Document number:	10634-ILF-OD-0007
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Design Engineer/Contractor:	ILF CONSULTING ENGINEERS Polska Sp. z o.o. ul. Osmańska 12 02-823 Warsaw, Poland Poland

Investment project name:

Waste to Energy Plant (WTE Plant) located on the premises of Combined Heat and Power Plant No. 4 Veolia Energia Łódź S.A.

Phase:	**BUILDING PERMIT DESIGN**
Discipline:	**MULTI-DISCIPLINE DOCUMENT**
Volume/package number:	**VOLUME I**
Title:	**Environmental impact report**

Warsaw, September 2020

REVISIONS

0	September 10, 2020	Approved for implementation
Revision	Date	Issue, modification

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The document uses the following abbreviations:

FGT – Flue Gas Treatment

NCV – Net Calorific Value

VOC – Volatile Organic Compounds

ACC – Automatic Combustion Control

CEMS – Continuous Emission Monitoring System

ETP – Effluent Treatment Plant

PCDD/F – Polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs)

TOC – Total Organic Carbon

OPIE – Operational Programme Infrastructure and Environment

RES – Renewable Energy Sources

WTE Plant – Waste to Energy Plant

EPL – Environmental Protection Law

EIA Act – Act on providing access to information about the environment and its protection, participation of the public in the environment protection and assessment of the environmental impact

CCGT – Combined Cycle Gas Turbine Plant

BAT – Best Available Techniques

RDF – Refuse Derived Fuel

SWB – Surface Water Bodies

GWB – Groundwater Bodies

LDP – Local Development Plan

EC-4 – Combined Heat and Power Plant No. 4, ul. Jadwigi Andrzejewskiej 5 (Veolia Energia Łódź)

1 GENERAL PART

1.1 Purpose and scope of the document

The subject of the study is an environmental impact assessment report as part of the repeated impact assessment included in the procedure for obtaining the Building Permit Decision for the project entitled: *"Construction of the Waste to Energy Plant at ul. Jadzi Andrzejewskiej 5 in Łódź, on a plot of land with cadastral number 56/222, geodetic district W-32"*.

The purpose of the project is to build a modern recovery system for energy in the form of heat and electricity from refuse-derived fractions from waste recovery and recycling processes. The plant will be characterized by high efficiency, high flexibility and a low level of pollutant emissions into the atmosphere. The plant will be equipped with a steam turbine, a heating module cooperating with the municipal district heating network, an air condenser and other necessary systems. In addition, the WTE Plant will be equipped with a system for the valorization and seasoning of furnace waste (slag).

The aim of the study is to prepare a repeated environmental impact assessment for the project involving the *"Construction of the Waste to Energy Plant at ul. Jadzi Andrzejewskiej 5 in Łódź, on a plot of land with cadastral number 56/222, geodetic district W-32"* in accordance with the information available at the present stage.

Point IX of the decision on environmental conditions stated the need to conduct an environmental impact assessment as part of the procedure on issuing the decision referred to in Article 72 Section 1 Point 1 of the EIA Act.

Article 72 Section 1 Point 1 indicates that issuance of the decision on environmental conditions takes place before obtaining the building permit decision, decision on approval of the building permit design and decision on permission to resume construction works – issued under the Act of July 7, 1994 – Construction Law (consolidated text: Journal of Laws of 2020, item 1333).

The repeated assessment procedure is described in Section V, Chapter 4 of the EIA Act.

1.2 Investor details

- Name of the company: Veolia Nowa Energia Sp. z o. o.
- Registered office of the Company: ul. J. Andrzejewskiej 5, 92-550 Łódź
- National Court Register (KRS) number: 0000385379
- NIP (Tax Identification Number): 7282775223
- Regon (Business ID No.): 101089565
- Share capital: PLN 5,000.00

1.3 Formal basis for drawing up the report

1. Design work agreement No. 80073481 concluded on February 10, 2020 between Veolia Energia Polska S.A. and ILF Consulting Engineers Polska Sp. z o.o.
2. Decision No. 51/U/2010 of the Mayor of the City of Łódź of June 28, 2010 on environmental conditions, Ref. No. OŚR.III.7626/25/10;
3. Decision of the Mayor of the City of Łódź of August 25, 2014 stating that the implementation of the planned project involving the "*Construction of the Waste to Energy Plant at ul. Jadzi Andrzejewskiej 5 in Łódź*" will be conducted in stages and that the conditions specified in the decision of the Mayor of the City of Łódź No. 51/U/2010 of June 28, 2010 on environmental conditions of the execution of the said project, Ref. No. DSS-OŚR-II.6220.122.2014;
4. Decision of the Mayor of the City of Łódź of June 20, 2016 stating that the implementation of the planned project consisting in *"Construction of the Waste to Energy Plant at ul. Jadzi Andrzejewskiej 5 in Łódź"* is carried out in stages and that the project implementation conditions are valid as defined in Decision No. 51/U/2010 on environmental conditions issued by the Mayor of the City of Łódź on June 28, 2010, Ref. No.: DSS-OŚR-II.6220.100.2016;
5. Decision No. 6/U/2020 of the Mayor of the City of Łódź dated January 22, 2020 on the transfer of decision No. 51/U/2010 of the Mayor of the City of Łódź of June 28, 2010 on environmental conditions, Ref. No.: OŚR.III.7626/25/10 issued for of the City of Łódź, to Veolia Nowa Energia Sp. z o.o.;

6. Decision No. DAR-UA-IX.944.2020 of the Mayor of the City of Łódź of July 2, 2020 on establishing the outline planning permission, Ref. No. DAR-UA-IX.6730.164.2020.

1.4 Qualification of the project

In accordance with § 2 Section 1 Point 46 of the Regulation of the Council of Ministers on projects that may significantly affect the environment (Journal of Laws of 2019, item 1839), the project in question is classified as – *facility for treatment – within the meaning of Article 3 Section 1 Point 21 of the Act of December 14, 2012 on waste – of non-hazardous waste using waste thermal treatment processes, cracking of waste, physical and chemical treatment of waste (process D9 of waste disposal listed in Annex No. 2 to the Act of December 14, 2012 on waste), having a capacity of not less than 100 t per day, excluding facilities for the recovery of waste that is biomass within the meaning of § 2 Point 1 of the Regulation of the Minister of Environment of March 1, 2018 on emission standards for certain types of facilities, fuel combustion sources and waste incineration or co-incineration equipment*, thus <u>the project belongs to the group of projects likely to always have a significant impact on the environment</u>.

1.5 Characteristics of the procedure on the project's repeated environmental impact assessment in the course of architectural-and-construction procedure

This report was prepared for the purpose of administrative procedure on the issuance of the Building Permit Decision, in the course of which the project's environmental impact assessment is conducted. The body issuing the Building Permit Decision for the said project will be the Mayor of the City of Łódź. Repeated environmental assessment is an administrative procedure that is carried out for the purpose of issuing decisions other than the decision on environmental conditions. These are certain decisions that are issued immediately prior to the implementation of a given project – such as a Building Permit Decision. In accordance with Article 89 of the EIA Act, the procedure for repeated environmental impact assessment will be conducted by the competent Regional Director for Environmental Protection.

Article 89 of the EIA Act states that upon receipt of an environmental impact assessment report for a project, the authority competent to issue a Building Permit Decision (an architectural-and-construction authority) applies to the Regional Director for Environmental Protection for approval of the conditions for project implementation.

In accordance with Article 90 Section 2 of the EIA Act, before issuing the decision on approval of the conditions for project implementation, the competent Regional Director for Environmental Protection applies to the following authorities for their opinions:

1) authority competent for issuing decisions, referred to in Article 72 Section 1 Point 1, 10, 14 and 18 of the EIA Act and the permit referred to in Article 82 Section 1 Point 4b of the EIA Act, for providing the opportunity for public participation in accordance with Article 33-36 and Article 38 of the EIA Act;
2) authority referred to in Article 78 of the EIA Act, and the authority competent for water-law assessments referred to in the provisions of the Act of July 20, 2017 – Water Law.

1.6 Environmental impact assessment procedure and its role in the investment process

The issues related to the environmental impact assessment procedure are regulated in the Act of October 3, 2008 on the provision of information on the environment and its protection, public participation in environmental protection and environmental impact assessments (consolidated text: Journal of Laws of 2020, item 283, as amended).

The procedure for the issuance of a building permit decision for projects likely to have a significant impact on the environment for which the authority establishing environmental conditions has determined the obligation to conduct a new environmental impact assessment proceeds as follows. In accordance with the specifics of the above procedure, the investor must attach to the application for a building permit a project's environmental impact report and a decision on environmental conditions. Then the architectural-and-construction administrative authority (starost or voivode) applies to the appropriate Regional Director for Environmental Protection for approval of the conditions for project implementation.

Having received the necessary documents (building permit decision application, report and decision on environmental conditions), the Regional Director for Environmental Protection applies to the starost (or voivode) to ensure public participation. The architectural and construction administration authority makes relevant information public and provide all interested parties with an opportunity to submit comments and proposals within 30 days. The public is informed in a manner customarily accepted at the seat of the office, by announcements in a manner customarily accepted in the place of the planned project, through the Public Information Bulletin (BIP) and possibly by placing an announcement in the press or in a manner customarily accepted in a locality or localities relevant for the subject of the procedure. Upon completion of public consultations, the starost (or voivode) passes its results to the Regional Director for Environmental Protection.

In addition to public consultations, a repeated environmental impact assessment requires that the sanitary inspector and the State Water Company (Państwowe Gospodarstwo Wodne Wody Polskie) issue an opinion on the conditions for project implementation. In order to do so, the Regional Director for Environmental Protection should provide the aforementioned authorities with an opinion on the documentation received from the starost (voivode). The sanitary inspector issues, within 30 days of receipt of the relevant application, the opinion in the form of a decision, which cannot be appealed against, pursuant to Article 123 of the Code of Administrative Procedure. Opinions of the State Water Management Company Wody Polskie are issued similarly.

Before issuing an approval, the Regional Director analyzes the evidence, opinions received, the results of public participation, and the results of the transboundary assessment, if any. It expresses its position within 45 days by way of a decision, which cannot be appealed against, under Article 106 of the Code of Administrative Procedure. The justification for such a decision should include information on the public participation procedure conducted and on the manner and scope of accepting comments and requests submitted in connection with public participation. The authority should refer, above all, to the manner and scope of using the opinions of the public, the findings of the environmental impact report, the opinion of the sanitary inspector and the State Water Management Company Wody Polskie, as well as the results of possible transboundary procedure.

Having received the agreement and analyzed the evidence gathered, the starost (voivode) issues a building permit. In its justification it should include, among others, the information on the manner of taking into account the conditions for project implementation specified in the decision on environmental conditions and the approval of the Regional Director for Environmental Protection. The parties have the right to appeal against this permit (Article 127 § 1 of the Code of Administrative Procedure).

A staroste (voivode) also announces information about the decision and the possible ways of accessing the documentation of the case, including the agreement of the Regional Director for Environmental Protection and the opinion of the competent Sanitary Inspection body and the State Water Management Company Wody Polskie.

1.7 Basic legal regulations and materials used to prepare the report

1.7.1 Legal regulations

1. Act of April 27, 2001 – Environment Protection Law (consolidated text: Journal of Laws of 2020, item 1219);
2. Act of October 3, 2008 on the provision of information on the environment and its protection, public participation in environmental protection and on environmental impact assessments (consolidated text: Journal of Laws of 2020, item 283, as amended);
3. Act of July 7, 1994 – Construction Law (consolidated text: Journal of Laws of 2020, item 1333);
4. Act of March 27, 2003 on spatial planning and development (consolidated text: Journal of Laws of 2020, item 293, as amended);
5. Regulation of the Council of Ministers of September 10, 2019 on projects which may have a significant environmental impact (Journal of Laws of 2019, item 1839);
6. Regulation of the Minister of the Environment of March 1, 2018 concerning emission standards for certain plants, fuel combustion sources and other combustion and waste co-firing facilities (consolidated text: Journal of Laws of 2019, item 1806);
7. Regulation of the Minister of Environment of January 26, 2010 on the reference values for certain substances in the air (Journal of Laws No. 16, item 87);
8. Regulation of the Minister of Environment of August 2, 2012 on zones where air quality is assessed (Journal of Laws of 2012, item 914);
9. Regulation of the Minister of Economy of December 21, 2005 on essential requirements for equipment used outside buildings regarding noise emissions into the environment (Journal of Laws, No. 263, item 2202, as amended);

10. Regulation of the Minister of Environment of December 9, 2003 on substances posing a special threat to the environment (Journal of Laws No. 217, item 2141);
11. Act of July 20, 2017 – Water Law (consolidated text: Journal of Laws of 2020, item 310, as amended);
12. Regulation of the Minister of Maritime Economy and Inland Navigation of July 12, 2019 on substances particularly harmful to water environment and conditions to be met when discharging wastewater to waters or ground, as well as when discharging rainwater or thaw water to water or water equipment (Journal of Laws of 2019, item 1311);
13. Waste Act of December 14, 2012 (consolidated text: Journal of Laws of 2020, item 797, as amended);
14. Act of July 19, 2019 amending the Act on maintaining tidiness and cleanliness in municipalities and certain other acts (Journal of Laws of 2019, item 1579, as amended);
15. Regulation of the Minister of the Climate of January 2, 2020 on the waste catalog (Journal of Laws of 2020, item 10);
16. Act of April 16, 2004 on nature protection (consolidated text: Journal of Laws of 2020, item 55);
17. Regulation of the Council of Ministers of October 18, 2016 on the Waste Management Plan for the Oder River Basin (Journal of Laws of 2016, item 1967);
18. Act of August 21, 1997 on protection of animals (consolidated text: Journal of Laws of 2020, item 638);
19. Act of June 9, 2011 – Geological and Mining Law (Journal of Laws of 2020, item 1064);
20. Act of May 17, 1989 – Geodetic and Cartographic Law (consolidated text: Journal of Laws 2020, item 276, as amended);
21. Act of February 3, 1995 on the protection of agricultural and forest lands (consolidated text: Journal of Laws 2017, item 1161, as amended);

22. Act of May 15, 2015 on ozone-depleting substances and certain fluorinated greenhouse gases (consolidated text: Journal of Laws of 2019, item 2158, as amended);

23. Act of April 13, 2007 on the prevention and remedy of environmental damage (consolidated text: Journal of Laws of 2019, item 1862, as amended);

24. Act of February 20, 2015 on renewable energy sources (consolidated text: Journal of Laws of 2020, item 261, as amended);

25. Regulation of the Minister of the Environment of July 2, 2010 on the types of plants whose operation should be reported (consolidated text: Journal of Laws of 2019, item 1510);

26. Regulation of the Minister of Economy of January 16, 2015 on type of waste permitted to be kept at a landfill site in a non-selective manner (Journal of Laws No. 2015, item 110);

27. Regulation of the Minister of the Environment of April 30, 2013 on landfills of waste (Journal of Laws of 2013, item 523);

28. Regulation of the Minister of Development of January 21, 2016 on requirements for conducting the waste-to-energy process and methods of handling waste generated as a result of this process (Journal of Laws of 2016, item 108);

29. Regulation of the Minister of Environment of November 10, 2010 on the method of determining the L(DWN) value of sound level (Journal of Laws of 2020, item 1018);

30. Regulation of the Minister of Environment of June 14, 2007 on permissible noise levels in the environment (Journal of Laws of 2014, item 112, as amended);

31. Regulation of the Minister of Maritime Economy and Inland Navigation of June 28, 2019 on substances which are especially hazardous for the water environment and whose discharge with industrial wastewater requires obtaining a water permit (Journal of Laws of 2019, item 1220),

32. Regulation of the Minister of Maritime Affairs and Inland Navigation of July 8, 2019 on the permissible quantities of pollutants that may be discharged with industrial wastewater (Journal of Laws 2019, item 300);

33. Regulation of the Council of Ministers of December 7, 2012 on types of technical equipment subject to technical inspection (Journal of Laws of 2012, item 1468).
34. Regulation of the Minister of Infrastructure of February 6, 2003 on occupational health and safety during construction works (Journal of Laws No. 47, item 401);
35. Regulation of the Minister of Family, Labor and Social Policy of June 12, 2018 on the threshold limit values of factors harmful to health in the working environment (Journal of Laws of 2018, item 1286, as amended);
36. Regulation of the Minister of Environment of August 24, 2012 on the levels of certain substances in the air (Journal of Laws of 2012, item 1031);
37. Regulation of the Minister of the Environment of September 1, 2016 on the method of conducting the assessment of the surface pollution (Journal of Laws of 2016, item 1395);
38. Regulation of the Minister of the Environment of October 30, 2014 on requirements for performance of measurements of emission rates and quantities of taken water (Journal of Laws, No. 2019, item 2286),
39. Regulation of the Minister of Culture and National Heritage of August 2, 2018 on conservation works, restoration works and conservation surveys conducted at a monument entered in the register of monuments or in the Heritage Treasures List, as well as construction works, architectural surveys and other activities conducted at a monument entered in the register of monuments, as well as archaeological surveys and search for monuments (Journal of Laws of 2018, item 1609, as amended);
40. Regulation of the Minister of Environment of November 19, 2008 on types of results of the measurements performed regarding the operation of the plant or equipment and of other data as well as time limits and methods of their presentation (Journal of Laws No. 215, item 1366, as amended);
41. Regulation of the Minister of Environment of June 20, 2007 on information on earth mass movements (Journal of Laws No. 121, item 840);

42. Regulation of the Minister of the Environment of July 2, 2010 on cases in which introducing gases or dusts into the air does not require any permits (Journal of Laws No. 130, item 881);

43. Regulation of the Council of Ministers of December 22, 2017 on the unit fee rates for using the environment (Journal of Laws No. 2017, item 2490, as amended);

44. Regulation of the Minister of Infrastructure of January 14, 2002 on specification of average standards for water consumption (Journal of Laws No. 8, item 70, as amended);

45. Regulation of the Minister of Economy and Labor of August 5, 2005 on occupational health and safety during works involving noise and mechanical vibrations exposure (Journal of Laws of 2005, No. 157, item 1318);

46. Regulation of the Minister of Environment of April 13, 2010 on natural habitats and species being an object of interest of the Community as well as on criteria to select the areas qualifying for consideration or determination as Natura 2000 sites (consolidated text: Journal of Laws of 2014, item 1713);

47. Regulation of the Minister of Environment of December 16, 2016 on protection of animal species (Journal of Laws, item 2183 as amended);

48. Regulation of the Minister of Environment of October 9, 2014 on plant species protection (Journal of Laws, item 1409);

49. Regulation of the Minister of Environment of October 9, 2014 on species protection of fungi (Journal of Laws, item 1408);

50. Regulation of the Minister of Development of January 29, 2016 on types and quantities of hazardous substances which decide on classification of a plant as a plant of increased or high risk of major industrial failure (Journal of Laws of 2016, item 138);

51. Resolution No. 88 of the Council of Ministers of July 1, 2016 on the National Waste Management Plan 2022 (Official Gazette of the Government of the Republic of Poland (Monitor Polski) of 2016, item 784);

52. Directive 2011/92/EU of the European Parliament and of the Council on the assessment of the effects of certain public and private projects on the environment;

53. Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment

54. Directive 2003/4/EC on public access to environmental information

55. Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora as amended by Directive 90/62/EEC

56. Directive 2009/147/EC of the European Parliament and of the Council of November 30, 2009 on the conservation of wild birds

57. Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control), Directive 2008/98/EC on waste and repealing certain Directives

58. Directive 2012/27/EU on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC. Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise

59. Directive 2000/14/EC of the European Parliament and of the Council of 8 May 2000 on the approximation of the laws of the Member States relating to the noise emission in the environment by equipment for use outdoors

60. Guideline VGB-R 450 L for the quality of feedwater, boiler water and steam in public and industrial power plants

61. Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration (OJ L. of 2019. No. 312, p. 55)

62. Commission Implementing Decision (EU) 2017/1442 of July 31, 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants (notified under document C(2017)5225);

63. Reference document on best available techniques (BAT) for waste incineration (JRC, European Commission, 2019)

64. UNECE Convention on Environmental Impact Assessment in a Transboundary Context [Espoo Convention]

65. UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters [Aarhus Convention]

66. Regulation of the Minister of Economy of July 16, 2015 on approval of waste to be disposed on the landfills (Journal of Laws of 2015, item 1277)

67. Regulation of the Minister of the Environment of August 29, 2019 on the video control system for the waste storage or landfilling location. Journal of Laws 2019, item 1755.

68. Regulation of the Minister of Internal Affairs and Administration of February 19, 2020 on fire protection requirements to be met by civil structures or their parts and other places intended for waste collection, storage or processing (Journal of Laws of 2020, item 296)

1.7.2 References

1. The Study of Conditions and Directions of Spatial Development of the City of Łódź adopted by Resolution No. LXIXI/1753/18 of the City Council in Łódź on 28 March 2018, amended by Resolution No. VI/215/19 of the City Council in Łódź on 6 March 2019.

2. Ecophysiographic study for the The Spatial Management Conditions and Directions Study (Key Diagram) for the City of Łódź (Łódź, July 2018)

3. FORECAST OF ENVIRONMENTAL IMPACT OF THE DRAFT PLAN FOR adaptation to climate change OF THE CITY OF ŁÓDŹ BY 2030

4. Update of assumptions for the plan of heat, electricity and gaseous fuel supply for the city of Łódź for 2017–2020 with a perspective to 2030 – https://bip.uml.lodz.pl/ostatnio-dodane/artykul/aktualizacja-zalozen-do-planu-zaopatrzenie-w-cieplo-energie-elektryczna-i-paliwa-gazowe-miasta-lodzi-na-lata-2017-2020-z-perspektywa-do-roku-2030-id16380/

5. Letter of the Chief Inspectorate for Environmental Protection, Ref. No. DM/ŁD/063-1/300/20/DR, Ref. No.: 723/ŁD, dated May 26, 2020

6. https://www.pgi.gov.pl/dokumenty-pig-pib-all/psh/psh-materialyinformacyjne/informatory-psh/4719-informator-psh-2017-gzwp/file.htm

7. https://www.pgi.gov.pl/psh/zadania-psh/8913-zadania-psh-jcwpd.html

8. http://powietrze.gios.gov.pl/pjp/zone/characteristic/PL1001/2019/true

9. Resolution No. VIII/90/15 of the Łódź Voivodeship Parliament of 31 March 2015 on amending Resolution No. XXXV/689/13 of the Łódź Voivodeship Parliament of 26 April 2013 on the air protection program for the zone in the Łódź Voivodeship to achieve the admissible level of suspended particulate matter and the target level of benzo(a)pyrene contained in PM10 suspended particulate matter and the short-term action plan. Name of the zone: Łódź agglomeration. Zone code: PL1001 (Official Journal of Łódź Voivodeship of 2015, item 2102)

10. List 10 Archaeological sites included in the records and register of archaeological monuments of the Voivodeship Monument Conservation Office (WUOZ), according to the AZP area cards, the Study of Conditions and Directions of Spatial

Development of the City of Łódź. Conditions – Appendix No. 1 to Resolution No. LXIX/1753/18 of the City Council of Łódź dated 28 March 2018,

11. Appendix to Resolution No. XVI/671/19 of the City Council of Łódź dated November 20, 2019 Commune Monument Care Program of the City of Łódź for 2019–2022, http://g.ekspert.infor.pl/p/_dane/akty_pdf/U72/2020/23/591.pdf#zoom=90
12. http://www.powietrze.lodzkie.pl/stacje-pomiarowe-automatyczne/%C5%82%C3%B3d%C5%BA-widzew
13. http://bazadata.pgi.gov.pl/data/hydro/jcwpd/jcwpd72.pdf
14. http://mjwp.gios.gov.pl/mapa/mapa,172.html
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2 PROJECT'S LEGAL BACKGROUND

2.1 Conditionings resulting from planning documents

2.1.1 The Waste Directive 2008/98/EC

The Waste Directive prioritizes prevention of waste generation, preparation for reuse and recycling. Implementation of modern waste management in accordance with the aforementioned hierarchy, which will have a positive economic effect and improve the quality of life.

As per Article 11 – which expresses the idea of creating a European recycling society – the directive obliges Member States to promote the reuse of products and prepare for reuse activities. These activities should primarily include:

1. encouraging and supporting reuse and repair networks;
2. using of economic instruments;
3. using of procurement criteria;
4. using of quantitative targets.

The realization of the recycling society is served by the specific ones listed in Section 2 of Article 11 of the aforementioned directive:

- by 2020, preparation for reuse and recycling of waste materials, at least such as paper, metal, plastic and glass from households and possibly other origins, provided that these waste streams are similar to household waste, will be increased to a minimum of 50% by weight;
- by 2020, preparation for reuse, recycling and other ways of material recovery, including backfilling of pits where waste replaces other materials, for non-hazardous construction and demolition waste, except for naturally occurring material as defined in category 17 05 04 of the European waste catalog, will be increased to a minimum of 70% by weight.

Below there is information on reuse and recycling levels that will apply from 2025, 2030 and 2035 (Article 11 Section 2 Letters c–e of Directive 2008/98/EC):

- by 2025, preparation for reuse and recycling of municipal waste will be increased to a minimum of 55% by weight,
- by 2030, preparation for reuse and recycling of municipal waste will be increased to a minimum of 60 % by weight,
- by 2035, preparation for reuse and recycling of municipal waste will be increased to a minimum of 65% by weight.

The principle of self-sufficiency and proximity with regard to municipal waste described in Article 16 of the Directive requires Member States to establish an integrated and self-sufficient network of waste treatment facilities and facilities for the recovery of mixed municipal waste collected from households. Such a network should:

- enable the Community as a whole to become self-sufficient in municipal waste treatment;
- allow waste treatment or recovery of municipal waste in one of the nearest suitable facilities, using the most appropriate methods and technologies, in order to ensure a high level of protection of the environment and public health.

Specific provisions for recovery of municipal waste by incineration with energy recovery as per Article 23 Section 4 – any installation involving incineration or co-incineration with energy recovery must meet the condition that energy recovery is to be carried out with a high level of energy efficiency (Article 23 Section 4). For new facilities, energy efficiency must be equal to or greater than: 0.65. The Directive provides a formula for calculating this indicator:

Energy efficiency = (Ep – (Ef + Ei))/(0,97 × (Ew + Ef))

where:

Ep – means the annual energy produced as heat or electricity.

It is calculated from the energy produced in the form of electricity being multiplied by 2.6 and from the heat produced for commercial use multiplied by 1.1 (GJ/year),

Ef – means the amount of energy entering the system annually from combustion of

fuels involved in steam generation (GJ/year).

Ew – means the annual amount of energy contained in the processed waste, calculated using the lower heating value of waste (GJ/year).

Ei – means annual amount of energy introduced from the outside, with the exclusion of Ew and Ef

(GJ/year).

0.97 is a factor accounting for energy losses due to bottom ash and radiation.

For calculations of the energy efficiency of the facility, see the chapter 13 titled: *"Comparison of the proposed technological solutions with the technology complying with the requirements referred to in Article 143 of the Environmental Protection Law."* Directive 2012/27/EU of the European Parliament and of the Council of October 25, 2012 on energy efficiency Council Directive 2012/27/EU promotes cogeneration as a technical solution to meet energy needs. The purpose of this legislation is to increase energy efficiency, strengthen power supply security by creating a scheme to promote and develop high-efficiency combined heat and power generation. As defined by the directive, cogeneration means the simultaneous generation of thermal energy and electrical and/or mechanical energy during the same process.

Cogeneration as an energy-saving method has potential benefits, such as:

- saving primary energy,
- avoiding network losses,
- reducing emissions of harmful substances into the atmosphere, especially greenhouse gases.

Increasing the use of cogeneration aimed at primary energy savings and security of energy supply. Apart from promoting a high-efficiency method of generating electricity and heat, the directive includes requirements for types of cogeneration technologies, ways to calculate the amount of electricity from cogeneration and a methodology for determining the efficiency of the process.

2.1.2 Operational Program Infrastructure and Environment

The Infrastructure and Environment Operational Programme (hereinafter – IaEOP) in the current perspective 2014–2020 is a national program supporting low-carbon economy, environmental protection, climate change mitigation and adaptation, transport and energy security, health and cultural heritage investments. The largest program financed by European Funds in the European Union. The main assumption is to support a resource-efficient and environmentally friendly economy.

The IaEOP identifies national goals in the area of sustainable development while maintaining consistency and balance between investment activities in essential infrastructure. The main goal of the program is to promote a resource-efficient and environmentally friendly economy that fosters territorial and social cohesion. This priority is based on the balance and complementarity of activities in three areas, i.e. clean and efficient energy, climate change adaptation, efficient utilization of resource, competitiveness. The program's structure consists of low-carbon economy, adaptation to climate change, environmental protection and efficient utilization of resource, sustainable transportation and energy security.

The priority axis on environmental protection, including adaptation to climate change, aimed at improving the quality of the environment – includes the area of waste management. With respect to municipal waste management, the IaEOP includes action objectives, such as reducing the amount of municipal waste subject to landfilling, which will be achieved by rationalizing the waste management system. The IaEOP proposes projects that aim to close the waste management system in accordance with the waste hierarchy, such as infrastructure for selective waste collection, recovery facilities, waste recycling, and facilities for mechanical and biological processing of waste. One of the components that can be part or all of the material scope of a project to ensure compliance of the waste management system is thermal treatment of the waste, which is an example of a recovery facility. Support in accordance with the IaEOP will be directed to the construction, reconstruction and renovation of the WTE Plants of so-called residual municipal waste allowing energy recovery, while reducing the amount of municipal waste subject to landfilling.

Investments related to WTE Plants are classified under Priority Axis II: environmental protection, including adaptation to climate change with Investment Priority 6i: investing in the waste management sector to meet the obligations of the Union's environmental acquis and to meet investment needs identified by Member States.

The specific goal of the projects should be to reduce the amount of municipal waste subject to landfilling.

Within the framework of the investment priority, it is envisaged that projects will be selected through competition and non-competition procedures (projects of strategic importance for the socio-economic development of the country). Particular attention at the selection stage will be paid to examining the degree of achievement of the environmental effect resulting from the objectives of the directive. Projects will be selected for funding as a result of the evaluation of individual projects based on objective criteria approved by the Monitoring Committee. The project selection criteria will serve to ensure effective and proper implementation of the objectives set out in the priority axis. The criteria will be precise, measurable and objective. In addition, it is permissible to give the substantive criteria appropriate scores and specific point weights.

2.1.3 Waste Management Plans / List of municipal WTE Plants or waste from the treatment of municipal waste.

The WTE Plant project in question was included in the “Waste Management Plan of the Łódź Voivodeship 2011 (including 2012–2015)” constituting an appendix to the Resolution No. XXIII/549/08 of the Łódź Voivodeship Parliament of March 31, 2008 (“Construction of a municipal WTE Plant in Łódź implemented under the project “Municipal waste management in Łódź – Phase II (under the project “Municipal waste management in Łódź – Phase II” the management of inactive municipal waste landfill sites in Łódź is also implemented)”, Table 78. Existing and planned investments in waste management in particular areas, p. 133).

The investment is not included in the “Waste Management Plan for the Łódź Voivodeship for 2016–2022 with consideration of the years 2023–2028”, constituting Appendix No. 1 to Resolution No. XL/502/17 of the Łódź Regional Parliament of June 20, 2017. The investment was thus not covered by the waste management plan of the voivodeship on the effective date of the Amendment Act, September 6, 2019.

The investment was notified on January 31, 2020 to the Minister of Climate for inclusion in the list of WTE Plants of municipal waste or waste from the treatment of municipal waste.

The aforementioned list will be issued by the Minister in charge of environmental affairs in the form of an ordinance, in accordance with Article 35b Sections 4 and 5 of the Waste Act in conjunction with Article 18 Section 5 of the Amendment Act.

In accordance with its obligation under Article 18 Section 1 of the Amendment Act in conjunction with Article 35c Sections 1, 2 and 3 of the Waste Act, Veolia Nowa Energia Sp. z o.o. submitted the information required to be submitted by Article 18 Section 1 of the Amendment Act to the Łódź Voivodeship Marshal by letter dated January 27, 2020. The above document was submitted to the Marshal for inclusion of the WTE Plant in the "list of WTE Plants of municipal waste or waste from the treatment of municipal waste, divided into: existing, planned for modernization, planned for expansion in terms of increased capacity, and planned for construction, with an indication for each plant of the existing capacity, if applicable, and the planned capacity, as well as the planned completion dates for the various stages of the investment" indicated in Article 18 Section 2 Point 1 of the Amendment Act. In accordance with Article 18 Section 2 Point 1 of the Amendment Act, the list was submitted by the Łódź Voivodeship Marshal to the Minister responsible for environmental affairs by February 29, 2020.

Referring to the position of the Ministry of Climate – "in accordance with the provisions of the Act of March 31, 2020 on amending the Act on special solutions related to the prevention, counteracting and combating of COVID-19, other infectious diseases and emergencies caused by them, and some other acts, the deadline for issuing an ordinance of the Minister of Climate on the list of WTE Plants intended for municipal waste or waste from the treatment of municipal waste has been postponed until December 31, 2020."

2.1.4 Other strategic documents

National Air Protection Program (NAPP)

Adopted on 3 September 2015, the National Air Protection Program (NAPP) aims to improve the quality of life of the population, protect their health and living conditions, subject to environmental protection principles.

It sets objectives and action lines to be followed, especially at the local level. The Project inquestion will contribute to the objectives of the NAPP in the following areas:

- the main objective: to improve the quality of life of the people of the Republic of Poland, especially the protection of their health and living conditions, in accordance with environmental protection and sustainable development principles, including specific objectives:

- specific objective: to achieve as soon as possible the limit and target levels of certain substances, as defined in Directive 2008/50/EC of 21 May 2008 on air quality and cleaner air for Europe and Directive 2004/107/EC of 15 December 2004 relating to arsenic, cadmium, mercury, nickel and polycyclic aromatic hydrocarbons in ambient air, and to maintain them in those areas where they are met, and in the case of PM2.5 also the exposure concentration limit and the National Exposure Reduction Target,
- specific objective: to achieve by 2030 the concentrations of certain substances in the air at the levels indicated by the WHO and the new requirements resulting from regulations projected by EU legislation.

This project implements the activities indicated in the NAPP under the area Development and dissemination of conductive technologies to improve air quality, including through the development of heat engineering that supports low emissions.

National Low Carbon Development Program

The project in question is also part of the implementation of the priorities set out in the National Low Carbon Development Program, which are intended to lead to the development of a low-carbon economy while ensuring the sustainable development of the country, i.e.:

- development of RES use,
- promotion of optimal use of raw materials,
- development of a low-carbon economy,
- dissemination of existing low-carbon technologies in production processes,
- promotion of low-carbon transformation in the public sector.

