuant to Council Directive 92/43/EEC, a first updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2007) 5403) Order of Regional Director for Environmental Protection in Gdańsk of 17 April 2014 on determining the plan for protection actions for the Natura 2000 site Piaśnickie Łąki PLH220021 (Journal of Laws of Pomeranian Voivodeship, item 1816).
Location	Krokowa commune
Area [ha]	1 085.0 ha
The object of protection	The following natural habitats are the objects of protection: 1130 – estuaries, 2120 – coastal white dunes (*Elymo-Ammophiletum*), 2130 – coastal grey dunes, 2180 – mixed forest and coniferous forest on coastal dunes, 6410 – Molinia meadows on calcareous, 7120 – degraded raised bogs still capable of natural or stimulated regeneration, 9190 – near-natural birch-oak woodlands (*Betulo-Quercetum*), 91D0 – bog woodlands (Vaccinio *uliginiosi-Betuletum*

	pubescentis, *Vaccinio uliginosi-Pinetum, Pino mugo-Sphagnetum, Sphagno girgensohnii-Piceetum* and birch-pine bog boreal forests.
Distance from the planned project	The location of nuclear power facilities is approx. 7.5 km from the western boundary of this site.
IV.5. Jeziora Choczewskie PLH220096 (Choczewskie lakes)	
Legal basis	Commission Decision of 10 November 2011 adopting, pursuant to Council Directive 92/43/EEC, a fourth updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2010) 9669)
Location	Choczewo, Gniewino, Łęczyce communes
Area [ha]	1 120.03
The object of protection	The following natural habitats are the objects of protection: 3110 – Lobelia lakes, 3160 – natural dystrophic lakes and ponds
Distance from the planned project	The location of nuclear power facilities is approx. 8 km from the northern boundary of this area.
IV.6. Widowo PLH220054	
Legal basis	Commission Decision of 12 December 2008 adopting, pursuant to Council Directive 92/43/EEC, a second updated list of sites of Community importance for the Continental biogeographic region (notified under document number C(2008) 8039)
Location	Krokowa commune
Area [ha]	99.14 ha
The object of protection	The following natural habitats are the objects of protection: 2120 – coastal white dunes (*Elymo-Ammophiletum*), 2180 – mixed forest and coniferous forest on coastal dunes, 9190 – near-natural birch-oak woodlands (*Betulo-Quercetum*).
Distance from the planned project	The location of nuclear power facilities is approx. 14 km from the western boundary of this site.
V. Special birds protection areas	
V.1. Przybrzeżne wody Bałtyku PLB990002 (Baltic coastal waters)	
Legal basis	Regulation of the Ministry of Environment of 21 July 2004 on the Natura 2000 special birds protection areas (Journal of Laws No. 229, item 2313).

Location	Baltic sea/Territorial sea of the Republic of Poland
Area [ha]	194 626.73 ha
The object of protection	The following species are the object of protection: alca *Alca torda,* black guillemot *Ceppus grylle,* European herring gull *Larus argentatus,* velvet scoter *Melanita fusca,* common scoter *Melanita nigra*. Two bird species from the Annex I of the Council Directive 79/409/EEC stay for winter on this area: black-throated loon and red-throated loon (C7). During winter, more than 1% of the migratory routes population of long-tailed duck (C3) and at least 1% of black guillemot and velvet scoter are present there.
Distance from the planned project	The location of nuclear power facilities is within the direct vicinity to the southern boundary of this site.
VI. Ecological sites	
VI.1. Białogórskie torfowisko (Białogóra peatbog)	
Legal basis	Order No. 183/00 of the Voivode of the Pomeranian Voivodeship of 28 November 2000 (Journal of Laws of Pomeranian Voivodeship, No. 115, item 738).
Location	Krokowa commune
Area [ha]	2.58
Description of the area	Transitional peatbog
Distance from the planned project	The location of nuclear power facilities is approx. 12 km from the southern boundary of this site. At the current stage the determination of the distance of the reserve from the planned elements of the technological system of cooling water intake and discharge is impossible due to the lack of detailed information on their location.
VI.2. Osoczne Oczko	
Legal basis	Order No. 183/00 of the Voivode of the Pomeranian Voivodeship of 28 November 2000 (Journal of Laws of Pomeranian Voivodeship, No. 115, item 738).
Location	Choczewo commune
Area [ha]	1.36 ha
Description of the area	Water reservoir with statiotes aloides
Distance from the planned project	The location of nuclear power facilities is approx. 1.5 km from the boundary of this site.

VI.3. Torfowisko in Szklana Huta (Peatbogs in Szklana Huta)	
Legal basis	Order No. 183/00 of the Voivode of the Pomeranian Voivodeship of 28 November 2000 (Journal of Laws of Pomeranian Voivodeship, No. 115, item 738).
Location	Choczewo commune
Area [ha]	0.86 ha
Description of the area	The area of transition peatbogs, important for protection of local genetic resources and unique types of environment.
Distance from the planned project	The location of nuclear power facilities is approx. 0.5 km from the boundary of this site.
VI.4. Źródliska Bezimiennej (Bezimmienna river springs)	
Legal basis	Order No. 183/00 of the Voivode of the Pomeranian Voivodeship of 28 November 2000 (Journal of Laws of Pomeranian Voivodeship, No. 115, item 738).
Location	Choczewo commune
Area [ha]	1.3 ha
Description of the area	This site covers numerous seepage spring areas important for the protection of local genetic and unique types of environment.
Distance from the planned project	The location of nuclear power facilities is approx. 0.5 km from the boundary of this site.
VI.5. Torfowisko przejściowe „Gajówka" („Gajówka transitional peatbog)	
Legal basis	Order No. 183/00 of the Voivode of the Pomeranian Voivodeship of 28 November 2000 (Journal of Laws of Pomeranian Voivodeship, No. 115, item 738).
Location	Choczewo commune
Area [ha]	1.78
Description of the area	Transitional peatbog
Distance from the planned project	The location of nuclear power facilities is approx. 1 km from the southern boundary of this site.

Source: own study



Key
Commune boundaries
Protected landscape areas
Landscape parks
National parks
Reserves
Special areas of conservation
Documentation sites

Ecological sites
Special protection areas
“Choczewo” location variant
“Lubiatowo – Kopalino” location variant
“Żarnowiec” location variant
Surface water courses
Marine area of the potential project location
Alternative directions of cooling water canal

Figure 21. Location variants against the results of nature protection forms

Source: Own study with the use of Esri, OpenStreetMap and the Directorate General of the State Forests data.

14 The proposed scope and methodologies for the environmental studies required for the environmental impact assessment procedure

Proper performance of the environmental impact assessment for the Project requires carrying-out of a complete and comprehensive research program, results of which will constitute a basis for preparation of the environmental conditions characteristics for the individual location variants. The research results will be used for further series of analyses and modelling activities and enable determination of scale of the individual environmental impacts, their scope and significance, and in consequence will be used for drawing-up of the conclusions concerning the environmental conditions of the Project execution.

With regard to the application of research results and possible effects of their improper collection, the methodology and scope of the environmental research program should be consulted and agreed as comprehensively as possible and the results of such arrangements should be reflected in the decision on the EIA Report scope.

14.1 Area under investigation

The area, on which the individual environmental and location research for the nuclear power plant should be carried out, must ensure:

1) Completeness of environmental data in the potential impact area of the Project,

2) Comparability of the collected data on the environmental conditions in the individual investigated location variants.

3) Consistency of the research results required for the environmental impact assessment with research carried out for the location permit.

To ensure meeting of the abovementioned conditions, it was assumed that research will be performed at least in the potential local impact area, i.e. at the areas of NPP locations and within a buffer of 5 km around its boundaries as well as within the boundaries of the potential cooling system infrastructure canals and within a buffer of 1 km from the boundaries of these canals, whereas in the marine area, in the radius of at least 5 km around the cooling water intake and discharge points. For certain research, the extended research areas were determined, presented in Chapter 14.2 of the PIS. Optional modification of the research area in the course of field works, in duly justified cases, is assumed. In such case, the research area and methodology for its determination shall be described in details in the EIA Report.

14.2 Proposed detailed methodology and scope for the environmental research program

The table below presents the scope and preliminary methodologies of biotic (terrestrial and freshwater environment and marine environment) as well as abiotic environment research required for preparation of the EIA Report. For each analyzed biotic and abiotic environmental component detailed requirements concerning the research performance are specified. In addition, the chapter presents also the general assumptions for the environmental research program and information on the study analyses planned for the EIA Report.

Research will be carried out for the period of at least 12 months, provided that the period of research of the individual environmental components may be modified in line with detailed methodology, which will be specified before the commencement of research.

Table 21. Scope and methodologies of environmental research required for the environmental impact assessment

I. BIOTIC ENVIRONMENT RESEARCH – land and freshwater environment	
I.1. Plant communities and natural habitats	
Detailed requirements	• Field survey should be carried out at times which are optimal for the individual types of natural habitats, i.e. in the course of optimal development phase of the component plants species; • Field identification of plant communities and natural habitats plots as well as range mapping should be carried out using the route method, along with recording the results on the maps supported with location of the plot boundaries using GPS; • Plot diagnostics should be carried out in accordance with the phytosociological method, based on phytosociological records considering the characteristic and differential species;

	• Assessment of natural habitat preservation status and their representativeness should include the parameters laid down in the Regulation of the Minister of Environment of 13 April 2010 on habitats and species being the subject of interest for the European Union as well as selection criteria for the areas qualifying for recognition or designation as the Natura 2000 areas and applied in the monitoring works carried out by the Chief Inspectorate for Environmental Protection (hereinafter referred to as CIEP), based on the Methodological Guidelines; • In the case of no detailed methodologies for the natural habitats listed in the Habitats Directive, the results of expert assessment should be presented according the criteria provided in the CIEP guidelines.
I.2. Vascular plants	
Detailed requirements	• Field survey should be carried out at times which are optimal for the individual vascular plant species; • Field identification of vascular plant sites should be carried out using the route method, along with searching of the potential occurrence sites and recording the results on the maps supported with location of the plot boundaries using GPS; • Preservation status assessment of populations and plant species listed in the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora should consider the parameters laid down in the Regulation of the Minister of Environment of 13 April 2010 on habitats and species being the subject of interest for the European Union as well as selection criteria for the areas qualifying for recognition or designation as the Natura 2000 areas and applied in the monitoring works carried out by the CIEP, based on the Methodological Guidelines; • In the case of no detailed methodologies for the vascular plant listed in the Habitats Directive, the results of expert assessment should be presented according the criteria provided in the CIEP guidelines; • Preservation status of populations and habitats of the remaining vascular plants should be specified by means of expert assessment, comparing the obtained indicators with the areas of occurrence of species throughout the country, their habitat requirements, based on literature and non-published data; • In the case of identified vascular plants, species identification of which is impossible on-site, collection of the herbarium materials should be envisaged.
I.3. Bryophyta	
Detailed requirements	• Field research should be carried out in time periods optimal for the individual bryophyte species; • Field identification of bryophyte sites should be carried out using the route method, along with searching of the potential occurrence sites and recording the results on the maps supported with location of the plot boundaries using GPS; • Preservation status assessment of bryophyte populations and species listed in the Council Directive 92/43/EEC of 21

	May 1992 on the conservation of natural habitats and of wild fauna and flora should consider the parameters laid down in the Regulation of the Minister of Environment of 13 April 2010 on habitats and species being the subject of interest for the European Union as well as selection criteria for the areas qualifying for recognition or designation as the Natura 2000 areas and applied in the monitoring works carried out by the CIEP, based on the Methodological Guidelines; • Preservation status of populations and habitats of the remaining bryophyte species should be specified by means of expert assessment, comparing the obtained indicators with the areas of occurrence of species throughout the country, their habitat requirements, based on literature and non-published data; • In the case of identified bryophyte, species identification of which is impossible on-site, collection of the herbarium materials should be envisaged.
I.4. Macroscopic fungi (Macromycetes)	
Detailed requirements	• In the period preceding the field survey and in the course of research, meteorological conditions should be analysed (diversification of fruiting bodies production of vast majority of macroscopic fungi in time depends significantly on weather conditions); • Field survey should be carried out in time periods optimal for the individual macroscopic fungi species; • Field identification of macroscopic fungi sites should be carried out using the route method, along with searching of the potential occurrence sites, inspection of all soil beds available for fungi and recording the results on the maps supported with location of the plot boundaries using GPS; • Preservation status of populations and habitats of the surveyed macroscopic fungi species should be specified by means of expert assessment, comparing the obtained indicators with the areas of occurrence of species throughout the country, their habitat requirements, based on literature and non-published data; • In the case of identified macroscopic fungi, species identification of which is impossible on-site, collection of the herbarium materials should be envisaged, followed by laboratory methods.
I.5. Lichenized fungi (lichens)	
Detailed requirements	• Field identification of lichen sites should be carried out using the route method, along with searching of the potential occurrence sites and recording the results on the maps supported with location of the plot boundaries using GPS; • Preservation status of populations and habitats of lichen species should be specified by means of expert assessment, comparing the obtained indicators with the areas of occurrence of species throughout the country, their habitat requirements, based on literature and non-published data; • In the case of identified fungi, species identification of which is impossible on-site, collection of the herbarium materials should be envisaged, followed by laboratory methods.