Long-term National Development Strategy. Poland 2030. The Third Wave of Modernity

Long-term National Development Strategy. Poland 2030. The Third Wave of Modernity (Resolution No. 16 of the Council of Ministers of 5 February 2013 on the adoption of the

Long-term National Development Strategy. Poland 2030. Third Wave of Modernity) – contains the basic areas, as well as the analysis and characteristics of the conditions necessary for the development of Poland in key areas against the background of the European Union, as well as the economic processes taking place in the world. The Strategy outlines measures whose main goal is to improve the quality of life of Poles.

The planned investment is in line with the objectives and directions of intervention of the Long-term National Development Strategy, i.e.:

- Objective 7: Ensuring energy security and protecting and improving the environment, under the objective “Areas of intervention: modernization of infrastructure and energy security and increasing the level of environmental protection.

Strategy for Responsible Development to 2020 (with a perspective to 2030)

Strategy for Responsible Development to 2020 (with a perspective to 2030) – is an update of the country's medium-term strategy, i.e. the Strategy for National Development 2020 (Resolution No. 8 of the Council of Ministers of 14 February 2017 on the adoption of the Strategy for Responsible Development to 2020 (with a perspective to 2030). The main objective is to create conditions for the growth of income of the Polish population, while increasing cohesion in the social, economic, environmental and territorial dimensions. The strategy is an instrument for the flexible management of the country's main development processes. It combines the strategic dimension with the operational dimension by identifying the necessary activities and implementation instruments. In the Strategy, the guiding principle is the principle of sustainable development of the entire country in economic, social, environmental and territorial dimensions, in which the implementation of the WTE Plant in question is in line.

Energy Security and Environment Strategy

Energy Security and Environment Strategy – perspective to 2020 (BEiŚ) was adopted by a resolution of the Council of Ministers on 15 April 2014 (Official Gazette of the Republic of Poland [M.P.] of 2014, item 469), and it covers two areas: energy and the environment, and defines, among other things, key reforms and necessary actions that should be taken in the perspective to 2020. The objective of the Energy Security and Environment Strategy is to ensure high quality of life for present and future generations, taking into account environmental protection, and to create conditions for the sustainable development of modern energy sector capable of ensuring energy security for Poland and competitive and efficient economy. The main objective will be achieved through the implementation of specific objectives, which show consistency with the Project in question in the following respect:

- Objective 1. Sustainable management of environmental resources
  - Area of Intervention 1.1. – Rational and efficient management of mineral resources,
- Objective 2. Ensuring a secure and competitive energy supply for the national economy
  - Area of Intervention 2.1. – Better use of domestic energy resources,
  - Area of Intervention 2.2. – Improved energy performance,
  - Area of Intervention 2.6. – Increased importance of distributed renewable energy sources,
  - Area of Intervention 2.7. – Energy development of suburban and rural areas,
- Objective 3. Improvement of the environment
  - Area of Intervention 3.3. – Air protection, including reducing the impact of the energy sector,

The project in question will contribute to the achievement of the aforementioned objectives and areas of the BEiŚ Strategy.

Innovation and efficiency strategy of the economy "Dynamic Poland 2020"

Strategy for innovation and efficiency of the economy "Dynamic Poland 2020" (Resolution No. 7 of the Council of Ministers of 15 January 2013 on the Strategy for Innovation and Efficiency of the Economy "Dynamic Poland 2020") – one of nine strategic documents implementing the country's medium- and long-term development strategy. The main objective of the Strategy is a highly competitive economy (innovative and efficient) based on knowledge and cooperation. The main goal will be implemented through four specific objectives, among which the Project in question will contribute to the fulfillment of Objective 3: Increasing the efficiency in the use of natural resources and raw materials, including in particular reducing the energy and material intensity of the economy.

Project's compatibility with the environmental objectives included in local strategic documents

Environmental protection program for Łódzkie Voivodeship 2016 for 2017-2020 with a perspective to 2024 (Program2016)

The document was adopted by Resolution No. XXXI/415/16 of the Sejmik of the Łódzkie Voivodeship on 20 December 2016. Its main objective is to seek to improve the condition of the environment in the voivodeship, to reduce the negative environmental impact of pollution, to protect and develop the values of the environment and to manage its resources in a rational way. The program also serves to implement objectives at the regional level that have been adopted in strategic documents at the national level, with particular emphasis on the Strategy for Energy Security and Environment – Perspective to 2020, the assumptions of which primarily cover the rational use of resources and ensuring the country's energy security, while reducing emissions of pollutants into the environment. The objectives set for implementation also result from legal requirements for meeting environmental quality standards in the various areas of intervention.

The Program 2016 in several areas of intervention has planned environmental objectives achievable through the implementation of activities in the indicated areas of intervention.

The objectives are presented below by area of intervention:

- Climate and air quality protection (OKJP)

OKJP.I. Improving air quality while ensuring energy security in the context of climate change

- Noise hazards (ZH)

ZH.I. Improving the acoustic climate in Łódzkie Voivodeship

- Electromagnetic fields (PEM)

PEM.I. Protection against electromagnetic fields

- Water management (GW)

GW. I. Achievement of good status of surface and groundwater bodies

GW. II. Protection from water-related extreme events

- Water supply and sewerage management (GWS)

GWS. I. Conducting rational water and sewage management

- Geological resources (ZG)

ZG. I. Rational management of geological resources

- Soils (GL)

GL. I. Protection and rational use of the earth's surface and degraded land reinstatement

- Waste management and waste prevention (GO)

GO. I. Waste management in accordance with the waste hierarchy, subject to the sustainable development of the Łódzkie Voivodeship

- Natural resources (ZP)

ZP. I. Protection of biodiversity and landscape

ZP. II. Conducting sustainable forest management

- Threats of major accidents (PAP)

PAP.I. Reduce the risk of a major accident and minimize the consequences in the event of an accident.

The Project in question is part of the area of intervention “Climate Protection and Air Quality (OKJP)”, as part of Objective I. “Improving air quality while ensuring energy security in the context of climate change.”

Activities contributing to the reduction of emissions from industrial sources and reducing the energy intensity of the economy through the modernization of process plants and facilities for the combustion of fuels for process purposes were planned as Area of Intervention 4 as part of the aforementioned area.

Environmental protection program for City of Łódź for 2018-2021 with a perspective to 2025

The Environmental Protection Program for the City of Łódź for 2018-2021 with a perspective to 2025 (EPP) is the primary tool for conducting environmental protection policy in the city. The Project in question is in line with the objectives of the aforementioned

Environmental Protection Program in the area of intervention: 1. Protecting climate and air quality improving air quality in the City.

Strategy for the Integrated Development of Łódź 2020+

This document was adopted by Resolution XLIII/824/12 of the Łódź City Council dated 25/06/2012.

The strategy is based on three areas defining priority action lines. These include:

1. Economy and infrastructure.
2. Society and culture.
3. Space and environment.

The strategy sets objectives for the implementation of the city's vision, defining results of fundamental importance in the long term and steering activities towards things suitable for the city's development concept. Strategic objectives are related to decisions to maintain or change the use of the City's resources, including those at the disposal of the private and non-governmental sectors. The operational objectives assigned to them set the action lines in relation to the projects suitable for the city's development.

The strategic and operational objectives of the city were created on the basis of an assessment of the current situation covering the problems and internal factors that were identified in the socialized work process and that affect the possibility of city's development (strengths and weaknesses) and external factors (opportunities and threats in the environment).

Low carbon economy plan for the city of Łódź (PGN)

The Project in question will contribute to the implementation of the objectives of the Low Carbon Economy Plan for the City of Łódź and was adopted for implementation by Resolution No. V/162/19 of the City Council of Łódź on 6 February 2019.

The priority objective of the PGN is: “Reducing emissions of greenhouse gases, i.e.: carbon dioxide, sulfur dioxide and nitrogen oxides, as well as emissions of air pollutants – particulate matter, including PM10, PM2.5, as well as other substances, such as benzo(a)pyrene.” In addition, the study also aims to achieve energy performance improvements and the use of renewable energy sources (RES). The document describes strategic targeted actions aimed at restoring air quality standards, including setting a schedule of short-term, medium-term and long-term actions. The actions planned in the Low Carbon Economy Plan for the City of Łódź will result in a reduction of the demand for electricity, heat energy and gaseous fuels for the city of Łódź.

The actions/tasks planned in the PGN apply to:

- low-carbon actions,
- efficient use of resources,
- improvement of energy performance,
- RES use,
- actions that cause changes in energy users' consumption attitudes,
- non-investment activities.

When starting to define a program of corrective actions aimed at restoring the air quality required by law, at first the actions resulting from existing plans, programs, strategies that will be implemented independently of this PGN were examined. The measures identified for implementation under the existing air protection program were also included.

The Air Protection Program for the Łódź Agglomeration zone defines the basic action lines and scope of actions necessary to restore the air quality standard for suspended particulate matter PM10:

- in terms of reducing emissions from significant point sources – energy fuel combustion:
    - reducing the volume of suspended particulate matter PM10 emissions through optimal control of the combustion process and increasing the efficiency of the energy production process,
    - changing to other fuels with lower ash content,
    - use of technologies that guarantee a reduction in air emissions,
    - use of flue gas dedusting technologies with high efficiency,
    - use of renewable energy sources in addition to fuel combustion,
    - reducing energy transmission losses,

    - elimination of emission sources;
- in terms of reducing emissions from significant point sources – technological sources:
    - the use of efficient waste gas dedusting technologies,
    - changing production technology, including the elimination of sources with significant dust emissions,
    - a change in the production profile contributing to the reduction of dust emissions.

This project will contribute to the implementation of the objectives included in the PGN on low-carbon economy for the City of Łódź, i.e.:

- reducing the volume of suspended particulate matter PM10 emissions through optimal control of the combustion process and increasing the efficiency of the energy production process,
- use of technologies that guarantee a reduction in air emissions,
- use of flue gas dedusting technologies with high efficiency,
- use of efficient waste gas dedusting technologies.

Air protection program for the Łódź agglomeration zone (POP)

The Air Protection Program for the Łódź agglomeration zone on the air protection program for the zone in the Łódzkie Voivodeship to achieve the admissible level of particulate matter and the target level of benzo(a)pyrene contained in suspended particulate matter PM10, as well as the short-term action plan, was adopted by Resolution of the Sejmik of the Łódzkie Voivodeship No. XXXV/689/13 on April 26, 2013. This Program has been prepared for the Łódź agglomeration – a zone in the Łódzkie Voivodeship with the code PL1001, a total area of 51,220 hectares and a population of 902,045 people.

The POP aims to reduce the levels of suspended particulate matter PM10 concentrations to the permissible levels and benzo(a)pyrene as an indicator of polycyclic aromatic hydrocarbons contained in PM10 to the target level.

Therefore, these two air pollutants were analyzed in detail in the program.

Also the city of Łódź, which belongs to the Łódź agglomeration zone, was listed as a city with exceeded limits.

The Łódź agglomeration zone, in the area of which the project in question is located, is one of the areas, due to the exceeded limits of permissible PM10 and B(a)P indicators (hence the classification to class C), it was required to develop POPs for it. It shows the necessity to take measures that will contribute to the reduction of air emissions in the city within the Łódź agglomeration zone.

As part of corrective measures to reduce emissions of suspended particulate matter PM10 and benzo(a)pyrene as part of the implementation of existing programs, it was proposed, among other things, to reduce spot emissions from economic activities:

- gradual introduction of technologies that allow the generation of electricity and heat in cogeneration,
- use of high-efficiency dedusting techniques,
- introducing additional measurement obligations for dust emissions from significant sources of dust emissions, due to the need of air protection.

The implementation of the Project in question, being in line with the objectives of the PGN, will contribute to ensuring good air quality and climate protection.

2.2 Formal and legal conditions

According to the Waste Act, thermal waste treatment is understood as the combustion of waste by oxidation, or other thermal waste processing, including pyrolysis, gasification, and plasma process, as long as the substances in these processes are subsequently combusted. Pursuant to the above-mentioned Act, recovery shall mean any process whose main result is giving the waste useful application by replacing with the waste other materials which would otherwise be used for a specific function, or whose result is preparation of the waste for serving such function in a given facility or in the economy. Pursuant to the above-mentioned Act, energy recovery is the thermal waste treatment to produce energy.

Pursuant to Article 18 Section 1 of the above-mentioned Waste Act, anyone who undertakes activities that cause or may cause waste shall plan, design and carry out such activities using such modes of production or forms of service, as well as raw materials and materials, so as to prevent the generation of waste in the first place or reduce the amount of waste and its negative impact on human life and health and the environment, including in the manufacture of products, during and after use.

Section 2 imposes an obligation on the waste owner to first subject the waste to recovery processes in situations where the waste could not be prevented. Pursuant to Section 3 of the above-mentioned Act, recovery is understood as the preparation of waste by its owner for reuse or recycling, if this is not technologically feasible, not environmentally and economically justified – it should be subjected to other recovery processes.

2.3 Legal conditions for NATURA 2000 sites

The need to carry out an assessment of the impact of a plan or project on a Natura 2000 site and the procedure in the event of a negative impact is a direct result of Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (known as the “Habitats Directive II”), introduced into Polish law by the Act of April 16, 2004 on nature protection.

According to Article 6 Point 3 of the Directive, any plan or project that is not directly related to or necessary for the development of the site, but which may significantly affect it, either separately or in combination with other plans or projects, shall be subject to an appropriate assessment of its effects on the site from the point of view of its conservation objectives. In light of the conclusions of this assessment and without prejudice to the provisions of Section 4, the competent national authorities shall give their consent to this plan or project only after ensuring that it will not adversely affect the site and, where appropriate, after obtaining the opinion of the general public.

Pursuant to Article 6 Point 4, if, despite a negative assessment of the effects on the site and the absence of alternatives, the plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including interests of a social or economic nature, the Member State shall apply all compensatory measures necessary to ensure the protection of the overall coherence of Natura 2000. The Member State shall inform the Commission of the compensatory measures adopted.

The assessment is to determine whether there will be a negative impact on the Natura 2000 site as a result of the plan. Both designated areas and those on the list compiled by the Minister of the Environment (Article 27 of the Act) are subject to assessment, and this also applies to areas that are on the list submitted by NGOs, the so-called “Shadow List.”

In the event that a negative impact on a Natura 2000 site is considered, the further procedure is contained in Article 6.4 of the Habitats Directive II, and in Polish law in Articles 34 and 35 of the Act. Special attention should be paid to requirements for habitats

and priority species (habitats and species of prime importance), the violation of which is possible only for the reasons listed in the law and requires the opinion of the European Commission. Types of habitats and species that are subject to protection are specified in the Regulation of the Minister of Environment of April 13, 2010 on natural habitats and species being an object of interest of the Community as well as on criteria to select the areas qualifying for consideration or determination as Natura 2000 sites.

3 LOCATION OF THE PROJECT IN THE WASTE MANAGEMENT SYSTEM OF THE ŁÓDZKIE VOIVODESHIP

3.1 Description of project area

Until September 6, 2019, the division into waste management regions was in effect. Łódzkie Voivodeship was divided into three waste management regions. An amendment to the Waste Act (July 2019) abolished the so-called regionalization obligation. Due to the adoption of the Act of July 19, 2019 amending the Act on maintaining tidiness and cleanliness in municipalities and certain other acts, the division of the Łódzkie Voivodeship into waste management regions was abandoned.

In July 2020, the Management Authority of the Łódzkie Voivodeship made available to the public a draft of the “Waste Management Plan for the Łódzkie Voivodeship for 2019–2025 including 2026–2031,” according to which waste management targets were established, such as:

1) reduction of the amount of produced waste:
   a. reduction of food waste;
   b. introduction of selective collection of biowaste from mass catering facilities;
2) raising public awareness of proper management of municipal waste, including food and other biodegradable waste;
3) ensuring that the waste management systems operate in accordance with the hierarchy of waste management methods. In order to calculate the individual percentage values indicated below, all municipal waste received and collected (including construction and overhaul waste from households) should be included:
   a. achieving the recycling level and preparation for re-use of the paper, metal, plastic and glass fractions from municipal waste at a minimum level of 50% of its weight until 2020;
   b. b. until 2020, the share of weight of thermally treated municipal waste and waste from municipal waste treatment in relation to the produced municipal waste may not exceed 30%;
   c. by 2025, 60% of municipal waste should be recycled

4) reduction of the share of mixed municipal waste in the entire stream of collected waste (increase in the share of selectively collected waste):

   a. inclusion of all owners of inhabited real properties in the selective municipal waste collection system;

   b. introduction of uniform standards for selective collection of municipal waste throughout the country by the end of 2021 – the standardization is aimed at ensuring a minimum level of selective waste collection especially with regard to municipalities where an unacceptable division into “dry” – “wet” waste is used;

   c. ensuring the highest possible quality of waste collected by appropriate selective waste collection systems, so that it can be recycled in the most efficient manner possible;

   d. introduction of systems for selective collection of green waste and other biowaste at source in all municipalities in Poland by the end of 2021;

5) reduction of the amount of biodegradable municipal waste directed to landfills in order not to prevent storage in 2020 of more than 35% of the weight of such waste in relation to the weight of waste produced in 1995;

6) discontinuation of landfilling of biodegradable waste collected selectively;

7) discontinuation of storage of mixed municipal waste without treatment;

8) reducing the number of sites for illegal landfilling of municipal waste;

9) establishment of a monitoring system for municipal waste management;

10) monitoring and control of handling of municipal waste fraction sorted from the stream of mixed municipal waste and not intended for landfilling (fraction 19 12 12);

11) balancing of the functioning of the municipal waste management system in the light of the applicable prohibition on landfilling of specific fractions of municipal waste and waste from municipal waste treatment, including waste with total organic carbon content exceeding 5% of dry mass and with gross calorific value exceeding 6 MJ/kg of dry mass, from January 1, 2016;

12) continuation of waste management by municipalities within the framework of municipal waste management regions;

13) ensuring that the waste management systems operate in accordance with the hierarchy of waste management methods; in order to calculate the individual percentage values indicated below, all municipal waste received and collected (including construction and overhaul waste from households) should be included;

14) by 2030, 65% of municipal waste should be recycled

15) reduction of municipal waste landfilling to a maximum of 10% by 2030"

In connection with the necessity to complete the waste management system in the Łódzkie Voivodeship, it is important to build Waste to Energy Plant (WTE Plant), in which the energy fraction of municipal waste produced by regional municipal waste treatment facilities – currently called municipal facilities (also waste from municipal waste treatment) – is to be thermally treated.

Planned investment projects should take into account the aims for recycling and preparing for reuse of all municipal waste, as no more than 30% of municipal waste and waste generated from its treatment can be treated by thermal methods.

3.2 Current state of waste management

The National Waste Management Plan 2022, as one of the main directions of changes in waste management in terms of waste recovery and disposal methods, assumes the construction or modernization of waste treatment lines, such as:

- Organic waste composting plant,
- Organic waste fermentation plant,
- WTE Plant with a component for treatment of waste produced from processed municipal waste and RDF, with energy recovery, taking into account the required levels of preparation for reuse and recycling.

This direction is due to the regulations that municipalities are obliged to under the Act on maintaining tidiness and cleanliness in municipalities. Municipalities are required to achieve a level of recycling and preparation for reuse of municipal waste, excluding non-hazardous construction and demolition waste constituting municipal waste, of at least:

- 50% by weight – for each year in 2020–2024,
- 55% by weight – for each year in 2025–2029,
- 60% by weight – for each year in 2030–2034,
- 65% by weight – for 2035 and for each subsequent year.

Obligations of municipalities to collect and manage municipal waste, as defined in the Act on maintaining tidiness and cleanliness in municipalities, are listed below:

- maintaining cleanliness and order in municipalities and creating the conditions necessary for their maintenance, in particular, the creation of appropriate organizational units, ensuring the construction, maintenance and operation of municipal waste treatment plants which are their own or are shared with other municipalities,
- supervision of municipal waste management, including implementation of tasks assigned to entities collecting municipal waste from real property owners,
- ensuring separate collection of municipal waste including at least: paper, metals, plastics, glass, multi-material packaging waste and biowaste,
- creation of Point of Selective Collection of Municipal Waste (so-called PSZOK),
- conducting informational and educational activities on proper management of municipal waste, especially on selective collection of municipal waste,
- carrying out an annual analysis of the state of municipal waste management, in order to verify the technical and organizational capabilities of the municipality.

The main objectives and directions of activities in the investment region have been defined, based on the forecast of waste generation, in the VWMP for the Łódzkie Voivodeship.

The capacity of municipal waste landfills is not sufficient to neutralize the residues from waste treatment in the mechanical and biological waste treatment plant (MBT)

3.3 Options for aggregating the impact of the designed facility with other existing or planned sources of pollutant emissions

In the case of sources of pollutant emissions, in each case there should be a cumulative impact with already existing sources (each additional source of emissions increases the concentration of substances in the air), while the scale and severity of these impacts may vary. In the case of the analyzed project, there will be cumulative impacts of the existing EC-4 and the planned investment project concerning the construction of a new gas cogeneration unit in a CCGT configuration and other possible sources of both linear, point and surface emissions. The reference methodology specified in the Regulation of the Minister of the Environment of January 26, 2010 on reference values for certain substances in the air (Journal of Laws of 2010, No. 16, item 87]), which was used in the analysis of the propagation of substances in the air, assumes comparison of the concentrations of substances in the air obtained in the conducted modeling with the permissible value minus the already existing background of pollution (determined by the Chief Inspectorate of Environmental Protection, ref. No. DM/ŁD/063-1/300/20/DR, file No.: 723/ŁD, letter dated May 26, 2020, determining the state of air quality in the area of the planned investment project), thus, in the case of adherence to the said reference methodology, which has been done, cumulative air quality impacts with already existing emission sources are taken into account every time in the analysis. Under the analysis, calculations of the propagation of substances in the air were performed, taking into account emissions from projected sources and emissions from existing sources.

There will be positive impacts on the population due to reduced health risks caused by the change in waste management.

The planned activity will be related to the use of electricity from the power grid and water from the water supply network in quantities that do not cause nuisance in the supply of these utilities to other consumers.

On a regional scale, indirect positive impacts on fauna, flora and protected areas can be expected due to a reduction in the risks associated with landfilling.

Negligible impact in the local context on the landscape. The buildings and the WTE Plant stack will not constitute a significant negative change. The dominant feature here is the existing EC-4.

Insignificant impacts will be created for emissions to the environment during construction and operation. At the local (city) scale, at the operation stage the impact on air quality will be insignificant, the WTE Plant will meet all permissible standards.

Positive impacts will be seen on a regional scale in terms of reducing air emissions. It will result from thermal waste treatment with energy recovery, i.e. the generation of steam to produce electricity and heat. This will result in a potential reduction in demand for fossil fuels (coal).

Emissions from increased vehicle traffic will also not significantly affect air emissions. They are limited by meeting environmental and BAT requirements.

4 DESCRIPTION OF THE EXISTING STATE OF THE AREA OF THE PLANNED PROJECT

4.1 Location

The planned project will be located in Łódź, one of the largest cities in the country, both in terms of population and area occupied. The city of Łódź is located in the center of Poland, in Łódzkie Voivodeship, on Łódź Upland. Łódź is adjacent to six voivodeships: Mazowieckie, Świętokrzyskie, Śląskie, Opolskie, Wielkopolskie and Kujawsko-Pomorskie. Łódzkie Voivodeship covers an area of 18,219 km^2, which accounts for 5.8% of the area of Poland. Administratively, Łódzkie Voivodeship is divided into 177 municipalities, located in 21 rural and 3 urban poviats.

The area of Łódź is bounded by the following geographical coordinates: 19°20'41” and 19°38'30” east longitude and 51°41'11” and 51°51'40” north latitude. The latitudinal extent of the city is 17'49” and the meridional extent is 10'29”.

<u>The planned project will be located in Łódzkie Voivodeship, within the city limits of Łódź, Widzew district, Olechów-Janów housing estate, north-western part of the Combined Heat and Power Plant EC-4 on the plot No. 56/222 with an area of 31411 m^2 at ul. Jadzi Andrzejewskiej 5.</u>

There are mainly industrial buildings in the vicinity of the project. The exceptions are allotment gardens ROD Elektron and Zarzew Municipal Cemetery.

4.2 Ownership status

The legal status of the property intended for the construction of the thermal waste conversion plant is settled. Plot of land with cadastral number 56/222, precinct W-32, situated in the City of Łódź at ul. Jadzi Andrzejewskiej 5 are the property of the State Treasury and are held in perpetual usufruct by VEOLIA ENERGIA Łódź S.A.

Pursuant to the "Agreement on the guarantee (promise) of developing the service infrastructure and granting the right to administer the real property for construction purposes for the needs of the Waste to Energy Plant located in Łódź at ul. Jadzi Andrzejewskiej 5" between VEOLIA ENERGIA Łódź Spółka Akcyjna and VEOLIA NOWA ENERGIA Spółka z ograniczoną odpowiedzialnością, the parties have decided to enter into an agreement-promise giving the right to manage the property for construction purposes within the meaning of Article 3 Point 11 of the Act of July 7, 1994 – Construction Law with reference to the specified construction works connected with the WTE Plant construction.

4.3 Existing development

The area designed for the WTE Plant location is situated in the north west part of the EC-4 site in Łódź at ul. Jadzi Andrzejewskiej 5. In this part of the plot, there is a storage shelter with a yard hardened using reinforced concrete slabs in front of the shelter, and a part of a concrete railroad ramp serving the plant rail siding of about 240 m^2. The rest of the area is covered with turf. The whole development described above is surrounded by metal mesh (separating the investment project site from the area of the operating EC-4) with an entrance gate located in the north east part of the plot. Along the western and southern fences, there is a row of conifers.

Existing landscaping: The area designed for the investment project is covered with turf and, as described above, a row of coniferous trees colliding with the planned investment project grows along a part of the fence. The area designed for the investment project is a typical anthropogenic landscape, being a fragment of an industrial plant. Its entire surface and adjacent areas are subject to strong anthropogenic influences associated with industry in that area. There is no natural vegetation on the premises of the CHPP (except for the row of conifers marked in the appendix).

On the investment project site, in the area free of the proposed enclosed structures, communication routes, maneuver yards, parking lots, parking spaces, process stations, and sidewalks will be constructed, while in the rest of the unpaved area biological development will be made of a decorative nature (e.g. biological development by way of sowing the area with grass and planting decorative vegetation).

The investment project area is located at EC-4 in Łódź. The investment project area includes:

- industrial storage shelter,
- railroad ramp,
- storage yard hardened with MON type road slabs.

The land designed for the investment project is flat, and the existing landscaping is a row of coniferous trees to be felled.

4.4 Development of adjacent areas

The investment project site is located in the industrial area. In the immediate vicinity of the plot, on which the WTE Plant construction is planned, there are:

- from the north of Jadzi Andrzejewskiej street and behind the street, there are the ROD Elektron allotment gardens behind which commercial buildings are located and further on there is a petrol station at Przybyszewskiego street. Behind Jadzi Andrzejewskiej street, there is 110/15 kV station (RPZ),
- from the east, there are premises of EC-4, where construction of a new gas cogeneration unit in the CCGT configuration is planned. Further on, there is a cemetery. Single-family buildings are located at Zakładowa street at a distance of approx. 1.3 km,
- from the south of the site, the plot borders the railroad tracks, while directly behind them, there are industrial development facilities and transshipment warehouses located at Manewrowa street all the way to Dąbrowskiego street,
- from the west, the plot borders directly Puszkina street, while behind it, there are industrial development facilities up to Lodowa street and Papiernicza street and a cemetery located northwest of the EC-4 site.

The nearest areas in relation to the investment project subject to acoustic protection are recreational and leisure areas located to the north – allotment gardens at Andrzejewskiej street (“ROD Elektron”).

4.5 Conditions of the local area development plan

There is no applicable local area development plan (MPZP) for the investment project site. The area is located in the “restricted area” (i.e. physically separated area) of EC-4 in Łódź.

The indicated location at Jadzi Andrzejewskiej 5 street, where the WTE Plant construction is planned, is not included in the local area development plan.

The planning document currently in force for the entire city area is the "Spatial Management Conditions and Directions Study (Key Diagram) for the City of Łódź" adopted under Resolution No. LXIXI/1753/18 of the City Council of Łódź of March 28, 2018, amended by Resolution No. VI/215/19 of the City Council of Łódź of March 6, 2019.

At the same time, it should be noted that the lack of the LDP does not exclude the generally applicable restrictions under the Regulation of the Minister of the Environment of June 14, 2007 on permissible noise levels in the environment (consolidated text: Journal of Laws of 2014, item 112). For example, the allotment gardens across J. Andrzejewskiej street, are under acoustic protection. The acoustic impacts of the proposed project are described in detail in chapter 8.7.

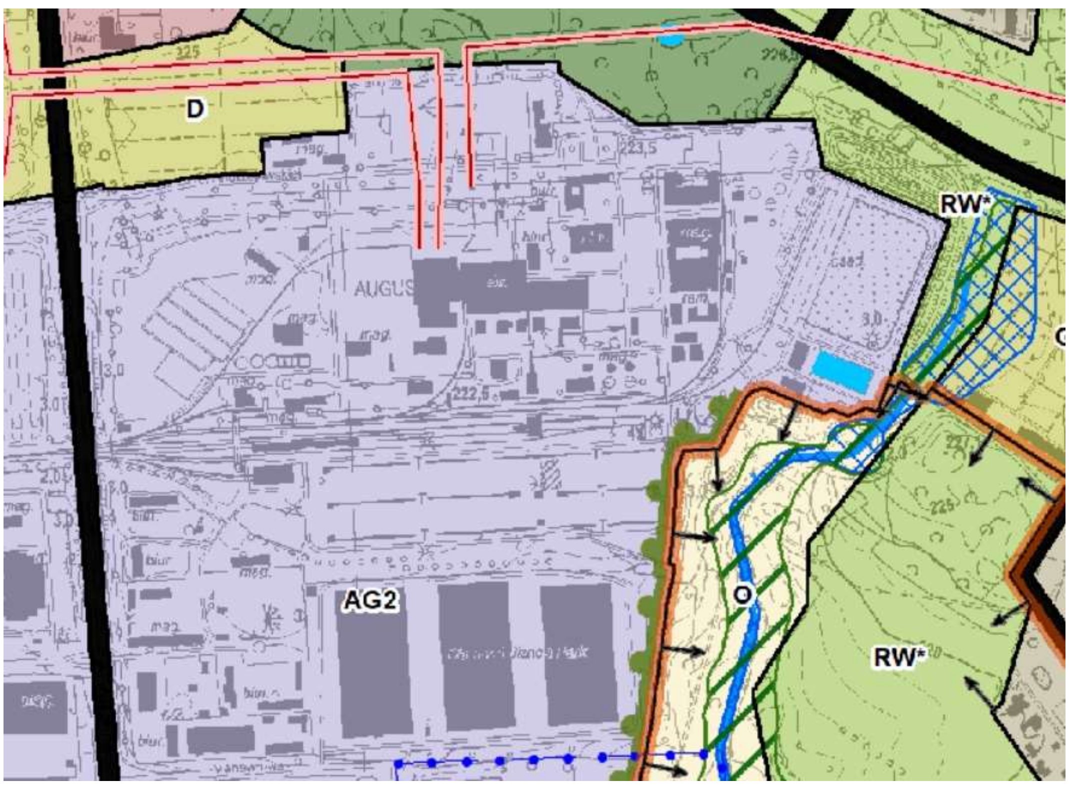


Figure 1 Location of the planned investment project against the background of functional and spatial units according to the Study of Conditions and Directions of Spatial Development of the City of Łódź (https://mapa.lodz.pl/portal/apps/webappviewer/index.html?id=afb4607e029b4999ae7e57a574ddd602)

According to the document “Study of Conditions and Directions of Spatial Development of the City of Łódź”, the investment project planned for the implementation in the area of the Combined Heat and Power Plant EC 4 in Łódź at ul. Jadzi Andrzejewskiej 5 is located in the areas intended for development, in the general urban zone marked with symbol ***AG2 – functional and spatial unit: Areas of economic activity with a significant nuisance.*** The AG2 unit represents an area of 980 ha (3% in the total city area).

4.6 Location conditions resulting from the current function of the area

This area plays a key role in the economic development of the city, with significant areas and homogeneous development, including the former industrial districts of Dąbrowa. The unit is located peripherally to the Greater Metropolitan Zone, located adjacent to communication routes and railroads.

Major spatial policy objectives in the unit:

1. Increasing the investment attractiveness of the city.
2. Organization, supplementation and creation of a new spatial structure.
3. The concentration of potential nuisance areas together with the formation of correct relations of sites with adjacent sites.

Land designation in the unit:

- acceptable: areas of industrial and service development, warehouses, storages, logistic centers, areas of communication service of supra-local importance,
- permissible with restrictions: areas of service development with acoustically protected functions – only to the extent of existing facilities and additions to their layout.

Directions, principles and indicators for land development and use relevant from the point of view of the implemented investment project:

- SPATIAL STRUCTURE:
    - an order to discharge wastewater from the investment project areas to the municipal sanitary sewerage system and to build roads to ensure efficient communication for the area;

- CREATING RELATIONS WITH ADJACENT AREAS:
  - reduction of the negative impact of economic activity areas on adjacent residential development and landscaping;
- LAND USE AND DEVELOPMENT INDICES:
  - biologically active area: minimum 5%
  - built-up area density: up to 1.0 (gross in relation to the entire area)
- NEW DEVELOPMENT HEIGHT:
  - maximum height of buildings – not more than 21 m with the optional possibility of increasing for technical elements or parts of buildings related to the process,
- PARKING POLICY:
  - demand for parking spaces for new production development, storages and warehouses: minimum 20 (in the OWRSW zone) and 25 (outside this zone) parking spaces per 100 employees,
  - demand for parking spaces for new commercial development: minimum 15 (in the OWRSW zone) and 25 (outside this zone) parking spaces per 1000 m^2 of usable floor area,
  - it is permissible to reduce the indicated parameter by 20% for commercial development and by 40% for production development, storages and warehouses, in the case of accessibility of a tram or bus stop within 400 m.

In the AG1 and AG2 areas, in places that are currently undeveloped – a road system with adequate traffic capacity is planned to provide efficient operation and move traffic out of the sites. This solution is intended to prevent traffic congestion and thus the accumulation of air pollution along circulation routes.

An element that is taken into account in the functional and spatial units are the rules of shaping proper relations with adjacent residential areas.

In the AG2 unit – areas of economic activity of significant nuisance – no limitations were set regarding the possibility of locating projects that may have a significant impact on the environment.

5 CHARACTERISTICS OF THE PLANNED PROJECT

5.1 Basic technical parameters of the project

5.1.1 Basic data

Chapter 20.1 presents “Compliance with the decision on environmental conditions” which also includes process issues that arise from the decision on environmental conditions. This table shows compliance/changes against all conditions of the above-mentioned decision.

The investment project will consist in the construction of a Waste to Energy Plant for 200,000 tonnes of waste per year with a net calorific value of 12.5 MJ/kg and availability of at least 7800 hours/year. The plant will be equipped with two independent waste-to-energy process lines, where each of them will consist of a grate boiler and a flue gas treatment. Both process lines will be used to recover energy to the water and steam system cooperating with the steam condensing extraction turbine. The steam from the turbine (from the bleeds and/or from downstream the turbine) will be transferred to the DH exchangers or to the air condenser.

Basically, the plant will produce electricity and heat. The process system will be configured to provide:

- production of heat only (operation with steam bypass to two DH exchangers and an air condenser),
- production of heat in cogeneration (simultaneous production of electricity and heat),
- production of electricity only (condensing operation),
- thermal waste treatment process only (operation to discharge steam from downstream the boilers to the air condenser).

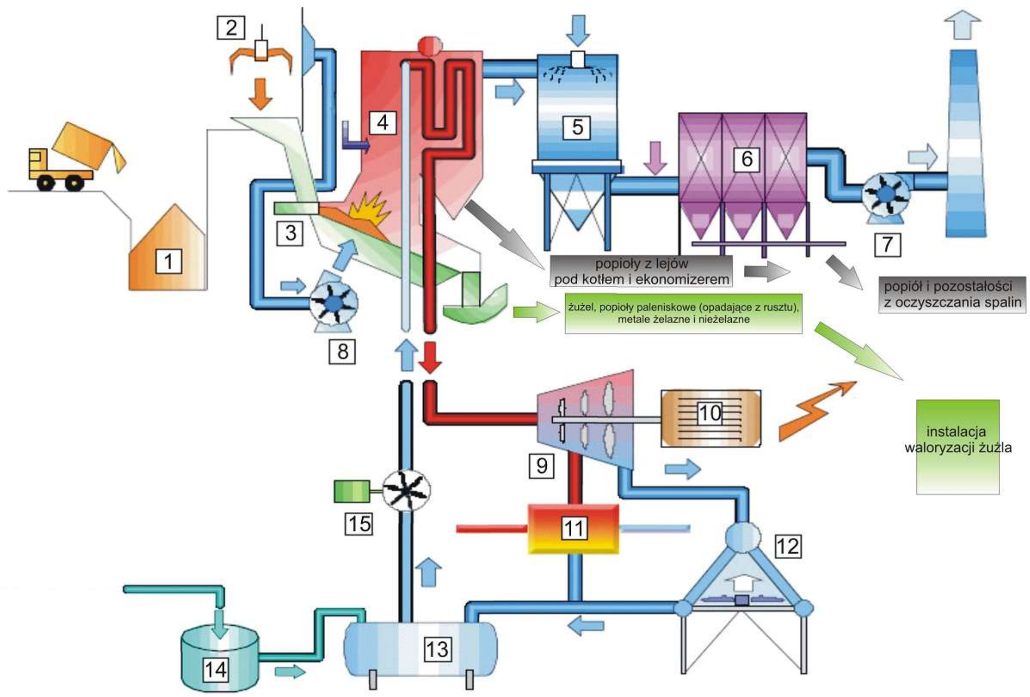
Table 2 Basic information about the WTE Plant

Item	Specification	unit of measure	min.
1	nominal annual number of operating hours of the WTE Plant	hours	7800
2	nominal number of operating days of the WTE Plant	day/year	325

Item	Specification	unit of measure	min.
3	number of waste delivery weeks	week	46
4	number of business days per week	days	5
5	number of waste delivery days	day/year	230
6	assumed WTE Plant processing capacity	ton/year	200 000
7	average vehicle load capacity: a) 80% walking floor vehicles – load capacity of 23 tons b) 20% “tub” type vehicles – load capacity of 10 tons	tons	20,4
8	average daily number of vehicles	piece/day	43
9	vehicle operating hours (between 6:00 AM and 4:00 PM)	hours	10
10	average hourly traffic volume	piece/hour	4,3

The main purpose of the investment project is thermal waste treatment; heat and electricity are treated as by-products of the waste treatment process. The heat will be collected by Veolia Energia Łódź and electricity will be primarily used to supply the auxiliaries of the WTE Plant. The electricity that cannot be used to supply the auxiliaries will be used outside the WTE Plant by external customers, including Veolia Energia Łódź.

The following is a simplified diagram of the waste thermal processing:



PL	EN
popioły z lejów pod kotłem i ekomizerem	ashes from hoppers under the boiler and ecomizer
popiół i pozostałości z oczyszczania spalin	ash and residues from flue gas cleaning
żużel, popioły paleniskowe (opadające z rusztu), metale żelazne i nieżelazne	slag, furnace ash (falling from the grate), ferrous and non-ferrous metals
instalacja waloryzacji żużla	slag valorization plant

Figure 2 Simplified example diagram of a thermal waste treatment process

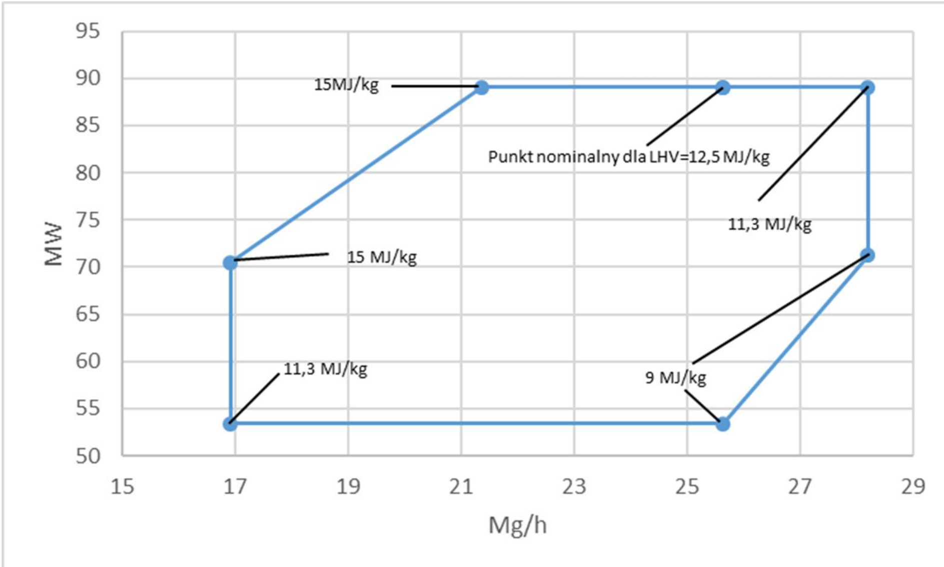
1. Waste collection
2. Waste loading
3. Dosing waste to the grate
4. Boiler
5. Injection of reacting substances for flue gas cleaning
6. Bag filter
7. ID fan
8. Primary air

9. Turbine
10. Generator
11. Heat exchanger
12. Condenser
13. Hot well
14. Water treatment
15. Supply pump

5.1.2 Waste properties

As a main fuel, the WTE Plant system will use shredded residual fraction waste, the so-called RDF / pre-RDF, which are assigned waste codes **19 12 10** (Combustible waste (refuse derived fuel)) and **19 12 12** (Other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11) respectively, according to the Regulation of the Minister of Climate of January 2, 2020 on the waste catalog (Journal of Laws of 2020, item 10). Additionally, the WTE Plant will be allowed to thermally treat waste with codes **19 12 08** (textiles), **19 12 07** (wood other than that mentioned in 19 12 06), **19 12 04** (plastic and rubber) and **19 12 01** (paper and cardboard).

Nominally, the waste will have a net calorific value of 12.5 MJ/kg. The permissible net calorific value range specified by the Employer is 8-16 MJ/kg. It should be noted that such a wide range of permissible net calorific value is not achievable due to the limitations of the grate furnace operating area. Ultimately, the furnace should be dimensioned for ranges such as: 9-15 MJ/kg, 10-18 MJ/kg or 8-14 MJ/kg. The following figure presents an example operation chart (diagram of thermal waste treatment) jointly for both process lines for the net calorific value range from 9 to 15 MJ/kg, assuming that the required technical minimum load of boilers is to be 60%. The target WTE Plant operation chart will be determined by the selected technology provider.



PL	EN
Punkt nominalny dla LHV=12,5 MJ/kg	Nominal point for LHV=12.5 MJ/kg

Figure 3 Approximate thermal treatment chart for the net calorific value range from 9 to 15 MJ/kg – jointly for both process lines

5.1.3 Morphology of waste to be thermally treated

Alternative fuel (secondary/substitute) – this is a flammable shredded waste with a homogeneous degree of mixing, resulting from the mixing of waste other than hazardous, with or without the share of solid or liquid fuel or biomass, which as a result of thermal treatment does not cause the exceeding of the emission levels set out in the Regulation of the Minister of the Environment on emission standards from systems related to the waste incineration process.

The term RDF (Refuse Derived Fuel), which refers to a carrier that increases raw material recovery from municipal waste and is a priority solution in industrialized countries. RDF is a material with a high net calorific value and homogeneous in terms of particle size.

RDF – is a fuel with standardized quality properties such as:

- net calorific value,
- chlorine content,

- mercury content,

generated from non-hazardous waste used as an energy source in waste incineration or co-incineration processes.

Waste used as a fuel has so far been referred to as substitute, alternative, secondary or waste fuels. In 2003, the European Commission adopted a document entitled “Refuse Derived Fuel, current practice and perspectives”, which defines Refuse Derived Fuel (RDF) as waste that has been treated to meet industry requirements mainly for high net calorific value.

The physical and chemical properties of alternative fuels depend on the type of waste they are made from. Alternative fuel is currently produced in Poland from the oversize fraction of waste (80-100 mm), with a working net calorific value of 16-20 MJ/kg. The main components of these fuels are plastic, paper, textiles, composite waste and wood. High-quality alternative fuels are obtained from materials with high net calorific value and low moisture content, such as plastic [Nowak, Szul].

The following table summarizes the morphological composition of RDF fuels based on tests of samples obtained from representative twelve Regional Municipal Waste Treatment Plants. Based on the tests performed, the percentage composition of municipal waste types included in the RDF alternative fuel was determined.

Table 3 Morphological composition of RDF fuels from representative Regional Municipal Waste Treatment Plants

No.	Voivodeship	Proportion of waste collected, [%]						
		textiles	foil	plastics	paper	cardboard	glass	other
RDF1	lubuskie	30	30	25	5	5	0	5
RDF2	mazowieckie	10	20	60	0	5	0	5
RDF3	wielkopolskie	0	35	40	10	10	0	5
RDF4	wielkopolskie	60	15	15	0	5	0	5
RDF5	pomorskie	0	60	30	5	0	0	5
RDF6	kujawsko-pomorskie	10	30	15	25	15	0	0
RDF7	zachodnio-pomorskie	30	20	30	10	5	0	5

No.	Voivodeship	Proportion of waste collected, [%]						
		textiles	foil	plastics	paper	cardboard	glass	other
RDF8	lubuskie	40	20	20	5	10	0	0
RDF9	mazowieckie	30	30	20	10	0	5	5
RDF10	mazowieckie	60	15	15	0	0	5	5
RDF11	warmińsko-mazurskie	60	15	15	0	0	5	5
RDF12	warmińsko-mazurskie	10	20	60	5	0	0	5
Average		**28**	**26**	**29**	**6**	**5**	**1**	**5**

Source: *Characterization of Refuse Derived Fuels from Selected Municipal Solid Waste Management Plants with an example of their valorization into gas fuel and chemicals [Malinowski, Chwiałkowski, 2017]*

The presented results can be considered as representative values for most of the currently produced alternative fuels from municipal waste in Poland. The average composition in the total weight of the fuel can be determined according to the following ratio:

- textile content ranges from 10-60%,
  - foil and plastics – from 15 to 60%,
  - paper – 5-25%,
  - cardboard – 5-15%,
  - a very small amount are pieces of glass, the presence of which was recorded in the RDF fraction in three Plants, 5% were "other" waste, which could not be separated from the total RDF fraction [*Malinowski, Chwiałkowski, 2017*].

The average content of particular fractions in RDF fuel produced in Poland was determined. Plastics (29%), textiles (28%) and foil (26%) account for the largest share. Paper and cardboard make up an average of 6% and 5% of the total composition of RDF fuel produced. Trace amounts are glass (1%) and other waste that could not be separated from the total RDF fraction.

The following tables show selected physical and chemical properties of RDF fuels

Table 4 Selected physical and chemical properties of RDF fuels

Parameter unit	Heat combustion [MJ/kg]	Moisture content %	Chlorine (Cl) %	Hydrogen (H) %	Value net calorific [MJ/kg]	Carbon [C] %	Ash %	Sulfur (S) %
Method of analysis	PN-93 Z-15400:2011	PN-EN 15414-3:2011	PN-EN 15408:2011	PN-EN 15407:2011	PN-93 Z-15400:2011	PN-EN 15407:2011	PN-EN 15403:2011	PN-EN 15408:2011
RDF1	23.6	36.8	0.37	5.24	12.9	37.7	29,6	0,24
RDF2	24.0	12.5	0.35	5	19.5	33.4	12,9	0,25
RDF3	23.1	24.5	1.71	4.98	15.6	35.4	34,6	0,23
RDF4	26.7	0.48	0.14	8.07	24.8	54.9	9,11	0,06
RDF5	30.5	3.98	0.21	8.18	27.4	52.5	8.65	0.16
RDF6	23.7	13.3	0.23	6.8	18.8	46.9	20,6	0,13
RDF7	23.7	15.8	0.49	5	18.5	32.5	29,6	0,27
RDF8	28.2	2.21	0.37	8.35	25.7	60	5.4	0,05
RDF9	23.6	19.3	0.72	6.1	17.3	43	30,4	0,24
RDF10	22.6	24.3	0.52	4.24	15.6	30.3	28,9	0,20
RDF11	21.6	10	0.38	5.79	17.9	41.4	18,1	0,22
RDF12	21.0	1.17	0.54	7	19.2	51.3	17.5	0,15
RDF13	27.8	3.2	1.29	7	24.5	60.8	15.8	0.28

Source: *Characterization of Refuse Derived Fuels from Selected Municipal Solid Waste Management Plants with an example of their valorization into gas fuel and chemicals [Malinowski, Chwiałkowski, 2017]*

The average gross calorific value for 13 plants is 25 MJ/kg, while the average net calorific value is 20 MJ/kg. The moisture content of the sampled RDF is 1-24.5%. The chlorine content after the rejection of extreme values ranges between 0.23% and 0.72%. The average net calorific value of this fuel for 75% of the plants is 15.1 [MJ/kg]. The average moisture content is 13.7%. Chlorine content – 0.503%.

The table below shows the content of selected metals in RDF fuel.

Table 5 Content of selected metals in RDF fuel

Metal	Manganese (Mn)	Aluminum (Al)	Iron (Fe)	Chromium (Cr)	Cadmium (Cd)	Zinc (Zn)	Copper (Cu)	Nickel (Ni)	Lead (Pb)	Mercury (Hg)	Calcium (Ca)	Magnesium (Mg)
Unit	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]	[mg/kg]
RDF1	37	3,439	1,121	13	0.2	575	341	2	36	138	5,524	389
RDF2	128	5,642	1,074	63	1.1	1,462	70	10	60	587	7,408	1,668
RDF3	135	3,386	2,226	55	0.5	378	23	4	34	314	5,507	823
RDF4	69	8,255	2,123	33	0.2	193	59	2	18	230	12406	1,343
RDF5	221	8,008	4,806	27	0.4	1,229	40	3	59	1,508	7,452	993
RDF6	74	10,422	2,019	57	0.2	437	71	11	146	135	12,325	2,301
RDF7	248	10,143	10,755	223	1.7	1001	1195	6	50	451	13,677	1,654
RDF8	86	4314	1180	48	0.2	184	32	2	16	114	2113	572
RDF9	97	8,605	2913	201	2.3	397	50	5	19	276	8,995	1,663
RDF10	165	6782	450	122	2.1	485	99	11	66	190	13,578	1,669
RDF11	140	7,334	3,533	50	8.5	520	104	17	59	580	13,491	1,783
RDF12	200	8,183	4,075	28	1.1	1570	84	10	90	174	13,638	1,749
RDF13*	513	5,883	8145	29	0.6	804	75	12	32	407	7,948	1,459

Source: *Characterization of Refuse Derived Fuels from Selected Municipal Solid Waste Management Plants with an example of their valorization into gas fuel and chemicals [Malinowski, Chwiałkowski, 2017]*

5.1.4 Amount of energy fraction and net calorific value

The chapter contains a detailed description of the energy fraction, as it will be the primary fuel used in the WTE Plant.

The PN-EN 15359:2012 standard entitled "Solid recovered fuels – Specifications and classes" regulates the rules of classification and parameter specification for solid recovered fuels (SRF) – which is also RDF, as fuel from renewable energy sources.

The classification system is based on three key parameters, namely: net calorific value, chlorine content and mercury content. These parameters affect the assessment of the fuel's utility value concerning the economic, process, and environmental terms.

According to the PN-EN 15359:2012 standard "Solid recovered fuels – Specifications and classes", the requirements for SRF are the following

Parametr klasyfikacyjny	Wartość statystyki	Jednostka	Klasa				
			1	2	3	4	5
Wartość opałowa (Q_i^r - NCV)	Średnia arytmetyczna	MJ/kg (stan roboczy)	≥ 25	≥ 20	≥ 15	≥ 10	≥ 3
Parametr klasyfikacyjny	**Wartość statystyki**	**Jednostka**	**Klasa**				
			1	**2**	**3**	**4**	**5**
Zawartość chloru (Cl)	Średnia arytmetyczna	% (stan suchy)	≤ 0,2	≤ 0,6	≤ 1,0	≤ 1,5	≤ 3
Parametr klasyfikacyjny	**Wartość statystyki**	**Jednostka**	**Klasa**				
			1	**2**	**3**	**4**	**5**
Zawartość rtęci (Hg)	Mediana	mg/MJ (stan roboczy)	≤ 0,02	≤ 0,03	≤ 0,06	≤ 0,08	≤ 0,16
	80-ty percentyl	mg/MJ (stan roboczy)	≤ 0,04	≤ 0,15	≤ 0,30	≤ 0,50	≤ 1,00

PL	EN
Parametr kwalifikacyjny	Qualification parameter
Wartość statystyki	Value of statistics

Jednostka	Unit
Klasa	Class
Wartość opałowa	Net calorific value
Średnia arytmetyczna	Arithmetic mean
MJ/kg (stan roboczy)	MJ/kg (operational condition)
Zawartość chloru	Chlorine content
% (stan suchy)	% (dry state)
Zawartość rtęci	Mercury content
Mediana 80-ty percentyl	Median 80^{th} percentile
Mg/MJ (stan roboczy)	Mg/MJ (operational condition)

An important criterion for assessing the energy potential of the energy fraction is the qualitative stability across seasons, and, in particular, between summer and winter seasons, which has constituted the test subject [Primus, Rosik-Dulewska, 2018].

Table 6 Selected combustion properties of the energy fraction

Item	*Value*	*Unit*	*winter*	*spring*	*summer*	*autumn*
1	*Net calorific value*	*MJ/kg*	*18.6*	*19.8*	*18.6*	*17.5*
2	*Gross calorific value*	*MJ/kg*	*19.9*	*21.2*	*20.0*	*19.0*
3	*Combustible fractions*	*%*	*70.3*	*73.7*	*72.0*	*75.3*
4	*Ash content*	*%*	*20.9*	*13.5*	*17.3*	*16.5*
5	*Sulfur content*	*%*	*0.5*	*0.2*	*0.2*	*0.3*

Source: Potencjał paliwowy frakcji nadsitowej odpadów komunalnych i jego rola w krajowym modelu gospodarki odpadami (Fuel potential of the oversize fraction of municipal waste and its role in the national waste management model), Primus, Rosik-Dulewska, Institute for Mineral and Energy Resources Management, Polish Academy of Sciences, 2018

5.1.5 Electrical systems data – power output

The power output system will consist of: synchronous generator, generator circuit breaker, bus ducts, unit transformer and power output cable line to the EC4 110 kV substation.

Generator

A synchronous generator with a star winding is assumed. The excitation system shall ensure maintenance of the generator stator winding voltage within specified limits in all operating conditions, from idle run to full load. The use of a static excitation system is planned.

The CCPP will be equipped with an integrated digital protection system consisting of

two protection subsystems.

The basic synchronization of the generator on the generator circuit breaker and back-up synchronization on the HV circuit breakers in the EC4 110kV switching station are planned.

Unit transformer

The unit transformer will be made as a three-phase, two-winding transformer with oil natural air forced radiator cooling (ONAF). The gear will be adjusted during operation ("under load").

Relays, indicators and sensors will be installed in the transformer to ensure fast and reliable operation of control, protection and cooling systems. The transformer will be provided with a complete system of protection against possible failures and interference conditions.

The transformer will be placed on rails on a concrete stand. The stand will be a basin for oil, rain water and water from automatic system fire-fighting operations. On the ground level, on the grates covering the pan, gravel will be distributed.

Generator circuit breaker

The generator circuit breaker unit will be mounted on the power outlet bus ducts inside the turbine hall building. The unit will include a MV circuit breaker in SF6 insulation or vacuum circuit breaker, disconnectors, earthing switches, surge arresters, and voltage and current transformers. The generator circuit breaker unit will be adapted for synchronization with the power system.

Power output line bus ducts

The power output line from the generator to the transformers will be implemented through MV bus ducts in air insulation. The generator circuit breaker will be mounted on the power output bus ducts. Downstream the generator circuit breaker there will be a bus duct branch to the MV auxiliary switchgear.

Unit power output line.

Power output from the unit transformer will be provided by means of a 110kV cable line. Under the roads, the line will be laid in encasement pipes surrounded by bentonite. At crossings with networks, cables will be placed in protective pipes. Along the cable line, there will be fiber-optic ducting for telemechanics.

5.1.6 Electrical systems data – auxiliaries

Primary power supply

The primary power supply will be provided from the branch of the power output bus duct (between the generator circuit breaker and the unit transformer). The bus duct will be inserted to the MV switchgear.

Back-up power supply

The back-up power supply will be implemented on 6.3 kV voltage. The PR-2 switchgear in the existing part of the CHPP will be connected to the WTE Plant MV switchgear by a cable line laid in the ground.

Main MV switchgear

The 6.3 kV switchgear for the WTE Plant auxiliaries will be a two-section switchgear with a coupling. One section will be supplied from the generator and the other section will be connected to the back-up power supply from the 6.3 kV switchgear for own consumption systems of the existing part of the Power Plant (PR-2 switchgear). Each section will be provided with its own voltage measurement feeder with an earthing switch for earthing busbars. The switchgear will supply: drives of considerable power (through 12-pulse inverter systems) and 6.3/0.4 kV distribution transformers.

The switchgear will be made of metal with independent compartments: low-voltage compartment, busbar compartment and with circuit breakers using withdrawable units. The switchgear will be provided with arc protection. The incoming feeders and the coupling will be covered by the automatic transfer switch (ATS).

Uninterrupted power supply system

The system will consist of: Diesel power generator set, 220 V DC battery bank, 220 V DC main switchgear, 400 V AC or 230 V AC main switchgear, power supply units and rectifier units.

The power of the diesel generating unit will be selected so that the WTE Plant's island operation can be stopped. The possibility of the WTE Plant start-up using the diesel generating unit is not planned.

Dry-type Transformers

MV/LV transformers will be made as two-winding transformers with resin insulation, adapted to operation inside buildings. No load adjustment of ±2x2.5% of rated voltage will be provided.

The rated power of transformers will be selected taking into account the redundancy required in the system. Transformer protection systems will ensure reliable and quick identification of emergency and interference conditions.

Dry-type transformers will be placed in transformer chambers where efficient natural cooling (AN/AN) will be provided. Rails will be installed in the chambers to allow entry and exit of units.

LV switchgears

Through MV/LV transformers, the MV switchgear will supply two sections of the main (process) LV (0.4 kV) switchgear. The power supply from transformers will be provided by LV bus ducts. The incoming and coupling feeders of the switchgear will be covered by the automatic transfer switch.

The main process switchgear will supply the auxiliary switchgear, UPS switchgear system, process substations, process consumers, fire consumers (ventilation, pumping station) and cranes.

The main LV switchgears will be provided with arc protection, will be of module type, with separated compartments for: bus ducts, functional units with withdrawable panels containing switching instrumentation and external connections.

5.1.7 Electrical systems data – general needs and general construction needs

<u>LV sub-switchgears</u>

The main process switchgear will supply the main switchgear for own consumption systems by means of two cable lines or bus ducts. The incoming and coupling feeders of the switchgear will be covered by the automatic transfer switch. The switchgear will supply the service socket units, lighting and ventilation substations, and substations for non-process power consumers (water pumps, hoisting equipment, sockets, ventilation, etc.).

Non-process substations will be located according to the needs in the Plant facilities.

<u>Lighting</u>

The basic lighting will be made using the LED technology. The process part will be illuminated by means of lighting fixtures with an increased IP rating. For high rooms, the use of high-bay luminaries or floodlights is planned.

The basic lighting will be supplied from the lighting substations located in the given facility.

The lighting will be controlled locally (switches in the room) or (e.g. for the bunker or the unloading hall) remotely from the control room.

The emergency evacuation lighting (lighting of the escape route) is planned in the building.

LED emergency lighting will be executed in the rooms and facilities in accordance with the valid regulations. Emergency evacuation luminaries will be separate from the basic lighting. The loss of voltage on the basic lighting circuits will cause the emergency lighting to switch on automatically ("dark mode" operation).

The complete lighting of the control room will be supplied from the emergency lighting switchgear and will function as emergency back-up lighting.

The power supply will be provided from the guaranteed voltage switchgear by means of cable systems with E90 fire resistive rating.

Emergency lighting substations will be installed in the facilities.

It is planned to provide lighting for roads and unloading stands. The luminaries will be installed on aluminum columns mounted to prefabricated foundations or fixed to facility facades / facility structures using dedicated extension arms. LED lighting is planned.

Lighting control will be autonomous – clock switch.

Power will be supplied by cables laid in the ground.

For road lighting, a separate switchgear will be provided in the electric building

Plug-in sockets and power supply for non-process consumers

In the staff welfare and administrative part, single-phase sockets are planned.

In office spaces equipped with raised floors, floorboxes containing single-phase sockets (including UPS) and communication sockets will be used.

Single-phase sockets will be supplied from dedicated non-process substations. These substations will also supply other non-process consumers such as louvers, pressure booster sets, water pumps, etc.

The process parts will use "overhaul units" with three-phase and single-phase sockets and protections. The units will be arranged so that the distance between them does not exceed 50 m.

Similar socket units will be located on the premises of the WTE Plant near the process equipment.

Earthing and equipotential bonding system

The use of foundation and ring earth electrodes is planned. The foundation earth electrodes will be laid in the lower reinforcement layer of buildings. Around the buildings and other facilities, ring earth electrodes will be provided. The earth electrodes on the premises of the WTE Plant will be connected to each other to form a network of earth electrodes. The WTE Plant earth electrode network will be added to the existing CHPP earth electrode network.

The earth electrodes of the 110kV instrumentation stands will be prepared in such a way as to reduce potential step voltage. The earth electrode density will be locally increased at the 110 kV instrumentation service stands.

The facilities will be equipped with an appropriate equipotential bonding system.

All the available conductive parts of the equipment and structures will be connected to the equipotential bonding system or directly to the earthing system.

The protective earthing system will consist of the following components:

- main earth electrode (including foundation earth electrode, ring earth electrode and vertical earth electrodes),
- main earthing busbar,
- local earthing busbars and equipotential bonding busbars,
- earthing, protective and equipotential bonding conductors (for mutual connections between the above mentioned elements and the available conductive parts).

The earthing and equipotential bonding system will be provided for the following equipment and structures:

- metal casings of electrical equipment made in the protection class I,
- steel structures,
- metal ducts and pipelines,
- all the exposed available conductive parts that may introduce foreign potential from outside or from another room,
- protective busbars in the switchgears,

Lightning and overvoltage protection systems

As far as possible, for the steel structure facilities, metal structural elements will be used as air terminals and down conductors. Where this is not possible, galvanized steel air terminals and down conductors will be used. A network of horizontal air terminals will be laid on the roofs. The equipment on the roof of the buildings will be protected by additional air rods.

The down conductors will be hidden under the building facade in a flame retardant installation pipe.

The control connections will be installed in inspection boxes embedded in chambers located in the ground. In the chambers, the ring earth electrodes will be connected with foundation earth electrodes.

All electrical switchgears and sub-switchgears will be equipped with appropriate overvoltage protection provided by means of surge arresters.

5.1.8 Heating systems

The following types of heating systems are planned in the WTE Plant facilities:

- Water heating systems,
- Electric heating systems,
- Heating systems using air heat pumps (electrically driven).

The parameters of the indoor air are as follows:

- for manned rooms, the internal air temperatures result from the “Regulation of the Minister of Labor and Social Policy on general regulations related to occupational health and safety” and the “Regulation of the Minister of Infrastructure on technical conditions to be met by buildings and their location” (Journal of Laws of 2019, item 1065).
- the required minimum temperatures for process rooms were determined on the basis of process requirements, depending on the processes taking place in a given room.
- High-parameter heating network and systems (high-temperature):
- temperature of 123/70°C,
- design pressure of 16 bar,
- Low-parameter central heating system (low-temperature):
- temperature of 80/60°C,
- nominal pressure of 6 bar.

Domestic hot water:

- temperature of 55/45°C with the possibility of superheating to 80°C to disinfect the system.

The purpose of the heating installations and systems, in combination with ventilation systems, is to provide the required indoor air temperatures in building rooms and spaces in conditions where the ambient air temperature is lower than the required ambient temperature. In process facilities, heating systems ensure that the assumed minimum temperature is maintained in winter conditions, for the planned and emergency shutdown of equipment, i.e. without taking internal process heat gains into account.

Own production of district heating water (high-parameter/high-temperature) will be treated as the main heat source. The water will supply heat exchanger stations in the individual facilities (due to the consistent nature of development, the number of these stations will be limited), which will be heated with a low-parameter medium. In facilities where this is possible and acceptable due to the absence of risk to personnel, a high-parameter/high-temperature medium may be used, without heat exchangers.

The WTE Plant facility will be equipped with a dedicated district heating connection from the existing EC-4 district heating network to supply heat for the time of plant shutdown or downtime. This connection will be used occasionally in situations where the WTE Plant will be completely shut down (emergency or scheduled shutdown) in the winter season. In order to avoid backflow in the main heat evacuation pipelines, this connection should be made directly at the connection to the supply main. To prevent cooling, pipelines must be placed in insulation that is common with the main pipeline.

Administrative, office, technical, storage etc. facilities / rooms (as required) will be provided with water heating by means of water convection heaters or water heating ventilation units.

Electric heating is planned for the electric, C&I, communication, etc. facilities/rooms, which are not equipped with air conditioning.

Heating with the use of air heat pumps, i.e. the heating function of the air conditioning system, is planned for the electric, C&I, and communication facilities/rooms, for the control room, etc. which are equipped with air conditioning and in facilities distant from the main building, such as the gatehouse. In some of these rooms, electric heaters may be additionally designed to protect the room in case of a decrease in the heating capacity of the air conditioning system (e.g. due to low ambient temperature).

Boiler house and turbine hall facilities do not require heating during normal operation due to significant internal heat gains; however, they will be equipped with heating elements (such as heating ventilation units) in case of winter shutdown of the WTE plant. Heating ventilation units with electric heaters are planned.

The unloading hall and waste bunker will not be heated.

5.1.9 Ventilation systems

The following types of ventilation systems are planned in the WTE Plant facilities:

- Mechanical comfort ventilation systems.
- Natural/gravity ventilation systems.
- Fire ventilation systems.

5.1.10 Fire ventilation

Fire ventilation systems will be used in the areas indicated in the Fire Protection Conditions. Wherever it is technically and computationally possible, natural (gravity) fire ventilation will be used. The following ventilation-fire protection systems are initially planned:

- Aeration of vertical escape routes,
- (Mechanical) smoke removal from horizontal escape routes,
- Smoke removal from the individual large-size facilities.

5.1.11 Air conditioning systems

Air conditioning/cooling is planned for the automation, communication, office, control and electrical rooms, where cooling with ambient air is insufficient. Rooms that require cooling will be equipped with air conditioning systems based on direct evaporation of split/multisplit or VRV/VRF cooling medium.

The aforementioned air conditioning systems will also be used for heating, if necessary.

Critical rooms (server room, control room, etc.) will be equipped with redundant n+1 cooling systems.

5.1.12 Instrumentation and control equipment and automation system

Proper functioning of the WTE Plant will be ensured by protection systems and a high degree of automation of the individual process units. The automated processes will be continuously monitored by appropriately trained personnel. This will ensure that the necessary corrective interventions can be taken if failures are found in the plant operation.

Full automation of the WTE Plant will be ensured by using automation systems operating in closed control loops and open control loops.

The level of instrumentation and the number of automation systems depend on the adopted process solutions for the main process stations.

The main process stations in terms of automation comprise:

- Incineration station,
- Boilers (energy recovery station),
- Water-steam system (energy recovery station),
- Turbine (energy recovery station),
- Flue gas cleaning system.

The following functions will be automated to ensure that a single operator can supervise the plant operation:

- functions that require a response in less than 10 minutes,
- routine, rarely performed functions,
- functions easy to automate,
- complicated, rarely performed functions,
- functions for which the time spent during a shift is more than 50 minutes,
- functions that require constant attention, longer than 30 minutes.

Control room

The room will house the operator stations together with the necessary technical equipment.

The room is designed for continuous stay of people and therefore it will be provided with conditions to control the working comfort.

Access to the room will be restricted to authorized persons and therefore the room will be subject to access control.

As part of the air conditioning systems, it will be possible to set the room temperature locally.

The lighting used will prevent glare, glow and flickering.

In order to prevent the immission of pollutants and odors, the control room will be overpressurized in relation to the adjacent rooms.

I&C engineering room

Room designed to accommodate engineering stations of the delivered automation systems.

The stay of people in the room will be based on current needs and will be temporary.

Access to the room will be restricted to authorized persons and therefore the room will be subject to access control.

C&I server room

The room will be fitted with cabinets containing IT equipment.

Access to the room will be restricted to authorized persons and therefore the room will be subject to access control.

C&I electronics room

The room is intended for the installation of controller cabinets and I/O cards of the automation system.

Access to the room will be restricted to authorized persons and therefore the room will be subject to access control.

C&I auxiliary room

Depending on the cable solutions of the control system, the auxiliary room can be arranged as a cable room or as a cable distribution room. In the case of lack of space in the C&I

electronics room, it will be possible to locate auxiliary power supply cabinets consisting of guaranteed voltage distribution substations.