I.6. Land and freshwater invertebrates	
Detailed requirements	• Research area should be correlated with the extent of habitats optimal for a given species and finally, the research area shall be defined based on in-house studies covering, among others, orthophotos analysis, scientific research results, etc., and the results of the preliminary field inspection. • In the course of research, data will be collected among others in a form of field inspection records (or any other adequate method using e.g. electronic/digital data record) for each species in accordance with the CIEP guidelines or, in the case of absence thereof, based on templates applied in the CIEP guidelines or any other, national and international recommendations meeting the reliability and objectivity criteria. • It is assumed to apply the terrestrial and freshwater invertebrates research methods adjusted to their biology and ecology, in accordance with the CIEP guidelines or, in the case of absence thereof, based on the national and international best practices and guidelines, using the standardized (e.g. of similar parameters) and calibrated equipment and devices enabling acquisition of reliable and verifiable results.
I.7. Freshwater ichtiofauna	
Detailed requirements	• Research area (including list of watercourse and control stations, including the controlled water bodies along with their geographical coordinates) should be finally defined based on the preparation of detailed research methodologies stage, based on the potential hydrological impacts, results of in-house works and preliminary field inspection. Survey shall additionally cover the water courses and bodies subject to correction of the riverbed and shoreline run or liquidation (concerns the water bodies). • For the assessment of the species composition and fish densities in the watercourses, the one-time sampling of fish with electricity, in accordance with the valid European Standard (The European Standard EN 14011:2003) and Polish Standard – PN-ER 14011 – (Polish Committee for Standardization 2006), and in the case of minor water bodies (standing water), e.g. trap method as the method supplementing the sampling with electricity in the shoreline area will be applied. In addition, searching for salmonid spawning nests is assumed (searching and counting of spawning nests). • The habitat quality assessment shall include the formation and number of the individual physical and morphological structures specific for natural water courses (swift current / river pool sequences, presence of diversified substrate, lairs, etc.); • Natural resources size assessment and habitat quality assessment should be carried out on the basis of the expert assessment based on the performed field inspection and on-site visits in the research areas; • Data collected in the course of research will be presented in a form of field inspection records (or any other adequate method using e.g. electronic/digital data record) based on tips provided in the national and international guidelines

	(among others, standards).
I.8. Herpetofauna – amphibians	
Detailed requirements	• A research schedule considering also the estimated scope and requirements focused on amphibian activity in the annual cycle shall be arranged on individual basis, for each species potentially occurring at the research area. • Data collected in the course of research will be presented in a form of field inspection records (or any other adequate method using e.g. electronic/digital data record) for Great crested newt (*Triturus cristatus*) and European fire-bellied toad (*Bombina bombina*) sites and additional records for registering the observations of the other identified amphibian species within the research area, in accordance with the CIEP guidelines or, in the case of absence thereof, based on templates applied in the CIEP guidelines or any other, national and international recommendations meeting the reliability and objectivity criteria. • For northern crested newt, application and presentation of the Habitat Suitability Index (HSI) is assumed, in line with the requirements of the CIEP methodological guide, whereas for the European fire-bellied toad, the collective habitat quality index is required. • The amphibian research methods shall be adapted to their biology and ecology, in accordance with the CIEP guidelines or, in the case of absence thereof, based on the national and international best practices and guidelines, using the standardized (e.g. of similar parameters) and calibrated equipment and devices enabling acquisition of reliable and verifiable results. • Application of research methods consisting in yields (e.g. of live traps in a form of plastic buckets dug into the soil and trapping the moving amphibians) will depend on a final inspection of the environmental conditions and arrangements with competent environmental protection authority.
I.9. Herpetofauna – reptiles	
Detailed requirements	• Data collected in the course of research will be presented in a form of field inspection records (or any other adequate method using e.g. electronic/digital data record) for each species in accordance with the CIEP guidelines or, in the case of absence thereof, based on templates applied in the CIEP guidelines or any other, national and international recommendations meeting the reliability and objectivity criteria. • The reptile research methods shall be adapted to their biology and ecology, in accordance with the CIEP guidelines or, in the case of absence thereof, based on the national and international best practices and guidelines, using the standardized (e.g. of similar parameters) and calibrated equipment and devices enabling acquisition of reliable and verifiable results. Individually, for each species potentially present within the research area, the range of temperatures, in which the reptiles are active, as well as optimal weather conditions enabling basking in the sun by the specimens of this group of animals shall be considered.

	• The recommended research methods for reptile species include direct observations, i.e. transect method combined with counting and identification of present animals (including dead specimens), yield (if necessary, e.g. for identification of the species / development stage / sex, in the course of observations), installation of artificial refuges and possible yield (as specified above) (the refuges should be removed upon the completion of research, provided that the maximum period of their application in a single site amounts to 3 vegetation periods).
I.10. Avifauna	
Detailed requirements	• Research shall be carried out additionally in the 2015 autumn migration period. • Data collected in the course of research shall be presented in a form of standardized field inspection protocol forms (FIPF) as well as tables, charts, diagrams, etc. presenting the research results collected in the PIPFs, compliant with the guidelines as well as with the national and international standards; • Avifauna research methods shall be adapted to their biology and ecology, in accordance with the CIEP guidelines or, in the case of absence thereof, based on the national and international best practices and guidelines, using the standardized (e.g. of similar parameters) and calibrated equipment and devices enabling acquisition of reliable and verifiable results. • Selection of applicable and final research method shall be defined upon field survey and in-house works, provided that such research shall be conducted among others by means of: – Counting in the observation points (10 minutes), – Counting in the observation points (60 minutes) – Transect-based counting; • Additional research of avifauna groups, e.g. of *Accipitriformes* order, breeding at the forest areas and non-breeding are assumed, if needed.
I.11. Chiropterofauna	
Detailed requirements	• Detailed survey will cover the sites or objects anticipated for removal, demolition, liquidation, etc., including the buildings and other cubature objects, wells, tunnels, trees as well as habitats used by the bats as the sites of movement, feeding, etc. (e.g. linear tree stands, including these accompanying the water courses, deciduous forests, water bodies and other); • The chiropterologist supervising the research is required to hold a license of the Polish Society for Bat Protection in a degree of a surveyor and yielder and hold applicable permits for exclusions from the prohibitions in force for these species) e.g. catching, keeping and deliberately disturbing and bothering bats; • Data collected in the course of research will be presented in a form of field inspection records (or any other adequate method using e.g. electronic/digital data record) based on the tips presented in the national and international

	guidelines (among other standards). • Chiropterofauna research methods shall be adapted to their biology and ecology, based on the national and international guidelines (here: EUROBATS), using the standardized (e.g. of similar parameters) and calibrated equipment and devices enabling acquisition of reliable and verifiable results, including these enabling bat activity recording. • The recommended research methods are optima for any and all bat species potentially present at the area of the planned project and include: – in-house works, – preliminary field inspection, – bat surveys using non-invasive methods including bat detector surveys (spring, summer and autumn) carried out on the transects as well as point spring and autumn surveillance in the Baltic Sea coastline along with simultaneous recording of bat activity, – searching for bat sites in the summer period, – searching for bat sites in the winter period.
I.12. Other mammal species	
Detailed requirements	• In practice, detailed survey should cover all types of natural, semi-natural and other habitats, including anthropogenic habitats; • Data collected in the course of the survey will be presented in a form of field inspection records (or any other adequate method using e.g. electronic/digital data record) based on the tips presented in the national and international guidelines. • The research methods shall be adapted to their biology and ecology, based on the national and international guidelines, using the standardized (e.g. of similar parameters) and calibrated equipment and devices enabling acquisition of reliable and verifiable results, including these enabling activity recording. • Due to the fact that mammals are a heterogeneous group of animals with regard to the behavioural biology, for each species or group of similar requirements / behaviour one should apply a set of research methods enabling detailed analysis of the potential occurrence sites of the researched mammal species; these methods include, among others: – Camera traps and animal track identification on the sandy strips (the method consists in identification, determination and counting of tracks of all animal species identified at the specially prepared surfaces – 'track traps' or plates covered with soot (or, alternatively, plates with floral foam), – identification of animal tracks at the designated natural areas, on uncovered soil and in the periods of snow cover presence, – identification of excrements, scent mounds and animal feeding tracks,

	– observation of mammals killed on the roads and live animals, – mapping and verification of burrow distribution, – voice surveillance (e.g. in the case of edible dormouse) and replaying the records of the selected species; – yielding of small animals in cone traps and live traps in the selected habitat types.
II. BIOTIC ENVIRONMENT RESEARCH – marine environment	
II.1 Phytoplankton	
Detailed requirements	• The research should be carried out in compliance with the applicable national and international methodologies and considering the specifics of biology and ecology of the research group; • The research results should cover the following scope of information: – phytoplankton taxonomic structure, – abundance (unit/dm-3) and biomass (mm3/m-3) of the average seasonals for the individual phytoplankton taxons and groups as well as their annual fluctuations, – chlorophyll value a (mg/m-3), – assessment of water quality status based on chlorophyll value a, – value of the biocenotic diversity indexes for the researched areas (e.g. Shannon-Wiener biodiversity index) – value of physical and chemical indicators, including among others: water temperature, transparency, electrolytic conductivity, dissolved oxygen, salinity, pH, ammonium nitrate, nitrate nitrogen, total nitrogen, phosphates, total phosphorus, silica, sulfates, chlorides, calcium, magnesium, total hardness.
II.2. Zooplankton	
Detailed requirements	• The research should be carried out in compliance with the applicable national and international methodologies and considering the specifics of biology and ecology of the research group; • The research results should cover the following scope of information: – zooplankton taxonomic structure – abundance (unit/dm-3) and biomass (mm3/m-3) of the average seasonals for the individual zooplankton taxons and groups as well as their annual fluctuations, – copepods (*Copepoda)* biomass, microphagous mesozooplankton biomass, average zooplankton size, – value of the biocenotic diversity indexes for the researched areas (e.g. Shannon-Wiener biodiversity index) – value of physical and chemical indicators, including among others: water temperature, transparency, electrolytic conductivity, dissolved oxygen, salinity, pH, ammonium nitrate, nitrate nitrogen, total nitrogen, phosphates, total phosphorus, silica, sulfates, chlorides, calcium, magnesium, total hardness.

II.3. Phytobenthos	
Detailed requirements	• The research should be carried out in compliance with the applicable national and international methodologies and considering the specifics of biology and ecology of the research group; • The research results should cover the following scope of information: – phytobenthos taxonomic structure – abundance and biomass (dry mass value in grams per square meter [g sm·m-2]), – value of the biocenotic diversity indexes for the researched areas (e.g. Shannon-Wiener biodiversity index) – distribution and plant bottom coverage ratio [%].
II.4. Zoobenthos	
Detailed requirements	• The research should be carried out in compliance with the applicable national and international methodologies and considering the specifics of biology and ecology of the research group; • The research results should cover the following scope of information: – zoobenthos taxonomic structure – abundance (unit/dm-3) and biomass (mm3/m-3) of the average seasonals for the individual zoobenthos taxons and groups as well as their annual fluctuations, – value of the biocenotic diversity indexes for the researched areas (e.g. Shannon-Wiener biodiversity index)
II.5. Ichtiofauna	
Detailed requirements	• The research should be carried out in compliance with the applicable national and international methodologies and considering the specifics of biology and ecology of the research group; • The research results should cover the following scope of information: – species composition, length composition (total length [Lt]), – abundance, distribution and biomass of fish and Cyclostomata at the research areas – value of the biocenotic diversity indexes for the researched areas – value of catch effort indexes (CPUE – Catch Per Unit Effort and BPUE – Biomass Per Unit Effort).
II.6. Avifauna	
Detailed requirements	• The research should be carried out in compliance with the applicable national and international methodologies and considering the specifics of biology and ecology of the research group; • The research results should cover the following scope of information: – avifauna taxonomic structure

	– abundance, including: indexes of: ▪ **density,** specifying the number of birds converted into 1 km^2. It considers only the specimens staying within 600 m of the transect strip and overflying birds recorded in the course of counting with the use of "snapshot" technique ▪ **frequency,** specifying total number of the specimen of a gives species converted into 1 hour of cruise. When calculating this index, one should consider both sitting and overflying birds, within the transept area and outside it. – value of the biocenotic diversity indexes for the researched areas.
II.7. Marine mammals	
Detailed requirements	• The research should be carried out in compliance with the applicable national and international methodologies and considering the specifics of biology and ecology of the research group; • Porpoise research shall be carried out in the annual mode, along with continuous monitoring with the use of hydroacustic detectors – C-POD. Seal survey should be carried out all year long, twice a month, during bird counting; • The research results should cover the following scope of information: – Result of acoustic data analyses – positive detection days. – Number of porpoise detection days. – Porpoise density in the full annual cycle, – Acoustic background monitoring results. – Percentage share of detection days comparing to the en tire data collection period of a given research station. – Sound level intensity in the 1/3 octave band 63 and 125 Hz for the individual seasons.
III. ABIOTIC ENVIRONMENT RESEARCH	
III.1. Meteorological phenomena and atmospheric variables	
Detailed requirements	• Research should be carried out following the WMO Doc no. 8 recommendations "Guide to Meteorological Instruments and Methods of Observation"; • Measurements of meteorological parameters of atmosphere should be carried out with regard to meeting the representativeness condition; • Monitoring includes meteorological phenomena (precipitations, lightning, hoarfrost, rime) and atmospheric variables (temperature, wind direction and speed, humidity, atmospheric pressure and cloudiness).
III.2. Atmospheric pollution research	

Detailed requirements	• Monitoring carried out in compliance with the principles in force for the National air quality monitoring network. • Monitoring covers research of the following concentrations: PM2.5 dust; Ni, Pb, Cd, As; Hg, NO3-, SO42-, Cl-, NH4+, Na+, K+ Ca2+, elemental carbon (EC) and organic carbon (OC), polyaromatic hydrocarbons (PAH) and the following gases: CO, NOx, ozone and SO2.
III.3. Radionuclide concentration in the environment	
Detailed requirements	• Monitoring carried out in compliance with the principles in force for the National radiation monitoring network. • Monitoring will be carried out using the gamma radiation spectrometry, liquid scintillation spectrometry (LSC) and alpha spectrometry; • In the course of the monitoring process, concentration of the following metals will be determined: As, Ba, Cd, Co, Cr, Cu, Mo, Ni Pb, Sn, Zn using the plasma emission spectroscopy.
III.4. Hydrogeological and sozological mapping	
Detailed requirements	• Research shall be carried out in the location area, i.e. up to 30 km from the boundaries of the planned location of the nuclear facility. • For hydrogeological mapping, performance of two measurement series throughout the year is planned; • The following will be identified: surface occurrence of groundwater, existing Wells, sources of potential groundwater contamination; • The existing wells and surface occurrences of groundwater will be subject to pH, specific electrolytic conductivity, temperature (in-situ research) and 7 main ions and corrosive effect on steel and concrete (laboratory tests) research. Groundwater table level will be also measured in the wells; • Research will be carried out with the use of at least: – Depth gauge (hydrogeological Whistler) – microcomputer conductivity meter – microcomputer pH meter – GPS receiver with accuracy <3 m; • The contractor responsible for sampling for laboratory tests should hold a water sampling probe and sampling containers; • The persons taking samples for laboratory tests must be accredited to water sampling. Indicator laboratory tests should be carried out in the laboratory accredited to the determinations tested. The samples should be delivered to the laboratory as soon as possible on the sampling day.