5.1.13 Electricity generation and released heat

5.1.13.1 Electricity

The maximum gross electric power output of the WTE Plant will amount up to 27 MWe. This means that the power output of the generator will be up to 32 MVA. With the assumed minimum WTE Plant availability of 7800 hrs/year, the plant will be able to generate up to 211 thousand MWh of electricity per year.

WTE Plant process auxiliaries are estimated at approx. 3-4 MWe depending on the mode of operation (condensation/cogeneration, respectively).

The following table shows the WTE Plant electricity generation capacity.

Table 7 WTE Plant electricity generation capacity

Parameter	Unit	Value
Gross electric power output for the condensing mode	MWe	Approx. 27
Net electric power output for the condensing mode	MWe	Approx. 24
Gross electric power output for the cogeneration mode (at 50 MWt for heat generation)	MWe	Approx. 17
Net electric power output for the cogeneration mode (at 50 MWt for heat generation)	MWe	Approx. 13
Technical minimum/island operation	MWe	Approx. 8

5.1.13.2 Heat

In the WTE Plant it will be possible to supply heat for the district heating network in several operating modes:

- Cogeneration – feeding two DH exchangers with steam from steam turbine extractions. In such a mode, the WTE Plant shall be able to generate up to approx. 50 MWt of heat;
- Steam turbine bypass operation, with the following basic operating options:

- Operation with the two above mentioned DH exchangers with power up to approx. 50 MWt – in this mode part of the steam from the boilers is directed to the heat exchangers, and the remaining part to the air condenser.

Due to technical limitations in the WTE Plant pumping engines (wide range of multi-mode operation), it is estimated that the minimum thermal power output from the WTE Plant will be approx. 7.5–15 MWt for operation outside the heating season and during the heating season, respectively.

The WTE Plant annual heat generation is assumed to be approx. 500 TJ.

The table below summarizes the WTE Plant thermal power generation capacity as described above.

Table 8 WTE Plant heat generation capacity

Parameter	Unit	Value
Thermal power available in the cogeneration mode	MWt	Approx. 50
Thermal power available in steam turbine bypass mode – operation with two DH exchangers	MWt	Approx. 50
Technical minimum (outside/during the heating season)	MWt	Approx. 7.5–15
Annual heat generation	TJ	Approx. 500

5.2 Process characteristics

5.2.1 Waste collection and temporary storage station

At the entrance to the facility, a gatehouse with two weighing stations (entry and exit) will be located. Owing to the weighing stations it will be possible to control the quantity of materials being brought in/out, such as:

- Waste for the waste-to-energy process – the weighing station will also be provided with equipment for detecting radioactive waste, so that when such waste is detected it can be directed to the quarantine station;
- Reacting substances for flue gas cleaning processes;

- Slag and other waste from the waste-to-energy process;
- Light fuel oil for the start-up fuel;
- Diesel oil for diesel generator set and mobile equipment needs.

As regards vehicular traffic forecast related to the satisfaction of the needs indicated above, the following estimate has been prepared:

- Transport of waste for the waste to energy process:

Table 9 Estimation of the number of vehicles in connection with the transport of waste for the thermal treatment

Item	Specification	unit of measure	quantity
1	nominal annual number of operating hours of the WTE Plant	hours	7,800
2	nominal number of operating days of the WTE Plant	day/year	325
3	number of waste delivery weeks	week	46
4	number of business days per week	days	5
5	number of waste delivery days	day/year	230
6	assumed WTE Plant processing capacity	ton/year	200,000
7	average vehicle load capacity: a) 80% walking floor vehicles – load capacity of 23 tons b) 20% “tub” type vehicles – load capacity of 10 tons	tons	20.4
8	average daily number of vehicles	piece/day	43
9	vehicle operating hours (between 6:00 AM and 4:00 PM)	hours	10
10	average hourly traffic volume	piece/hour	4.3

- Slag transport (from the WTE Plant): max 8/day – this applies to the collection of post-seasoned slag in the case the slag seasoning hall is completely filled,
- Transport of process waste (ashes from boilers and solid waste from flue gas cleaning) – 5 transports / week on average,
- Transport of carbamide to the denitrification system – 2 vehicles/month,

- Transport of activated carbon to the system for removal of heavy metals and other pollutants – 1 vehicle/month,
- Transport of bicarbonate to the desulfurization system – 2 vehicles/month,
- Light fuel oil and diesel oil transport – 5 vehicles/year,
- Chemicals transport to the Water Treatment Plant – 2 vehicles/month,
- Effluent transport – 1 vehicle/year,
- Diesel oil transport to the loader – 3 vehicles/year.

The above is due to the stream of the medium used/waste generated, dimensioning of the silo/tank and the available wheeled silos (silos for the transport of a given substance).

After entering the premises of the WTE Plant:

- Waste (fuel for the waste to energy process) will be directed to the unloading hall, where trucks will unload into the waste bunker through 5 gates,
- Slag collection trucks will be dispatched to the slag valorization and seasoning hall.
- Trucks collecting process waste (ashes from boilers and solid waste from flue gas cleaning) will be dispatched to the station of temporary process residue bunkers,
- Carbamide transport will be dispatched to the carbamide storage and preparation room within the waste bunker building,
- Bicarbonate and activated carbon transport will be directed to the unloading station at the wall of the flue gas cleaning station. Both bicarbonate and activated carbon will be unloaded into the silo,
- Light oil transport, depending on the purpose (diesel generator set/start-up fuel), will be dispatched to the generator set station or to the oil Tank and pumping station.
- The transport of chemicals will be dispatched to the Water Treatment Plant building,
- Effluent transport will be dispatched for loading from the buffer tank,
- The diesel oil transport to the loader will be directed to the diesel oil refueling area of the site transport vehicles.

As mentioned above, waste before incineration will be directed to the bunker. The bunker will be a facility for temporary storage of waste intended for the waste to energy process. It will be equipped with 5 gates, two of which will be lockable, which will allow for the so-called "high storage" (i.e. storage of waste in the largest possible amount in order to maintain uninterrupted operation of the plant for 5 days in the case of planned temporary lack of deliveries – e.g. during holiday periods).

The waste bunker should ensure waste retention for 3–5 days. At the stage of preparing the assumptions for the basic engineering, various variants of bunker dimensions were analyzed and selected as follows:

- Width: 15 m,
- Length: 33.5 m,
- Depth: 10 m.

The above dimensions mean that the usable volume of the bunker will be approx. 11,500 m^3. For nominal net calorific value (12.5 MJ/kg) and waste density of 300 kg/m^3, this capacity is sufficient for 5.6 days (approx. 135 h). For nominal net calorific value of 12.5 MJ/kg and waste density of 250 kg/m^3, this capacity is sufficient for 4.7 days (approx. 112 h).

The data of the waste bunker are listed below:

Table 10 List of adopted data

Assumptions for the waste bunker		
Parameter	Unit	Quantity
Nominal net calorific value of waste	MJ/kg	12.50
Waste density	kg/m^3	250–300
Waste retention in the bunker	dni	approx. 5.00
Height of waste arrangement above level 0	m	18.00
Bunker length	m	33.50

Assumptions for the waste bunker		
Parameter	Unit	Quantity
Bunker width	m	15.00
Bunker depth	m	10.00
Bunker volume	m^3	11,500

Waste in the bunker will be mixed (homogenized) and transported to the loading chamber of boilers using two overhead cranes, one of which will be a backup solution. This means that each of them will be able to supply both waste-to-energy process lines. The overhead cranes will be equipped with multi-unit grabs and an additional grab used, i.a., to unblock the hoppers (in the case of hoppers blocked with a larger load of waste). The operation of the overhead cranes will be controlled by operators whose stations will be located in the control room. The assumptions for overhead cranes are listed below:

Table 11 Technical data of waste overhead cranes

Assumptions for overhead cranes		
Parameter	Unit	Value
Quantity	-	2.00
normal performance at maximum continuous operation	t/h	25.64
maximum overhead crane performance	t/h	32.00
maximum amount of waste to be removed from the bunker area and to be mixed in the bunker area	t/h	64.00
Waste density	kg/m^3	300.00
minimum gripper volume	m^3	6.5
failure-free operation time	-	24/7
availability	h/year	8.760

Assumptions for overhead cranes		
Parameter	Unit	Value
Assumed operating modes	-	manual, semi-automatic, automatic

5.2.2 Boiler system

The boiler system will consist of two process lines. Each of them will be able to operate independently and therefore will consist of a grate boiler and a flue gas cleaning plant. Operation of the boilers and the flue gas cleaning system will be managed by the DCS.

Boilers can be made in a horizontal or vertical version.

Boilers will be of drum type with natural circulation.

Boilers will generate steam with the below parameters:

- Live steam pressure: 60 barg,
- Live steam temperature: 420°C,
- Live steam flow rate: 55.3 t/h – (steam flow rate from one boiler).

5.2.2.1 Grate system

Each boiler will be equipped with its own grate. The single grate system consists of, i.a.:

- Bottom hopper

  The bottom hopper is the element that connects the waste bunker with the grate in the incineration station. Waste from the bunker transported by a gripper overhead crane is lowered to the bottom hopper. It will be designed in such a way as to minimize the consumption of materials used for its construction, to minimize the compression of waste in the hopper and to distribute waste evenly on the grate surface. Inside the hopper, a hydraulic damper is installed which prevents backfire during system downtime. At the bottom of the hopper, a feeder is installed, whose task is to push the waste to the grate surface. It is moved by hydraulic actuators. Its operation allows for maintaining an even level of waste on the grate.

Pursuant to the requirements of the Regulation of the Minister of Development of January 21, 2016 on requirements for carrying out the waste-to-energy process and methods of handling waste produced as a result of this process, the grate will be equipped with an automatic waste feeding system, making possible to stop their feeding:

a) during start-up, until the required temperature is reached,

b) during the operation, if the required temperature is not reached,

c) if continuous measurements show that any permissible emission value has been exceeded due to disturbances or failures of protective equipment limiting the emission to the air.

- Grate

The purpose of the grate is to ensure drying, degassing, gasification, combustion and after-combustion of fuel with a uniform course of the combustion process.

The grate is inclined at an angle and consists of alternating fixed and movable rows of grate bars. The moving rows of grate bars move forward and backward, which results in the transport of fuel and its rotation, and at the same time breaking of slag.

The grate track is made up of modules and in the longitudinal direction consists of several grate sections with rows of grate bars. The grate sections form the main combustion grate. The grate bars will be made of materials resistant to abrasion and corrosion.

Each grate section consists of a structure made of steel elements with fixed rows of grate bars and is used to install grate trolleys.

The grate trolleys are equipped with a hydraulic drive (cylinder). This allows the grate speed to be adjusted individually to the fuel quality.

The hoppers under the grate are used to guide primary air through the surface of the grate to the bed and at the same time to direct slag transfer through the grate to the feeder that collects it.

The hoppers contain components of grate trolleys, including bearings of these trolleys and a part of the grate drive shaft with a set of levers and drive rods for trolleys. The grate drive cylinders and the grate drive shaft bearing will be located outside the hoppers.

The hoppers consist of a steel structure reinforced with ribs and each is equipped with a manhole. Each hopper is divided into a straight top section and a conical bottom section. The outlet of the lower part of the hopper will be designed as an immersion channel reaching to the tray and water bath located under the hoppers of the slag conveyor transferring through the grate deck, thus shutting off air supply from the primary air zones between them and the environment.

The grates will be equipped with hydraulic stations that supply drives for the grate zones, shut-off dampers and feeders in bottom hoppers and shut-off dampers in slag chutes to the slag trap.

- Cooling system

In the grate area, the bottom hopper and hydraulic system are cooled with water as a standard. Elements closely related to the grate, especially the combustion zone, may be cooled by air or water. This depends on the size of the grate, its nominal thermal load and the technology supplier. The grate cooling system will be integrated into the closed cooling water system.

5.2.2.2 Slag handling system

The slag collecting at the ends of the grate, together with fly ash partially entering this area, reach the water bath of the slag trap through the slag pit and there they are cooled down. The slag pit submerged in water bath forms a shut-off of false air supply to the combustion chamber from the environment. With the aid of the pusher, the slag is pressed outwards through a rising discharge chute. The discontinuous discharge of slag from the slag removal equipment by the pusher extrudes excess water from the slag. The slag removal equipment consists of a steel sheet housing with reinforcement ribs and an inner drive shaft and a discharge pusher.

The drive shaft is driven by an external hydraulic actuator. The receiver, discharge pusher and chute are protected by plates made of material with increased abrasion resistance. Wide inspection holes enable easy access to the slag removal equipment interior.

Evaporated water or water taken by slag is made up by the level controller. Water for cooling purposes will be taken from the process water tank, which will be supplied with a stream of cooled blowdown and bottom blowdown from the boilers or condensate from the sampling system, drains from systems, etc.

Slag from the boiler slag traps will be fed to vibrating and/or belt conveyors in order to transport it to the slag valorization and weathering system.

In emergency situations, in case of a failure of the conveyor, it will be possible to collect slag in emergency containers and transport it to the slag valorization and weathering system.

5.2.2.3 Air / flue gas system

The waste fed to the boiler grate will undergo the waste-to-energy process by ensuring appropriate amount of air. The thermal waste treatment on the grate can be divided into several stages:

- Drying: in the first zone, waste is heated by radiation or convection to over 100°C, resulting in the evaporation of moisture;
- Degassing: further heating to over 250°C results in the release of volatiles (moisture and gases with a low flash point);
- Thermal treatment: in the third part, the complete waste-to-energy is achieved;
- Gasification: during the gasification process, volatile products are oxidized by molecular oxide. The vast majority of flammable substances are oxidized at 1000°C in the upper zone of the furnace chamber;
- After-combustion: after-combustion is used to minimize the content of unburned parts and CO in flue gas. In this zone, air is supplied to achieve complete combustion. This is called secondary air. The time of flue gas residence in this zone is min. 2 seconds at min. temperature of 850°C according to the requirements of the Regulation of Minister of Development of January 21, 2016 on requirements for carrying out the thermal treatment process and methods of handling waste produced as a result of this process (Journal of Laws of 2016, item 108).

Air for thermal waste treatment process will be provided in two stages:

- Primary air supplied under the grate of boilers;

- Secondary air supplied to the after-combustion zone in the first vertical line of the boiler.

Both primary and secondary air will be taken from the area of the bunker and the unloading hall through air intakes installed on the wall separating the waste bunker and the incineration station. Both air systems (primary and secondary air) will be equipped with dedicated fans and air preheaters. Each boiler will be equipped with dedicated fans and heaters.

It is not planned to apply fine filtration systems in the primary and secondary air ducts due to potential operational problems of such systems (clogging of filtration mats). It is planned to use rough filters.

Air heaters will be supplied with steam from a medium pressure steam header from the steam turbine system. Combustion air is heated to stabilize the combustion process when damp waste of waste with low net calorific value is fed to the grate. The heaters will be exchangers of the shell and tube type. They will be equipped with a compressed air tube cleaning system.

Thermal treatment process in accordance with the requirements of the Regulation of the Minister of Development of January 21, 2016 on requirements for conducting the thermal waste treatment process and methods of handling waste generated as a result of this process (Journal of Laws of 2016, item 108) will be conducted in such a way that the total organic carbon content in furnace slag and ash is lower than 3% or the loss on ignition of furnace slag and ash is lower than 5% of dry mass.

Pursuant to the above Regulation, the combustion chambers of the boilers will be equipped with continuous measurement system of flue gas temperature, oxygen concentration in flue gas and flue gas pressure.

The flue gas produced as a result of the waste-to-energy process, once the energy is collected by the water-steam system, will be transferred to the flue gas cleaning system.

5.2.2.4 Water and steam system

Feed water system

- The feed water system starts with the feed water tank integrated with the thermal deaerator. It is assumed that the system will be equipped with one feed water tank serving both process lines (1 x 100%).
- From the tank, water will be directed to the feed water pump system. It is assumed that the pumps will be installed in a 3 x 100% configuration, where 100% flow means full capacity of both process lines. Each pump shall be driven by an electric motor cooperating with the inverter. The hydraulic system of the pumps shall be equipped with minimum flow valves protecting the feed water pumps against damage in case of closing of the shut-off valves.
- Feed water from the common header will be fed to pipelines supplying it to each process line. Feed water will then be fed to the system of economizers that heat it. The economizers will be installed as the last heating surfaces of the boilers. The water from the economizers will be transferred to the drums (one per boiler).

Steam system

- Water that is directed to the boiler drums, described in the above chapter, will then be directed to the membrane pipes in vertical lines for evaporation. Next, the resulting saturated steam will be directed to steam superheaters installed in further part of the boiler (in the horizontal part). The temperature of steam from downstream the superheaters will be controlled by steam desuperheaters supplied with feed water stream from upstream the economizers.
- Live steam from downstream the boilers will be fed to a common header, from where it will be transferred to the steam turbine system.
- The entire boiler pressure system will be protected against excessive pressure increase by safety valves, which will be installed on the boiler drums and on the pipes of the live steam from boilers. Exhausts from safety valves will be discharged to the roof of the incineration station.

Drain, dewatering and vent system

- The boilers will be designed so as to enable their complete draining and venting. Appropriate drainage and valving systems will be used for this purpose. Automatic stream traps will be used for normal operation.
- Low pressure drains will be routed directly to the process tank.
- Pressure drains, including those from the surface blowdown system of the boiler drums
- or the bottom blowdown system (drains from the boilers) of other heated parts of the boilers, will be transferred to the pressure flash tank and further through the atmospheric flash tank to the process tank.
- The WTE Plant will be equipped with a common pressure flash tank and an atmospheric flash tank for both boilers.
- Flash steam from the atmospheric flash tank will be directed to the deaerator in the feed water tank.
- Water collected in process tanks No. 1 and 2 will be used to make up losses in the cooling water of the boiler slag traps or for the production of demineralized water in the Water Treatment Plant.

5.2.2.5 Start-up oil and start-up and supportive burner system

The boilers will be equipped with start-up burners in accordance with the requirements of the Regulation of the Minister of Development of January 21, 2016 on requirements for conducting the thermal waste treatment process and methods of handling waste generated as a result of this process (Journal of Laws of 2016, item 108), whose task will be to enable the cold start-up of the system and to enable the system shut down from the hot state, as well as to maintain the optimal combustion temperature in the furnace, in order to maintain the required efficiency of the process and to reduce NOx emissions.

The burners shall be selected so as to enable achievement of flue gas temperature of at least 850ºC in the zone above the place of the last air supply to the combustion chamber.

Each boiler will be equipped with two start-up and supportive burners (2 x 50% of the boiler demand = 2 x 30% of the firing rate of one boiler).

The oil tank and pumping station will be used for storage and pumping of light fuel oil for the needs of supplying the start-up and supportive burners of the boilers.

Unloading will take place from a tight tray and a station equipped with a complete billing system.

The oil tank will be sized so as to ensure the possibility of one cold start-up of the plant and to support the combustion process for at least 24 h.

For a nominal net calorific value of waste of 12.5 MJ/kg and an assumed waste stream, the fuel energy input shall be 89 MW. This means that an energy flow rate of approximately 54 MW is required to keep the burners in operation for the commissioning period (ca. 15 h) at 60% of the thermal load of the boilers. This in turn means that for a net calorific value of 42.6 MJ/kg (according to PN-C-96024 “Petroleum products. Fuel oil”), the required oil flow rate supplied to the burners is equal to approx. 1.268 kg/s (0.317 kg/s for each burner).

Such a fuel flow rate, together with a start-up time of 15 hours, requires the volume of the oil tank to be approx. 90 m^3. It is assumed that the tank will be of double-walled steel structure. The tank will be underground.

It is assumed that the light oil pumping station will be equipped with a system of two screw-type pumps in a 2 × 100% configuration, where 100% means covering the needs of both boilers.

The system will be equipped with a complete metering system necessary for verified billing of oil consumption, all necessary shut-off valves, control valves, etc. In order to ensure stable pressure in the system, a connection between the delivery side of the pumps and the oil storage tank is provided.

The compressed air produced in the compressed air system will be used to atomize the fuel. The compressor station will be located in the technical building.

The burners will be equipped with a dedicated control system integrated with the WTE Plant control system (DCS).

5.2.2.6 Heating surface cleaning system

The boiler will be equipped with a rapping system, installed on one side of the horizontal line, separately for the area of superheaters and evaporators and separately for the area of economizers, to provide external cleaning of the tube bundles. The system has an autonomous control system, allowing for adjusting the frequency and the cleaning area of heating surfaces. The rappers will be equipped with pneumatic drives.

In addition, the second and third vertical pass will be equipped with a cleaning system that uses demineralized water under pressure. This system is made up of flexible pipes covered with a stainless steel mesh, connected at one end to a high pressure pump. The other end is inserted into the appropriate spray nozzle. The pipe which in its resting position is wound onto the drum, is automatically lowered into the flue gas duct, owing to suitable openings equipped with automatic gate valves, after the cleaning sequence has been started.

To control the automatic cleaning system, a local control panel will be installed, with a PLC inside, which controls all parts necessary for the cleaning cycle, including pumps, valves, hose holders and duct shut-off gate valves.

Alternatively, a system using the pressure wave effect may be used for cleaning vertical passes. The wave is produced by burning methane in a specially designed system (modules). The modules are installed directly at the membrane tube walls of the boiler in selected locations. The system is controlled by its own PLC and is integrated with the DCS.

5.2.2.7 Flue gas cleaning system

The WTE Plant will be designed, equipped, built and operated in order not to exceed the permitted emission values for exhaust gases. Emissions will be limited by using state-of-the-art technology. The plant will be equipped with a metering system that enables emissions to be measured and controlled continuously.

The following flue gas cleaning systems will be used for the Waste to Energy Plant (WTE Plant):

- flue gas desulfurization using the dry method with the use of sodium bicarbonate ($NaHCO_3$) to reduce acidic compounds of SO_2, HF, HCl, dust, combined with the stream and dust method using activated carbon to reduce heavy metals, dioxins and furans;
- flue gas dedusting using a fabric filter. Dedusting efficiency of 99.8%;
- denitrification of flue gases by primary and secondary SNCR methods using solid carbamide solution to reduce NO_x emissions.

Denitrification

- In order to reduce the concentrations of nitrogen oxides NO_x, the Selective Non Catalytic Reduction (SNCR) process is proposed, which allows for the smooth achievement of the legally required emission standard for NO_x – in accordance with the emission standards and BAT requirements / BAT conclusions. The 40% dry carbamide solution will be used as the reacting substance.
- Compared to the SCR (Selective Catalytic Reduction) method, SNCR is less energy intensive, has lower investment and operating costs, and does not require an expensive cleaning or catalytic bed replacement process.
- With the current development of the SNCR technology, it is possible to achieve NOx emission levels below 120 mg/m^3. Leading companies in the market offering flue gas cleaning system solutions, including SNCR-based NO_x reduction systems, guarantee a reduction in their emissions below 100 mg/m^3.
- The reduction of nitrogen oxide concentrations can be achieved by two clearly different methods:
  - through reduction, which we consider to be a primary method, consisting in the reduction in nitrogen oxides "at source" of their formation. It mainly consists in optimizing the incineration process,
  - through a reduction, which we consider to be a secondary method, consisting in the chemical reduction of nitrogen oxides as a result of being subjected to the action of carbamide $CO(NH_2)_2$, according to the reactions below:
- Nitrogen oxides reactions with carbamide:
  - $4\ NO + 2\ CO(NH_2)2 + O_2 \quad -> \quad 4\ N_2 + 4\ H_2O + 2\ CO_2$;
  - $2\ NO_2 + 2\ CO(NH_2)_2 + O_2 \quad -> \quad 3\ N_2 + 4\ H_2O + 2\ CO_2$.
- The products of the reduction reaction comprise gaseous environmentally neutral nitrogen and steam (also carbon dioxide and carbamide).
- Carbamide $CO(NH_2)_2$ will be produced by evaporating water from a liquid solution in contact with hot flue gas in the furnace chamber. At low temperature, the reagent does not react with nitrogen oxides, while it burns at higher temperature, thus

increasing nitrogen oxide emissions. It is important that the reagent is injected exactly within the correct temperature range.

- The injection nozzles, with compressed-air assisted spraying, result in continuous, accurate and deep distribution of the reagent in the furnace. Reagent should be injected into the furnace at a minimum of two nozzle levels, so that it is always within the optimum temperature range of the reaction, regardless of the boiler load.
- Injection within the optimum temperature range will be monitored continuously by measuring temperature at the injection levels.
- The reacting substance solution will be prepared in a dedicated carbamide storage and preparation room within the waste bunker building. Demineralized water will be used to prepare the solution. It is estimated that 220 kg/h of solution will be used for two combustion lines (110 kg/h for one line). This means using 88 kg/h of dry carbamide for two lines (44 kg/h for one of the lines).
- The dry carbamide silo will be sized for a 30-day retention. With the flow rate of carbamide used of 88 kg/h and density of 754 kg/m^3, the monthly demand for carbamide is approx. 84 m^3. Therefore, a silo with a rounded volume of 85 m3 has been adopted for the purpose of the document.
- Carbamide from the silo will be transported pneumatically by means of a blower to a tank in which it will be mixed and dissolved in demineralized water. Then, through a system of pumps, the prepared solution will be directed to the injection nozzles in the boiler, which will be installed above the after-combustion zone in the appropriate flue gas temperature zone.

<u>Desulfurization and removal of heavy metals and other pollutants</u>

- The process of flue gas desulfurization using the dry method, aided by a bag filter, will allow for meeting the current and future emission standards and norms, due to a very efficient reduction in the amount of acidic components of flue gas (HCl, HF, SO_2), heavy metals, dusts, dioxins and furans contained in flue gas, generated during the waste incineration process.
- In the dry method, in the reaction chamber flue gas comes into contact with the reagent reducing acidic components of flue gas (HCl, HF, SO_2) and an adsorption reagent reducing heavy metals, dioxins and furans. The reacting substances used

will be sodium bicarbonate $NaHCO_3$ and activated carbon. Acidic pollutants will be neutralized through contact and reaction with fine alkaline particles.

- The flue gas comes into contact with the powdered reagent in a reaction chamber installed immediately downstream of the boiler pass. Each boiler will be equipped with its reaction chamber. Reactions with reagents are an active phase of the process.
- Acidic gases, mainly HCl, HF and SO_2, are neutralized in contact with the reagent in accordance with the following reactions:
  - $Na_2CO_3 + 2\ HCl \rightarrow 2\ NaCl + CO_2 + H_2O$,
  - $Na_2CO_3 + 2\ HF \rightarrow 2\ NaF + CO_2 + H_2O$.

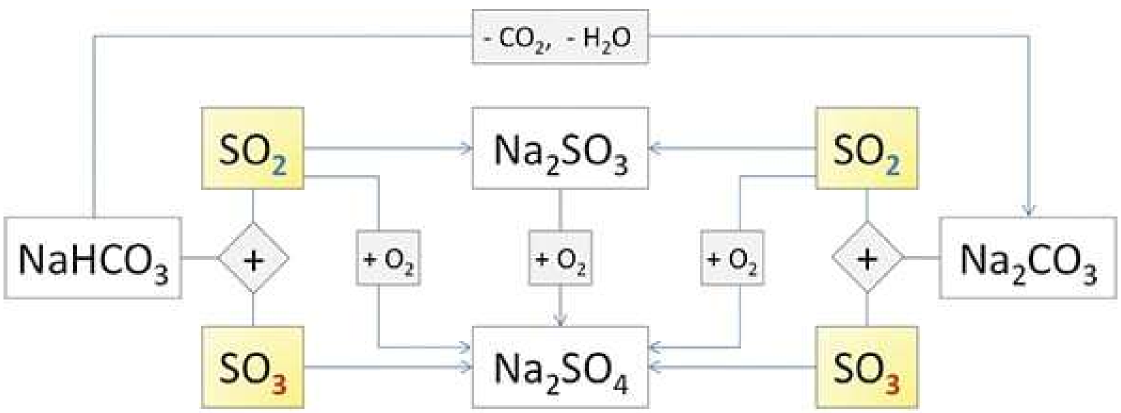


Figure 4 Diagram of desulfurization reaction using sodium bicarbonate ($NaHCO_3$)

- Activated carbon allows the reduction of heavy metals to be increased and dioxins and furans to be captured.
- Reacting substances will be stored in dedicated separate silos. The silos will be installed inside the flue gas cleaning station and will be located as close to the wall as possible. This location will allow direct unloading of reacting substances from tanker lorries thanks to stub pipes installed on the building wall.
- The sodium bicarbonate ($NaHCO_3$) silo will be sized for 15-day retention. With the flow rate of reacting substance used of 660 kg/h for two lines and a density of 2200 kg/m^3, the demand for sodium bicarbonate ($NaHCO_3$) is approximately 108 m^3. Therefore, a silo with a rounded volume of 110 m3 has been adopted for the purpose of the document.

- The activated carbon silo will be dimensioned for 65-day retention. With the flow rate of reacting substance used of 22 kg/h and density of 500 kg/m^3, the demand for activated carbon is approx. 68 m^3. Therefore, a silo with a rounded volume of 70 m3 has been adopted for the purpose of the document.
- The above reacting substance consumption refers to optimized consumption. Optimization will take place by recirculating a part of the collected ash in the fabric filters. The captured ash will contain part of unreacted reacting substances. In order to “activate” it, the intermediate pressure steam flow rate from the IP steam header will be used.
- The dry flue gas desulfurization system ensures thorough flue gas cleaning with optimum reacting substance consumption and moderate production of process residues. It is compliant with the BAT requirements.

Dedusting

- Installation of individual bag filters with dedusting efficiency at a level ensuring compliance with the BAT limits/emission standards is assumed for each boiler.
- Solid particles flowing with flue gas from downstream the reaction chamber will settle on the surface of filter bags. The bag filter constitutes an important stage in flue gas cleaning, because it not only dedusts the flue gas, but the excess of reacting substances present on bag surfaces will still react with flue gas.
- From the filters, the captured dust will be directed back in part to the reaction chamber to optimize the use of the reacting substances and in part to temporary process residue tanks. The residues will be collected by specialized external companies for further management. Loading will be carried out by means of a loading sleeve to tankers. The sleeve is first lowered from the stand-by position into the inlet port of the tanker. Once the bellows outlet cone is seated on the tanker inlet, a slack cable knuckle mounted outside the transmission box stops the bellows lowering. A limit switch in the transmission box stops both expansion and shortening of the bellows. Material loading begins when the hopper outlet valve is opened. During tanker loading, the polymer coating of the outlet cone acts as an ideal dust seal. The slack cable knuckle triggers further stretching of the bellows as the tanker settles as its weight increases. A level monitoring device installed in the center of the

outlet cone signals the maximum level of material in the tanker chamber and commands the tank outlet valve to close. After about 10 seconds, the bellows begin to shorten and return to the standby position so that the external filter can extract the remaining dust. When the bellows are fully shortened, the cable limit switch in the transmission box stops the unit operation. Transport will be carried out using dedicated tankers, thus eliminating the risk of dust spreading during its transport. Rapping of dust deposited on the surface of bag filters will be supported by compressed air pulses. Air will be drawn from the compressed air system.

- It should also be noted that dedusting also takes place partly at boiler height by collecting dust from hoppers under the superheater and economizer lines.
- The total flow rate of dust captured in hoppers under the boilers and in bag filters will be 1440 kg/h for both combustion lines (720 kg/h for one of them). The dust from under the hoppers will be generated in the amount of 590 kg/h for two lines (295 kg/h / 1 line), and the filter bag dust will be generated in the amount of 850 kg/h for two lines (425 kg/h / 1 line).
- Dust captured from under the hoppers of the boilers will be transported pneumatically to a dedicated 300 m^3 bunker. Such a bunker will allow for 1-week retention.
- On the other hand, dust captured in the bag filters will be transported pneumatically to two separate tanks; the capacity of each of them will also be 300 m^3. The indicated two bunkers will also allow for retention lasting approx. one week.
- All three bunkers will be installed on a dedicated station of temporary process residue bunkers located near the combustion and flue gas cleaning station. The station will be prepared in such a way that tanker lorries collecting ash (process waste) can arrive directly under the bunkers for unloading.

<u>Stack and Continuous Emission Monitoring System (CEMS)</u>

- The flue gas from both process lines will be directed to a common stack. The stack will be equipped with a separate flue gas duct for each line. The stack will be insulated in places where the WTE Plant personnel will have easy access to prevent burns.

- Each process line will be equipped with a dedicated ID fan (1 x 100%) in order to ensure appropriate negative pressure along the entire flue gas pass. Silencers will be installed in the flue gas ducts, separate for each line.

- Each flue gas duct will be equipped with flue gas metering points coupled with the Continuous Emission Monitoring System (CEMS). This system will be equipped with parameter analyzers, in accordance with the BAT requirements.

- The content of gas components will be measured using the reference methodology as specified in the Regulation of the Minister of Environment of October 30, 2014, on requirements for performing measurements of emissions and of water consumption and standards referred to therein.

- As far as reporting is concerned, new flue gas monitoring systems are planned to be connected to the dedicated MikroB S.A. Mikros system existing at the EC-4 Combined Heat and Power Plant for the exchange of information within the entire EC-4 Combined Heat and Power Plant. Emission reporting and ongoing supervision of emission levels will be performed independently by the WTE Plant. Additionally, for the needs of the power unit operators, the values of individual measurements in CEMS systems and their operating statuses will be presented in the automation system.

- Access to the metering points will be provided by means of a ladder from level 0 or by means of a service platform connecting bag filters and stack.

- When the metering system indicates that the permissible emissions of pollutants are exceeded, then in accordance with the requirements of the Regulation of the Minister of Development of January 21, 2016, on requirements for carrying out the waste-to-energy process and methods of handling waste produced as a result of this process, the process of thermal waste treatment will be stopped when the exceeding lasts for more than four hours. The total annual time during which such exceeded states occur will not exceed 60 hours during the calendar year.

5.2.3 Slag valorization and seasoning system

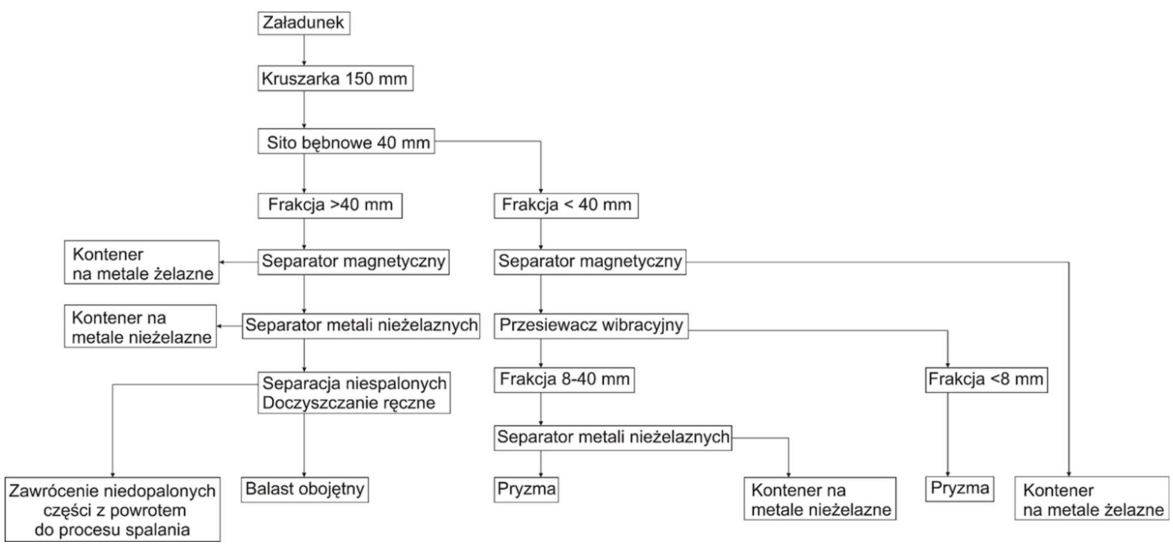
One of the methods of IBA disposal compliant with the BAT document is its valorization. The valorization process consists of mechanical treatment with separation of a suitable slag fraction, separation of ferrous and non-ferrous metals from its composition, and then slag exposure to the atmosphere (air) for a period of from approx. 4 up to approx. 6 weeks.

The IBA valorization process at the WTE Plant will take place in three stages:

- Stage 1
  - Slag that is created as a result of the thermal waste treatment will be transported from the slag trap with a water seal to the slag collection place in the valorization and seasoning hall using conveyors. Slag residence time in this place will be up to 15 days. The loaders will then transport the slag to the slag sorting and mechanical treatment facility. The transport of slag to the valorization and seasoning hall will be managed by the DCS system.
- Stage 2
  - The slag will be fed to the crusher by means of loaders. The crusher grinds it to a fraction smaller than 150 mm. The <150 mm slag fraction is transferred to the drum classifier equipped with a sieve with mesh diameter of 40 mm. Once slag is separated in the drum classifier into two fractions with a diameter of 0-40 mm and 40-150 mm, both fractions go into separate magnetic separators. Separators separate ferrous metals from the slag and then they are sent to containers. Further on the 0-40 mm fraction, once ferrous metals are removed from it, is transferred into the vibration classifier where the slag is divided into two fractions with a diameter of 0-8 mm and 8-40 mm. The 0-8 mm fraction that does not contain ferrous metals is placed in a heap in the slag seasoning hall. The 8-40 mm fraction is transferred into the non-ferrous metals separator. Separated non-ferrous metals go into a container. After the separation of non-ferrous metals, the fraction is placed in heaps in the slag seasoning hall.
  - Ferrous and non-ferrous metals will be separated from the 40-150 mm fraction, the unburned parts of the waste will be sent back for incineration, and the non-recoverable slag fraction will be sent to laydown area.
- Stage 3
  - Slag placed in heaps with fractions of 8-40 mm and 0-8 mm will be seasoned in the seasoning hall. Slag, as a solid residue from the process of thermal waste treatment, consists mainly of inflammable substances, water-insoluble

silicates, and aluminum and iron oxides. After the valorization process, the slag will be collected by trucks.

- The slag seasoning process consists in penetration of the air humidity into slag grains, where hydration process takes place. The hydration process consists in binding water to chemical compounds contained in IBA grains. Such a method of slag valorization clearly improves its resistance to leachability of heavy metals, allowing their full recovery outside the plant, for example as aggregate used for road and highway base course in accordance with the Regulation of the Minister of the Environment of May 11, 2015 on waste recovery outside systems and equipment.
- The block diagram of the slag valorization system is shown in the following figure.



PL	EN
Załadunek	Loading
Kruszarka 150 mm	Crusher 150 mm
Sito bębnowe 40 mm	Drum screen 40 mm
Frakcja >40 mm	Fraction >40 mm
Frakcja < 40 mm	Fraction < 40 mm
Separator magnetyczny	Magnetic separator
Separator metali nieżelaznych	Separator of non-ferrous metals
Kontener na metale żelazne	Container for ferrous metals

Kontener na metale nieżelazne	Container for non-ferrous metals
Separacja niespalonych	Separation of unburned elements
Doczyszczanie ręczne	Manual cleaning
Balast obojętny	Neutral ballast
Zwrócenie niedopalonych części z powrotem do procesu spalania	Return of non-combusted parts back to the combustion process
Przesiewacz wibracyjny	Vibrating screen
Pryzma	Heap

Figure 5 Block diagram of a slag valorization plant

5.2.4 Steam turbine system

The WTE Plant will include a condensing-extraction turbine. The turbine will be of single-casing type. It will be coupled with a synchronous generator by means of a gear box. The turbine generator frame will also be provided with an integrated lubricating and jacking oil system together with an oil tank and a set of AC/DC pumps. A hydraulic oil system will be installed in the vicinity of the turbine for the needs of the drives of the main valves of the turbine. The turbine will be equipped with a turning gear.

In order to avoid leakage of steam operating in the turbine, the turbine shaft will be provided with labyrinth glands and gland steam will be supplied. Gland steam will flow to the gland steam condenser cooled with condensate from downstream the main condensate pumps.

The turbine will be supplied with live steam with the following parameters:

- Pressure: 60 barg;
- Temperature: 420°C;
- Flow rate: 28.5 – 110.5 t/h.

Live steam will be supplied to the turbine via a common header from the steam boilers.

The turbine will be protected against excessive pressure increase by means of control valves and a quick-closing valve.

Turbine extractions will supply the intermediate pressure (IP) steam headers and low pressure (LP) steam headers. The extractions will be equipped with non-return flap valves and shut-offs with an electric drive in order to protect the turbine against steam backflow.

These headers may also be supplied directly from the live steam header through dumping stations (separate for the IP and LP header). Steam in the dumping stations will be cooled with feed water collected from the discharge side of the pumps.

Steam from the IP header will supply primary and secondary air preheaters, the deaerator integrated with the feed water tank, reaction chambers in the flue gas cleaning system (activation of recirculated reacting substances) and the peak-load DH exchanger No. 1.

Steam from the LP header will supply the primary DH exchanger and the regenerative LP condensate preheater.

Once steam transfers energy to the turbine, steam will be transferred to the air condenser system. The system will also be equipped with a 100% turbine bypass station to the condenser. The bypass steam will be cooled with condensate from downstream the main condensate pumps.

Steam from downstream the steam turbine or from downstream the bypass station will be transferred to the condenser. Condensate from steam condensation will flow by gravity to the condensate tank. The tank will also collect condensate from the primary and secondary air preheaters, condensate from the gland steam condensation and from downstream the regenerative LP preheater. The condensate from the tank will go to the main condensate pump system, which will be installed directly below it. The pumps will be in a 2 x 100% configuration. The condensate from the pumps will collect heat from steam in the gland steam condenser and in the regenerative preheater. After preheating, it will be combined with the condensate stream from downstream the DH exchangers. Then the total condensate flow will be transferred to the feed water tank together with the deaerator.

The process system described above will enable the following operating modes:

- Condensing operation mode – steam from the boilers will be used exclusively for the generation of electricity; full load, partial load or minimum load operation for the WTE Plant auxiliaries can be distinguished here;
- Operation in cogeneration mode – steam from the boilers will be used for the generation of electricity and heat in the DH exchangers (in this mode, the primary

heat exchanger and peak-load heat exchanger No. 1 are in operation; here we can distinguish operation at full load, partial load or a load such that the turbine generates electricity in the quantity necessary to supply auxiliaries, and the primary and peak-load heat exchangers No. 1 are at rated load;

- Bypass mode with bypass to the condenser – in this mode the system does not generate any energy, it allows for thermal processing of waste without the turbine operation;
- Bypass operation mode with steam bypass to the heating module and the condenser – in this mode, the steam turbine operates at its minimum load in order to supply auxiliaries and, simultaneously, all heat exchangers (primary and peak-load) are operating or the system is completely shut down, and all steam is transferred only to the DH exchangers and the condenser.

The operation and protection of the steam turbine will be managed by the TCS, which will be connected to the DCS.

5.2.5 District heating water system

The district heating water system consists of:

- 3 heating water pumps – 3x50%, where 50% means half of the water flow for 50 MWt of heat in summer conditions,
- Primary heat exchanger of shell and tube type,
- Peak-load heat exchanger of shell and tube type,
- 2 condensate pumps downstream each DH exchanger (2x100% for each heat exchanger),
- Bypass lines for each heat exchanger,
- System for the measurement of the amount of heat transferred to the network and the flow rate to balance the amount of water in the system.

Basically, for cogeneration or bypass operation up to 50 MWt, a primary heat exchanger or primary heat exchanger and peak-load heat exchanger will be used.

The DH exchangers (DH water exchangers) are supplied with steam from turbine extractions or steam from the pressure reducing and cooling station by the IP and LP steam headers.

Cold water from the EC4 district heating network flows into the WTE Plant energy recovery station from the tie-in points in the existing return mains. The heating water pumps inside the building transfer cold water to the basic shell and tube heat exchanger, where the first heating stage is carried out. During normal operation, two water pumps are operating in parallel and the third one is in stand-by mode. Following the first stage, water flows to the peak-load heat exchanger, where the second and final stage of heating in the cogeneration mode takes place. Next, hot water is again transferred via the DN500 pipeline to the EC-4 district heating network upstream the OX-67 valving, or directly to the 2nd delivery header for district heating output to the consumers.

The basic method to control water temperature will be to control the steam pressure with control valving mounted on the pipeline feeding steam to the heat exchanger. The heat exchanger will be equipped with a condensate cooler, a bypass enabling complete shutdown of the heat exchanger and additional water temperature control downstream it. Flow measurements for the purpose of settlement of the heat from the WTE Plant will be installed on the return pipeline maintaining the required straight sections upstream and downstream the flow meter. In addition, a flow meter will be installed on the pipeline for hot water output from the WTE Plant in order to balance the amount of water in the district heating system.

The WTE Plant will be equipped with a dedicated district heating connection to supply heat during the plant shutdown or outage. This connection will be used occasionally, in situations where the WTE Plant is not able to generate heat, e.g. the plant will be completely shut down (emergency or scheduled shutdown). The connection will be made directly at the tie-in to the supply main line to avoid backflow in the main heat output pipelines. To prevent cooling, the pipeline shall be routed in an insulation common with the main pipeline.

The district heating system will meet the technical conditions set out in the Regulation of the Minister of Economy of January 15, 2007, on detailed conditions for the operation of district heating systems.

The make-up of water charge will be the only exception. Any heating water losses in the district heating mains will be made up through the existing EC-4 plants. On the other hand, through the installed waste treatment plant, the WTE Plant will fill the network fragment of the WTE Plant with demineralized water only after longer outages or will make up losses in the internal systems only (on an ongoing basis). This issue will be regulated in the agreement for connection to the district heating system.

When sizing the pipelines supplying cold water to the heating module and removing hot water from the system, the water flow rates and the criterion of keeping the flow rate below 3 m/s were used.

Newly designed district heating pipelines from the WTE Plant to the existing EC-4 mains will be routed as follows:

- at the exit of the energy recovery station facility via the newly designed pipe rack at ≈ +7.5 m towards the air condenser and further northwards to the tie-in points to the existing district heating mains. In the northern location of the WTE Plant, the return cold heating water (tie-in points to the two existing EC-4 mains) and the point of supply tie-in from the WTE Plant will be provided directly to the 2nd EC-4 delivery header for district heating output to the consumers,
- the second supply pipeline (point of supply tie-in from the WTE Plant to the existing EC-4 district heating network) will be routed via a low pipe rack eastwards upstream the OX-67 valving in parallel to the existing DN900 mains. A compensating loop shall be provided above each internal road.

The heating water system operation will be managed by the DCS. The exchange of information between the WTE Plant DCS and the EC-4 CHPP district heating output dispatch center will be ensured.

5.2.6 Air condenser system

The air condenser will be used to condense steam from downstream the turbine or steam from the turbine bypass station. It will be located near the energy recovery station and will be a separate facility. The device will consist of finned tube bundles. The bundles will be arranged in one line. In order to increase the cooling capacity, 4 fans will be installed, the motors of which will be supplied by frequency converters.

Within the pressure range, the condenser will be designed to maintain negative pressure required by the steam turbine at its outlet and to ensure operation in an increased pressure condition when operating with a bypass station.

The operating pressure at the nominal point will be approx. 150 mbar(a). The design pressure of tube bundles will be 0.49 bar(g).

Nominally, the condenser will emit to the environment up to approx. 51 MW.

Negative pressure in the condenser will be generated and maintained by 2x100% vacuum pumps installed inside the combustion station building.

A stream of demineralized water will flow into the condensate stream downstream the condenser from the water treatment plant to make up the steam-water cycle.

The condenser will be equipped with an automatic tube bundle cleaning system. Cleaning will be carried out by spraying demineralized water approx. once a year (depending on the degree of bundle soiling). The condenser structure will be provided with access cages and ladders and service platforms.

The operation of the condenser, including the vacuum maintenance system, will be managed by the DCS.

The following table shows the basic process parameters of the air condenser:

Table 12 Process assumptions for condenser selection

Process assumptions for condenser selection		
Parameter	Unit	Value
Amount of collected heat	MWt	51.00
Steam flow rate	t/h	approx. 93.00
Outlet pressure	mbar(a)	150.00
Steam dryness	%	83.70
Inlet air temperature	ºC	30.00

Process assumptions for condenser selection		
Parameter	Unit	Value
Atmospheric pressure	mbar	992.40
Minimum inlet air temperature	ºC	-20.00

5.2.7 Closed cooling water system

The closed cooling water system will be used to cool auxiliary systems of the boiler and turbine.

Heat will be collected from, i.a., the hydraulic system of grates, other boiler components, oil lubricating the turbine shaft, generator and gearbox, vacuum pumps, water and steam sample coolers, etc.

A system for direct cooling of devices with a non-freezing medium is foreseen. A ready-made 50% solution of propylene glycol in water will be used, containing suitable corrosion inhibitors, operating normally at the temperature down to -35°C.

The cooling system includes a dry mechanical draft cooling tower, cooling agent transfer pump unit, filters, equipment coolers and make-up sub-systems with a storage tank and an expansion vessel.

Water circulation in the cooling circuit is provided by a pump unit (2x100%), with one pump operating permanently during the WTE Plant operation and the other operating as a stand-by pump.

Adequate water distribution through the individual coolers (ensuring proper cooling and similar cooling agent temperature increase) is achieved

by means of control valving on cooler outlets.

The dry mechanical draft cooling tower will be built in a two-section system (2x70%) and will have a nominal thermal power of approx. 2 MW.

Due to the limited space on the plot dedicated to the WTE Plant, the cooler will be placed on the roof of the main control room building.

The closed cooling water system operation will be managed by the DCS.

5.2.8 Compressed air system

The WTE Plant will be equipped with a common compressed air production, conditioning and transport system. Air in this form is necessary for the below purposes:

- C&I purposes such as valve drives,
- Pneumatic transport, blowing, atomization and other needs of boiler systems, flue gas cleaning, turbine and other,
- Service air (e.g. workshop tool drive).

Compressed air will be produced in the compressor station, which will be located in a separate room in the Technical Building.

The compressed air system will consist of:

- Oil-injected screw compressors with air cooling system equipped with motors and inverters – 3 x 50%,
- Adsorption air dryers with “hot” regeneration – 3 x 50%,
- Oil separators,
- Rough, fine and final filters,
- Air tank,
- Compressor ventilation system,
- Compressor master control system,
- Piping and valving.

The parameters of compressed air are presented below:

- The minimum pressure of compressed air depends on the requirements of the individual consumers and should not be lower than 6 bar(g) on the supply side of consumers. It is assumed that the compressors will be able to provide pressure of 10 bar(g) at the Plant output.
- The air purity class should be at least class two according to

- ISO 8573-1, 2001 (pressure dew point = -40°C).

It is estimated that the total maximum needs of all consumers will not exceed approx. 2100 Nm^3/h.

Air from the cooling of compressors can be recirculated to the room to be heated during the winter season. During an outage, water outage heating will be provided to ensure the minimum room temperature required by equipment suppliers during the plant outage.

In summer, for operation with high ambient temperature, a booster FD fan will be installed on the turbine hall roof.

The compressor station operation will be controlled by a dedicated central control system. Information exchange between this system and the DCS will be ensured. From the DCS level it will be possible to change the basic setpoints of the compressed air system (e.g. on/off, pressure setpoint change).

5.2.9 Chemical dosing system

A dosing station is foreseen, comprising:

- sodium phosphate (V) (Na_3PO_4) dosing station with a dosing pump injecting the preparation on the feed water pump discharge side in order to control the boiler water pH value,
- oxygen reducing agent (Elimin-Ox or equivalent) dosing station, with a dosing pump injecting the preparation to the feed water pump suction pipes.

The operation of the chemicals dosing system will be managed by the DCS.

5.2.10 Sampling system

Inside the building of the incineration or energy recovery station, a sampling station will be located, designed to take samples for the analysis of the physical-and-chemical parameters of the following media:

- Feed water,
- Boiler circulating water,
- Superheated steam,

- Saturated steam,
- Condensate from the hot well,
- Condensate from DH exchangers.

Systems for sampling and sample preparation will be executed in compliance with the Polish Standards pertaining to steam and water sampling from tanks and pipelines, as well as with OH&S and UDT (Office of Technical Inspection) regulations.

The sampling system shall operate in tandem with the automatic CCPP start-up and shutdown system.

The sampling station will be equipped with, i.a.:

- valving enabling manual operation in a manner ensuring full functionality of the system in which it is installed,
- type, kind and material performance of valving shall be adjusted to the medium,
- valving of the same type from one manufacturer,
- coolers with the minimum consumption of cooling water (technologically justified),
- compact panel design,
- drains.

In addition, oxygen content and pH value of boiler feed water will be measured continuously.

5.2.11 Water Treatment Plant

The demineralization line will operate based on RO (reverse osmosis) and CEDI electrodeionization, with a nominal capacity of 10.0 m^3/h. The proposed system will consist of two parallel lines ensuring 100% redundancy of processes with the possibility of periodic operation of two lines at the same time. Raw water will be sourced from the municipal network and surface blowdowns from the water-steam system of the boiler in the amount of Q = 14.1 m^3/h.

In the first stage, water will be pre-filtered on two carbon filters operating in parallel. The main task of carbon filters will be to remove free chlorine and other chlorine compounds found in mains water. At the same time, the mechanical impurities contained in raw water will be retained. Next, filtered water will be directed to softeners. The task of the softeners will be to remove from water calcium and magnesium compounds, elements responsible for water hardness. The softener unit will consist of two columns operating alternately (one column is operating, the other, after the regeneration process, is waiting to be put into operation) and a common brine tank. Softeners will produce water with hardness of <0.1 dH. A continuous hardness measurement will be installed downstream the softeners to control hardness of the produced water. The softened water will flow into two buffer tanks, each with a capacity of V = 2.5 m^3. From the buffer tanks, softened water will be fed to the RO units by two pumps operating in a 2x100%Q system. NaOH solution will be dosed to water before it flows to the RO units to correct reaction. This will result in the binding of CO_2 and HCO_3 contained in the treated water, which could adversely affect the CEDI system. At the same time, it will allow for obtaining the required pH value of the produced demineralized water.

Such prepared water will flow onto the 1st stage RO (reverse osmosis) membranes, on which initial water demineralization will take place. The RO system will consist of two RO units, each with a capacity of 10.5 m^3/h. The reverse osmosis system continuously produces 2 water streams. One of them, the permeate, is a stream of water almost completely desalinated. The second, the concentrate, is a wastewater in which ionic compounds removed from permeate are concentrated.

On RO membranes, water conductivity will be reduced to approx. 3 μS/cm. These membranes capture ionic pollutants. The 1st stage RO permeate will be transferred to the buffer tank with a capacity of V = 7.5 m^3. In order to limit the amount of wastewater discharged from the treatment plant, the concentrate from the 1st stage RO will be transferred to the buffer tank with a capacity of V = 2.0 m^3, from where it will be supplied to the 2nd stage RO unit using a pump system. The 2nd stage RO unit is designed to concentrate further the stream of the discharged concentrate and water recovery. The 1st stage RO unit will produce a stream of concentrate in the amount of approx. 3.5 m^3/h. From this stream, the 2nd stage RO unit will produce approx. 2.4 m^3/h of permeate and 1.1 m^3/h of concentrate. The 2nd stage RO permeate will be also transferred to the buffer tank with a capacity of V = 7.5 m^3, in which it will be mixed with the 1st stage RO permeate. The 2nd stage RO concentrate will be, however, transferred directly to the industrial wastewater drainage system.

The pre-demineralized water, being a mixture of permeates from both RO stages, will be transferred to the CEDI electrodeionization system, where the final water demineralization will take place. Continuous electrodeionization (CEDI) is a continuous process used to produce ultra-pure water using ion-selective membranes, ion-exchange resins and electric current. A direct current (DC) electrical potential removes ions from the feed water with continuous resin regeneration (in CEDI stacks, the ions that have passed through RO membranes due to slippage, are exchanged for hydrogen and hydroxyl ions).

The CEDI system is a device that produces water of the desired and predictable quality, removing more than 99% of salts, with proper conductivity of feed water flowing from the reverse osmosis (RO) of less than 50 μS/cm.

The nominal capacity of each CEDI line is 10.0 m^3/h.

After complete demineralization, water treated by the CEDI system (diluate) will be collected in the demineralized water retention tank with a capacity of V = 90 m^3, and then transferred to the plant.

The resulting CEDI concentrate will be transferred to softened water tanks for reuse.

In order to maintain the required quality parameters of demineralized water, it will be necessary to equip the water tank with a CO_2 absorber and an anti-bacterial filter.

5.3 Architecture

5.3.1 Waste collection and temporary storage station

<u>Gatehouse and weighing station</u>

The gatehouse building will house rooms for the work of security personnel, pedestrian and cargo traffic entering the premises (1 person on a 12-hour shift), as well as 2 persons (BDO Specialists) on the 1st shift. A working room and staff welfare and sanitary rooms will be provided, in a number consistent with occupational health and safety and sanitary regulations. Access to sanitary and welfare rooms will be provided (on the ground floor of the administration and welfare building at a distance compliant with OH&S regulations) also for car drivers arriving from outside. In the building, records of the weighed vehicles (at the entrance/exit) will be kept and detection of the potential content of radioactive elements in the load will be checked.

The CCTV system will allow for monitoring of gates, entrance wicket, barriers, scales and vehicle traffic by ensuring an appropriate location of the gatehouse at the entrance and exit gate, and the use of glazing in the eastern, northern and southern parts of the building. Entrance to the gatehouse – from the south of the building. The weighbridges will be located directly next to the gatehouse. Two above-ground weighbridges, basins and weighbridge platforms made of reinforced concrete resistant to environmental impacts are envisaged.

On the northern wall of the gatehouse building, from the side of ul. Jadzi Andrzejewskiej, there will be a board displaying the current level of emission from the WTE Plant.

Unloading hall

The unloading hall will protect the zone of waste unloading into the bunker. It will be equipped with two external gates: entrance and exit gates. Inside, five stations for unloading trucks into the bunker, closed by remote-controlled (manually controlled) gates, are envisaged. There will be designed a zone for a group of visitors to the waste unloading area, accessible from the outside. In the hall, there will be a separate lockable concrete room intended for isolation and storage of radioactive materials detected during the collection of waste transport for the time of conducting the neutralization procedure for these substances.

Waste bunker

The bunker with a capacity ensuring the supply of waste for process purposes will be equipped with 2 overhead cranes on one truck substructure. It has been envisaged to provide the possibility of parking the overhead cranes in emergency situations, to provide stowage and overhaul stations for grabs, as well as the possibility of collecting, for overhaul purposes, large units from outside of the bunker from the level of the internal access road.

Closing elements of openings of the unloading stations, separating the space between the hall and the bunker, in the form of automatically controlled gates closing the openings in the bunker wall. Two of the gates, on the opposite side of the Control Room (with specified flame resistance rating), will be lockable and it will be possible to fill them up with waste in order to ensure the required retention. The other three gates will be roll-up or sectional gates with specified fire resistance rating.

Air supply openings with louvers will be provided in the bunker walls. The steel platform above the gates will provide access to ventilation equipment mechanisms. Process building

The facility will be a part of the waste-to-energy building and the enclosure for the incineration section, the flue gas cleaning and exhaust station, energy recovery station, the main control room and the laboratory.

Incineration station including incineration building

The incineration building included in the process building will constitute a part of the process building and will be an enclosure of two boilers connected to the remaining parts and stations of the process building.

Flue gas cleaning station

Functions related to flue gas cleaning, analysis and discharge will be performed in the building. The stack will discharge the treated flue gases. A container – CEMS station – will be designed near the stack.

Energy recovery station

According to the function of the installed process equipment.

Main control room, laboratory

Most of the building will be occupied by electrical systems (LV and MV substations, transformers) and DCS cabinets.

The control room will be located at a level of hoppers so that the crane operator will be able to observe the bunker. A separate zone of seats for overhead crane operators will be designed directly inside it, with an inspection window enabling to observe the bunker interior. The control room will be air conditioned. The inspection window of overhead crane operators will allow them to directly observe waste being collected and the entire bunker space. Observation will also be done using the CCTV system on monitors.

The control room will be communicated through a stair tower allowing access through the incineration station with the bunker in the area of the loading hoppers and to the openings in the ceiling at their level for inspection purposes and when servicing grabs or overhead cranes.

In the vertical circulation route, there will be an aerated exit staircase and cargo and passenger elevator with fire atria, service and ventilation shafts.

On the adjacent levels, there will be staff welfare and sanitary rooms for employees of that building, as well as a server room and automation cabinet rooms.

Administration and staff welfare part

The administration and staff welfare building will be used for office employees and as staff welfare rooms for some of those employed in the WTE Plant in office positions and on the ground floor for external drivers. The building will also house a conference room for 20 people. It will be possible to show multimedia presentations for groups visiting the WTE Plant. The building will be suitable for the employment of a disabled person to perform office work (the building will be equipped with a passenger elevator for the disabled, a toilet for the disabled on each floor, a parking space at the main entrance to the building with dimensions as for the disabled). The building also provides for a part of open space offices on the first floor for the office function, enabling arrangements made according to current needs of the WTE Plant, including staff welfare rooms.

5.3.2 Process residue management station

Slag valorization hall

According to the adopted technology. A permanent workplace is not assumed. Automated process.

Sanitary facility intended for yard workers (e.g., loader operators) is assumed in the building.

Slag seasoning hall

The hall function according to the technology.

Storage facilities

A storage and workshop hall, with the possibility of garaging the means of site transport with sanitary appliances.

5.3.3 Condenser

According to the process function.

5.3.4 WTP – Water Treatment Plant

The building encloses the process equipment used for preparing demineralized water. Demineralized water will be stored in a dedicated tank located outside the building.

5.3.5 Power generating unit

A container structure (with an integrated day consumption tank), foundation on a reinforced concrete slab.

5.3.6 Technical building

The building will house a compressor station and a fire-separated fire-fighting equipment room, including a foam-forming agent tank.

5.3.7 Transformer station

The free standing oil-filled transformer will be placed in a sump and will be enclosed by a system fence with a steel woven mesh gate in system spans.

At the current stage of design works, it is assumed that an oil-filled transformer will be enclosed as it is a less favorable option in terms of the environment and fire protection.

5.3.8 Oil tank and pumping station

The light oil unloading and storage station will consist of an underground, double-shell light oil tank, a single-story oil pumping station building with process equipment for refueling and pumping it, and a reinforced concrete tray with slopes, connected to the drainage system through a separator.

The storage of light oil for auxiliary burners.

5.3.9 Fire water tank and pumping station.

A typical overground tank on a foundation slab will be used.

The fire protection pumping station is designed as an overground container facility, a single-story building with a steel structure in sandwich panel cladding.

For outdoor and indoor firefighting.

5.3.10 Noise barriers

Noise barriers are designed along the northern boundary of the site:

- The barrier is 8 m high and approximately 52.1 m long. Barrier of WTE Plant 1,
- The barrier is 5 m high and approximately 36.8 m long. Barrier of WTE Plant 2,
- The barrier is 2 m high and approximately 22.2 m long. WTE Plant 3.

The approximate location of the barrier is indicated by the above names and magenta color in Figures 10 and 11 of Appendix 2. The barriers should feature the insulation class B3 (PN-EN-1793-2) and the absorption class A4 (PN-EN-1793-1).

5.3.11 Fencing

The plant site will be fenced with a complex, system segmental fence (galvanized coated fence panels, wire thickness ø5.0 mm / fence height min. 2.03 m (mesh size 50x200 mm). The fence will be equipped with sliding/swing entrance gates, depending on the location. Manual and/or remote control

Steel fence posts set on prefabricated foundations.

5.3.12 Pipe rack

Between the energy recovery station and the air condenser, a two-level pipe rack will be placed for external process pipelines (including turbine outlet steam, condensate pipeline and thermal power output pipelines from the WTE Plant, demineralized water pipeline). The expected pipe rack levels are about +10.0 m and about +21.0 m above the ground level.

5.4 Utilities

5.4.1 Demineralized water

Demineralized water will be used for filling and making up the water-steam cycle, filling the internal heating water system and filling and making up any cooling water losses. It will be produced in a dedicated water treatment plant located on the premises of the WTE Plant.

The parameters of the demineralized make-up water will comply with the VGB-R 450 L standard for the quality of feed water, boiler water and steam for utility and industrial power plants:

Table 13 Parameters of demineralized make-up water

Parameter	Unit	Value
pH	-	7.0
Conductivity	µS/cm	< 0.2
SiO_2 content	µg/kg	< 20
Iron content	µg/kg	<10.0
Copper content	µg/kg	< 1.0

In turn, the table below shows the water balance for the dimensioning of the water treatment plant process lines. It is assumed that the water treatment plant will be provided with two fully redundant process lines.

Table 14 Demineralized water balance

	Target	Water quality	Stream [m^3/h]	Frequency of intake
1	Make-up of the water-steam cycle (max. approx. 2.7% of the steam flow rate)	demineralized	3	Permanent intake
2	Boiler cleaning	demineralized	0.8	Periodic intake – several times a month for several hours
3	Steam for activation of recirculated reacting substances in the desulfurization process	demineralized	0.3	Permanent intake

	Target	Water quality	Stream [m³/h]	Frequency of intake
4	Water for dissolving carbamide in the SNCR denitrification process	demineralized	0.165	Permanent intake
5	Water sampling	demineralized	0.2	Permanent intake
6	Power reserve	demineralized	5	-
7	Heating water make-up (filling the plant)	demineralized	5	Periodic intake – only at the time of filling the plant
8	**Total demineralized water (sum of rows 1-6)**	**demineralized**	**9.465**	
9	**Total heating water (row 7)**	**demineralized**	**5**	

Heating (demineralized) water for filling the plant will additionally meet the requirements listed in the table below.

Table 15 Requirements for make-up water for heat for district heating purposes

Parameter	Unit	Value
Total hardness	German deg.	≤ 0.05
p alkalinity	mval/dm³	≤ 0.5 – 1.0
m alkalinity	mval/dm³	≤ 2.5
O_2 oxygen content	µg/kg	≤ 0.05
SO_3^{2-} sulfate content	µg/kg	3 - 5
Chloride content	µg/kg	≤ 600
Oil content	µg/kg	≤ 1
Other	According to PN-85/C-04601	

5.4.2 Potable water

Potable water will be taken from the municipal water supply network owned by Zakład Wodociągów i Kanalizacji Sp. z o.o. in Łódź (hereinafter referred to as ZWIK).

The potable water will be used for process, water treatment plant, sanitary and personnel use purposes, and for safety showers and emergency eye washers. The potable water system will also supply the fire water tank.

The total demand for potable water for the above mentioned purposes is ~10.00 dm^3/s (36.0 m^3/h)

Table 16 Parameters of water from municipal network

Item	Parameter	Unit	Value in Łódź water
1	Color	mg/l	Acceptable by consumers and without abnormal changes
2	Turbidity	NTU	below the limit of detection <0.20 ÷ 0.55 (Acceptable by consumers and without abnormal changes)
3	Hydrogen ion concentration (pH)	-	7.0 ÷ 7.4
4	Electrical conductance	µS/cm	386 ÷ 425
5	Odor	-	Acceptable by consumers and without abnormal changes
6	Taste	-	Acceptable by consumers and without abnormal changes
7	Ammonium ion	mg/l	below the limit of detection <0.06
8	Nitrates	mg/l	0.86 ÷ 3.2
9	Nitrites	mg/l	below the limit of detection <0.04
10	Total iron	µg/l	below the limit of detection <20 ÷ 33
11	Manganese	µg/l	below the limit of detection <20 ÷ 21
12	Aluminum (Al)	µg/l	below the limit of detection <20
13	Permanganate index	mg/l	below the limit of detection <0.50 ÷ 1.3
14	Free chlorine dioxide (ClO_2)	mg/l	below the limit of detection <0.020 ÷ 0.251
15	Total free chlorine and chlorine dioxide	mg/l	0.25 ÷ 0.40
16	Σ chlorates and chlorites	mg/l	0.197 ÷ 0.477
17	Calcium	mg/l	71 ÷ 75
18	Magnesium	mg/l	5.3 ÷ 7.3
19	Hardness	$mgCaCO_3/l$	203 ÷ 214
20	Hardness	dH	11.4 ÷ 12.0
21	Hardness	mval/l	4.06 ÷ 4.28

Item	Parameter	Unit	Value in Łódź water
22	Hardness	mmol/l	2.03 ÷ 2.14
23	Carbonate hardness	$mgCaCO_3/l$	182 ÷ 187
24	Escherichia coli	jtk/100 ml	0
25	Coliform bacteria	jtk/100 ml	0
26	Enterococcus	jtk/100 ml	0
27	Clostridium perfringens including spores	jtk/100 ml	0
28	Total number of microorganisms in 22±2°C	jtk/1 ml	without abnormal changes
29	Total organic carbon (TOC)	mg/l	without abnormal changes
30	Fluorides	mg/l	0,11 ÷ 0,17
31	Chlorides	mg/l	9,5 ÷ 11,0
32	Sulfates	mg/l	20 ÷ 27
33	Cyanides	µg/l	below the limit of detection <20.0
34	Boron	mg/l	below the limit of detection <0.10
35	Antimony	µg/l	below the limit of detection <1.0
36	Arsenic	µg/l	below the limit of detection <1.0
37	Chromium	µg/l	below the limit of detection <2.0
38	Zinc	mg/l	0.002 ÷ 0.007
39	Cadmium	µg/l	below the limit of detection <0.3
40	Copper	mg/l	below the limit of detection <0.004
41	Nickel	µg/l	below the limit of detection <4.0
42	Lead	µg/l	below the limit of detection <2.0
43	Mercury	µg/l	below the limit of detection <1.0
44	Selenium	µg/l	below the limit of detection <1.0
45	Sodium	mg/l	4.91 ÷ 6.21
46	Potassium	mg/l	1.02 ÷ 1.24
47	Silver	mg/l	below the limit of detection <0.001
48	Trichloromethane (chloroform)	mg/l	0.0009 ÷ 0.0149
49	Bromodichloromethane	mg/l	0.0022 ÷ 0.0039
50	Bromoform (tribromomethane)	µg/l	below the limit of detection <0.10
51	Dibromochloromethane	µg/l	0.16 ÷ 1.23

Item	Parameter	Unit	Value in Łódź water
52	Total trihalomethanes Σ THM	µg /l	1.6 ÷ 19.1
53	Benzene	µg/l	below the limit of detection <0.10
54	1,2-dichloroethane	µg/l	below the limit of detection <0.10
55	Trichloroethylene	µg/l	below the limit of detection <0.10
56	Tetrachloroethylene	µg/l	below the limit of detection <0.10
57	Σ trichloroethylene and tetrachloroethylene	µg/l	below the limit of detection of parameters from items 55–56
58	Σ pesticides	µg/l	below the limit of detection <0.020
59	Benzo(a)pyrene	µg/l	below the limit of detection <0.00078
60	Benzo(b)fluoranthene	µg/l	below the limit of detection <0.00090
61	Benzo(k)fluoranthene	µg/l	below the limit of detection <0.00102
62	Benzo(ghi)perylene	µg/l	below limit of detection| <0.00104
63	Indeno(1,2,3-cd)pyrene	µg/l	below the limit of detection <0.00107
64	Σ Polycyclic aromatic hydrocarbons	µg/l	below the limit of detection of parameters from items 59–63

(1) – not more than 30 mg/l of magnesium if the sulfate concentration is equal to or higher than 250 mg/l. At a lower sulfate content, the permissible magnesium concentration is 125 mg/l; a value recommended for health reasons means that it is desirable for human health, but does not impose an obligation for plumbing companies to make up the minimum content.