III.5. Groundwater quality	
Detailed requirements	• Research should be performed for the groundwater bodies, on the reception basin basis; • 3 aquifiers will be assessed, including app. 40 hydrogeological boreholes in total; • Analysing the physical and chemical properties of groundwater in the scope of indicators compliant with the Regulation of the Minister of Environment concerning the forms and methods of surface water bodies and groundwater bodies monitoring and in the scope of corrosive effect on concrete and steel and radioactive isotope concentrations; • Indicator research will be performed on quarterly basis; • Research will be performed in compliance with the sampling standards in force (PN-ISO 5667-11/2004; Water Quality – Sampling – Part 11: Guidance On Sampling Of Ground Waters) and laboratory test standards; • The contractor responsible for sampling for laboratory tests should hold a water sampling probe and sampling containers; • The persons taking samples for laboratory tests must be accredited to water sampling. Indicator laboratory tests should be carried out in the laboratory accredited to the determinations tested. The samples should be delivered to the laboratory as soon as possible on the sampling day.
III.6. Groundwater table level	
Detailed requirements	• Research should be performed for the groundwater bodies, on the reception basin basis; • 3 aquifiers will be assessed, including app. 40 hydrogeological boreholes in total; • Research will be performed with the use of automatic measuring system equipped in water level pressure transducer along with devices used for data collection and transfer (streaming); • Research will be performed in the continuous mode, with the use of the automatic measurement network.
III.7. Inland surface water hydrometry	
Detailed requirements	• Research will include the land hydrographic objects (rivers, lakes) potentially impacted by the project; • Research will be performed in compliance with the following standards in force: – PN-EN ISO 18365:2014-02E Hydrometry – Selection, establishment and operation of a gauging station, – PN-EN ISO 748:2009P Measurement of liquid flow in open channels using current-meters or floats, – PN-EN ISO 772:2011 Hydrometry. Vocabulary and symbols • Monitoring will be performed with the use of the following equipment: – water level sensor (relevant sensors should be selected, with regard to the river type and from among the

	following sensor types: floating, pressure and radar sensors). – flow meters for testing the flow rate in the rivers (select the most relevant one with regard to the river type: conventional current meter, ultrasound method, electromagnetic method, acoustic method, etc.); these will be mobile devices, number of which does not need to be equal to the measurement profiles; – ice thickness gauges – applicable devices for data recording, so called data logger, along with software.
III.8. Baltic Sea waving and currents	
Detailed requirements	• Research will be performed on the point basis. Data will be acquired from measuring floats located in the places of the planned outflows of cooling water canals, for each location; • Monitoring process will require the following equipment: – sea level probe – acoustic profile meter for measuring the sea water direction and speed, – ice thickness gauges – applicable devices for data recording, so called data logger, along with software.
III.9. Hydrological mapping	
Detailed requirements	• Research shall be carried out in the location area, i.e. up to 30 km from the boundaries of the planned location of the nuclear facility. • Monitoring will be performed in compliance with the good practices in force, included among others in the applicable guides, e.g. Werner-Więckowska H., Gutry-Korycka M., 1996, "Przewodnik do hydrograficznych badań terenowych", PWN, Warsaw ; • Research will be carried out with the use of at least: – GPS receiver with accuracy <3 m; – tachymeter
III.10. Coastline tachymetry	
Detailed requirements	• Measurements will be carried out for all locations at the coastline section corresponding to the potential location of the cooling water canals; • Research will be performed with time step on a quarterly basis; • Research will be carried out with the use of at least: – GPS receiver with accuracy <3 m;

	– tachymeter
III.11. Inland surface water quality	
Detailed requirements	• Samples will be taken on quarterly basis; • The contractor responsible for sampling for laboratory tests should hold a water sampling probe and sampling containers; • Analysing the physical and chemical properties of groundwater in the scope of indicators compliant with the Regulation of the Minister of Environment concerning the forms and methods of surface water bodies and groundwater bodies monitoring and in the scope of corrosive effect on concrete and steel and radioactive isotope concentrations; • Research will be performed in compliance with the laboratory test and sampling standards in force: – PN-ISO 5667-6/2003; Water Quality – Sampling – Part 6: Guidance On Sampling Of Rivers And Streams and laboratory test standards – PN-ISO 5667-4/2003; Water quality – Sampling – Part 4: Guidance On Sampling From Lakes, Natural And Man-made.
III.12. Sea water quality	
Detailed requirements	• On the point basis, in the sites of measuring floats located in the places of the planned outflows of cooling water canals, for each location; • Research will be performed in compliance with sampling standards in force (PN-ISO 5667-9/2005; Water Quality – Sampling – Part 9: Guidance On Sampling From Marine Waters) and laboratory test standards; • The contractor responsible for sampling for laboratory tests should hold a water sampling probe and sampling containers; • Analysing the physical and chemical properties of groundwater in the scope of indicators compliant with the Regulation of the Minister of Environment concerning the forms and methods of surface water bodies and groundwater bodies monitoring and in the scope of corrosive effect on concrete and steel and radioactive isotope concentrations;
III.13. Baltic Sea batymetry	

Detailed requirements	• Baltic Sea area covered by batymetric research will be determined by at least the range of cooling water canals; • Batymetric measurements should be performed at least on a quarterly basis; • Before research, a measurement profile design should be prepared. Density of measurement profiles will depend on the bottom form of a research part of the Baltic Sea. • Basic components of the measurement system include: – specialist floating craft intended for hydrographic works; – satellite positioning system of a hydrographic craft; – digital ultrasound probe.

III.14. Measurements of noise emission to the environment

Detailed requirements	• Research will be performed with consideration to the existing and designed noise protection areas: • Before commencing the measurements, one should inspect the area in details with a view to noise protection, including primarily analysing the local spatial development plans (LSDP) along with determination of the permissible noise levels at the researched area – pursuant to the Regulation of the Minister of Environment of 1 October 2012 amending the regulation on the permissible noise levels in the environment. • Acoustic background measurements should be made based on the reference methodology for noise measurements in the environment, referred to in Annex 7 of the Regulation of the Minister of Environment of 30 October 2014 on the requirements for measurements of the emission values and taken-in water. • Basic components of the measurement system include: – noise level – acoustic calibrator – stand with microphone cable – atmospheric conditions measurement station

Source: own study

14.3 General requirements for the execution of the environmental research program

Apart from detailed requirements referring to the individual types of research, standard requirements, applying to all performed research, were specified.

1. Research shall cover the area of all analysed location variants, provided that as, in the course of preparations or execution of the research program, any of the variants is considered unreasonable, research in this area may be discontinued.
2. Biotic environment research will cover, depending on the analysed environmental component, the natural habitats listed in Annex I and species listed in Annex II and IV to the Council Directive 92/43/EEC of 21 May 1992 on the on the conservation of natural habitats and of wild fauna and flora, bird species listed in Directive 2009/147/EC of 30 November 2009 on the conservation of wild birds, species listed in the Regulation the Minister of the Environment from 9 October 2014 regarding protection of plant species, Regulation of the Minister of Environment of 9 October 2014 regarding protection of fungi species, Regulation of the Minister of the Environment of 6 October 2014 regarding animal species protection and rare and endangered species of 'special care' listed in the red books and lists.
   The abiotic environment components will be analysed in compliance with the legal provisions in force, including among others: Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of water Policy, Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration, Act of 18 July 2001 – Water Law, Act of 9 February 2015 – Geological and Mining Law along with the executive orders thereto and the Act of 27 April 2001 – Environmental Protection Law.
3. Research period may be modified in the case of occurrence of the conditions, which might prevent their performance.
4. Research shall be conducted using the non-invasive or low-invasive methods, minimizing the risk of negative impact on the preservation status of the researched environmental components.
5. Research shall be conducted with the use of standardized equipment and devices adjusted to the research requirements and enabling acquisition of reliable and verifiable results.
6. Before commencement of research and in their course, one should control the correctness of operations of the used equipment and devices, including among others, GPS receivers (in particular in the scope of proper calibration).
7. Research must be performed by trained persons, under the supervision of the persons holding applicable (corresponding to the object of research) at least higher education in a given field and documented experience in performance of such research.

14.4 Study analyses required for the Environmental Impact Assessment Report

For preparation of the environmental impact report for the nuclear power plant, apart from the performance of the above mentioned field research enabling determination of the environmental status before the commencement of construction works, also necessary study analyses will be carried out, including modelling (hereinafter: analyses), aiming at determination of the

environmental impact of the planned investment. These will cover the analyses performed on standard basis for other projects (including modelling of noise distribution in the environment, analyses of changes in water conditions related to situation of the facility, etc.), as well as analyses specific for the nuclear power plant facility (including modelling of distribution of radioactive substance release to the environment, analyses of radioactive waste and used fuel management and analyses of ionizing radiation impact on human health, etc.).

Apart from the above mentioned analyses aiming at meeting the requirements of the Community law and national law in the scope of environmental impact assessments, analyses for nuclear power plants specified in the applicable guidelines of the International Atomic Energy Agency[77] will be carried out. These will concern such issues related to the execution of the planned project as changes to the socio-economic situation, or intensity, type or safety of traffic.

Other works

Furthermore, apart from the environmental research listed in the table, any other necessary works, including field works, aiming at providing support to the analyses carried out for the EIA Report for the planned nuclear power plant, will be performed. The examples of such works include, among others, noise and electromagnetic radiation measurements for determining the background for a given environmental component before commencement of construction of the nuclear power plant. For the needs of the environmental impact assessment of the planned project on the landscape values, an applicable photo documentation will be performed.

15 The proposed scope of the EIA Report and methodology for the environmental impact assessment

15.1 General scheme of impact assessment

The EIA report is a document that describes all the works and all results of tests and analyses made to assess the environmental impact of the NPP.

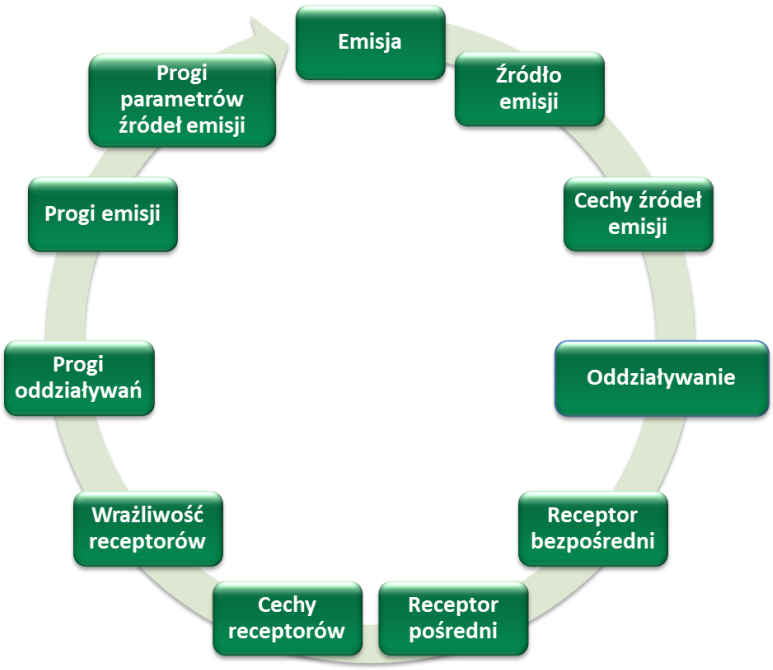
It should be emphasized that the EIA Report for the NPP will be the first study of its kind regarding nuclear power plants in Poland, and works related to it will be preceded by the first environmental research program on such a large scale in Poland. For these reasons, and in connection with the system requirement of carrying out the EIA at an early stage of project preparation, before selecting specific technologies, preparatory works aimed at defining the template for the Report and the schedule of impact assessment were also pioneering.

The main requirement for the assessment concept will be determining the NPP parameters that are important for the scale of its impact on the environment, and consequently what environmental conditions and in what wording in the decision on environmental conditions should restrict the

[77] International Atomic Energy Agency, 2014, Managing Environmental Impact Assessment for Construction and Operation in New Nuclear Power Programmes, Technical Reports Series No. NG-T-3.11, Vienna

project's design so as to ensure that its execution will not cause significant environment damage, regardless of the technology finally selected from those considered at the EIA stage.

The analytic cycle, carried out in order to meet this requirement, is presented in the diagram below.



Emission
Emission source
Properties of emission sources
Impact
Direct receptor
Indirect receptor
Receptor features
Receptor sensitivity
Impact thresholds
Emission thresholds
Thresholds of emission source properties

Figure 22. Schematic relationships between emissions and their sources, impact on the environment and parameters of the project.
Source: own study

This cycle will include a series of actions and analyses, and their results and conclusions will be presented in subsequent volumes and chapters of the EIA Report. Information about subsequent steps in the planned process of assessment of NPP's impact on the environment is presented below.

1) Preparatory stage:
   a) determining the components of the NPP and technologies, equipment and processes that can be applied during construction, operation and decommissioning of the NPP,

b) determining, on the basis of available literature and expert consultations, possible impacts of nuclear power plants on various elements of the environment,
c) specifying environment components which are sensitive to various direct impacts of the NPP,
d) identifying sources of emissions and environmental disturbances caused by the NPP,
e) identifying factors that determine the occurrence and the scale of impacts:
    i. on the project side,
    ii. on the environment side,
f) specifying relationships in land and marine ecosystems which may cause secondary effects,
g) planning an environmental research program aimed at providing information on resources and their condition, and sensitivity to the impacts of the NPP,

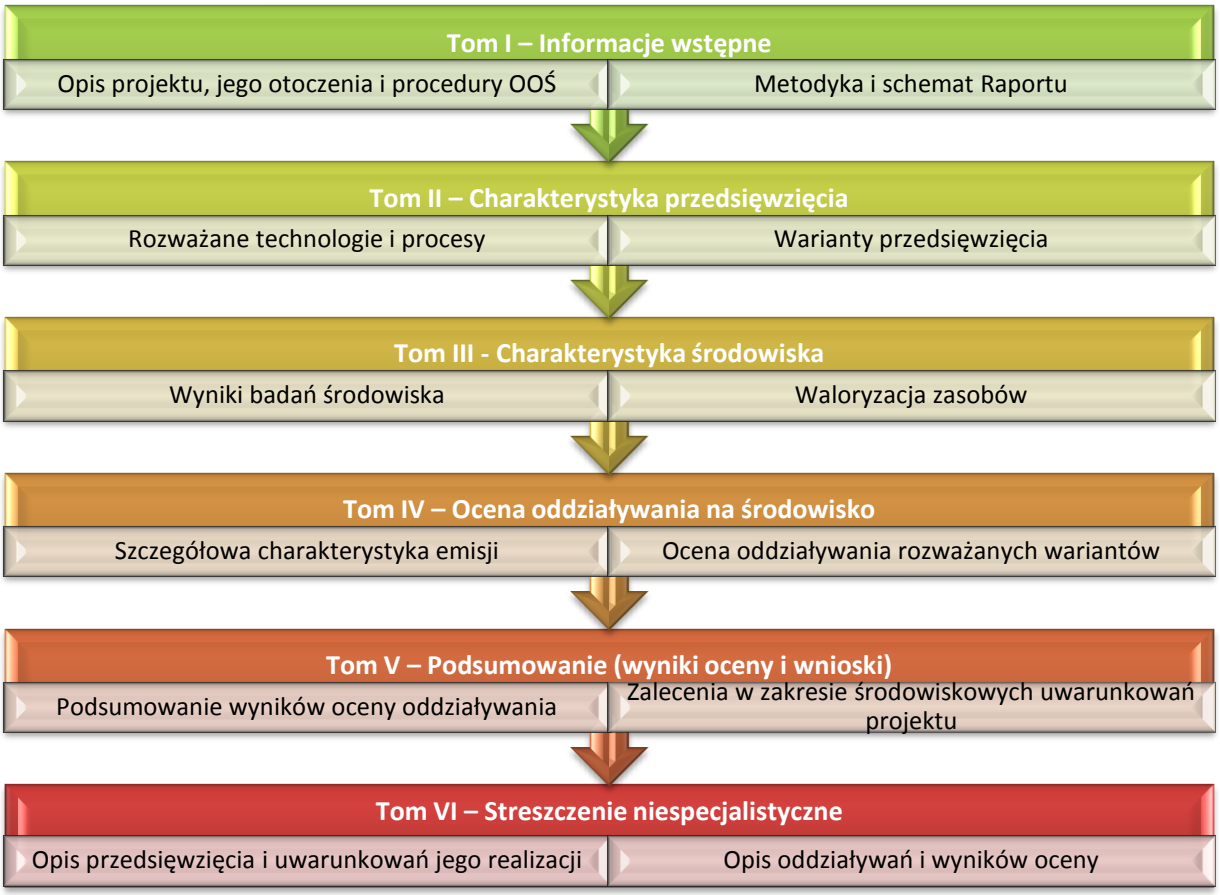
2) Assessment stage:
a) verifying the occurrence of environment components sensitive to the impacts in the NPP's impact area, their sensitivity to the impacts and links between them,
b) developing the NPP technical envelope – the technical concept containing a set of maximum and minimum parameters of various components of the project,
c) identifying sources of emissions and disturbances that may be caused by the NPP, and verifying project parameters affecting the occurrence and scale of impacts in identified environmental conditions,
d) analysing the possible scale of NPP's impacts and verifying whether materiality thresholds can be exceeded by impacts on individual components of the environment in various options being considered:
    i. for individual impact of various components of the project,
    ii. for cumulative impacts across the entire project,
    iii. for cumulative impacts with other plans or projects,
    iv. analysis of unplanned impacts,
    v. analysis of transboundary impacts,
e) analysis of available mitigating methods and their impact on reducing the scale of impacts,
f) assessing of the impact on the integrity, coherence and object of protection of Natura 2000 sites.

3) Conclusions stage:
a) identifying bounding parameters of environmental sensitivity to the impact of individual components of the NPP, whose maintaining ensures that the thresholds of significant impacts of the project on individual elements of the environment are not exceeded.

15.2 Structure of the EIA Report

The results and conclusions from all the activities described above will be presented in the EIA Report. Due to the huge amount of materials and data, and the multi-threaded nature of the study, it will be split into six separate volumes, and each volume containing from several to over a dozen

chapters. Each chapter covers a separate topic, which is described in a holistic way so that the given topic can be characterised in a most comprehensive way. Basic information about the content and purpose of the Report's volumes is presented below.



Volume I – Introduction	
Description of the project, its environment and the EIA procedure	Methodology and structure of the report
Volume II – Characteristics of the Project	
Considered technologies and processes	Project options
Volume III – Characteristics of the Environment	
Results of environmental research	Valuation of resources
Volume IV – Environmental Impact Assessment	
Detailed characteristics of emissions	Impact assessment for the options being considered
Volume V – Summary (Assessment Results and Conclusions)	
Summary of impact assessment results	Recommendations regarding the project's environmental conditions
Volume VI – Non-specialist Summary	
Description of the project and the conditions of its execution	Description of impacts and assessment results

Figure23. Outline of the EIA Report
Source: own study

15.3 Interrelation matrices

The most important element of the assessment of NPP's impact on the environment will be determining the interrelations between the farthest-reaching technical parameters of all potential emission sources in the project options being considered and the possibility of impacts that may permanently, irreversibly disturb the environment's functioning.

The tool that will be used for this purpose will be the "emission source-emission-impact-receptor" interrelation matrix, which will be created for the impact assessment. The diagram of the matrix is presented in the table below.

Table 22. Template of the matrix of interrelations between potential emissions and disturbances caused by the NPP and their sources, direct and indirect impacts on the environment and the factors determining them, set against the technological parameters of farthest-reaching scenarios for the NPP

Type of emission or disturbance	Emission source	Impact type	Ecosystem elements directly affected	Interrelations (indirect impacts)	Environmental factors affecting the scale of impact	Project's parameters affecting the scale of impact	Farthest-reaching scenario (FRS)

Source: own study

15.4 Assessment stage

15.4.1 Identification of assessment objects

As it was mentioned before, the first action which will begin the stage of environmental impact assessment for the NPP, will be identifying the object of the evaluation, i.e. verifying the occurrence of environment components sensitive to the impact of the NPP in the impact zone.

15.4.2 Identification of impacts

Identification of all possible impacts of the project on the given environment component, including the integrity, coherence and object of protection of Natura 2000 sites, will be made based on:

1) description of the project – preliminary technical concept and project execution schedule
2) expertise – experience in nuclear power plant impact on the environment, gathered during the execution of other projects of this type,
3) knowledge about the initial state of the environment, gathered on the basis of the available literature and other publicly available information (including information provided by competent authorities) and results of the pre-execution environmental research program dedicated to the project, carried out before the execution,

4) project's interactions with the environment – a matrix summarizing the possibility of interactions of the project with the environment, taking into account all previously identified receptors. Potential impacts will then be subjected to detailed analysis in the context of the individual components of the environment, taking into account the criteria that are described later in this chapter.

All impact for farthest-reaching scenarios for the technologies being considered shall be described and characterised as part of the environmental impact assessment.

15.4.3 Defining the spatial extent of the assessment

Defining the spatial extent of the assessment will be done by indicating the area which may be affected by the project.

The scope of individual impacts will vary depending on environmental conditions, environment component and the type of impact.

The scope of potential impacts on Natura 2000 sites will also be analysed individually for each potential impact on these areas.

15.4.4 Defining the time frame of the assessment

Defining the time frame of the assessment will consist in identifying timeframes within which various impacts may occur, determined by the successive stages of the project, i.e. construction, operation and decommissioning.

15.4.5 Determining the significance of environmental resources

Not all species (habitats, groups, objects) identified during the environmental studies are vulnerable to the impacts associated with the execution of the NPP project. Not all species and habitats potentially vulnerable to impacts of the NPP are protected or endangered, or are of vital importance for the functioning of the ecosystem. Therefore, the next element of the assessment will be assigning one of five values to each receptor (environmental resource): negligible, little, medium, high or very high. The assessment of significance will be made individually for each resource, primarily based on existing regulations (protection status of the species, etc.), knowledge of the initial state of the resource (including the results of the pre-execution environmental research program dedicated to the project) and knowledge about its sensitivity (sensitivity as a function of the resource's ability to adapt to the potential change resulting from the execution of the project, and the ability to return to the initial state). When assessing the importance of individual resources, also their protection status will be taken into account, particularly within the framework of the European Natura 2000 system. Species and habitats protected in Natura 2000 sites or having a significant impact on maintaining the integrity of these areas, or listed in the annexes to the Habitats Directive and the Birds Directive, will be put in the high or very high importance category.

The classification of importance of receptors (environment resources) and general definitions of the various categories are described in the table below. For each resource/receptor, individual categorization of their importance was made, based on detailed criteria.

Table 23. Classification of the importance of receptors (natural resources)

Resource importance category	Definition	
Negligible	Abiotic components / Biotic components / Socio-economic components:	Resources of negligible importance for the functioning of the ecosystem, occurring in large numbers (common), not susceptible to changes related to the execution of the project or having the ability to adapt to changes in the environment.
Low	Abiotic components:	Resources of little importance for the functioning of the ecosystem or resources of moderate importance, hardly susceptible to changes related to the execution of the project or having the ability to adapt to changes in the environment or to naturally and quickly return to the initial state.
	Biotic components:	Species/habitats that are not protected or endangered, occurring in large numbers (common), with little importance for the functioning of the ecosystem, hardly susceptible or having the ability to adapt to changes in the environment or to naturally and quickly return to the initial state.
	Socio-economic components:	Socio-economic resources of little importance from the economic, cultural and social point of view, hardly susceptible or having the ability to adapt to changes in the environment or to naturally and quickly return to the initial state.
Medium	Abiotic components:	Resources of moderate or high importance for the functioning of the ecosystem, having little or not having the ability to adapt to changes in the environment.
	Biotic components:	Species/habitats that are not protected, frequently occurring globally, but rare in the region of Pomerania and the Baltic Sea, or species that are protected, but not susceptible or hardly susceptible to impacts of the project. Species of importance for the functioning of the ecosystem, or species with decreasing but not endangered population.
	Socio-economic	Socio-economic resources of little general importance,

Resource importance category	Definition	
	components:	but important for the resource base or livelihood on a local scale.
High	Abiotic components:	Resources of high but not essential importance for the functioning of the ecosystem, not having the ability to adapt to changes in the environment or to fully return to the initial state.
	Biotic components:	Species/habitats that are protected under national and/or international laws, rare and endangered at the national level, important for the functioning of the ecosystem.
	Socio-economic components:	Socio-economic resources that are protected under national and/or regional laws or strategies, important for the resource base or livelihoods on a regional scale.
Very high	Abiotic components:	Resources of basic and essential importance for the functioning of the ecosystem, not having the ability to adapt to changes in the environment or to return to the initial state.
	Biotic components:	Species/habitats under special protection under national and/or international laws, rare and endangered internationally, essential to the functioning of the ecosystem.
	Socio-economic components:	Socio-economic resources protected under national and/or international laws or strategies, important for the resource base and livelihoods at a national level, for which the impacts of the project may significantly prevent their use.

Source: own study

15.4.6 Determining the nature and type of impacts

At this stage, a classification will be made of each potential impact based on:

1) its nature:
    a) positive impact – resulting in an improvement in relation to the initial state,
    b) negative impact – resulting in an undesirable change in relation to the initial state.
    c) no impact;
2) its type:
    a) direct impact – resulting from a direct interaction between an action planned under the project and the environment resource,
    b) indirect impact – resulting from other actions that are not directly related to the project,

c) secondary – not resulting from direct interaction between an action planned under the project and the environment resource, shifted in time in relation to such action, possibly extending beyond the area of the action; classified as a consequence of direct or indirect impact,
d) cumulative – occurring in association with other impacts related to the development of other projects that relate to the same environment resources.

15.4.7 Determining the size of the impact

Determining the size of the impact will be another component of the assessment. The size of the impact is a function of several variables, which include:

1) scale of the impact, related to the resource/population affected by the impact:
    a) local – impact on populations/socio-economic elements important on a local scale,
    b) regional – impact on populations/socio-economic elements important on a regional scale,
    c) national – impact on populations/socio-economic elements important on a national scale,
    d) international – the impact on populations/socio-economic elements important on an international scale.

The scope (local, regional, national, international) will be determined individually for each component of the environment, upon the termination of environmental research, taking into account the specificities of distribution of populations.

2) Impact frequency:
    a) single – impact of a discontinuous nature over time, which is certain to occur only once and will not be repeated in the analysed time frame,
    b) repeatable – impact of a discontinuous nature over time, which can occur multiple times in the analysed time frame,
    c) constant – impact of a continuous nature, lasting continuously in the analysed time frame;
3) Impact duration:
    a) temporary – impact which ceases when its source action is stopped, and the receptor returns to its initial state when the action being the source of the impact ceases; also irregular, sporadic impacts,
    b) short-term – impact of limited duration, which does not cease when its source action is stopped, and lasts 1–2 years/vegetation cycles after the action is stopped,
    c) medium-term – impact of limited duration, which lasts from 1 year/vegetation cycle to 3–5 years/vegetation cycles after the source action is stopped; also discontinuous, sporadic impact, regularly repeated over a longer period of time (e.g. seasonal disturbances),
    d) long-term – impact that lasts more than 5 years/vegetation cycles after the source action is stopped, or impact which causes permanent changes in the affected resources and persists after the completion of plant operation;
4) Impact intensity:

a) low – impact on the threshold of detection,
b) medium – impact noticeably affecting the functioning of a resource/species/population/ecosystem/Natura 2000 site (e.g. active avoiding reaction noticeable in individuals of various species, change in the status of a social group), but not affecting its structure/functioning parameters,
c) high – impact significantly affecting the functioning of a resource/species/population/ecosystem/Natura 2000 site (e.g. temporary loss of hearing – TTS, long-term change in the status of a social group), affecting its structure/functioning parameters,
d) very high – impact causing a complete change in the functioning of a resource/species/population/ecosystem/Natura 2000 site, a visible change in the structure/functioning parameters (e.g. damaging of vital functions, permanent/intergenerational changes in the status of a social group);

5) Reversibility:
   a) reversible impact – ceases to be noticeable immediately or in a short time after the source action is stopped,
   b) irreversible impact – noticeable even after the source action is stopped; resources do not return to the initial state despite the implementation of mitigation measures.