5.4.3 Fire water

The external in-house fire protection system will be made as an external loop network. Above-ground DN100 cast iron fire hydrants with protection in case of breaking will be installed on the external system, spaced not more than 150 m apart. The external system will also supply internal water and water-foam fire protection systems located in the designed buildings and facilities. The external fire protection system loop will be supplied from the fire water pumping station operated together with the above-ground fire water tank with a capacity of V = 1300 m^3. The tank will be located near the access road, so as to enable access by the Fire Service vehicles, and will be equipped with a water intake point for the State Fire Service (SFS) vehicles. The tank will be supplied from the external potable water network. The total fire water demand, taking into account the water demand for outdoor fire-fighting for 4 hours and the total water demand for fire protection systems for 2 hours, as well as the water reserve of 100 m^3 to supply the fire water supply system in the tall building, is 1300 m^3 in the fire water tank, with a minimum capacity of min. 132 dm^3/s.

5.4.4 Washing water

It is envisaged to use rainwater from the roof part of the process building as much as possible for washing the floors.

Average water consumption for washing purposes is 10 – 20 dm^3/m^2 (depending on soiling).

5.4.5 Heating water

Heating water is a medium that transfers heat generated by the WTE Plant to consumers through the district heating network. Demineralized water is used as the medium. In order to integrate the WTE Plant into the district heating network, it is envisaged to connect the heating module of the plant with the network through two pipelines – a return (“cold”) water and a feed (“hot”) water pipeline. The internal heating water system of the WTE Plant will be filled from the newly built Water Treatment Plant. On the other hand, the current make-up of heating water losses will be provided from the existing EC-4 systems. Therefore, the WTE Plant will not be equipped with a system for making up the losses of at least 2% of the heat carrier flow rate required by the Regulation of the Minister of Economy of January 15, 2007 on detailed conditions for the operation of district heating systems. An appropriate agreement will be concluded between the WTE Plant Investor (Veolia Nowa Energia Sp. z o.o.) and the district heating network operator (Veolia Energia Łódź S.A.) under the District Heating Network Connection Agreement.

Pipelines for heat output from the WTE Plant (supply and return pipelines) connecting the WTE Plant heating module with the main lines of the district heating network of the EC-4

Combined Heat and Power Plant in Łódź should be designed taking into account the values of temperature, pressure and flow rate that may occur in the system.

The basic parameters of heating water in the district heating system in Łódź supplied with heat from EC-4 are as follows:

- pressure in the city delivery headers of 0.8–1.35 MPa(g),
- pressure at the WTE Plant outlet of min. 0.85–1.4 MPa(g)
- minimum pressure in the return headers of 0.2 MPa
- heating water design temperature (compliant with the control parameter table – Table 17 District heating network control table):
    - supply temperature: 123°C/70°C,
    - return temperature: 70/45°C;
- Water flow from the WTE Plant (depending on the load and season): 242 – 2626 t/h.

Table 17 District heating network control table

Ambient temperature	Supply temperature	Return temperature
°C	°C	°C
12.0	70	45
11.0	70	45
10.0	70	45
9.0	70	45
8.0	70	45
7.0	70	45
6.0	70	45
5.0	70	45
4.0	71	46
3.0	74	47
2.0	76	49
1.0	78	50
0.0	80	51
-1.0	82	51
-2.0	84	52
-3.0	86	53
-4.0	88	53
-5.0	89	54

Ambient temperature	Supply temperature	Return temperature
-6.0	91	55
-7.0	93	55
-8.0	94	56
-9.0	96	57
-10.0	98	58
-11.0	100	58
-12.0	101	59
-13.0	103	60
-14.0	106	61
-15.0	108	62
-16.0	110	63
-17.0	113	65
-18.0	116	66
-19.0	119	68
-20.0	123	70

5.4.6 Heating water

Part of the stream of water heated in the heating module of the WTE Plant will be transferred to the WTE Plant auxiliaries station. The water after dissipating heat in the station will be transferred by the circulating pump to the pipeline supplying the WTE Plant with return water.

If it is not possible to generate heat in the WTE Plant, it is planned to supply heat for auxiliaries directly from the delivery mains in the EC-4. A pipeline for these purposes will be run in the delivery pipeline line to evacuate heat from the WTE Plant. The auxiliary pipeline will run inside the insulation of the delivery pipeline, allowing it to be heated and thus protected from freezing during periods when it is not in use.

5.4.7 Oils and lubricants

Various types of oils and greases will be used in the WTE Plant. Due to the specificity and individuality of the selection of oils and greases, their types and quantities will depend on the supplier of the main process equipment. The basic systems in the WTE Plant facility will comprise steam turbine oil system (lubricating and hydraulic oil) and grate system (hydraulic oil). The estimated amount of oil in the turboset oil system is, depending on the turbine supplier, approx. 10 m^3 for the lubrication system, and approx. 1 m^3 for the hydraulic system. In the case of the grate, the hydraulic oil volume will be approx. 1.5 m^3/grate.

Start-up fuel

For the purpose of the supply of burners supporting the operation of boilers during start-up and to stabilize the furnace temperature, light fuel oil will be used according to PN-C-96024 “Petroleum products. Fuel oil”.

Diesel generator set

For the purpose of diesel generator set and fire water pumps, diesel oil will be used, which will meet the requirements for the “standard” fuel oil in accordance with the Regulation of the Minister of Economy of October 9, 2015 on the quality requirements for liquid fuels (Journal of Laws of 2015, item 1680, as amended).

5.4.8 Industrial gases

Technical gases will be used in the WTE Plant for the purposes as below:

- inert gases to neutralize the atmosphere inside individual chambers and hoppers of the bag filters and silo in case of activated carbon smoldering
- calibration gases necessary for the operation of the continuous exhaust gas monitoring system (CEMS).

5.4.9 Power supply

The basic power supply for auxiliaries will be provided from the branch of the power output busbar. 6.3kV electricity will supply the main MV switchgear. This switchgear supplies the main process switchgear through 6.3/0.4 kV transformers, and through inverter transformers and inverters – the largest process consumers.

Back-up power supply for the CCPP auxiliaries will be provided from the existing CCPP, from the PR-2 switching station with a 6.3kV cable line.

Emergency power supply for the CCPP auxiliaries will be provided by a container-mounted power generating unit. The emergency power generating unit will enable safe stopping of the plant in the case of power outage in the basic and back-up circuit. It is not planned to start up the plant without a back-up power source (black-start).

5.5 Fire hazard characteristics

The thermal processing of waste takes place without using flammable materials which belong to the group of fire hazardous materials as defined in § 2 section 1 point 1 of the Regulation of the Minister of Interior and Administration of June 7, 2010 on fire protection of buildings, other civil structures and sites (Journal of Laws No. 109, item 719 of 2010).

<u>Waste</u>

Due to the nature of the WTE Plant, the main flammable material present on the site is the non-recyclable refuse-derived energy fraction from municipal waste with a nominal net calorific value of approx. 12.5 MJ/kg.

In the waste bunker, waste will be stored and transported by means of grippers to the boiler grate waste feed hopper. The bunker space will be equipped with a detection system using thermal imaging cameras conducting continuous temperature analysis of the waste stack and water and foam cannons. The water and foam cannons will be activated automatically by a signal from the fire alarm system initiated by thermal imaging detection system at an early stage of a waste fire. There will also be a possibility of manual control of the water and foam cannons from the control center from the control room with the overhead crane operator stations.

The volume of waste in the bunker is estimated to be about 11500 m^3.

<u>Light fuel oil</u>

Light fuel oil meeting the requirements of the PN-C-96024 standard, stored in the underground tank constructed as part of the project in the volume of 71 tons, will be used as start-up fuel for the boiler.

Light fuel oil has its flash point higher than 55°C and the gross calorific value of approx. 43 MJ/kg, and falls under Class III petroleum products.

According to the Regulation of the Minister of Economy of November 21, 2005 on technical requirements to be met by liquid fuel bases and stations, long-distance transfer pipelines for crude oil and oil products transport and their location (consolidated text: Journal of

Laws of 2014, item 1853, as amended) – the Diesel oil being used with the flash point above 55°C falls under Class III petroleum products. According to the annex to the aforementioned Regulation – explosion hazard zones are identified only for process equipment intended for storage and distribution of crude oil and petroleum products of Classes I and II.

Diesel oil

For the Diesel generator set and as fuel for vehicles used on the premises of the Plant, Diesel oil will be used which will meet the requirements for "standard" Diesel oil in accordance with the Regulation of the Minister of Economy

of October 9, 2015 on quality requirements for liquid fuels

(Journal of Laws of 2015, item 1680).

Diesel oil has its flash point above 55°C and the gross calorific value of approx. 44 MJ/kg.

According to the Regulation of the Minister of Economy of November 21, 2005 on technical requirements to be met by liquid fuel bases and stations, long-distance transfer pipelines for crude oil and oil products transport

and their location (consolidated text: Journal of Laws of 2014, item 1853, as amended) – the Diesel oil being used with the flash point above 55°C falls under Class III petroleum products. According to the annex to the aforementioned Regulation – explosion hazard zones are identified only for process equipment intended for storage and distribution of crude oil and petroleum products of Classes I and II.

Other oils and greases

Various types of oils and greases will be used on the premises of the project.

The primary systems at the Energy Recovery Station will be the turbine and generator oil systems. Turbine oil has the gross calorific value of approx. 42 MJ/kg, the flash point of over 180°C and the density of approx. 875 kg/m^3.

Hydraulic oil in the hydraulic system has the gross calorific value of approx. 43 MJ/kg, the flash point of over 230°C and the density of approx. 879 kg/m^3.

The estimated amount of oil in the turboset oil system is, depending on the turbine supplier, approx. 10 m^3 for the lubrication system, and approx. 1 m^3 for the hydraulic system. In the case of the grate, the hydraulic oil volume will be approx. 1.5 m^3/grate.

5.6 Road infrastructure

Transport service for the planned Waste to Energy Plant (WTE Plant) facility will be provided from Jadzi Andrzejewskiej street. In the first stage, access will be provided at the existing entrance used for the EC-4 Combined Heat and Power Plant at Veolia Energia Łódź S.A., with the existing internal roads. The target access, subject to a separate procedure, will be provided by the designed access road connecting Jadzi Andrzejewskiej street directly to the entrance to the premises of the WTE Plant.

The designed road system on the WTE Plant premises provides proper service to individual facilities.

Parking spaces are provided in the area of the administration building. A total of 6 parking spaces including 1 for a disabled person’s vehicle are provided.

On the WTE Plant premises, it is planned to design an educational path that will allow for safe sightseeing of the facility.

<u>Fire roads</u>

Pursuant to chapter 6 of the Regulation of the Minister of Interior and Administration of July 24, 2009 on fire water supply and fire roads, the designed facility will include fire roads adapted to the needs of fire protection units, that also meet the process requirements of facility operation.

Fire roads will meet the following requirements:

- its width will be no less than 4 m, and its longitudinal gradient should not exceed 5%;
- the closer edge of a fire road will be no less than 5 m away from the wall of the protected building and no more than 25 m for PM facilities, and no more than 15 m for facilities with a human risk category;
- load capacity of a road at least 100 kN/axle;
- outer radii of a road curve will not be less than 11 m;

- viaducts, trestles, passages and other similar equipment or fixed elements located above fire roads shall have a clearance with the height
- and width of no less than 4.5 m.

5.7 External water supply, sewerage and fire protection systems

5.7.1 External water supply system

The external in-house potable water system will supply water for process, water treatment plant, sanitary and personnel use purposes, and for safety showers and eye washers. The potable water system will also supply the fire water tank.

Potable water will be drawn from the municipal water supply network which is owned by Zakład Wodociągów i Kanalizacji Sp. z o.o. (hereinafter ZWiK) according to the issued technical requirements for the connection to the municipal water supply and sewerage network for plot No. 56/222 at Andrzejewskiej street in Łódź of Waste to Energy Plant, ref. No.: WTT.424.1589.2020/W/SZ of June 24, 2020. Available pressure at the tie-in point (according to the information obtained from ZWiK) is approx. $p_{avail.}$ 0.23 – 0.28 MPa and is insufficient for the needs of the Plant. Therefore, in order to ensure the required pressure at each water intake point, a pressure boosting unit will be located on the premises of the Waste to Energy (WTE) Plant, which will increase the pressure to 0.6 MPa.

The external in-house potable water system will be made of PE100 SDR17 pipes and fittings designed for PN10 pressure, with the diameter of Dy160 – Dy40, joined by butt welding or electrofusion couplings and couplers. The pipelines must be laid in dry excavations, on specially prepared and reinforced subsoil. Pipe laying, bedding, sidefilling and backfilling must be carried out in accordance with the instructions given by the pipe manufacturer. The external network will be equipped with soft-sealed, flanged, 1.0 MPa shut-off gate valves with an extended stem, casing and valve box. All materials and ready-made components to be used for the external potable water system will comply with local and environmental conditions and currently applicable standards and regulations. Prior to handing over the pipelines for operation, leakproof tests, flushing and disinfection must be performed.

5.7.1.1 Potable water balance

Calculation of potable water demand for welfare purposes resulting from employment

- $n = 44$ – number of people employed on the WTE Plant site,
- $n_1 = 37$ – number of technical workers using showers,
- $q_1 = 120$ dm^3/person/day – average unit consumption for personnel using showers,
- $q_2 = 30$ dm^3/person/day – average unit consumption for the remaining personnel,
- $n_2 = 7$ – number of technical workers not using showers,
- $Q_{d\ avg}$ – average daily water consumption.

$Q_{d\ avg} = n_1 \times q_1 + n_2 \times q_2 = 37 \times 120 \times 10^{-3} + 7 \times 30 \times 10^{-3} = 4.65$ m^3/d

- $Q_{d\ max}$ – maximum daily water consumption

$Q_{d\ max} = Q_{d\ avg} \times N_d = 4.65 \times 1.2 = 5.58$ m^3/d

where: N_d – daily minimum/maximum demand ratio

- $Q_{h\ avg}$ – average hourly water consumption

$Q_{h\ avg} = Q_{d\ max}/24 = 5.58/24 = 0.23$ m^3/h

- $Q_{h\ max}$ – maximum hourly water consumption

$Q_{h\ max} = Q_{h\ avg} \times N_h = 0.23 \times 1.5 = 0.35$ m^3/h

where: N_h – hourly minimum/maximum demand ratio

Calculation of potable water demand for welfare purposes resulting from sanitary appliances

Table 18 List of sanitary appliances

Type of draw-off outlet	Connection diameter	Quantity of appliances	Hot and cold water	
			Normative outflow [dm^3/s]	Total outflow [dm^3/s]
showers	15	5	0.30	1.50
wash basins	15	42	0.14	5.88
toilet	15	21	0.13	2.73
sinks	15	9	0.14	1.26
dishwasher	15	1	0.14	0.14
fume cupboard	15	1	0.14	0.14

urinals	15	6	0.30	1.80
Total for all facilities:				**11.95** (excluding showers)

To determine the design flow intensity, it was assumed that 100% of the showers would be active simultaneously. $\Sigma qn < 20$ dm^3/s was determined for the remaining sanitary appliances as for the office and administration building.

$\Sigma qn = 11.95$ dm^3/s excluding showers calculated at 100%, simultaneous flow intensity

$q = 0.682 \times (\Sigma qn)^{0.45} - 0.14$

$q = 0.682 \times (11.95)^{0.45} - 0.14 = 1.94$ dm^3/s + 1.5 dm^3/s (for showers) = 3.44 dm^3/s

<u>Potable water demand for process purposes</u>

- $Q_{tech.max}$.=26.0 m^3/h – maximum hourly demand for process purposes;
- $Q_{tech.s}$ = 6.5 dm^3/s – demand for process purposes – seconds.

<u>Potable water demand for fire water tank filling purposes</u>

- Q_{tech}=13.5 m^3/h – demand for fire water tank filling purposes

Water intake for other purposes is not assumed when filling the fire water tank.

<u>Potable water demand for safety showers and emergency eye washers</u>

Only one safety set is assumed to be in operation at a time, for which the water demand is approximately 1.67 dm^3/s.

Since this is only emergency consumption, it is not included in the overall water balance.

<u>Total demand for potable water</u>

The total demand for potable water is:

- Q_{sum} = 3.44 dm^3/s (demand for potable water resulting from sanitary appliances) + 6.5 dm^3/s (demand for process purposes) = 9.94 dm^3/s (10 dm^3/s assumed)

5.7.2 External fire protection system

The external in-house fire protection system will be made as an external loop network. Above-ground DN100 cast iron fire hydrants with protection in case of breaking will be installed on the external system, spaced not more than 150 m apart. Upstream the hydrants, shut-off gate valves and pressure reducers will be installed in dedicated manholes to maintain appropriate pressure upstream the hydrant. The external system will also supply internal water and water-foam fire protection systems located in the designed buildings and facilities. The external fire protection system loop will be supplied from the fire water pumping station operated together with the above-ground fire water tank with a capacity of V = 1300 m^3. The tank will be located near the access road, so as to enable access by the Fire Service vehicles, and will be equipped with a water intake point for the State Fire Service vehicles. The tank will be supplied from the external potable water network.

Underground pipelines of fire fighting system will be made of pipes and fittings from PE100 SDR11 of Dy355 – Dy110 diameter for pressure PN16 connected by butt welding or couplings and electrofusion coupling. The pipelines must be laid in dry excavations, on specially prepared and reinforced subsoil. Pipe laying, bedding, sidefilling and backfilling must be carried out in accordance with the instructions given by the pipe manufacturer. The external fire protection system will be equipped with soft-sealed, flanged, 1.6 MPa shut-off gate valves with an extended stem, casing and valve box. Support blocks must be used for system appurtenances. The designed external system will be provided with drains at the lowest points. Prior to handing over the pipelines for operation, leakproof tests and flushing must be performed.

The external fire fighting system and all its parameters will be designed

and executed in accordance with the Act of August 24, 1991 on fire protection, the Regulation of the Minister of Interior and Administration of June 7, 2010 on fire protection of buildings, other civil structures and areas and in accordance with the Regulation of the Minister of Interior and Administration of July 24, 2009 on fire water supply and fire roads.

5.7.2.1 *Fire water demand*

In order to determine the required amount of water for firefighting purposes, fire zones affecting the determination of the highest required amount of water for firefighting purposes were analyzed.

The total fire water demand, taking into account the water demand for outdoor fire-fighting for 4 hours and the total water demand for fire protection systems for 2 hours, as well as the water reserve of 100 m^3 to supply the fire water supply system in the tall building, is 1300 m^3 in the fire water tank, with a minimum capacity of min. 132 dm^3/s.

5.7.3 External sanitary sewerage system

The external sanitary sewerage system will receive gray and black water from sanitary and social fixtures.

Sanitary sewage will be gravitationally directed to the sanitary sewage pumping station marked on the plan as PS, from where it will be pumped to a sanitary manhole on the city sanitary foul sewer D = 0.50 m in ul. Puszkina (plot reg. No. 12/31) according to the issued technical requirements for the connection to the municipal water supply and sewerage network for plot No. 56/222 at Andrzejewskiej street in Łódź of Waste to Energy Plant, ref. No. WTT.424.1589.2020/W/SZ of June 24, 2020.

A compact pumping station is designed, completely equipped with submersible pumps with parameters of each: Q = 4.46 dm^3/s, H = 10 m H_2O. It is planned to use two pumps operating in the alternating or simultaneous system, depending on the amount of incoming wastewater. The pumping station well will consist of 35/45 reinforced concrete rings. The manway cover for the pumping station is not designed for crossing over; it is rectangular and has dimensions enabling easy assembly and disassembly of the pumps and access of the personnel to the pumping station, made of acid-resistant steel, equipped with a hold-open device protecting against accidental closing of the open well with a padlock handle. Delivery pipelines inside the pumping station will be made of acid-resistant steel. A shut-off gate valve and a ball type check valve will be made of cast-iron. Moreover, the pumping station will be equipped with a deflector at the inlets, a ladder made of acid-resistant steel enabling access to the tank bottom, pump guides made of acid-resistant steel, a chain made of acid-resistant steel for operational assembly and disassembly of the pumps, an air supply and exhaust vent stack as well as other necessary equipment required for proper operation of the pumping station. The pressure sewerage section will be made of Dy90 PE100RC SDR17 pipes and fittings.

The gravity external sanitary sewerage system will be made of PVC-U, SN≥8kN/m^2 pipes and fittings with a diameter of Dy110 – Dy200. The pipelines must be laid in dry excavations, on specially prepared and reinforced subsoil. Pipe laying, bedding, sidefilling and backfilling must be carried out in accordance with the instructions given by the pipe manufacturer. The manholes will be made as inspection manholes of concrete rings with a min. diameter of 1.0 m, with covers of D400 or C250 class (depending on the location). All materials and ready-made components to be used for the external sanitary sewerage system will comply with local and environmental conditions and currently applicable standards and regulations. Before handing over the pipelines for operation, an exfiltration test must be performed.

5.7.3.1 Gray and black water balance

Design flow intensity of gray and black water on the basis of appliances

Table 19 Design flow intensity of gray and black water on the basis of appliances

Item	Type of intake point	Quantity	Unit outflow (discharge) DU [dm^3/s]	Total ΣDU [dm^3/s]
1	Toilet	21	2.0	42.0
2	Sink	8	0.8	6.4
3	Wash basin	42	0.5	21.0
4	Urinal	6	0.5	3.0
5	Shower	5	0.8	4.0
6	Dishwasher (laboratory part)	1	1.0	1.0
7	Sink (laboratory part)	1	1.0	1.0
8	Fume cupboard (laboratory part)	1	1.0	1.0
			Total:	79.4
		q=	**K √ΣDU**	**4.46**
		K=	0.5	

Amount of gray and black water resulting from employment

The amount of gray and black water resulting from employment is 100% of the water demand for domestic purposes:

Table 20 Estimated amount of gray and black water discharged

Item	Type of consumption	Working hours	Amount of gray and black water			
			hourly		daily	annual
		[number of days]	dm^3/h	m^3/h	m^3/d	$m^3/year$
1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**
1.	Average wastewater amounts	365	230	0.23	4.65	1,697
2.	Maximum wastewater amounts		350	0.35	5.58	2,037

Therefore, the total amount of wastewater will be:

- $Q_{maxs.}$ = 0.00446 m^3/s,
- $Q_{maxh.}$ = 0.35 m^3/h,
- $Q_{avg.d.}$ = 4.65 m^3/day,
- $Q_{perm.max.y.}$ = 2037 $m^3/year$.

Gray and black water quantity

Typical gray and black water will be discharged to the municipal sewerage system. Wastewater from the laboratory (from the sink, dishwasher and fume cupboard) will be discharged through the wastewater neutralizer. In wastewater discharged to the municipal sewerage network, the pollution values published on the website www.zwik.lodz.pl should not be exceeded.

5.7.4 Industrial wastewater

Industrial wastewater generated as a result of the functioning of the WTE Plant will be handled as follows:

- wastewater from the water treatment plant (from filter cleaning, from RO) will be transferred to the process water tank No. 2 with a capacity of 50 m^3, and then used to make up losses in the bottom ash remover,

- surface blowdowns and bottom blowdowns from the atmospheric tank will be transferred to the process tank No. 1 with a capacity of 160 m^3, and then used to produce demineralized water and/or to make up losses in the bottom ash remover,
- condensate from the sampling systems will be transferred to the process water tank No. 2 with a capacity of 50 m^3, and then used to make up losses in the bottom ash remover,
- wastewater from washing dirty surfaces of the tipping hall will be pre-treated in the industrial wastewater pre-treatment plant, consisting of an oil/water and suspended matter separator with a flow rate of Q = 3.0 dm^3/s, integrated with the sedimentation tank with a capacity of approx. 2500 l, and then transferred to the process water tank No. 2 with a capacity of 50 m^3 to be used to make up losses in the bottom ash remover,
- other process wastewater, i.e. condensate from the stack, drains from the combustion station, drains from the energy recovery station, drains from the flue gas cleaning station, drains from the grate and the cooling circuit of the power generation section, wastewater from condenser washing (periodically once a year), drains from the IBA storage yard and wastewater from the emptying of the bottom ash remover (service inspections, failures), will be transferred to the process water tank No. 2 with a capacity of 50 m^3 to be used to make up losses in the bottom ash remover.

The WTE Plant will be equipped with a sewerage system and a buffer (septic) tank with a capacity of 50 m^3. Fire water run-off that may be produced during fire fighting operations will be discharged to that tank.

Industrial wastewater will not be discharged to the sewerage system owned by ZWIK. In emergency situations, wastewater will be collected by a licensed collecting company (septic tanker) and removed for neutralization.

Wastewater generated during an emergency situation (not present during normal operation) from:

- the reacting substance dosing zone to demineralized water,
- the boiler water reacting substance dosing zone,
- the drip tray of the sodium bicarbonate $NaHCO_3$ and activated carbon silos,

- the drip tray of the carbamide solution tank,
- the drip tray of the process residue bunkers

will be discharged into septic chambers and then collected by an authorized recipient (septic tanker) and transported for neutralization.

5.7.5 External rainwater drainage system

Rainwater and thaw water from the roofs of buildings and facilities as well as roads, sidewalks, yards and green areas will be drained to the external rainwater drainage system of the WTE Plant, and then it will be drained to the rainwater and thaw water pre-treatment plant equipped with an oil/water and suspended matter separator with a nominal flow rate of 40 dm^3/ and the maximum flow rate of 400 dm^3/s and a sedimentation tank with a capacity of approx. 8099 l, and then it will be discharged to the buffer tank with a capacity of V = 250 m^3. A flow controller (85 dm^3/s) and a shut-off gate valve will be installed at the outlet of the retention tank. A pumping system will also be installed in the retention tank for the purpose of greenery watering.

Additionally, rainwater and thaw water from the oil unloading tray, before being discharged to the external rainwater drainage system, will be pre-treated in the oil/water separator with a flow rate of 3.0 dm^3/s.

Rainwater from the basin under the transformer, before being discharged to the external rainwater drainage system, will be pre-treated in the oil/water separator with a flow rate of 3.0 dm ^{3}/s. In addition, a gate valve will be installed at the outlet to close the outlet automatically (upon a signal from the Buchholz relay) during a failure or fire-fighting operation.

After pre-treatment, rainwater and thaw water in the amount not exceeding 85 dm^3/s (in accordance with the issued technical requirements for the connection to the municipal water supply and sewerage network for plot No. 56/222 at Andrzejewskiej street in Łódź for the Waste to Energy Plant, ref. No.: WTT.424.1589.2020A/V/SZ of June 24, 2020) will be transferred to the municipal rainwater drainage system. The balance of rainwater and thaw water management at the WTE Plant site is presented later in this document.

The external rainwater drainage system will be made of PVC-U or PP, SN≥8 kN/m^2 pipes and fittings with a diameter of Dy110 – Dy400. The pipelines must be laid in dry excavations, on specially prepared and reinforced subsoil. Pipe laying, bedding, sidefilling and backfilling must be carried out in accordance with the instructions given by the pipe manufacturer. The manholes will be made as inspection manholes of concrete rings with a min. diameter of 1.0 m, with covers of D400 or C250 class (depending on the location).

All materials and ready-made components to be used for the external rainwater drainage system will comply with local and environmental conditions and currently applicable standards and regulations.

5.7.5.1 Calculations of the amount of rainwater or thaw water produced in the area of the planned investment project and the method of its management

Determination of rainfall intensity

To calculate the quantity of rainwater, which will be generated on the area of the planned project, the maximum representative rainfall intensities predicted for the city of Łódź were assumed for the duration t = 15 min, which, for the probability of occurrence p = 50% (i.e. once every 2 years), equals to q = 161 $dm^3/s*ha$.

The amount of rainwater Q from the site was calculated using the following formula:

$$Q = F\ \psi \cdot q\ [dm^3/s]$$

where:

- F – drainage area [ha];
- q – representative rainfall intensity [$dm^3/s*ha$];
- Ψ – runoff coefficient [-].

The values of the runoff coefficient ψ, depending on the type of surface, were selected based on literature data by taking respectively:

Table 21 Values of runoff coefficients for a given drainage area type

Item	Surface type	Runoff coefficient according to literature data	Assumed runoff coefficient ψ
1	Hardened surfaces (asphalt and concrete squares and access roads, sidewalks)	0.85 - 0.95	0.90

Item	Surface type	Runoff coefficient according to literature data	Assumed runoff coefficient ψ
2	Roof surfaces	0.80 – 1.00	1.00
3	Green roofs	0.30 – 0.50	0.50
4	Vegetation areas	0.00 – 0.15	0.10

Table 22 Rainwater balance with rainfall intensity of q = 161 dm³/s*ha

Surface type	Runoff coefficient ψ	Surface F [ha]	Flow intensity Q [dm^3/s]
Roof surfaces	1.00	1.03	165.59
Hardened surfaces (asphalt and concrete squares and access roads, sidewalks)	0.90	0.94	136.35
Roof surfaces – green roofs	0.50	0.57	45.56
Vegetation areas	0.10	0.58	9.34
Total		**3.12**	**356.84**

Table 23 Rainwater balance with rainfall intensity of q = 15 dm³/s*ha

Surface type	Runoff coefficient ψ	Surface F [ha]	Flow intensity Q [dm^3/s]
Roof surfaces	1.00	1.03	15.43
Hardened surfaces (asphalt and concrete squares and access roads, sidewalks)	0.90	0.94	12.70
Green roofs	0.50	0.57	4.25
Vegetation areas	0.10	0.58	0.87
Total		**3.12**	**33.25**

Table 24 Rainwater management balance

Type of surface from which rainwater and thaw water are discharged	Surface F [ha]	Inflow Q [dm^3/s]	Rainwater and thaw water management
Surface area of the green roof of slag valorization building	0.57	45.56	Green roof irrigation. *Excess and overflow discharged to an external rainwater drainage system.*
Part of the roof surface of the process building	0.24	38.64	Rainwater tank (water for floor washing) V=35 m^3 *Excess and overflow discharged to an external rainwater drainage system.*
Other roof surfaces of buildings and facilities	0.79	126.95	Rainwater buffer tank with a capacity of V = 250 m^3 (water intended for

Type of surface from which rainwater and thaw water are discharged	Surface F [ha]	Inflow Q [dm³/s]	Rainwater and thaw water management
			watering greenery). *Excess in an amount not exceeding 85 dm³/s discharged into the municipal rainwater drainage system.*
Hardened surfaces (asphalt and concrete squares and access roads, sidewalks)	0.76	110.12	Rainwater buffer tank (water intended for watering greenery) V=250 m³ *Excess in an amount not exceeding 85 dm³/s discharged into the municipal rainwater drainage system.*
Paved surfaces – runoff to rain gardens	0.18	25.65	Rain gardens V=53m³ *Excess and overflow discharged to an external rainwater drainage system.*
Rain garden area	0.02	3.72	

It is assumed that rainwater and thaw water will be handled and used to the maximum extent on the premises of the WTE Plant.

5.8 Internal water supply and sewerage systems

5.8.1 Waste collection and temporary storage station

5.8.1.1 Gatehouse and weighing station

The gatehouse will be equipped with the following water supply and sewerage systems:

- potable water and domestic hot water system,
- sanitary sewerage system,
- rainwater drainage system.

5.8.1.2 Potable water and domestic hot water system

The gatehouse will be equipped with a potable water system supplying potable water to sanitary equipment. The system will be made of PP pipes. An electric economizer will be installed for domestic hot water heating. The potable water system will be supplied from the plant external potable water supply system.

5.8.1.3 Sanitary sewerage system

The gatehouse will be equipped with a sanitary sewerage system to discharge wastewater from sanitary equipment. The system will be made of PVC pipes. Ventilation of the sanitary sewerage system will be carried out through a ventilation pipe routed above the roof and terminated with an exhaust pipe. Sanitary sewage will be discharged to the plant external sanitary sewerage system.

5.8.1.4 Rainwater drainage system

Rainwater and thaw water from the gatehouse roof will be drained through gutters and rainwater drain pipes. Rainwater from the roof drainage will be discharged to the external rainwater system.

Rainwater from the weighing stations will also be drained to the rainwater drainage system.

5.8.1.5 Unloading hall

The unloading hall will be equipped with the following water supply and sewerage systems:

- hydrant fire water system,
- fire protection sprinkler system,
- washing water system,
- industrial wastewater drainage system,
- rainwater drainage system.

5.8.1.6 Fire water system (hydrants)

The unloading hall will be equipped with a fire water supply system (hydrants), including fire water supply to the 52 hydrants. The minimum water intake capacity measured at the outlet of the water nozzle for the 52 hydrant will be 2.5 dm^3/s with the minimum pressure of 0.2 MPa.

The hydrant system will be made of galvanized steel pipes. The fire water supply system will be equipped with the necessary shut-off and vent valving.

Pipelines of the fire water supply system will be fixed to the civil engineering structures of the hall using typical clamps. Pipe penetrations through space dividers will be made in protective sleeves. The fire separating elements will be provided with fire penetration sleeves with fire resistance rating (EI) required for these elements. The fire water supply system (hydrants) will be supplied from the external fire water system (ring).

5.8.1.7 Fire protection sprinkler system

A sprinkler system for process openings for the filling of waste into the bunker is designed. The sprinkler system is a dry system that is activated only in case of fire.

Sprinkling intensity - 10.2 $l/min/m^2$

Fixed fire-fighting equipment systems will be made of galvanized steel pipes. Pipelines of the fire water supply system will be fixed to the civil engineering structures of the hall using typical clamps. Pipe penetrations through space dividers will be made in protective sleeves. The fire separating elements will be provided with fire penetration sleeves with fire resistance rating (EI) required for these elements.

The control and alarm station of the sprinkler system will be located in a separate fire equipment room at the level ±0.00 in the technical building. The control and alarm station will be supplied from the fire water manifold, which will be supplied from the external fire water system (ring).

5.8.1.8 Washing water system

The unloading hall will be equipped with a washing water system including water supply to the inlet valves with the DN25 hose connector.

The valves with the hose connector will be placed approx. 1.0 m above the floor level.

The washing water system will be made of PP PN10 pipes.

Pipelines of the washing water system will be fixed to the civil engineering structures of the hall using typical clamps. Pipe penetrations through space dividers will be made in protective sleeves. The fire separating elements will be provided with fire penetration sleeves with fire resistance rating (EI) required for these elements.

Rainwater will be used to wash the floors.

5.8.1.9 Industrial wastewater drainage system

The unloading hall will be equipped with an industrial wastewater drainage system including floor drainage. The floor will be drained by means of linear drainage. Wastewater from washing of the unloading hall surface will be discharged to the industrial wastewater drainage system, and next, after pre-treatment in the sedimentation tank and the oil/water separator (with a flow rate of Q = 3.0 dm^3/s) integrated with the sedimentation tank (with the capacity of V = 2500 l), it will be used for slag quenching (making up losses in the slag trap).

5.8.1.10 Rainwater drainage system

The unloading hall will be equipped with a rainwater drainage system to discharge rainwater and thaw water from the roof. Rainwater from the roof drainage will be discharged to the external rainwater drainage system.

5.8.1.11 Waste bunker

The waste bunker will be equipped with the following water supply and sewerage systems:

- fixed fire-fighting water and foam and water equipment systems:
    - electric water and foam fire monitors controlled automatically by a thermal imaging camera and manually by the operator,
    - water and foam sprinkler systems above the feed hoppers to the boiler grate,
    - water sprinkler system for the glass panes of the crane operator's cabin,
- rainwater drainage system.

5.8.1.12 Fixed fire-fighting water and foam and water equipment systems

Fixed fire-fighting water and foam and water equipment systems are dry systems activated only in case of fire.

Fixed fire-fighting water and foam and water equipment systems will be made of galvanized or black steel pipes with anticorrosive protection, connected by screwing or by means of a groove pipe connection system. Pipelines of the fire water supply system will be fixed to the civil engineering structures using typical clamps. Pipe penetrations through space dividers will be made in protective sleeves. The fire separating elements will be provided with fire penetration sleeves with fire resistance rating (EI) required for these elements.

The intensity for each system is:

- water and foam fire monitor systems – 10.0 l/min/m^2
- water and foam sprinkler systems above the feed hoppers to the boiler grate – 10.2 l/min/m^2,
- water sprinkler system for the glass panes of the overhead crane operator's cabin – 10.2 l/min/m^2.

The control and alarm stations of the fire water and water and foam systems will be located in a separate fire equipment room at the level ±0.00 in the technical building. A foaming agent tank will also be installed in the above mentioned room. The control and alarm stations will be supplied from the fire water manifold, which will be supplied from the external fire water system (ring).

5.8.1.13 Rainwater drainage system

The waste bunker will be equipped with a rainwater drainage system to discharge rainwater and thaw water from the roof. Rainwater from the roof drainage will be discharged to the external rainwater drainage system.

5.8.2 Process building

The process building includes:

- incineration station including incineration building,

- energy recovery station,
- main control room, laboratory,
- administration and staff welfare part,
- flue gas cleaning station.

The building will be equipped with the following water supply and sewerage systems:

- hydrant fire water system,
- water and foam sprinkler system to protect the turbine oil system,
- washing water system,
- potable water and domestic hot water system,
- sanitary sewerage system,
- industrial wastewater drainage system,
- rainwater drainage system.

5.8.2.1 Fire water system (hydrants)

The process building (incineration and flue gas cleaning station, energy recovery station) will be equipped with a perimeter fire water system (hydrants), including fire water supply to the 52 hydrants. The minimum water intake capacity measured at the outlet of the water nozzle for the 52 hydrant will be 2.5 dm3/s with the minimum pressure of 0.2 MPa.
At the level of oil burners and at the level ±0.00, water and foam hydrants will be installed in the energy recovery station.

The main control room, laboratory and administrative and staff welfare part will be equipped with a fire water supply system (hydrants), including fire water supply to the 52 and 25 hydrants. The minimum water intake capacity measured at the outlet of the water nozzle for the 25 hydrant will be 1.0 dm3/s with the minimum pressure of 0.2 MPa.

The 52 hydrants and ZH52 landing valves will be installed in the staircase vestibules.

The hydrant system will be made of galvanized steel pipes. The fire water supply system will be equipped with the necessary shut-off and vent valving.

Pipelines of the fire water supply system will be fixed to the civil engineering structures using typical clamps. Pipe penetrations through space dividers will be made in protective sleeves. The fire separating elements will be provided with fire penetration sleeves with fire resistance rating (EI) required for these elements. The fire water supply system (hydrants) will be supplied from the external fire water system (ring).

5.8.2.2 Water and foam sprinkler system

The turbine oil system will be protected by a water and foam sprinkler system.

Sprinkling intensity – 10.2 l/min/m^2

Fixed fire-fighting equipment systems will be made of steel pipes with anticorrosive protection, connected by screwing or by means of a groove pipe connection system. Pipelines of the fire water supply system will be fixed to the civil engineering structures using typical clamps. Pipe penetrations through space dividers will be made in protective sleeves. The fire separating elements will be provided with fire penetration sleeves with fire resistance rating (EI) required for these elements.

The control and alarm station of the water and foam sprinkler system will be located in a separate room at the level ±0.00 in the energy recovery station. The control and alarm station will be supplied from the fire water manifold, which will be supplied from the external fire water system (ring).

5.8.2.3 Washing water system

The process building will be equipped with a washing water system including water supply to the inlet valves with the DN25 hose connector.

The valves with the hose connector will be placed approx. 1.0 m above the floor level.

The washing water system will be made of PP PN10 pipes.

Pipelines of the washing water system will be fixed to the civil engineering structures using typical clamps. Pipe penetrations through space dividers will be made in protective sleeves. The fire separating elements will be provided with fire penetration sleeves with fire resistance rating (EI) required for these elements.

Rainwater will be used to wash the floors.

5.8.2.4 Potable water and domestic hot water system,

The building will be equipped with a potable water system supplying potable water to sanitary and staff welfare rooms (administration and staff welfare part, control room and laboratory), as well as to emergency eye washers and safety showers. Potable hot water will be prepared in a capacitive domestic hot water heat exchanger with a coil supplied from the heating system. A safety valve and an expansion vessel should be installed on the cold water pipe supplying the economizer. The system will be made of polypropylene PP PN10 pipes for cold water and PN16 for hot and circulating water, which will be connected by means of welding and screwed threaded fittings. Circulation will be provided by a circulating pump. The necessary shut-off, control, safety and vent valving will be installed on the system. A backflow preventer valve will be installed upstream the intake points that pose a risk of secondary pollution of the internal system. The pipelines shall be fastened to space dividers with the use of typical fasteners preferred by the pipe manufacturer. Pipe penetrations through space dividers will be made in protective sleeves. The potable water system will be supplied from the plant external potable water supply system.

5.8.2.5 Sanitary sewerage system

The building will be equipped with a sanitary sewerage system to discharge wastewater from sanitary and staff welfare facilities and from the laboratory after preliminary cleaning in an wastewater neutralizer. The system will be made of PVC pipes. The waste lines will be fastened to space dividers with the use of typical fasteners preferred by the pipe manufacturer. Ventilation of the sanitary sewerage system will be carried out through a ventilation pipe routed above the roof of the sanitary building and terminated with an exhaust pipe. Cleanout openings will be installed at the soil vent pipes above the floor of the level ±0.00 m. Soil vent pipe penetrations through space dividers will be made in protective sleeves. Sanitary sewage will be discharged to the external sanitary sewerage system.

5.8.2.6 Industrial wastewater drainage system

The building will be equipped with a sewerage system including floor drainage and discharging industrial wastewater from process drains. The floor will be drained through drainage channels and pipelines laid in the foundation slab. The sewerage system pipes laid under the floor will be made of PEHD or cast iron pipes.

Industrial wastewater generated as a result of the functioning of the WTE Plant will be handled as follows:

- wastewater from the water treatment plant (from filter cleaning, from RO) will be transferred to the process water tank No. 2 with a capacity of 50 m^3, and then used to make up losses in the bottom ash remover,
- surface blowdowns and bottom blowdowns from the atmospheric tank will be transferred to the process tank No. 1 with a capacity of 160 m^3, and then used to produce demineralized water and/or to make up losses in the bottom ash remover,
- condensate from the sampling systems will be transferred to the process water tank No. 2 with a capacity of 50 m^3, and then used to make up losses in the bottom ash remover,
- wastewater from washing dirty surfaces of the tipping hall will be pre-treated in the industrial wastewater pre-treatment plant, consisting of an oil/water and suspended matter separator with a flow rate of Q = 3.0 dm^3/s, integrated with the sedimentation tank with a capacity of approx. 2500 l, and then transferred to the process water tank No. 2 with a capacity of 50 m^3 to be used to make up losses in the bottom ash remover,
- other process wastewater, i.e. condensate from the stack, drains from the combustion station, drains from the energy recovery station, drains from the flue gas cleaning station, drains from the grate and the cooling circuit of the power generation section, wastewater from condenser washing (periodically once a year), drains from the IBA storage yard and wastewater from the emptying of the bottom ash remover (service inspections, failures), will be transferred to the process water tank No. 2 with a capacity of 50 m^3 to be used to make up losses in the bottom ash remover.

The WTE Plant will be equipped with a sewerage system and a buffer (septic) tank with a capacity of 50 m^3. Fire water run-off that may be produced during fire fighting operations will be discharged to that tank.

Industrial wastewater will not be discharged to the sewerage system owned by ZWIK. In emergency situations, wastewater will be collected by a licensed collecting company (septic tanker) and removed for neutralization.

Wastewater generated during an emergency situation (not present during normal operation) from:

- the reacting substance dosing zone to demineralized water,
- the boiler water reacting substance dosing zone,
- the drip tray of the sodium bicarbonate $NaHCO_3$ and activated carbon silos,
- the drip tray of the carbamide solution tank,
- the drip tray of the process residue bunkers

will be discharged into septic chambers and then collected by an authorized recipient (septic tanker) and transported for neutralization.

5.8.2.7 Rainwater drainage system

The building will be equipped with a rainwater drainage system to discharge rainwater and thaw water from the roof. Rainwater from the roof drainage will be discharged to the rainwater tank and then used to wash the floors and water greenery. The overflow from the tank will be directed to the external rainwater drainage system.

5.8.3 Process residue management station

5.8.3.1 Slag valorization hall

The slag valorization hall will be equipped with the following water and sewerage systems:

- hydrant fire water system,
- floor drainage system,
- potable water and domestic hot water system,
- Sanitary sewerage system,
- rainwater drainage system.

5.8.3.2 Fire water system (hydrants)

The slag valorization hall will be equipped with a fire water supply system (hydrants), including fire water supply to the 52 hydrants. The minimum water intake capacity measured at the outlet of the water nozzle for the 52 hydrant will be 2.5 dm3/s with the minimum pressure of 0.2 MPa.

The hydrant system will be made of galvanized steel pipes. The fire water supply system will be equipped with the necessary shut-off and vent valving.

Pipelines of the fire water supply system will be fixed to the civil engineering structures of the hall using typical clamps. Pipe penetrations through space dividers will be made in protective sleeves. The fire separating elements will be provided with fire penetration sleeves with fire resistance rating (EI) required for these elements. The fire water supply system (hydrants) will be supplied from the external fire water system (ring).

5.8.3.3 Floor drainage system

The valorization hall will be equipped with a floor drainage system. Drainage will be provided by means of floor slopes and directing any slag eluates to the sump pit. The wastewater will be used to replenish the losses in the slag trap.

5.8.3.4 Potable water and domestic hot water system

The valorization hall will be equipped with a potable water system supplying potable water to sanitary equipment. The system will be made of PP pipes. An electric economizer will be installed for domestic hot water heating. The potable water system will be supplied from the plant external potable water supply system.

5.8.3.5 Sanitary sewerage system

The valorization hall will be equipped with a sanitary sewerage system to discharge wastewater from sanitary equipment. The system will be made of PVC pipes. Ventilation of the sanitary sewerage system will be carried out through a ventilation pipe routed above the roof and terminated with an exhaust pipe. Sanitary sewage will be discharged to the plant external sanitary sewerage system.

5.8.3.6 Rainwater drainage system

The valorization hall will be equipped with a rainwater drainage system to discharge rainwater and thaw water from the roof. Rainwater from the roof drainage will be discharged to the external rainwater drainage system.

5.8.3.7 Slag seasoning hall

The slag seasoning hall will be equipped with the following water and sewerage systems:

- hydrant fire water system,
- floor drainage system,
- rainwater drainage system.

5.8.3.8 Fire water system (hydrants)

The slag seasoning hall will be equipped with a fire water supply system (hydrants), including fire water supply to the 52 hydrants. The minimum water intake capacity measured at the outlet of the water nozzle for the 52 hydrant will be 2.5 dm3/s with the minimum pressure of 0.2 MPa.

The hydrant system will be made of galvanized steel pipes. The fire water supply system will be equipped with the necessary shut-off and vent valving.

Pipelines of the fire water supply system will be fixed to the civil engineering structures of the hall using typical clamps. Pipe penetrations through space dividers will be made in protective sleeves. The fire separating elements will be provided with fire penetration sleeves with fire resistance rating (EI) required for these elements. The fire water supply system (hydrants) will be supplied from the external fire water system (ring).

5.8.3.9 Floor drainage system

The seasoning hall will be equipped with a floor drainage system. Drainage will be provided by means of floor slopes and directing any slag eluates to an external channel with sump pit at the end. The wastewater will be used to replenish the losses in the slag trap.

5.8.3.10 Rainwater drainage system

The seasoning hall will be equipped with a rainwater drainage system to discharge rainwater and thaw water from the roof. Rainwater from the roof drainage will be discharged to the external rainwater drainage system.

5.8.3.11 Storage facilities

Storage facilities will be equipped with the following water and sewerage systems:

- potable water and domestic hot water system,

- Sanitary sewerage system,
- rainwater drainage system.

5.8.3.12 Potable water and domestic hot water system

Storage facilities will be equipped with a potable water system supplying potable water to sinks and washbasins. The system will be made of PP pipes. An electric economizer will be installed for domestic hot water heating. The potable water system will be supplied from the plant external potable water supply system.

5.8.3.13 Sanitary sewerage system

Storage facilities will be equipped with a sanitary sewerage system to discharge wastewater from sanitary equipment. The system will be made of PVC-U and PVC-HT pipes. Ventilation of the sanitary sewerage system will be carried out through a ventilation pipe routed above the roof and terminated with an exhaust pipe. Sanitary sewage will be discharged to the plant external sanitary sewerage system.

5.8.3.14 Rainwater drainage system

The storage facilities will be equipped with a rainwater drainage system to discharge rainwater and thaw water from the roof. Rainwater from the roof drainage will be discharged to the external rainwater drainage system.

5.8.4 Condenser

The facility does not need to be equipped with internal water supply and sewerage systems.

Rainwater from the surface under the condenser will be discharged to the external rainwater drainage system.

Wastewater from the condenser washing process will be transferred to the closed outlet sewerage manhole in which a portable pump will be placed to pump wastewater to the process tank located in the process building. Wastewater will be used to make up losses in the bottom ash remover or will be transported for disposal by an entity holding relevant licenses.

5.8.5 WTP – Water Treatment Plant

The building will be equipped with the following water supply and sewerage systems:

- hydrant fire water system,
- washing water system,
- potable water system,
- floor drainage system,
- rainwater drainage system.

5.8.5.1 Fire water system (hydrants)

The building will be equipped with a fire water supply system (hydrants), including fire water supply to the 52 hydrants. The minimum water intake capacity measured at the outlet of the water nozzle for the 52 hydrant will be 2.5 dm^3/s with the minimum pressure of 0.2 MPa.

The hydrant system will be made of galvanized steel pipes. The fire water supply system will be equipped with the necessary shut-off and vent valving.

Pipelines of the fire water supply system will be fixed to the civil engineering structures of the hall using typical clamps. Pipe penetrations through space dividers will be made in protective sleeves. The fire separating elements will be provided with fire penetration sleeves with fire resistance rating (EI) required for these elements. The fire water supply system (hydrants) will be supplied from the external fire water system (ring).

5.8.5.2 Washing water system

The building will be equipped with a washing water system including water supply to the inlet valves with the DN25 hose connector.

The valves with the hose connector will be placed approx. 1.0 m above the floor level.

The washing water system will be made of PP PN10 pipes.

Pipelines of the washing water system will be fixed to the civil engineering structures using typical clamps. Pipe penetrations through space dividers will be made in protective sleeves. The fire separating elements will be provided with fire penetration sleeves with fire resistance rating (EI) required for these elements.

5.8.5.3 Potable water system

The building will be equipped with a potable water system supplying potable water to the water treatment plant equipment (to the raw water tank), to the emergency eye washer and to the safety shower located at the chemical dosing equipment, and to the valves with a hose coupling. The system will be made of polypropylene PP PN10 pipes connected by means of welding and screwed threaded fittings. The necessary shut-off, control, safety and vent valving will be installed on the system. A backflow preventer valve will be installed upstream the intake points that pose a risk of secondary pollution of the internal system. The pipelines shall be fastened to space dividers with the use of typical fasteners preferred by the pipe manufacturer. Pipe penetrations through space dividers will be made in protective sleeves. The potable water system will be supplied from the plant external potable water supply system.

5.8.5.4 Floor drainage system

The building will be equipped with a sewerage system including floor drainage and discharging wastewater from the water treatment plant equipment. The floor will be drained through drainage channels. Wastewater will be discharged to a drain and drainage tank located inside the building, from where it will be pumped to the process building and used for slag quenching (making up losses in the slag trap) or other process purposes.

Rooms with chemicals will be drained to sump pits. Wastewater will be transported for disposal by an entity holding relevant licenses.

5.8.5.5 Rainwater drainage system

The building will be equipped with a rainwater drainage system to discharge rainwater and thaw water from the roof. Rainwater from the roof drainage will be discharged to the external rainwater drainage system.

5.8.6 Power generating unit

Does not need to be equipped with water supply and sewerage systems.

5.8.7 Technical building

The technical building will be equipped with the following water supply and sewerage systems:

- floor drainage system,
- rainwater drainage system.

5.8.7.1 Floor drainage system

The technical building will be equipped with a sewerage system including floor drainage for compressor room, fire protection room and discharging water from fire protection system drains. The floor will be drained through drainage channels included in the design. Wastewater will be discharged to a process tank in the process building and will be used for making up losses in the slag trap.

5.8.7.2 Rainwater drainage system

The building will be equipped with a rainwater drainage system to discharge rainwater and thaw water from the roof. Rainwater from the roof drainage will be discharged to the external rainwater drainage system.

5.8.7.3 Transformer station

The transformer station will be equipped with the following water supply and sewerage systems:

- fire protection sprinkler system,
- drainage system.

5.8.7.4 Fire protection sprinkler system

A sprinkler system of the oil unit transformer stand is designed. The sprinkler system is a dry system that is activated only in case of fire.

Sprinkling intensity – 10.2 $l/min/m^2$

Fixed fire-fighting equipment systems will be made of galvanized steel pipes. Pipelines of the fire water supply system will be fixed to the civil engineering structures of the hall using typical clamps. Pipe penetrations through space dividers will be made in protective sleeves. The fire separating elements will be provided with fire penetration sleeves with fire resistance rating (EI) required for these elements.

The control and alarm station of the sprinkler system will be located in a separate room at the level ±0.00 in the energy recovery station. The control and alarm station will be supplied from the fire water manifold, which will be supplied from the external fire water system (ring).

5.8.7.5 Drainage system

The transformer will be equipped with a drip tray with a capacity of min. 130 m^3 for receiving the oil in case of system leak, for water from a fire-fighting operation as well as rain water and thaw water. The drain from the tray will be connected to the external rainwater drainage system, discharging rainwater during normal system operation. An oil/water separator with a flow intensity of Q=3.0 dm^3/s and an automatic shut-off gate valve to shut off the drain in the event of a leakage or a fire-fighting operation will be installed at the drain. The gate valve will be closed based on the signal from the Buchholz relay.

5.8.8 Oil tank and pumping station

The oil tank and pumping station do not need to be equipped with internal water supply and sewerage systems.

Rainwater from the oil unloading tray will be discharged through the oil/water separator to the rainwater drainage system.

Rainwater and thaw water from the roof of the oil pumping station will be discharged by means of a strainer basket and an external drain gutter to the external rainwater drainage system.

5.8.9 Fire water tank and pumping station

5.8.9.1 Fire water pumping station technology.

For the purposes of the WTE Plant fire protection system, a container fire water pumping station will be designed with main diesel supply pumps and a pilot pump.

Each supply water pump will ensure operating parameters as follows: Q = approx. 550–600 m^3/h, P = approx. 1.2 MPa. In order to maintain service pressure in the fire protection system, a pilot pump will cooperate with the supply pumps.

The supply pumps will be provided with a Certificate of Conformity issued by the Fire Protection Science and Research Center (CNBOP) for application in fixed fire extinguishing equipment.

Rainwater and thaw water from the pumping station enclosure will be discharged by means of external gutters and downpipes. The floor of the pumping station will be provided with drainage.

5.8.9.2 Fire tank technology

The fire water tank with net capacity of 1,300 m^3 will be designed as a steel above-ground, hot-dip galvanized tank to be screwed at the construction site, with an EPDM membrane that excludes direct contact of water with the steel walls of the tank and ensures full tightness of the tank.

The tank will be equipped with an immersion heater and thermal insulation to protect against freezing.

5.9 Information on energy demand and its consumption

The planned Thermal Waste Treatment Plant will feature the following energy demand and consumption:

- Electricity
    - estimated peak demand for energy in condensing operation: approximately 3.2 MWe;
    - estimated peak demand for energy in cogeneration operation: approximately 3.6 MWe;
    - estimated total annual electricity consumption: approximately 30,000 MWh
- Heat:
    - Estimated peak demand for heating purposes: 100 kW;
    - Estimated peak process heat demand for ventilation: 310 kW;
    - Estimated peak domestic hot water demand: 70 kW;
    - Estimated total heat energy consumption: approximately 28,000 GJ.

6 PROJECT OPTIONEERING

6.1 Decision not to implement the project

6.1.1 Effects on waste management if decision is taken not to implement the project

Failure to implement the planned investment project can make proper waste management impossible in the future in Łódzkie Voivodeship. The lack of investment in the thermal treatment of the energy fraction will make the management of this fraction a problem and lead to inefficiencies in the waste management system.

Given the significant oversupply of the energy fraction in the future, its disposal will incur significant costs, so in the long run it will cause a total inefficiency in the voivodeship waste management system, contributing to a significant increase in waste management costs.

The use of alternative fuel in power generation processes offers both economic and environmental benefits. The use of alternative fuels from waste saves a significant amount of carbon while achieving noticeably better emissions performance.

If the WTE Plant is not implemented, the energy fraction could still be used in cement plants, and the remainder will be stored combustible waste, which, according to the Regulation of the Minister of Economy of July 16, 2015 on approval of waste to be disposed on the landfills – cannot be sent to a landfill, as it does not meet the requirement of a permissible level of gross calorific value below 6 MJ/kg. The mass of collected and stored combustible waste generated after the mechanical and biological treatment process should therefore be transferred to the Waste to Energy Plant.

The generation of fuel from municipal waste left over from mechanical and biological treatment and non-recyclable waste is justified, given that this high calorific material can successfully replace fossil fuels in the generation of electricity and heat.

The investment project is in line with the objectives of the Circular Economy.

Additional arguments include the environmental benefits resulting mainly from lower atmospheric emissions from the combustion of alternative fuels, as well as the possibility of reducing landfill, which is one of the main goals in a circular economy.

The construction of the planned investment project will contribute to the implementation of modern technologies for the production of electricity and heat, increase the energy security of the region, as well as optimize and increase the efficiency of production and consumption of electricity and heat.

6.2 Waste to energy plant optioneering

The technology and location option was selected and determined as part of the Environmental Circumstance Decision. This report, prepared for the purpose of the repeated Environmental Impact Assessment reassessing the environmental impact of the project, is intended to assess the impact of the selected option on the basis of detailed data that was not known at the stage of obtaining the aforementioned Environmental Circumstance Decision.

The aforementioned Environmental Circumstance Decision indicates that an air condenser will be built at the WTE Plant to condense steam from behind the steam turbine. Due to the technological characteristics of such a device (dimensions, use of fans to force air flow, location of the condenser on the plot of land intended for the WTE Plant), the air condenser is a significant source of noise emissions.

Accordingly, two types of air condensers were analyzed for the WTE Plant optioneering in terms of noise emissions:

- Conventional air condenser,
- “Hexacool” type air condenser.

A conventional air condenser is shown in Figure 6, and a "Hexacool" type condenser is shown in Figure 7.

In a conventional condenser, the highest point is the steam header from behind the turbine, from which the tube bundles depart to form the shape of the roof. Fans are placed under the tube bundles, which are mounted at such a height as to provide sufficient distance from the ground so that air flows freely through the fans. The air behind the fans flows through the tube bundles, thus taking heat away from the steam and causing it to condense.

In contrast, in a “Hexacool” type condenser, the tube bundles are mounted vertically and the fans are located above them. Fans pull in air, thus forcing it to flow through the tube bundles and receive heat from the steam.

In the case of the WTE Plant, the dimensions of both condensers (land occupancy) are similar. In contrast, the two devices differ in sound power. The “Hexacool” condenser selected for the technological parameters of the WTE Plant, as confirmed by one of the potential suppliers of such a device, has an sound power of 103 dB(A). In contrast, for a conventional condenser, the sound power, which has also been confirmed by one of the potential suppliers of such a device, will be 102 dB(A).

Both types of equipment show significantly lower sound power than that specified in the Environmental Decision (106 dB(A)).

In view of the fact that the conventional condenser has a lower sound power than the condenser of “Hexacool” construction – it was decided to use it in the project due to the lowest environmental impact in terms of noise emissions.

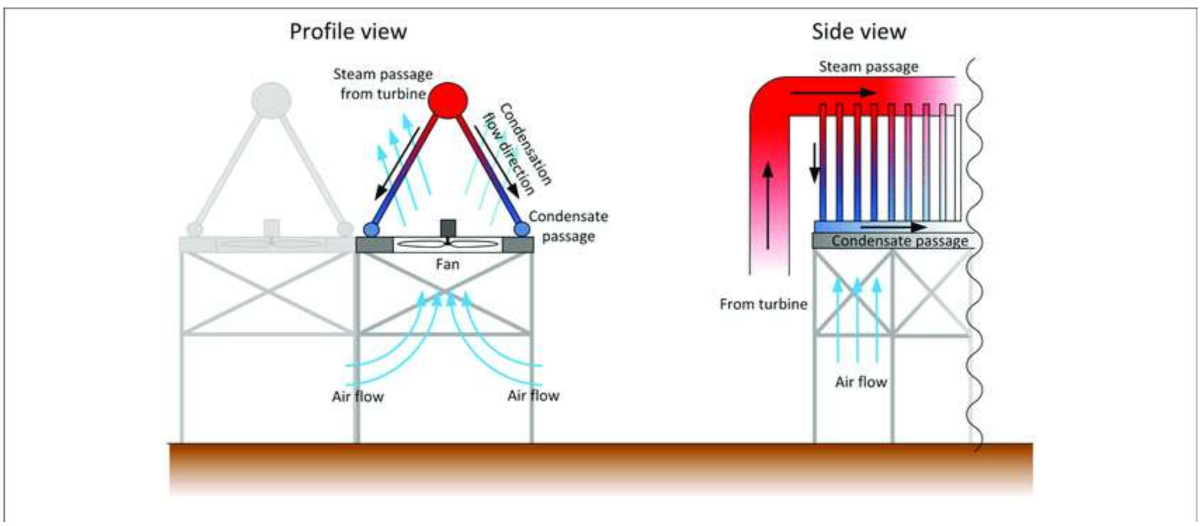


Figure 6 Conventional air condenser design

- Profile view,
- Air flow,
- Fan,
- Steam passage from turbine,
- Condensation flow direction,
- Condensate passage,

- Side view,
- From turbine.

Source (as of September 4, 2020): https://www.researchgate.net/figure/Schematic-layout-of-an-A-frame-type-air-cooled-condenser_fig6_329872593

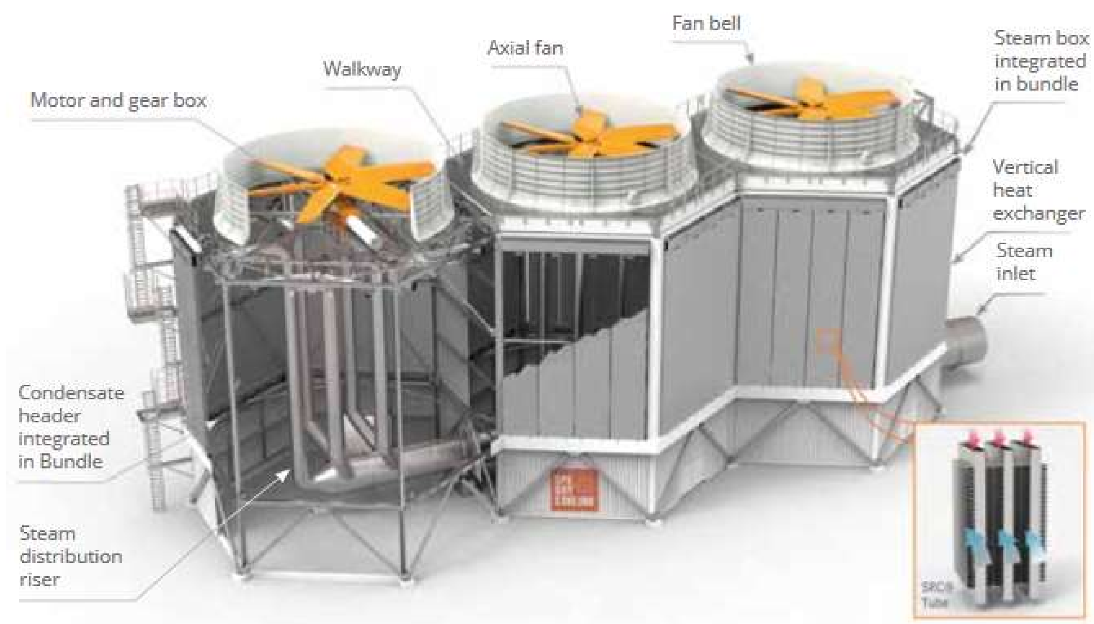


Figure 7 "Hexacool" air condenser design

- Steam distribution riser,
- Condensate header integrated in bundle,
- Motor and gear box,
- Walkway,
- Axial fan,
- Fan bell,
- Steam box integrated in bundle,
- Vertical heat exchanger,

- Steam inlet.

Source (as of September 4, 2020):

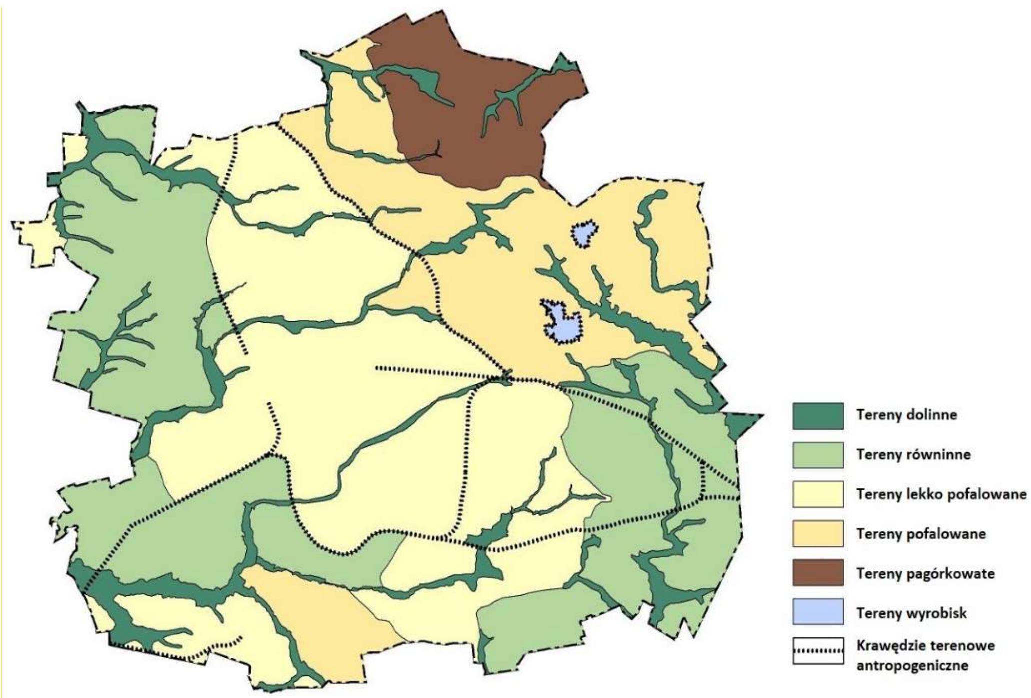
https://spgdrycooling.com/wp-content/uploads/2018/08/NEW-SPXDC-PR-HX02-%C2%A92018-SPX-DRY-COOLING.pdf

7 NATURAL AND CULTURAL ENVIRONMENT CONDITIONS

7.1 Physical and geographical location

According to the generally accepted division of Poland into physico-geographical units, Łódź lies in the Central Poland Lowlands sub-province, macro-regions: South Mazowieckie Heights and South Wielkopolska Lowland and in mesoregions: Łódź Heights (north-eastern part of the city) and Łaska Upland (central and western part of the city).