After that, the impact size will be assigned to one of 5 categories: no change, negligible, small, moderate, high, according to the matrix shown in the table below.

The matrix does not include the frequency or reversibility of the impact. These categories were additionally described in the assessment.

Table 24. Impact size assessment matrix

Impact size	Exposure scale	Duration	Intensity
No change	No resource loss, no impact on the structure and functioning of the resource		
Negligible	Local	Temporary	Small
	Local	Temporary	Medium
	Local	Temporary	High
	Local	Temporary	Very high
	Local	Short-term	Small
	Local	Short-term	Medium
	Local	Short-term	High
	Local	Medium-term	Small
	Local	Medium-term	Medium
	Local	Long-term	Small
	Regional	Temporary	Small
	Regional	Temporary	Medium
	Regional	Temporary	High
	Regional	Short-term	Small
	Regional	Short-term	Medium

Impact size	Exposure scale	Duration	Intensity
	National	Temporary	Small
Little	Local	Short-term	Very high
	Local	Medium-term	High
	Local	Long-term	Medium
	Regional	Temporary	Very high
	Regional	Short-term	High
	Regional	Medium-term	Small
	Regional	Medium-term	Medium
	Regional	Long-term	Small
	National	Temporary	Medium
	National	Temporary	High
	National	Short-term	Small
	National	Short-term	Medium
	National	Medium-term	Small
	International	Temporary	Small
	International	Temporary	Medium
	International	Short-term	Small
Moderate	Local	Medium-term	Very high
	Local	Long-term	High
	Local	Long-term	Very high
	Regional	Short-term	Very high
	Regional	Medium-term	High
	Regional	Medium-term	Very high
	Regional	Long-term	Medium
	Regional	Long-term	High
	National	Temporary	Very high
	National	Short-term	High
	National	Short-term	Very high
	National	Medium-term	Medium
	National	Long-term	Small
	International	Temporary	High
	International	Short-term	Medium
	International	Medium-term	Small
High	Regional	Long-term	Very high
	National	Medium-term	High
	National	Medium-term	Very high
	National	Long-term	Medium
	National	Long-term	High
	National	Long-term	Very high
	International	Temporary	Very high
	International	Short-term	High

Impact size	Exposure scale	Duration	Intensity
	International	Short-term	Very high
	International	Medium-term	Medium
	International	Medium-term	High
	International	Medium-term	Very high
	International	Long-term	Small
	International	Long-term	Medium
	International	Long-term	High
	International	Long-term	Very high

Source: own study

15.4.8 Determining the importance of the impact

The importance of individual impacts will be assessed taking into account the importance of the resource/receptor and the size of the impact, using the impact assessment matrix shown in the table below.

Depending on the relationship between the importance of the resource/receptor and the size of the impact, each impact will be classified into one of six categories: very high, high, moderate, low, negligible, no change.

Table 25. Impact importance assessment matrix

Importance of resource/receptor	Impact size				
	High	Moderate	Little	Negligible	No change
Very high	Very high	High	Moderate	Low	No change
High	High	Moderate	Low	Low	No change
Medium	Moderate	Low	Low	Negligible	No change
Low	Low	Low	Negligible	Negligible	No change
Negligible	Low	Negligible	Negligible	No change	No change

Source: own study

The different categories of impact importance can be generally defined in accordance with the terminology presented in the table below.

Table 26. General definitions of different impact importance categories

Impact importance	General definition
Very high	Change of resource/receptor of international or national importance, which takes place despite the implementation of mitigation measures and may result in the loss or significant changes in the structure or parameters of the resource/receptor/ecosystem, leading to serious disturbances of its functioning, including the loss of favourable conservation status, including Natura 2000 sites. Usually the impacts of a negative nature, which are crucial in the process of determining the environmental conditions of the project
High	Large or very large changes in the resource/receptor/ecosystem (of both negative and positive nature), which take place despite the implementation of mitigation measures. Changes are considered to be significant in regional terms, may affect the achievement of national, regional or local goals, including favourable conservation status, including Natura 2000 sites, or lead to violation of law.
Moderate	Medium changes in the resource/receptor/ecosystem, which take place despite the implementation of mitigation measures. Changes are considered to be significant in regional, but not national or international terms, fall within standards and are irrelevant to maintaining the favourable conservation status.
Low	Minor changes in the resource/receptor, which take place despite the implementation of mitigation measures. Changes fall within standards,

Impact importance	General definition
	are often indistinguishable from natural level of changes. They can be considered as local, but are not crucial in the process of determining the environmental conditions of the project.
Negligible	Unnoticeable changes in the resource/receptor, which take place after the implementation of mitigation measures.

Source: own study

Important impacts include those high and very high impacts (in accordance with the classification shown in Table 22 and Table 23), that cause long-lasting, irreversible damage to the environment or its component, jeopardizing its proper functioning. With regard to the assessment of the impact on Natura 2000 sites, both categories are classified as likely to have a significant impact on maintaining the favourable conservation status of Natura 2000 sites, as well as their integrity and coherence. Both categories identified at the screening stage predispose to perform a proper assessment. A “Very high” category found as a result of the proper assessment, qualifies the project as significantly affecting Natura 2000 sites.

15.4.9 Assessment of cumulative effects

As part of the assessment of the project’s impact on environment for all resources/assessment objects, analyses of cumulative impacts will also be made, taking into account the different types of actions undertaken in the framework of executing the project, and actions carried out or planned for other projects executed by external entities.

The analyses will include activities carried out or planned for projects with similar or different nature, which meet the following criteria:

1) a project which is built, operated, or in the construction phase,
2) a project for which a decision on environmental conditions had been issued, and no construction activities have yet been started at the stage of preparing this EIA report,
3) a project for which proceedings had been initiated to issue a decision on environmental conditions, but the decision has yet not been issued at the stage of preparing this EIA report.

For each resource/receptor, impacts which can accumulate at various stages of the project will be individually indicated, and then the importance of such impacts will be assessed, qualifying into one of 6 impact categories: no impact, negligible impact, small, moderate, high or very high, according to the scale presented in the table below. The assessment of cumulative impacts will also include issues related to cumulative impacts on the integrity, coherence and object of protection of Natura 2000 sites.

The assessment of the importance of cumulative impacts will be, if possible, carried out in accordance

with the general assessment methodology adopted, which has been described earlier, but its scope and depth will depend on the information and quality of documentation available for individual projects.

Table 27. Classification of cumulative impacts

No cumulative impacts
Negligible cumulative impacts
Small cumulative impacts
Moderate cumulative impacts
High cumulative impacts
Very high cumulative impacts

Source: own study

Definitions of the categories of cumulative impacts are the same as those shown in Table 7 above.

15.4.10 Assessment of unplanned impacts

Unplanned impacts are the result of sudden unplanned events or accidents which are not related to actions included in the project schedule.

Additional factors will be included in the assessment of the importance of impacts, i.e. likelihood of an event that will be a source of the impact, and its potential consequences.

The assessment of importance of unplanned impacts will be carried out based on the existing expertise and experience related to the execution of similar projects.

The assessment of unplanned impacts will also take into account the potential impact on the integrity, coherence and object of protection of Natura 2000 sites.

15.4.11 Assessment of related impacts

Related impacts are understood as a chain of all the impacts that may occur in the ecosystem as a result of an impact on one of its components. The purpose of assessing related impacts will be to verify whether direct impacts on one of the receptors will become a source of indirect impact on another receptor or on the ecosystem as a functional whole, in particular in connection with direct impacts on this receptor. This is because in such situation it is necessary to implement additional measures aimed at minimizing such impacts.

The assessment of each of the individual components of the environment will take into account its interrelations with other components of the environment, both in terms of direct impact on other

components, which exert an indirect influence on this component, and indirect effect of direct impacts of the component being assessed on other components of the environment.

The assessment of related impacts will also take into account the possibility of the influence of these impacts on the integrity, coherence and object of protection of Natura 2000 sites.

15.4.12 Assessment of the impact on the integrity, coherence and object of protection of Natura 2000 sites

The object of the assessment, in accordance with Art. 6 of the Habitats Directive, is solely the scope and scale of impact of the planned project on these components of the environment, for the protection of which individual Natura 2000 sites were established, as well as the integrity and coherence of these areas, ensuring the favourable status of their conservation.

For the purpose of this study:

- Integrity of Natura 2000 site (Engel, J., 2009) means maintaining the favourable conservation status of natural habitats and populations of plants and animals, for the protection of which the area was established. Integrity of the area also includes maintaining the structures and ecological processes that are essential for the sustainability and proper functioning of natural habitats and plant and animal populations.
- Coherence (Institute for Sustainable Development) of the Natura 2000 site network is the completeness of natural resources in the network and maintaining the functional interrelations between different Natura 2000 sites at the level of biogeographic region in the country, ensuring the maintenance of favourable conservation status of habitats and species. Coherence refers to the interrelations between Natura 2000 sites, i.e. the ecological corridors that determine the spatial continuity of the entire network. The coherence assessment includes:
    - representativeness and abundance criteria,
    - occurrence related to scope,
    - fragmentation of space,
    - assessment of the favourable conservation status based on national environmental monitoring.
- The aim of the analysis is to demonstrate whether the project's impacts reach the scale of important impacts, i.e. impacts that permanently impair the favourable conservation status of habitats and species, for the protection of which Natura 2000 sites were established.
- The assessment of the impact on the coherence of Natura 2000 sites should take into account the importance of the area for maintaining the coherence of the network in relation to the species and habitats that are protected in this area.

The proposed methodology of assessment of the impact on the integrity, coherence and object of protection of Natura 2000 sites is based on and is consistent with the guidelines described in:

1) EC Directorate General Environment study: "Assessment of plans and projects significantly affecting Natura 2000 sites – A Methodological guidance on the provisions of Article 6 (3) and (4) of the Habitats Directive 92/43/EEC" of November 2001.,
2) "Natura 2000 in impact assessment of projects on the environment" by J. Engel (Ministry of Environment, 2009).

To ensure compliance and coherence with the requirements of EIA Directive, and considering the fact that many projects which are likely to affect Natura 2000 sites will also be projects covered by the EIA Directive, procedures in these guidelines are similar to those commonly used in EIA. These guidelines are also consistent with the general approach recommended in European Commission documents regarding the research, scoping and verification in EIA. Moreover, the scope of the EIA Directive covers all plans that require assessment under Article 6 of the Habitats Directive. According to EC guidelines, in cases where projects or plans fall within the scope of activities covered by the EIA Directive, assessments described in Article 6 may constitute a part of these assessments. However, in the appropriate report on the impact on the environment, assessments provided for in Article 6 should be clearly distinguished and identified, or reported separately.

In a report for the NPP, the assessment of impact on the integrity, coherence and object of protection of Natura 2000 sites will be an inherent part of the assessment of the environmental impact of the NPP. All elements of the description of the project, its impacts and environmental conditions of its execution will take into account the elements necessary to carry out an assessment of impact on Natura 2000 sites, as shown in the above paragraphs describing the methodology of EIA.

The adopted workflow will include 4 stages of assessment (the assessment may terminate after each of these stages):

1) **first stage (research, initial assessment, screening) –** a process during which probable influences of the project on Natura 2000 sites are identified (alone or in combination with other projects or plans), and an analysis is made to determine whether the predicted impacts can have a significant influence on these areas;
2) **second stage (proper assessment)** – assessment of the impact of the project on the integrity, coherence and object of protection of Natura 2000 sites (alone or in combination with other projects or plans) with respect to the structure of these areas, their function and conservation objectives; conducted only if the predicted impacts of the project may have a significant influence on Natura 2000 sites; if there are adverse impacts, potential mitigation measures are also assessed;
3) **third stage (assessment of alternative solutions)** – a process during which an analysis is made of alternative options for achieving the objectives of the project or plan, that allow to avoid adverse impact on the integrity, coherence and object of protection of Natura 2000 sites;
4) **fourth stage (assessment in cases where no alternative solutions exist and adverse impacts persist, assessment of compensatory measures)** – assessment of compensatory measures where in the light of necessary public interest requirements it is considered that the project or plan should be implemented.

The following criteria and factors will be taken into account during the assessment:

1) individual elements of the project which may, alone or in combination with other plans or projects, affect Natura 2000 sites,

2) any possible direct, indirect or consequential impact of the project (alone or in combination with other plans or projects) on Natura 2000 sites, foreseeable as a simple consequence of the following properties:
   - size and scale,
   - land occupation,
   - distance from the Natura 2000 site or its parts of key importance for the protection,
   - physical changes resulting from the execution of the project,
   - emissions (into water or air) and waste,
   - transport requirements,
   - duration of the construction, operation, decommissioning, etc.,
   - cumulative impacts with other projects and plans,
   - others,
3) all probable changes in the characteristics of the area, resulting from:
   - reduced area/loss/fragmentation of habitats,
   - reduced population/loss of population (changes in density/biomass)
   - changes in the functioning and structure of species and habitats,
   - changes in key protection value indicators (water quality, etc.),
4) all probable impacts on the integrity and coherence of Natura 2000 sites caused by:
   - interference with key relationships that define the structure of the area,
   - interference with key relationships that define the function of the area,
5) materiality levels of the identified impacts, expressed with respect to:
   - loss,
   - fragmentation,
   - interruption,
   - disturbances,
   - changes in key elements of the area (e.g. water quality, etc.).

The assessment for project in question will be made based on:

- best available scientific and expert knowledge,
- existing inventory materials for the area (results of pre-execution environmental research),
- existing experience from the execution of other similar projects,
- information on objects of protection of the individual Natura 2000 sites remaining in the zone of potential impacts of the project,
- factors determining the coherence and integrity of these areas.

16 Public consultations program

16.1 Preliminary issues

Documents that define the requirements regarding information and social education in the field of nuclear power engineering are Nuclear Power Program for Poland, the Atomic Law and IAEA's guidelines (NG-T-3.11 Managing EIA for construction and operation in new NP programmes, 2.3). In line therewith, the main burden of educating the society at the stage of preparing national strategies and programmes rests with the Ministry of Economy and PAA. The moment an investor/operator is selected and a potential location is indicated, the responsibility for educating and informing as well as engaging stakeholders in the process of determining the potential environmental impact of the project lies with that investor/operator.

Because of the fact that the first Polish NPP build project is unique in the country it arouses strong emotions and provokes numerous discussions both at local and national level. The objective of the communication activities is to ensure the transparency of the investment process and access to information for the identified stakeholder groups as well as to take into account the best social interest at each stage of the project.

In the potential locations of the first Polish NPP (the communes of Choczewo, Krokowa, Gniewino in the Pomeranian voivodeship), where areas attractive for tourists are also situated, the investment may be seen on the one hand as distorting the landscape in the immediate vicinity (visual conflict: 'a beach' vs. 'concrete') and the so-called 'fear of the new'. The source of the residents' anxiety may also be the fear of losing their present livelihood (e.g. in the tourist, hospitality, fishery industries etc.) or the necessity to change the manner of earning their living. On the other hand, the implementation of an investment as sizeable as NPP build gives an enormous pro-development impulse, which in the event of proper agreement with local communities may constitute a material compensation of the would-be losses stemming from the environmental, land, social and economic changes taking place in the vicinity of the investment.

Another question raising fears is widely understood safety and security of the power plant – related to radiation, the problem of waste or spent nuclear fuel storage as well as the reactor technology security. The subject of environment protection and potential influence of the investment on the natural environment is also significant.

Since stable and conscious support for nuclear power engineering is one of the most important conditions of the investment execution it requires making sure that the society has access to reliable and updated knowledge on the topics connected with nuclear power engineering and the investment process. Such activities have to be continuous and executed consistently at each stage of the project as information related to nuclear power engineering is often the cause of anxiety and is burdened with negative connotations.

16.2 Assumptions for the public consultations program

16.2.1 Analysis of the local socio-economic conditions

At a preliminary stage of the project, following indication of the proposed locations for the NPP an analysis of the local and regional socio-economic conditions was conducted in order to determine the direct and indirect stakeholders, identify the most important factors causing conflicts and select the communication tools. In order to execute the dedicated communication activities properly and customise them to the select stakeholder groups, the groups have been identified and divided against 2 criteria – level of interest and exposure to the project's impact and their influence on its execution. In line with the 2 variables a weight has been assigned to each of the groups together with a proper strategy of their engagement. Basic factors of potential social conflicts have also been determined together with sensitive socio-economic areas which may be impacted by the execution of the planned Project.
On the basis of the analysis' results means of communication have been selected for particular stakeholder groups, from transmitting information (one direction communication), through social dialogue aimed at reaching a consensus (two way communication) up to enabling the participation of the Stakeholders in the process of decision taking. Stakeholders map constitutes Attachment 1 to this section.

16.2.2 Communication tools

As was mentioned earlier the basic objective of the communication activities of the Investor is to assure that the Stakeholders have information suitable for the needs and expectations at each stage of the project execution and to enable acquiring knowledge about the social conditions that may influence project execution. In order to reach the widest possible circle of addressees with the information the Company performs communication activities on many levels applying numerous and various communication tools.
Techniques which are and will be applied include written materials such as bulletins, advertisements, e-mails, brochures, reports, a dedicated newsletter. To disseminate information on the project PGE EJ 1 organizes activities including Investor's meetings with the residents, lectures by experts etc. The first point of contact are Local Information Centres that function in each of the 3 communes. PGE EJ 1 also develops Internet communication tools including an education-information portal ***www.swiadomieoatomie.pl***, a corporate portal ***www.pgeej1.pl***, a video channel on YouTube, and an electronic newsletter.

An important component of the Investor's activities is cooperation with the media, educating the journalists, periodic press conferences presenting the project status and results of the public opinion polls in the locations. Also, the Investor cooperates with select local and national media editorial staff with a view to issuing supplements, educational publications on nuclear power engineering. Cooperation with media enables reaching a wide circle of recipients both with key messages from the field of education and with information on the status of the project.

At each stage of the project the Investor carries out information-education activities but also verifies the level of knowledge about the project among the stakeholders and their concerns and expectations through public opinion polls, direct meetings (e.g. in Local Information Centres). Public opinion polls have been conducted from 2011 in semiannual intervals by an independent research centre and show invariably a high level of support for the investment in the vicinity and in all the 3 location communes. According to the last poll conducted in Oct/Nov 2014 the level of support in the commune of Krokowa amounts to 66% and in the communes of Gniewino and Choczewo 78%. The results of the polls regarding the current communication needs allow for adapting both the content and the communication channels to the needs expressed.

16.2.3 Public consultations

In order to ensure exchange of information on the investment process at each further stage of the Project execution regular consultations will be held with the stakeholders in line with the Polish and international requirements applicable to the Project. Both site investigation and environmental survey results and document drafts subject to particular administrative proceedings will be consulted. Consultations carried out in line with the above methods will include: local community representatives and the groups identified in the communities, non-governmental
and industry organisations as well as other stakeholders, whose participation is obligatory in the discussion on e.g. on the results of the EIA (also at the international level).
The consultations will be held according to the diagram below:

1) Information on the planned consultations (the scope, date and place, form of comment submission) placed on the websites devoted to the project, location communes websites, disseminated through Local Information Centres and passed to commune self-government authorities.
2) Uploading the materials subject to consultations onto the websites devoted to the project and in the LICs.
3) Gathering comments to the document within the set deadline through electronic mail and through LICs.
4) Organisation of meetings with the interested parties in order to clarify any doubts and relate to the comments submitted as well as publishing the Company's position on the websites devoted to the project.

The above mode of informal consultations conducted by the Company will accompany the formal consultations carried out by the proper bodies under the right of access to information in the Uooś procedure.

16.3 Communication activities performed to date

From the moment of indicating potential locations the Investor has been carrying out a number of activities allowing the public full access to reliable and transparent information both at the national and local level.

16.3.1 Communication activities – national level

One of components of the national campaign is a programme entitled 'Świadomie o atomie', launched in October 2011 so as to provide reliable information on all the topics connected with nuclear power generation. www.swiadomieoatomie.pl is an education portal containing a compendium of the newest and most important information on nuclear power engineering and the investment executed in Poland. On a national level the Investor realizes a long-term programme of cooperation with academic centres entitled 'Atom dla nauki' ('Atom for science'). Its main objective is to kindle interest among students and academics with the subject of nuclear power engineering, advancement of young scientists and building a large expert resources – addressing the needs of the Investor, Polish Regulator, public administration and business related to the power plant – that constitute a condition for the development of nuclear power engineering. The programme is dedicated to persons dealing with science and technology as well as social, natural or medical science.

The Investor has been engaged in education projects of national scale carried out together with experts' centres. Atomowy Autobus – a mobile lab organized continuously since 2011 by the The Foundation Forum Atomowe (Atomic Forum) and School on Nuclear Power – organized by the National Centre for Nuclear Research. The Investor is present with the educational offer at scientific picnics in many cities in Poland.

Taking into account a limited number of publications concerning nuclear power engineering the Investor in cooperation with national centres prepares publications and brochures for recipients in different age groups.

16.3.2 Communication activities – local level

In compliance with the IAEA guidelines ((INSAG-20 Stakeholder Involvement in Nuclear Issues, 4.1), on the basis of the stakeholder mapping process a special place in the process of social consultations has been offered to local communities which will be most affected by the investment under way. This is also why from the moment of identification of potential locations the Investor has been carrying out large-scale activities focused around the locations of the first Polish NPP (the communes of Choczewo, Krokowa, Gniewino) and other interested parties.

Before commencing site investigation and environmental surveys in the locations of Choczewo and Żarnowiec PGE EJ 1 carried out numerous communication activities in the form of dedicated meetings e.g. for opinion leaders, on the basis of which it issued a publication (e.g. 'Site characterization – questions and answers') distributed in print for all households in 3 communes and in electronic form and as press materials in the major newspapers in the Pomerania. Additionally, exhibitions presenting the characterization plans were organized together with experts' duty hours.

Even though in accordance with the provisions of the Atomic Law the Investor sets up a LIC only at the stage of lodging an application for construction license, PGE EJ 1 has launched unified Local Information Centres (LICs) as early as in 2013 in 3 location communes under consideration – Choczewo, Gniewino, Krokowa. In a LIC all residents and persons visiting the communes may obtain information on the project and nuclear power engineering and submit their comments with regard to the process.

The Investor organizes in the considered location communes a series of educational activities (e.g. visits to Centrum Nauki Eksperyment, the Pomeranian scientific-technological park), supports both sports and safety activities (sailing schools sponsorship) and activities of associations and organizations promoting and protecting local culture. During holidays LIC points turn into Holiday Information Spots, they are transferred to tourist attractions with a view to facilitating access to information on the investment and nuclear power engineering among tourists. Moreover, the Investor organizes thematic industry conferences (e.g. 'NPP – opportunity or threat for tourism in Pomerania' in 2014) dedicated to select stakeholder groups. The Investor organizes educational trips to local stakeholder groups among others to National Centre for Nuclear Research in Świerk together with sightseeing the only Polish research reactor 'Maria' and to the waste repository in Różan. The Investor's initiative particularly appreciated by the local stakeholders are study visits to NPPs operating in Europe (e.g. in France, Switzerland, Spain). During such visits the participants have the chance not only to see how nuclear power plants function but also to meet and exchange views with local residents and authorities. Study visits are an opportunity to confront one's ideas with actual opinions regarding potential nuisance during construction and operation but also advantages and opportunities offered by such investment.
The Investor's representatives are in constant contact with the authorities of the location communes considered. During direct meetings and e.g. commune council sessions the Investor discloses the latest information on investment assumptions.

16.4 Plan of communication activities for particular stages of the project

16.4.1 Scoping stage

Objective:

- information on the location variants considered
- information about the project schedule, including public consultations,
- information on the scope and methodology of research,
- gathering information on potential social conflicts.

Activities performed:

- meetings with commune authorities, participation in commune council sessions,
- organisation of informational meetings with residents of select villages,
- preparing informational materials about the conducted activities,
- cooperation with local media to inform about the ongoing work, preparing dedicated articles, broadcasts.

Activities planned:

Currently, the Investor intends to employ indirect communication (leaflet, press articles, corporate website www.pgeej1.pl, location commune websites) and direct communication (dedicated meetings with village residents) to give all the interested parties information on the framework of the scoping

procedure, the locations encompassed thereby, works schedule and potential nuisance for the local residents provided in a manner tailored to the recipients. Planned communication activities include:
Planned communication activities include:

- preparing a dedicated tab on the Company's corporate website ***www.pgeej1.pl***,
- follow-up with informational meetings in the villages,
- updating the commune authorities with work progress,
- preparing informational materials, in line with residents' informational needs and making them available in the LIC, during commune events, etc.
- preparing a periodic newsletter and its distribution (hard and soft copies) to the location commune authorities and opinion leaders,
- follow-up with cooperation with media in order to inform on work progress (press conferences, dedicated articles and broadcasts).

16.4.2 Environmental impact assessment stage

Objective:

- information on the results of the environmental surveys,
- information on the results of the analyses of potential impact on the environment, including impact on property,
- information on the preferred location variant,
- gathering information on the social and environmental conditions which should be taken into account in the EIA report and the environmental decision.

Activities planned:
The Investor will continue informational activities also pending EIA Report preparation, consulting the content of the Report through its presentation on the corporate website www.pgeej1.pl and at necessary bilateral meetings with the interested parties. Within the framework of the activities the Investor will present the results of the EIA procedure, especially in the scope of potential impact of the investment on health and safety, influence on the landscape or local assets. The Investor aims to ensure that the stakeholders have a chance to ask questions directly via the Company website www.pgeej1.pl.

Planned communication activities include:

- Preparing a dedicated tab on the Company's corporate website ***www.pgeej1.pl***, based on the current needs of the residents,
- Enabling Report consultations through ***www.pgeej1.pl***,
- Follow-up with informational meetings in the villages,
- Updating the commune authorities with work progress,
- Development of an informational materials database available in the LIC,
- Follow-up with cooperation with media in order to inform on work progress (press conferences, dedicated articles and broadcasts).

16.4.3 Siting decision stage

Objective:

- information on the results of site investigation,
- information on nuclear safety conditions at the location,
- collecting data about socio-economic and social conditions that exert influence on the security of the investment location.

Activities planned:

When the final location is indicated the existing Local Information Centres will turn into NPP's Local Information Centre. In compliance with the provisions of the Atomic Law Art. 39, paragraph 1 and 2 the Investor of the nuclear facility, not later than by the day of filing the application for construction permit, (…), shall set up a Local Information Centre, which shall be maintained until decommissioning of the nuclear facility.

The Atomic Law stipulates in detail the tasks before the Local Information Centre:

1) gathering and sharing current information on the operation of the nuclear facility;
2) gathering and sharing current information on the state of nuclear safety and radiation protection around the nuclear facility;
3) cooperation with administrative bodies and state legal persons and other organizational units in running activities connected with public information, education, dissemination and scientific/technical and legal information in the scope of nuclear power engineering and nuclear safety as well as radiation protection of the nuclear facility;
4) the Local Information Centre places information referred to in paragraph 3 subparagraph 1 and 2 on its websites and in the local information bulletin it issues;
5) The Local Centre may be established for more than one nuclear facility under the condition that the facilities will be situated in their immediate vicinity.

16.4.4 Construction stage

Objective:

- informing of the construction schedule and its course,
- informing of the demand for local resources,
- gathering information on local resources necessary/useful at the stage of power plant construction.

Activities planned:

At the stage of location permit and construction comprehensive communication will be ensured so that information concerning the schedule (including the power plant construction schedule, which will be known after contract award resulting from the Integrated Proceedings), the technology selected, adverse impacts on local community but also potential benefits and the possibility to get involved in the project execution reaches as many interested persons as possible. According to

the IAEA guidelines (NG-T-3.11 Managing EIA for construction and operation in new NP programmes, 2.3) this procedure ensures not only full process transparency but also a two-direction communication and taking into account significant problems and fears concerning the risk as early as at the stage of analyses and construction. Arranging for an opportunity for the stakeholders to contribute to the project as early as possible may speed up the process of decision taking since it ensures that justified issues are addressed at the beginning of the process and it develops possibilities of seizing opportunities connected with the planned investment.

16.4.5 Operation stage

Objective:

- informing about the results of the environment monitoring carried out,
- informing of the safety and nuclear threats,
- gathering information on the investment's influence on local and regional social, environmental and economic conditions.

Activities planned:

Simultaneously, irrespective of informational activities taken at a local level, including the activities run by the Local Information Centre mentioned in point 1.4.3. above the NPP operator from the moment of start-up will be obliged to give to anybody, irrespective of actual or legal interest, written information about the state of the nuclear facility, its influence on people's health and the natural environment as well as the size and isotope composition of the radioactive substance releases to the environment. Atomic Law imposes an obligation on the NPP operator to publish such information on its website not less than once in 12 months. Moreover, the NPP operator is obliged forthwith to hand over to the President of the Polish Atomic Agency, the governor of the voivodeship, the poviat authorities and the authorities of the commune where the nuclear facility is located and the authorities of neighboring communes, information on events in the NPP that may cause or are causing hazard. Information on unplanned events that cause hazard are published by the President of the Polish Atomic Agency in the Public Information Bulletin on its websites. The NPP Operator shall make available on its websites the information on the events that cause hazards and took place within the period of last 12 months.

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411 965,9614 792 353,6075

Attachment 1. Location variants of the investment

18°0'0"E

N

Legend

Location variants of the investment

Prepared by PGE EJ1 Sp. z o.o.
Warsaw 2015

Scale 1:150 000

- Luzino Names of geodesic precincts
- Boundaries of geodesic precincts
- Alternative routes of cooling water corridor
- "Choczewo" location variant
- "Lubiatowo-Kopalino" location variant
- "Żarnowiec " location variant
- "Choczewo" location marine area
- "Lubiatowo-Kopalino" location marine area
- "Żarnowiec " location marine area

0 2,5 5 10 km

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

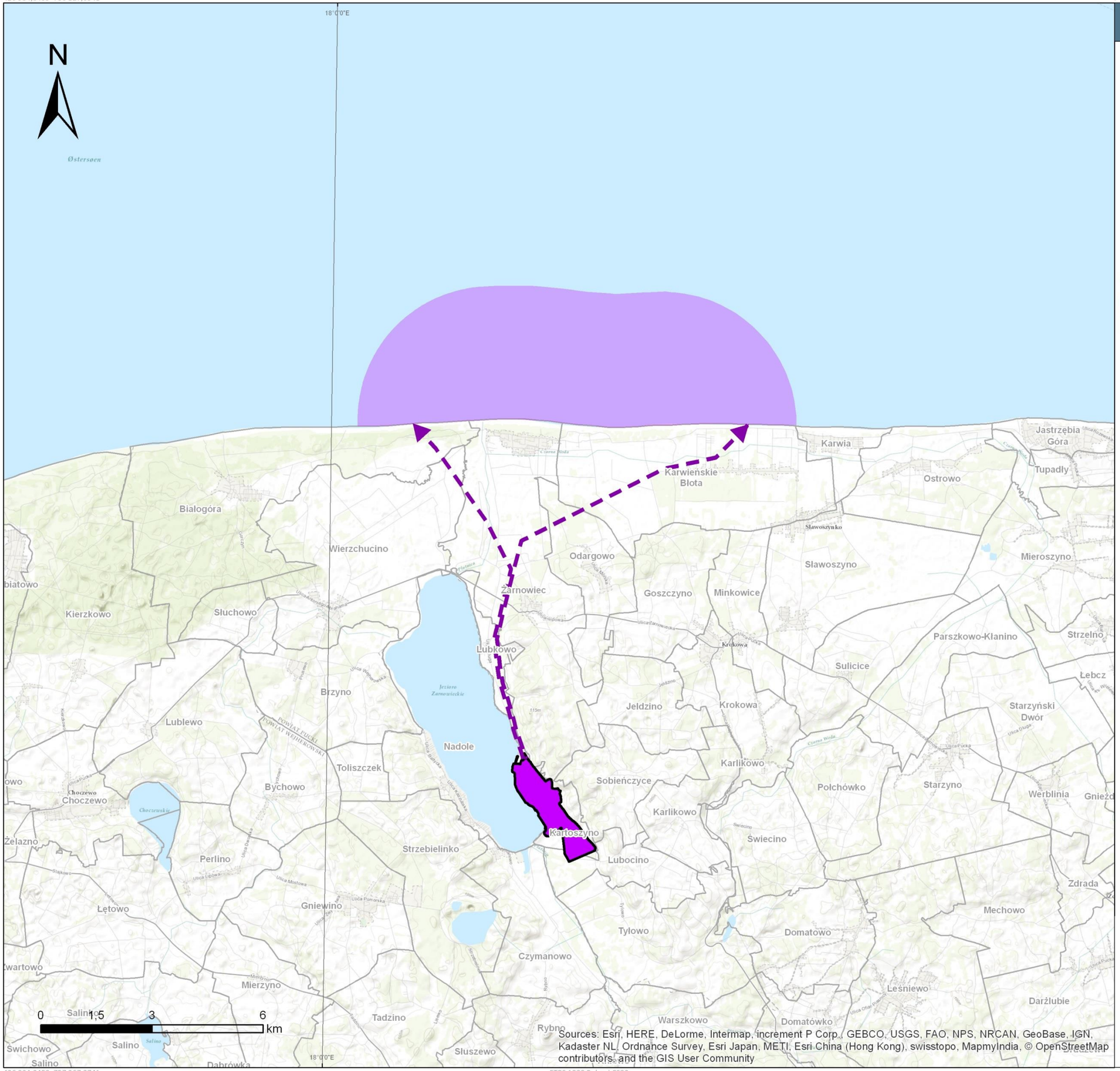
PGE EJ 1 sp. z o.o.

411 965,9614 749 213,2175

ETRS 1989 Poland CS92

426 934,3459 786 127,6341

Attachment 2. ”Żarnowiec” location variant



Legend

“Żarnowiec” location variant

Prepared by PGE EJ1 Sp. z o.o.
Warsaw 2015

Scale 1:100 000

- Luzino — Names of geodesic precincts
- Boundaries of geodesic precincts
- Alternative routes of cooling water corridor
- "Żarnowiec" location variant
- "Żarnowiec " location marine area

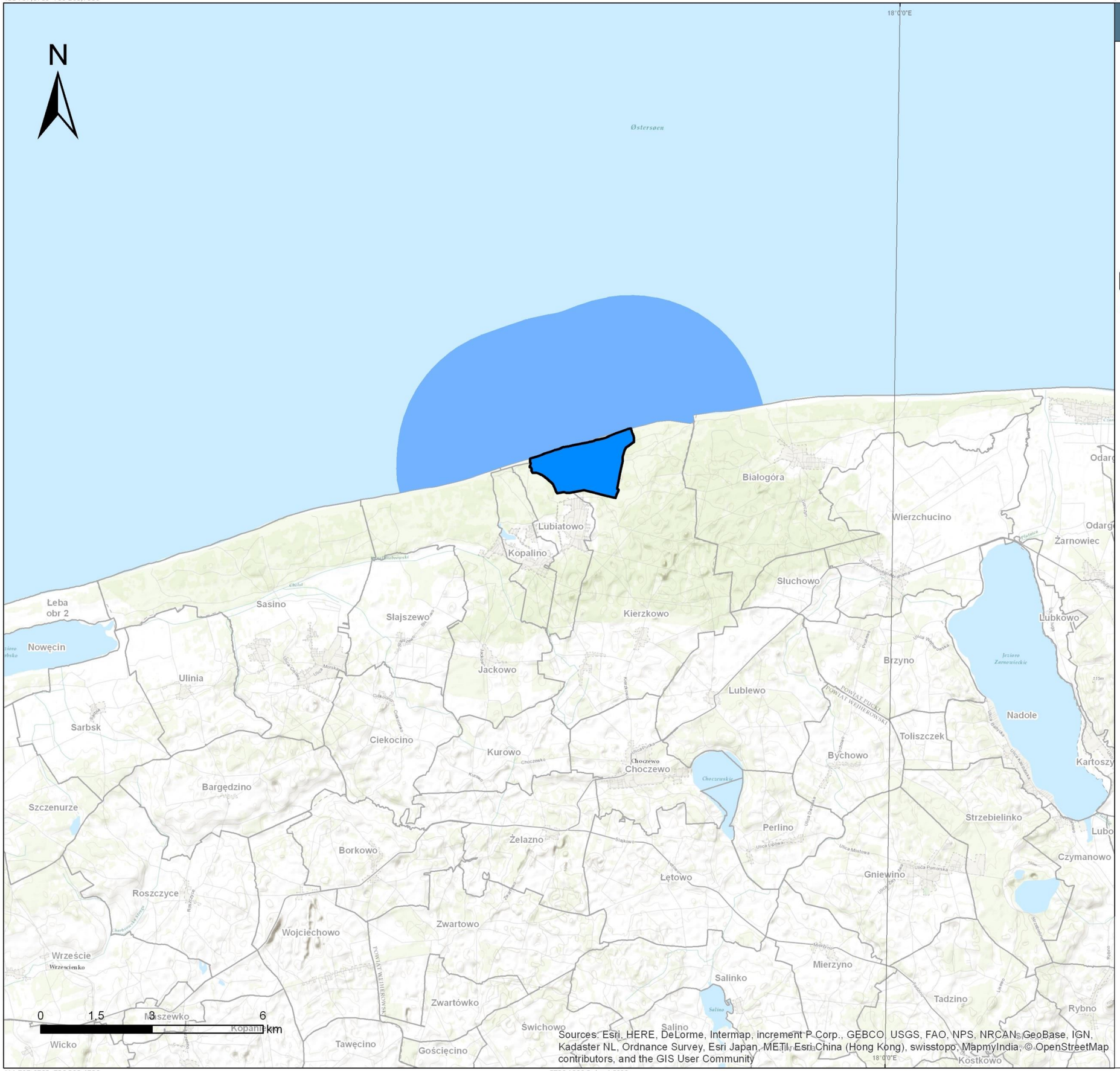
PGE EJ 1 sp. z o.o.

426 934,3459 757 367,3741

ETRS 1989 Poland CS92

411 737,6785 785 265,7336

Attachment 3. ”Choczewo” location variant



Legend

”Choczewo” location variant

Prepared by PGE EJ1 Sp. z o.o.
Warsaw 2015

Scale 1:100 000

Luzino Names of geodesic precincts

Boundaries of geodesic precincts

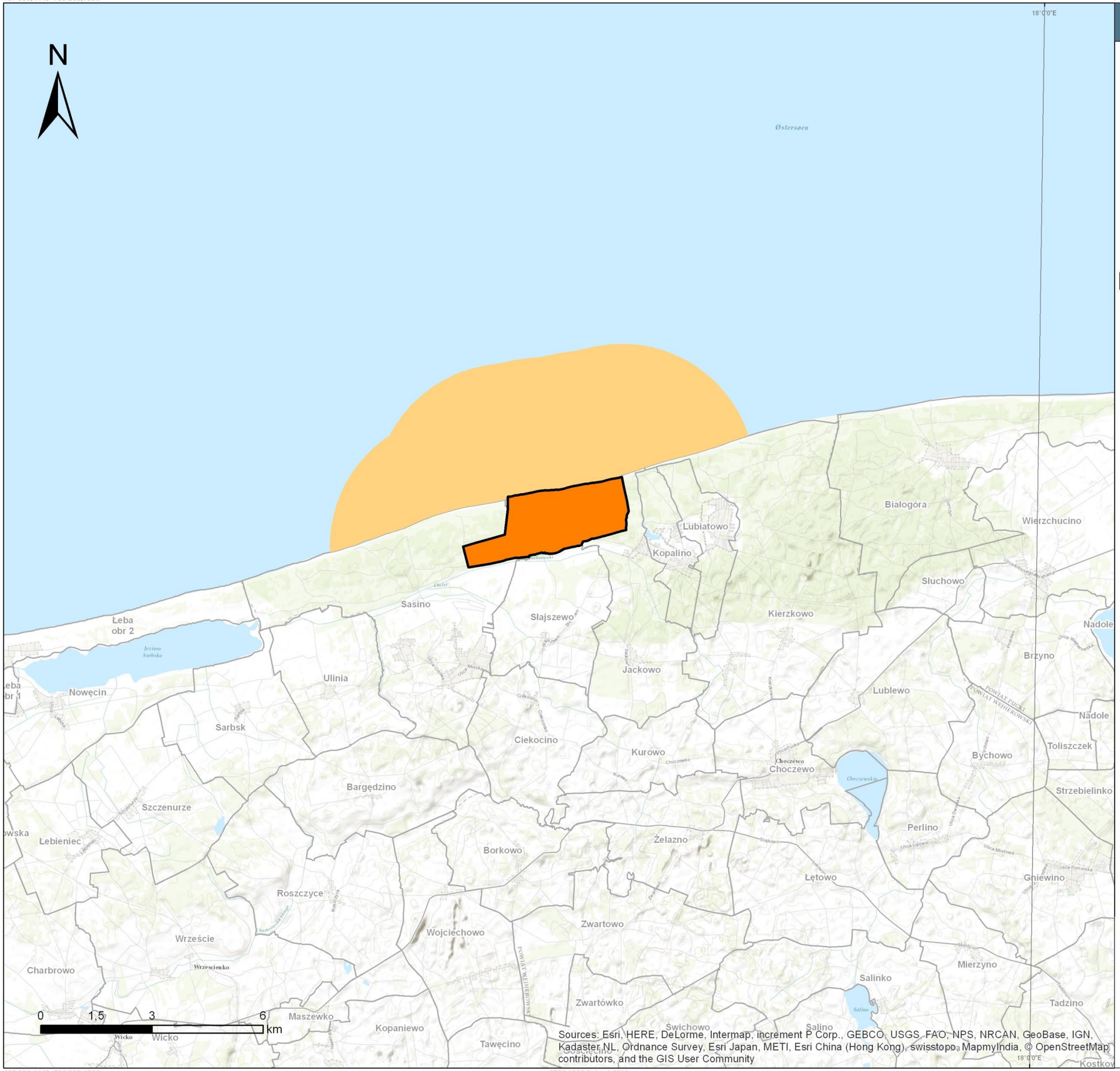
"Choczewo” location variant

"Choczewo” location marine area

PGE EJ 1 sp. z o.o.

411 737,6785 756 505,4736

ETRS 1989 Poland CS92



Legend

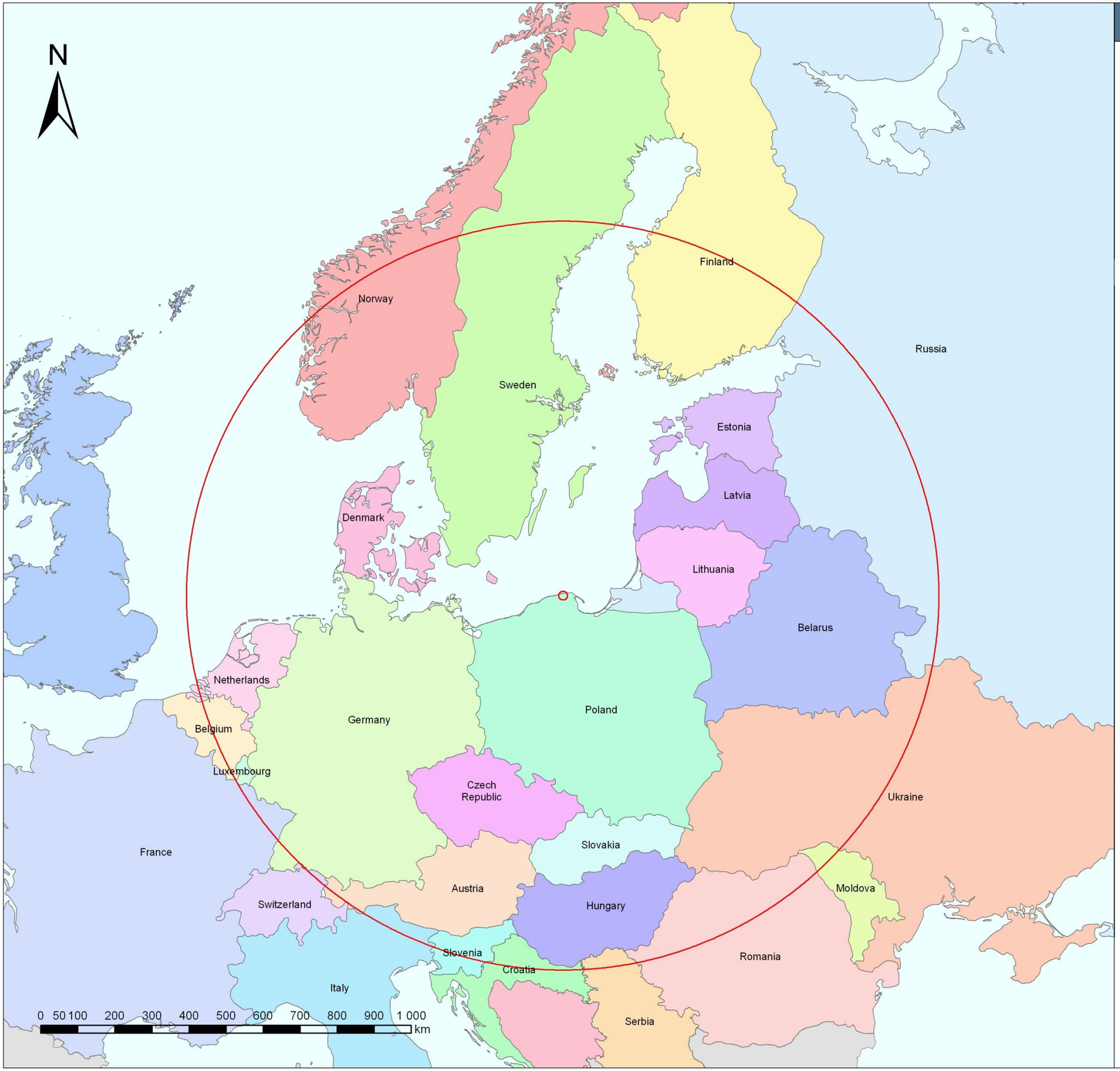
"Lubiatowo-Kopalino" location variant

Prepared by PGE EJ1 Sp. z o.o.
Warsaw 2015

Scale 1:100 000

- Luzino — Names of geodesic precincts
- Boundaries of geodesic precincts
- "Lubiatowo-Kopalino" location variant
- "Lubiatowo-Kopalino" location marine area

PGE EJ 1 sp. z o.o.



Legend

Location of the investment in respect of European countries

Prepared by PGE EJ1 Sp. z o.o.
Warsaw 2015

Scale 1:10 000 000

1 000 km radius from the location

Country	Distance from the location in km
Austria	656
Belgium	894
Belarus ja	345
Croatia	911
Czech Republic	446
Denmark	177
Estonia	419
Finland	584
France	917
Netherlands	712
Lithuania	188
Luxembourg	941
Moldova	926
Germany	248
Norway	589
Russia	102
Romania	813
Serbia	952
Switzerland	982
Sweden	175
Slovakia	573
Slovenia	875
Ukraine	505
Hungary	705
Italy	933
Latvia	233

PGE EJ 1 sp. z o.o.

409 729,2215 793 317,6991

18°0'0"E

55°0'0"N

N

Morze Bałtyckie

Choczewo

Lubiatowo

Kopalino

Kierzkowo

Białogóra

Wierzchucino

Słuchowo

Karwieńskie Błota

Odargowo

Żarnowiec

Lubkowo

Goszczyno

Władysławowo

Puck

Krokowa

Jeldzino

Łeba

Sasino

Słajszewo

Jackowo

Ulinia

Ciekocino

Kurowo

Lublewo

Brzyno

Toliszczek

Nadole

Sobieńczyce

Karlikowo

Bychowo

Bargędzino

Strzebielinko

Kartoszyno

Świecino

Lubocino

Gniewino

Tylowo

Domatowo

Wicko

Czymanowo

Tadzino

Rybno

Warszkowo

Wejherowo

Łęczyce

Nowa Wieś Lęborska

Luzino

Reda

Łęczyce

0 2,5 5 10 km

18°0'0"E

409 729,2215 750 177,3091

ETRS 1989 Poland CS92

Legend

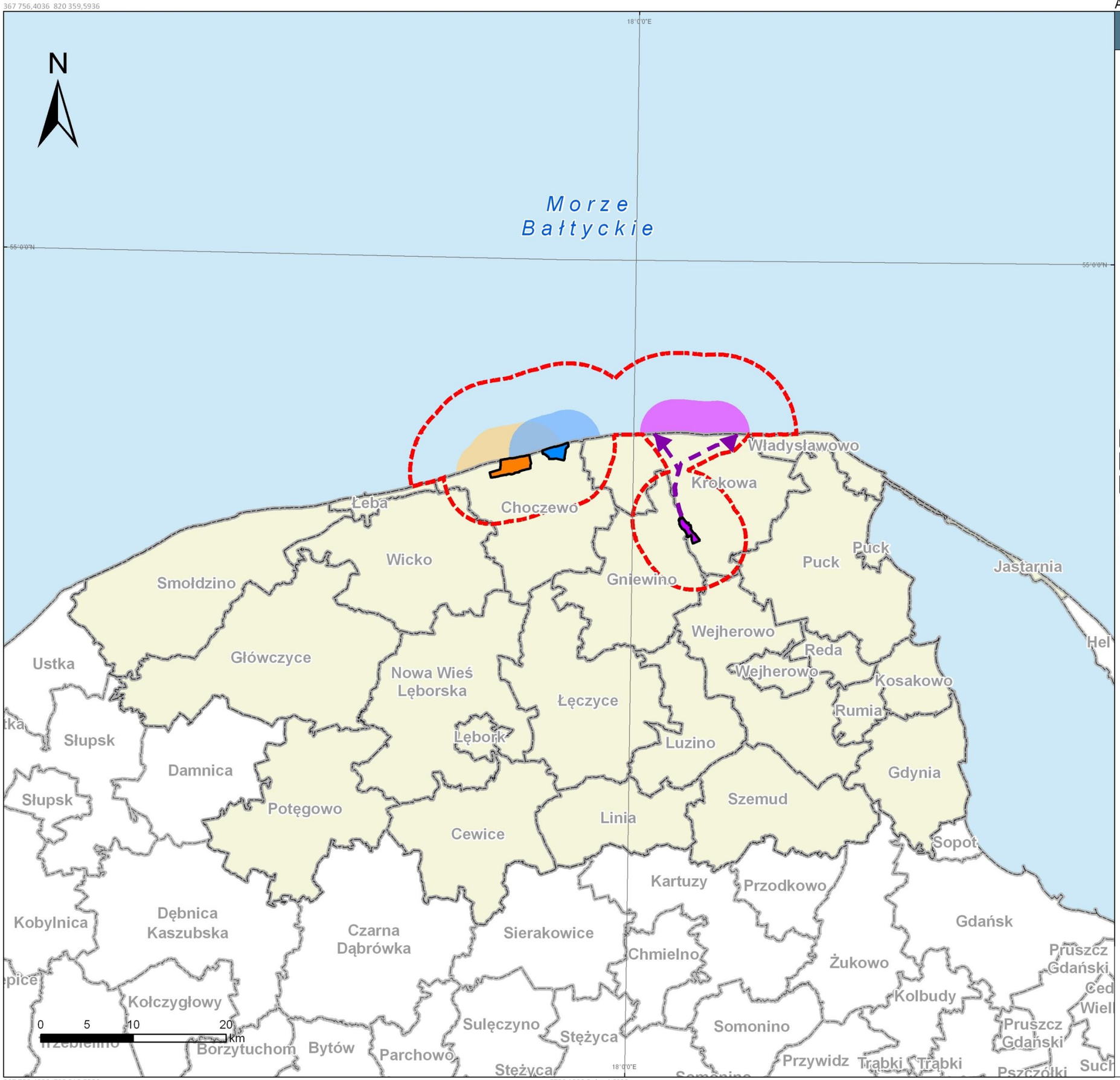
Map of the forecasted scope of impacts of the project drawn for the purpose of determining the parties to the proceedings

Prepared by PGE EJ1 Sp. z o.o.
Warsaw 2015

Scale 1:150 000

- Luzino Names of geodesic precincts
- Puck Names of communes
- Alternative routes of cooling water corridor
- Boundaries of direct potential impacts of the project
- Boundaries of geodesic precincts
- Boundaries of communes
- "Choczewo" location variant
- "Lubiatowo-Kopalino" location variant
- "Żarnowiec" location variant
- "Choczewo" location marine area
- "Lubiatowo-Kopalino" location marine area
- "Żarnowiec " location marine area

PGE EJ 1 sp. z o.o.



Legend

Map of the relevant territorial range in which the "public concerned" will be directly informed of the possible participation in the environmental decision process

Prepared by PGE EJ1 Sp. z o.o.
Warsaw 2015

Scale 1:400 000

- Puck — Names of communes
- Alternative routes of cooling water corridor
- Boundaries of direct potential impacts of the project
- Boundaries of communes
- "Choczewo" location variant
- "Lubiatowo-Kopalino" location variant
- "Żarnowiec" location variant
- "Choczewo" location marine area
- "Lubiatowo-Kopalino" location marine area
- "Żarnowiec " location marine area
- Territorial range of public notification

PGE EJ 1 sp. z o.o.

Attachment 8. Table of the geodesic precincts in the area of potential direct impacts of the Project

Poviat	Commune	Geodesic precincts in impact area			
		Code of geodesic precinct	Name of geodesic precinct	fully	Code of geodesic precinct
Lębork	Wicko	220805_2.0001	Bargędzino		X
		220805_2.0012	Ulinia		X
Puck	Krokowa	221106_2.0001	Białogóra		X
		221106_2.0002	Brzyno		X
		221106_2.0003	Goszczyno		X
		221106_2.0004	Jeldzino	X	
		221106_2.0005	Karlikowo	X	
		221106_2.0006	Kartoszyno	X	
		221106_2.0007	Karwieńskie błota		X
		221106_2.0008	Krokowa		X
		221106_2.0009	Lubkowo		X
		221106_2.0010	Lubocino	X	
		221106_2.0012	Odargowo		X
		221106_2.0016	Słuchowo		X
		221106_2.0017	Sobieńczyce	X	
		221106_2.0019	Świecino		X
		221106_2.0020	Tyłowo		X
		221106_2.0021	Wierzchucino		X
		221106_2.0022	Żarnowiec		X
	Puck	221107_2.0004	Domatowo		X
Wejherowo	Choczewo	221504_2.0001	Jackowo		X
		221504_2.0002	Kopalino	X	
		221504_2.0004	Ciekocino		X
		221504_2.0007	Sasino		X
		221504_2.0008	Słajszewo	X	
		221504_2.0010	Kurowo		X
		221504_2.0012	Lublewo		X
		221504_2.0013	Lubiatowo	X	
		221504_2.0016	Kierzkowo		X
	Gniewino	221505_2.0001	Bychowo		X
		221505_2.0003	Czymanowo	X	
		221505_2.0005	Gniewino		X
		221505_2.0009	Nadole		X
		221505_2.0011	Rybno		X
		221505_2.0015	Strzebielinko	X	
		221505_2.0016	Tadzino		X
		221505_2.0017	Toliszczek		X
	Wejherowo	221510_2.0016	Warszkowo		X

Attachment 9. Table of communes in which the "public concerned" will be directly notified of the possible participation in the environmental decision process.

Poviat	**Communes – territorial range of public notification**	
	Commune	**Code of administrative unit**
Lębork	Lębork	2208011
	Łeba	2208021
	Cewice	2208032
	Nowa Wieś Lęborska	2208042
	Wicko	2208052
Puck	Jastarnia	2211021
	Puck	2211031
	Władysławowo	2211041
	Kosakowo	2211052
	Krokowa	2211062
	Puck	2211072
Słupsk	Główczyce	2212042
	Potęgowo	2212072
	Smołdzino	2212092
Wejherowo	Reda	2215011
	Rumia	2215021
	Wejherowo	2215031
	Choczewo	2215042
	Gniewino	2215052
	Linia	2215062
	Luzino	2215072
	Łęczyce	2215082
	Szemud	2215092
	Wejherowo	2215102
Gdynia	Gdynia	2262011

List of Figures

List of Tables

List of Attachments