The city's terrain slopes from northeast to southwest. The altitude in the area of Łódź and its neighboring areas do not exceed 300 m above sea level, which is considered the limiting value for upland areas. The highest point of the town is Łódź Heights at 280 m above sea level, and the lowest point is Smulska Valley at 163.6 m above sea level. The height difference between these points do not exceed 120 m.



PL	EN
Tereny dolinne	Valley areas
Tereny równinne	Plains
Tereny lekko pofalowane	Slightly rolling areas
Tereny pofalowane	Rolling areas

Tereny pagórkowate	Hilly areas
Tereny wyrobisk	Excavation sites
Krawędzie terenowe antropogeniczne	Anthropogenic terrain edges

Figure 8 Variable topography of Łódź according to the land slope criterion (source: Study of Conditions and Directions of Spatial Development for the City of Łódź. Conditions)

The planned project, located in the eastern part of Łódź, lies within the Łódź Heights – a geographical region in the southern part of the Mazovian Lowland, in the area of the South Mazovian Heights. The landscape of the region consists of a rolling upland, with numerous hills with relative heights of about 30 to 60 meters, built of boulder clays and fluvioglacial sands, descending with clear, strongly dissected steps towards the north and south. The highest point of Łódź Hills lies just outside of the city limits in the village of Dąbrowa and is 284.1 meters a.s.l.

The watershed between the basins of the Vistula and the Oder runs through the Łódź Heights. It is also here that the Bzura and most of its right tributaries originate. In the western part of the region the dominant landscape is urban-industrial (Łódź Industrial District), in the central and eastern part, it is agricultural.

7.2 Geological conditions

In geological terms, the area of Łódź lies within two structural units: the anticlinorium of Central Poland and the Szczecin-Łódź-Miechów synclinorium. The boundary between the two runs through the northeastern areas of the city. The lower-level units are the Kujawskie anticlinorium and the Mogileń and Łódź Trough, the southern section of which is the Łódź Trough (the central and southwestern areas of the city), which is the predominant tectonic unit of the Łódź area. The surface continuous layer of land in the city area is formed by Quaternary formations: mainly glacial, as well as fluvial, slope, lake and eolian.

The land occupying most of the city – mainly post-glacial sandy formations (water-glacial sands, common in the entire area, e.g. Łagiewniki, Arturówek, Nowosolna, Widzew, Olechów, Lublinek, Nowe Złotno) and clays (common in the vast area from Radogoszcz through Śródmieście to Bronisin) – does not pose any restrictions to investments. In addition to their physical properties, the generally deep groundwater table (less than 2 m below sea level) and the absence of geodynamic and glacitectonic phenomena within them are also conducive to this. The areas are characterized by favorable conditions for construction.

The planned project is located in areas formed by fluvioglacial sands that include sands and outwash plain gravels.

The WTE Plant site is located in the northeastern wing of the Mogilno-Łódź Trough. The basin is filled with Lower Cretaceous formations, sands and sandstones and Upper Cretaceous formations in the form of limestones, marls and gaizes, locally reaching a thickness of up to 3,000 m. The top of the Cretaceous formations is highly eroded and dislocated, with a typically erosional relief. Tertiary formations are not present in the area of the proposed site, and the Upper Cretaceous top is formed in the zone of ordinates 145–155 m above sea level, at the depth below 75.0 m below sea level.

The surface portions of the site are built up by a thick series of Quaternary sediments ranging in thickness from about 60.0 m to over 80.0 m. They rest directly on the Upper Cretaceous bedrock. These are mainly Pleistocene, glacial accumulation and fluvioglacial formations. At the floor, the series is opened by a series of fluvioglacial sands of the Great Interglacial and a co-occurring series of anaglacial sands of the Oder glaciation. The top of these formations is formed at elevations 152 to 160 m a.s.l. Above it, there is a thicker series of glacial tills of the Oder glaciation. Its thickness locally reaches over 40.0 m, but it is a discontinuous series, passing locally into limnoglacial silts and even glacial gravels. The top of glacial formations of the Oder glaciation is formed in the subsoil in the zone of ordinates 190–200 m above sea level, and locally much lower, which results from a strong erosion transformation. A relatively continuous layer of preglacial sands of the Warta glaciation lies above it. The top of these sands is formed in the bedrock at the WTE Plant site at variable depths: from approx. 6.0 m to more than 12.0 m. These formations are overlayed by a litofacially variable series of glacier-front formations deposited during the Pilica stadial of the Warta glaciation. These are mainly water-glacial sands containing pockets and interbeddings of glacial clays and limnoglacial silts. The top of the moraine series of the Pilica stage is formed at the depth of 0.6 m to over 2.0 m below sea level and it rests under a variable and thick layer of modern anthropogenic fills.

According to the ecophysiographic study to the Study of Conditions and Areas for Spatial Development of the City of Łódź (adopted under Resolution No. LXIXI/1753/18 of the Łódź

City Council of 28 March 2018, amended under Resolution No. VI/215/19 of the Łódź City Council of March 6, 2019), geological structure determined the low abundance of the city's raw material base. In the area of Łódź, as of December 31, 2015, 14 deposits have been documented, all of which are natural aggregate deposits (sands) belonging to the group of common minerals. All currently documented aggregates belong to the fine aggregate category, and there is a lack of coarse aggregate deposits in the Łódź area, which is supplied from neighboring areas.

At present, the main prospective areas of raw material exploitation are areas of documented mineral deposits, that is areas in the vicinity of the areas currently subject to exploitation at the following streets: Marmurowa, Nad Niemnem, Jana Kasprowicza and Beskidzka, as well as Listopadowa, Obłoczna, Iglasta and Hyrna, for the following deposits: Łódź-Iglasta III and Łódź-Iglasta IV. It is estimated that with rational management of the resources within the proven deposits, they will be sufficient for several years.

The results of geological surveys to date indicate that the development of the useful mineral resources in the Łódź area is not prospective, therefore it is necessary to rationally manage the existing resources.

There are no documented mineral deposits or areas of forecasted mineral deposits in the WTE Plant areas in Łódź and the neighboring areas. There are also no mining areas or sites.

There are no areas of natural geological hazards or landslide hazard in the Łódź area.

7.3 Hydrological conditions

7.3.1 Surface waters

The planned project is located in the area of the surface water body with the code RW6000171832189 and named Jasień. It is a type of a lowland sandy stream (17) with the status of a heavily modified water body (SZCW) due to exceeding the m4 indicator because of regulation and the location of about 75% of the catchment in an urbanized area (the City of Łódź). The length of this watercourse is 21.15 km.

The current status of the surface water body is determined to be poor, the water exhibits poor ecological potential and there is a threat of failure to achieve the environmental objectives for the water, therefore derogations have been allowed temporarily from the implementation of the environmental objectives as a result of technical feasibility and disproportionate costs. Due to the low reliability of the surface water body assessment and the related inability to identify the reasons for the failure to achieve good condition, it is not possible to plan rational corrective actions. The planning and implementation of any measures will generate unjustified costs. In connection with the monitoring research carried out, it will be possible to assess the actual state and threat of the surface water body. If the bad condition is confirmed, action will be taken to identify its causes. Such a step-by-step approach will make it possible to rationally plan the necessary actions and ensure their required effectiveness.

The failure to achieve the environmental objectives results also from undertaking new investment projects (Art. 4.7 FWD) – construction of the flood control channel on the Jasień River, including:

- extension of the Jasień riverbed with a causeway in the lower part of the river below the bridge in Zatokowa street,
- regulation of the Jasień River from Prądzyńskiego street to the connection with the Karolewka river in Łódź 1+216 ÷ 2+400,
- renovation of the open channel of the Jasień River in Łódź from Nowe Sady street to the connection with the Karolewka River 2+400 ÷ 3+000

Planned deadline for achieving the environmental objectives is 2021.

7.3.2 Groundwater

The planned project is located within a groundwater body with the EU identifier: PLGW600072

Groundwater body No. 72 is located in the Warta and Middle Vistula water region and its area is 1,831.0 km^2. Within this unit there are 3 groundwater bodies with numbers 150, 151, 401. Quaternary and Cretaceous aquifers are distinguished in the area of groundwater body No. 72.

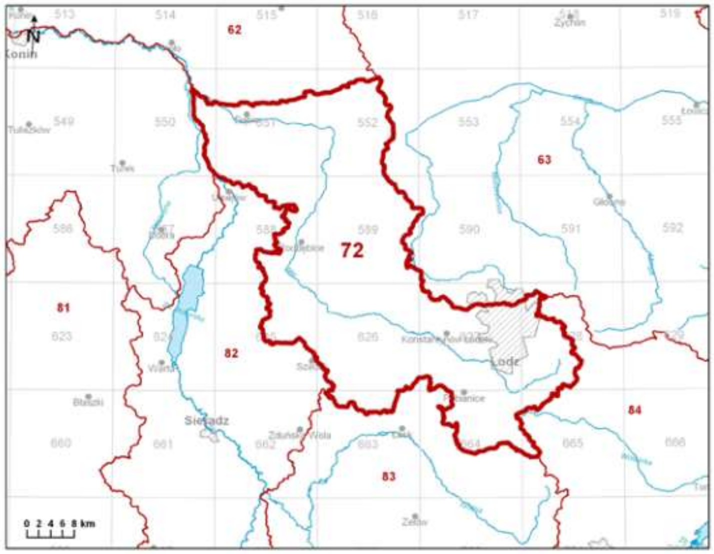


Figure 9 Groundwater body No. 72

Source: www.pgi.gov.pl

The Quaternary (Q) aquifer within groundwater body No. 72 is generally of secondary nature. It is locally present as usable, mainly in the eastern part of the unit and in places where it lies directly on Cretaceous formations and forms a connected level with it. The waters of this stage are found among fine-grained or differentiated sands, between clay horizons or under boulder clays of the Central Polish glaciation, at a depth of 2 m below ground level (in valleys and depressions) to about 80 m below ground level (interclay level). The thickness of water-bearing formations ranges from 5 to 40 m, usually averaging a dozen or so m. The water table can be free (in valleys and depressions) or confined (interclay level). The described stage is devoid of isolation, and there is partial isolation only occasionally. However, since there are no outbreaks of pollution at these sites, the degree of risk to these waters is low to medium.

The Cretaceous (K) aquifer is considered usable over most of groundwater body No. 72. The aquifer is fracture-porous in nature. It is found in fractured marls, sandy marls with sparse limestone beddings, calcareous gesas and sandstones with calcareous binders. The depth of the layer most often ranges from 10 m to 140 m below ground level, and its thickness ranges from 5 to 140 m. Groundwater generally occurs under subartesian pressure. Locally, the Cretaceous stage indicates a hydraulic bond with the waters of the Quaternary stage. In these places, the groundwater table is free. Water supply to the Cretaceous aquifer is by lateral inflow from the southeast and by precipitation infiltration and seepage from overlying aquifers. The drainage base of the Cretaceous horizon is the Warsaw-Berlin Proglacial Valley. The degree of groundwater vulnerability is weak or low over most of the area. In the northern and central parts of the unit, the degree of hazard is high due to the lack of isolation formations and land use.

The drainage area is in 74.15% developed with agricultural areas, in 14.23% with forest and green areas, in 11.12% with anthropogenic areas, in 0.26% with wetlands and in 0.24% with water areas.

The share of underground recharge in the total runoff of rivers within the groundwater body is 45%. Groundwater-dependent terrestrial ecosystem are wetlands, which account for 48% of the protected areas.

The condition of the body of groundwater that depends on the impacts of groundwater on terrestrial ecosystems dependent on groundwater was assessed in 2012 as good SR (sufficient reliability).

Assessment of the status of the groundwater body:

- The quantitative status is defined as good.
- The chemical status is defined as good.
- Overall assessment of the condition of the body of groundwater is defined as good
- The assessment of the risk of failure to achieve the environmental objectives has been identified as not threatened.

7.4 Climatic conditions

In the area of the planned project, the prevailing winds are from the west, south-west directions and periodically, especially in winter, from the east direction. The highest wind speeds are during the winter. The highest insolation values are recorded in June and July, the lowest in November and December. Cloudiness in the Łódź Highlands is 6 degrees on an 11-degree scale.

The warmest month of the year is July, with an average temperature of +19.5°C, while the coolest is January, with an average temperature of -1.4°C. The temperature range throughout the year is from -20°C to +30°C.

Atmospheric pressure averages 994 hPa.

Relative humidity is 75%.

The highest precipitation amounts are in June and July and the lowest are in April and December.

Average atmospheric conditions in the period 2014-2019 based on the data of the Institute of Meteorology and Water Management:

- Wind speed: 3.3 m/s,
- temperature: +9.8°C,
    - average temperature for January: -1.4°C,
    - average temperature for July: +19.5°C,
    - temperature range: from -20°C to +30°C,
- pressure: 994 hPa,
- relative humidity: 75%,
    - Scope: 0–100%.

7.5 Status of pollutant emission to ambient air

The air quality in the area of the planned investment project was determined by the letter of the Chief Inspectorate for Environmental Protection, ref. No. DM/ŁD/063-1/300/20/DR, file No.: 723/ŁD, dated May 26, 2020. The background values of pollutants (average annual concentration values of substances) determined in the aforementioned letter are shown in the table below.

Table 25 Status of air quality in the planned project area

Item	Name of the substance	Number CAS	Level of the background R [µg/m³]	Permissible level of substance in the air D_a [µg/m³]	Value available D_a - R [µg/m³]
1	Nitrogen dioxide	10,102-44-0	17	40 (1	23
2	Sulfur dioxide	7,446-09-5	4	20 (2	16
3	Particulate matter PM10	-	27	40 (1	13
4	Particulate matter PM2.5	-	19	25 / 20 (1,3	6 / 1

5	Benzene	71-43-2	1	5 (1	4
6	Lead	7,439-92-1	0,01	0.5 (1	0.49

1) – A level acceptable for the protection of human health
2) – Permissible level for plant protection.
3) – Permissible level, which was in force until December 31, 2019 (the values of average annual concentrations given in GIOŚ letter refer to 2019) / the current permissible level.

Values for the permissible level of substances in the air are annual values (i.e. in their case the averaging period is a calendar year). These values were established in the Regulation of the Minister of Environment of August 24, 2012 on the levels of certain substances in the air.

The values of average annual concentrations of pollutants provided by GIOŚ relating to the last full year for which the development and verification of data from monitoring of the state of air quality was completed (2019) are at levels that do not exceed the permissible values that were in force in the aforementioned year.

Moreover, the given average annual concentration of PM2.5 is at a level lower by 1 $\mu g/m^3$ than the permissible target level, which is currently in force (from January 1, 2020).

For substances in the air for which GIOŚ did not determine the background level, the background value is assumed at the level of 10% of the reference value.

Concentration values presented in the above table include, among others, the impact of the existing Combined Heat and Power Plant EC4 on the air quality condition.

The nearest permanent measurement point in the vicinity of the planned project is the air quality monitoring station Łódź-Widzew located at ul. Czernika 1/3 and approx. 2 km away from the planned project.

7.6 Soils

On the basis of soil, agricultural and geological map portal “Geoportal” of Łódzkie Voivodeship, the areas within the area of the planned project – are classified as Tz – densely built-up areas. This area, based on the Regulation of the Minister of Regional Development and Construction on land and building registration (Journal of Laws of 2019, item 393) is classified as industrial land – Ba. Information about the land use function of the plot of land of the planned WTE Plant has also been confirmed in the Land and Mortgage Register of the Investor with number LD1M/00243174/9

Regulation of the Minister of Environment of September 1, 2016 on the method of conducting the assessment of the surface pollution (Journal of Laws of 2016, item 1395), groups of land are separated based on their use in a given area, as defined in regulations issued pursuant to Article 26 Section 2 of the Act of May 17, 1989 – Geodetic and Cartographic Law – as follows:

1) soil group I:
   a) residential areas, marked with symbol B,
   b) other built-up areas, marked with symbol Bi,
   c) urbanized areas undeveloped or under development, marked with symbol Bp,
   d) developed agricultural land, marked with Br symbol,
   e) recreation and leisure areas, designated with the symbol Bz, excluding the areas listed in point 3(e), including:
      - recreation center areas, children's playgrounds, beaches and landscaped parks, squares and greens (apart from median strip),
      - sports areas, such as: stadiums, sports fields, ski jumps, toboggan runs, sports shooting ranges, swimming pools, golf courses,
      - areas with entertainment functions, such as amusement parks and theme parks,
      - zoological and botanical gardens;
2) soil group II:
   a) arable land, marked with symbol R and areas of family allotment gardens arranged on land marked with symbol R,
   b) orchards, designated by the symbol S,
   c) permanent meadows, marked with symbol Ł,
   d) permanent pastures, designated by symbol Ps,
   e) land under ponds, marked with symbol Wsr,
   f) land under ditches, marked with symbol W,

g) areas of family allotment gardens arranged on land marked with symbol Bz;

3) soil group III:

a) forests, marked with symbol Ls,

b) wooded and shrub land, marked with symbol Lz,

c) wooded and shrubby areas on agricultural land, marked with symbol Lzr,

d) wastelands, marked with symbol N,

e) recreation and leisure areas, designated with the symbol Bz, excluding the areas listed in point 1(e), including:

- areas with historical character, such as: castle ruins, fortified settlements, barrows, nature monuments,
- areas of unmanaged greenery not classified as forests and wooded and shrubby land,

f) ecological land, marked with a symbol consisting of the letter "E" and the symbol of the appropriate land use determining the manner of development or use of the land, in particular E-Ls, E-Lz, E-N, E-Ps and E-R,

g) miscellaneous areas, marked with symbol Tr;

4) soil group IV:

a) industrial areas, marked with symbol Ba,

b) fossil lands, marked with symbol K,

c) communication areas, including:

- roads, marked with symbol dr,
- railroad areas, marked with symbol Tk,
- other communication areas, marked with symbol Ti,
- land designated for the construction of public roads or railroads, marked with symbol Tp.

The status of soil and ground quality in the WTE Plant area was determined on the basis of one-time quality monitoring including 5 soil samples from the 0.9-1.0 m below ground level depth zone and from the zone below 2.0 m below ground level.

None of the contamination indicators measured in the soils during the above-mentioned monitoring, exceeds the acceptable concentrations established by the then valid Regulation of the Minister of the Environment of September 2, 2002 on soil quality standards and land quality standards for the group C areas, which currently corresponds to the group IV – industrial areas, mines and transport areas.

Based on the sozological maps, no idle lands of anthropogenic origin were found in the vicinity of the planned WTE Plant project.

The following are the results of physical and chemical tests of soil samples and the classification of chemically aggressive environment for the soil according to “Hydrogeological documentation defining hydrogeological conditions in the subsoil of the planned Waste to Energy Plant on the premises of Veolia Nowa Energia Sp. z o.o., at ul. J. Andrzejewskiej 5 in Łódź” made by GEOTEKO in June 2020.

Table 26 Summary of results of physical and chemical tests of soil samples – group IV

Parametr	Jednostka	Miejsce poboru próbki				[1]Wartości dopuszczalne
		OW-1	OW-8	OW-16	OW-21	
Głębokość poboru próbki	[m ppt]	0,25	0,25	0,25	0,25	
Zawartość wilgoci	%	8.7	5,7	5,1	5,3	
Całkowite siarczany (SO_4)	mg/kg	-	-	-	-	
Kwasowość		-	-	-	-	
Bor (B)	mg/kg s.m	0,7	0,4	1,4	1,2	-
Kadm (Cd)		0,6	0,4	0,2	<0,2	15
Chrom (Cr)		24	7	41	13	1000
Kobalt (Co)		4	2,5	4	4	200
Ołów (Pb)		27	6,3	28	14	600
Rtęć (Hg		<0,3	<0,3	<0,3	<0,3	30
Cynk (Zn)		130	31	220	46	2000
Suma benzyn (C_6-C_{12})	mg/kg s.m	<0,1	<0,1	<0,1	<0,1	500
Suma olejów mineralnych (C_{12}-C_{35})		<10	<10	<10	<10	3000
Naftalen	mg/kg s.m	<0,05	<0,05	<0,05	<0,05	20
Acenaftylen		<0,05	<0,05	<0,05	<0,05	
Acenaften		<0,05	<0,05	<0,05	<0,05	
Fluoren		<0,05	<0,05	<0,05	<0,05	
Fenantren		<0,05	<0,05	<0,05	<0,05	
Antracen		<0,05	<0,05	<0,05	<0,05	20
Fluoranten		<0,05	<0,05	<0,05	<0,05	
Piren		<0,05	<0,05	<0,05	<0,05	
Benzo(a)antracen		<0,05	<0,05	<0,05	<0,05	20
Chryzen		<0,05	<0,05	<0,05	<0,05	20
Benzo(b)fluoranten		<0,05	<0,05	<0,05	<0,05	20
Benzo(k)fluoranten		<0,05	<0,05	<0,05	<0,05	20
Benzo(a)piren		<0,05	<0,05	<0,05	<0,05	20
Ideno(1,2,3-c)piren		<0,05	<0,05	<0,05	<0,05	20
Dibenzo(a,h)antracen		<0,05	<0,05	<0,05	<0,05	20
Benzo(g,h,i)perylen		<0,05	<0,05	<0,05	<0,05	20
Suma WWA		<0,80	<0,80	<0,80	<0,80	

PL	EN
Parametr	Parameter
Jednostka	Unit
Miejsce poboru próbki	Sampling point
Wartości dopuszczalne	Limit values
OW-1	OW-1

Głebokośc poboru próbki	Sampling depth
Zawartość wilgoci	Moisture content
Całkowite siarczany	Total sulfates
Kwasowość	Acidity
Bor	Boron
Kadm	Cadmium
Chrom	Chromium
Kobalt	Cobalt
Ołów	Lead
Rtęć	Mercury
Cynk	Zinc
Suma benzyn	Total petroleum hydrocarbons C6-C12
Suma olejów mineralnych	Total mineral oils
Naftalen	Naphthalene
Acenaftylen	Acenaphthylene
Acenaften	Acenaphthene
Fluoren	Fluorene
Fenantren	Phenanthrene
Antracen	Anthracene
Fluoranten	Fluoranthene
Piren	Pyrene
Benzo(a)antracen	Benzo(a)anthracene
Chryzen	Chrysene
Benzo(b)fluoranten	Benzo(b)fluoranthene
Benzo(k)fluoranten	Benzo(k)fluoranthene
Benzo(a)piren	Benzo(a)pyrene
Ideno(1,2,3-c)piren	Ideno(1,2,3-c)pyrene
Dibenzo(a,h)antracen	Dibenzo(a,h)anthracene
Benzo(g,h,i)perylen	Benzo(g,h,i)perylene
Suma W W A	Total polycyclic aromatic hydrocarbons (PAHs)
[m ppt]	[m BGL]

[1]Permissible contents of risk-causing substances group IV – Regulation of the Minister of Environment of September 1, 2016 on the method of conducting the assessment of the surface pollution (Journal of Laws of 2016, item 1395)

Table 27 Summary of results of physical and chemical tests of soil samples – group IV

Parametr	Jednostka	Miejsce poboru próbki				[1]Wartości dopuszczalne $>1 \times 10^{-7}$/ $<1 \times 10^{-7}$
		OW-1	OW-8	OW-16	OW-21	
Głębokość poboru próbki	[m ppt]	1,0 – 1,2	1,0 – 1,2	1,0 – 1,2	1,0 – 1,2	
Oznaczenie gruntu		Ps/Pd/Pg	Pd	Gpz	Ps+Ż	
Zawartość wilgoci	%	8,4	3	6,9	4,8	
Całkowite siarczany (SO_4)	mg/kg	150	140	160	-	
Kwasowość		<10	<10	<10	-	
Bor (B)	mg/kg s.m	0,4	<0,2	0,6	0,8	-
Kadm (Cd)		0,4	<0,2	<0,2	<0,2	6 / 20
Chrom (Cr)		7	4,7	10	6,1	300 / 800
Kobalt (Co)		2,5	1,6	2,7	2,2	50 / 300
Ołów (Pb)		6,3	4,6	6,5	5,5	200 / 1000
Rtęć (Hg		<0,3	<0,3	<0,3	<0,3	4 / 50
Cynk (Zn)		31	11	22	15	300 / 5000
Suma benzyn (C_6-C_{12})	mg/kg s.m	<0,1	<0,1	<0,1	<0,1	50 / 750
Suma olejów mineralnych (C_{12}-C_{35})		<10	<10	<10	<10	1000 / 3000
Naftalen	mg/kg s.m	<0,05	<0,05	<0,05	<0,05	10 / 40
Acenaftylen		<0,05	<0,05	<0,05	<0,05	
Acenaften		<0,05	<0,05	<0,05	<0,05	
Fluoren		<0,05	<0,05	<0,05	<0,05	
Fenantren		<0,05	<0,05	<0,05	<0,05	
Antracen		<0,05	<0,05	<0,05	<0,05	10 / 40
Fluoranten		<0,05	<0,05	<0,05	<0,05	
Piren		<0,05	<0,05	<0,05	<0,05	
Benzo(a)antracen		<0,05	<0,05	<0,05	<0,05	10 / 40
Chryzen		<0,05	<0,05	<0,05	<0,05	10 / 40
Benzo(b)fluoranten		<0,05	<0,05	<0,05	<0,05	5 / 20
Benzo(k)fluoranten		<0,05	<0,05	<0,05	<0,05	5 / 20
Benzo(a)piren		<0,05	<0,05	<0,05	<0,05	5 / 40
-c)piren		<0,05	<0,05	<0,05	<0,05	5 / 20
Dibenzo(a,h)antracen		<0,05	<0,05	<0,05	<0,05	5 / 20
Benzo(g,h,i)perylen		<0,05	<0,05	<0,05	<0,05	5 / 20
Suma WWA		<0,80	<0,80	<0,80	<0,80	

PL	EN
Parametr	Parameter

Jednostka	Unit
Miejsce poboru próbki	Sampling point
Wartości dopuszczalne	Limit values
OW-1	OW-1
Głebokośc poboru próbki	Sampling depth
Zawartość wilgoci	Moisture content
Całkowite siarczany	Total sulfates
Kwasowość	Acidity
Bor	Boron
Kadm	Cadmium
Chrom	Chromium
Kobalt	Cobalt
Ołów	Lead
Rtęć	Mercury
Cynk	Zinc
Suma benzyn	Total petroleum hydrocarbons C6-C12
Suma olejów mineralnych	Total mineral oils
Naftalen	Naphthalene
Acenaftylen	Acenaphthylene
Acenaften	Acenaphthene
Fluoren	Fluorene
Fenantren	Phenanthrene
Antracen	Anthracene
Fluoranten	Fluoranthene
Piren	Pyrene
Benzo(a)antracen	Benzo(a)anthracene
Chryzen	Chrysene
Benzo(b)fluoranten	Benzo(b)fluoranthene
Benzo(k)fluoranten	Benzo(k)fluoranthene
Benzo(a)piren	Benzo(a)pyrene
Ideno(1,2,3-c)piren	Ideno(1,2,3-c)pyrene
Dibenzo(a,h)antracen	Dibenzo(a,h)anthracene
Benzo(g,h,i)perylen	Benzo(g,h,i)perylene

Suma W W A	Total polycyclic aromatic hydrocarbons (PAHs)
[m ppt]	[m BGL]

[1]Permissible contents of risk-causing substances group IV – Regulation of the Minister of Environment of September 1, 2016 on the method of conducting the assessment of the surface pollution (Journal of Laws of 2016, item 1395)

<u>None of the samples tested, to the extent of the analyses performed, were found to exceed risk substance limits.</u>

The classification of chemically aggressive environment for soil according to PN-EN 206:2013 was also made:

Table 28 Chemically aggressive environment classification for soil

Miejsce poboru wody	wg normy PN-EN 206:2013 (głębokość poboru próbki 1,0 - 1,2 m)
OW-1	gleba nie stanowi środowiska chemicznie agresywnego względem betonu.
OW-8	gleba nie stanowi środowiska chemicznie agresywnego względem betonu.
OW-16	gleba nie stanowi środowiska chemicznie agresywnego względem betonu.

PL	EN
Miejsce poboru wody	Place of water intake
Wg normy PN-EN 206:2013 (głębokość poboru próbki 1,0 – 1,2 m)	According to the standard PN-EN 206:2013 (sampling depth 1.0 – 1.2 m)
OW-1	OW-1
Gleba nie stanowi środowiska chemicznie agresywnego względem betonu.	The soil is not a chemically aggressive environment in relation to the concrete.

7.7 Cultural assets

Łódź is an important cultural center in Poland. It is home to numerous buildings recognized as historic landmarks and hosts dozens of festivals and reviews each year. Most cultural objects are located along the line of Piłsudskiego – Piotrkowska – Kościuszki/Zachodnia streets.

Most of the historic buildings date back to the 19th and 20th centuries. They are located in different parts of the city, but many of them are situated along the most representative street of Łódź, which is listed in the register of historical monuments. In addition, Piotrkowska Street was recognized as one of the "7 Wonders of Poland" in the prestigious competition on the occasion of the 100th anniversary of Independence, the largest fair of the tourism industry World Travel Show, which emphasizes its uniqueness in Poland.

The WTE Plant site is located in an industrial area that is not distinguished by exceptional architectural style, is not on the Register of Historic Places and is not included in the local area development plan. At the same time, it should be noted that the lack of Local Area Development Plan does not exclude generally applicable restrictions under the Regulation of the Minister of the Environment of June 14, 2007 on permissible levels of noise in the environment For example, allotment gardens across J. Andrzejewskiej Street, are covered by acoustic protection. The acoustic impacts of the proposed project are described in detail in chapter 8.7.

Activities that could have an impact on monuments and cultural goods are not planned to be carried out.

8 PLANNED PROJECT ENVIRONMENTAL IMPACT

8.1 Project impact on protected areas including Natura 2000 sites

The Nature Conservation Act of April 16, 2004 defines the following forms of nature conservation (Article 6 section 1):

- national parks,
- nature reserves,
- landscape parks,
- protected landscape areas,
- Natura 2000 areas,
- natural monuments,
- documentation sites,
- ecological areas,
- nature and landscape complexes,
- species-related protection of plants, animals and fungi.

The aforementioned Act implements 10 forms of nature conservation. Each form fulfills a different role in the Polish system of nature protection and serves different purposes, therefore it is characterized by a different protection regime and the scope of limitations in use.

Forms of nature conservation form a large and diverse set of measures to implement nature conservation, formed as a result of the development of the scientific basis of nature conservation and its long-standing practice.

The areas covered by the territorial form of protection, protected due to their natural values, are located far away from the area of the planned project. The closest forms of nature conservation are listed and characterized below.

- National parks

There are no national parks in the Łódzkie Voivodeship, the closest enclave of the Kampinos National Park in the form of the European Bison Breeding Center is in Smardzewice (about 50 km from the planned project location). The Kampinos National Park is located at a distance of about 82 km from the planned project and its buffer zone is about 80 km away.

- Landscape parks

Nearby the planned project, the closest landscape park is the Łódź Heights Landscape Park with its buffer zone, located at a distance of about 7 km, while others are located at a distance of over 30 km.

- Nature reserves

The closest reserve in the vicinity of the planned project is Polesie Konstantynowskie reserve, located at a distance of approximately 8 km. The next closest reserve is Wiączyń, located about 9 km away, and Łagiewnicki Forest, about 9.5 km away.

- Natura 2000 areas

There are no special bird protection areas of the Natura 2000 program within 30 km of the planned project. Within 15 km from the planned project there are special habitat protection areas of the Natura 2000 program indicated below:

- Gałkowska Beech Forest PLH100016

The area is located approximately 10 kilometers from the planned project. It covers an area of 103.41 ha and is a part of the Gałków sacred forest – a vast forest complex located between Łódź and Koluszki, with an area of about 1000 ha. The vegetation of the Gałków sacred forest is spatially significantly diversified; the northern part is dominated by forest habitats (mainly oak-hornbeam forests and fir and beech forests), while the southern part are mixed coniferous forests and fresh coniferous forests.

The beech forests with fir in the Gałków sacred forest are a well-known and valued natural site. The location on the northern border of the natural range of fir and beech gives this site special importance. Existing for half a century, the reserve represents a natural type of a beech and fir forest, characteristic of moraine uplands in a watershed area. There are numerous specimens of age-old trees (beech trees up to 200 years old) with monumental character on the territory of the reserve.

- Janinowska Beech Forest PLH100017

The site is located approximately 14 kilometers from the planned project and covers an area of 528.96 hectares. The area includes the Janinów forest complex, one of the most valuable natural beech stands at the local northern geographical border of central Poland. Acidic beechwoods in the Janinów sacred forest are well developed, showing features of naturalness on a large surface. They are partially single-species, mature stands with beeches up to 190 years old (beech seed stand). At the northeastern border of the complex and the southeastern edge of the sacred forest there are springs of valuable nature – a place of occurrence of many interesting plant and animal species. In the northern part of the sacred forest there is the Parowy Janinowskie nature reserve, established in 2000. On an area of 41.66 ha, the original post-erosion arroyos are subject to protection, with a total length of over 2.5 km and a depth of about 8 m. It is a valuable site both in terms of geomorphology, geobotany and sightseeing. The main object of protection are acidic beechwoods, covering about 60% of the area. The biogeographical significance of the beech stand determining the natural range limit of this species is important. Old beech stands are an important faunistic refuge for species requiring the presence of age-old trees. In the vascular flora, the presence of 2 mountain species deserves special attention: Huperzia selago and Polygonatum verticillatum.

Species found in the area: Western barbastelle (Barbastella barbastellus), greater mouse-eared bat (Myotis myotis), northern crested newt (Triturus cristatus).

- Ecological arables

The following local nature conservation sites are located near the planned project:

Wiskitno Lake (Jeziorko Wiskitno)	approx. 2.5 km to the southeast
Boggy Land at Pomorska (Mokradła przy Pomorskiej)	approx. 3 km to the north
Ponds in Mileszki (Stawy w Mileszkach)	approx. 3.2 km to the northeast
Meadow in Wiączyń (Łąka w Wiączyniu)	approx. 5.7 km to the northeast
Ponds in Nowosolna (Stawy w Nowosolnej)	approx. 7.3 km to the northeast
Alder riparian woods on the Ner River (Olsy nad Nerem)	approx. 9.2 km to the west
Birch boggy land (Mokradła Brzozy)	approx. 9.9 km to the northwest

Majerowskie Field (Majerowskie Pole)	approx. 10 km to the northwest
Majerowskie Muds (Majerowskie Błota)	approx. 10 km to the northwest

- Outstanding natural features

The following outstanding natural features are located in the vicinity of the planned project (within 1.5 km):

PL.ZIPOP.1393.PP.1061011.5108	approx. 0.50 km to the southeast
PL.ZIPOP.1393.PP.1061011.5106	approx. 0.50 km to the southeast
PL.ZIPOP.1393.PP.1061011.5106	approx. 0.55 km to the southeast
PL.ZIPOP.1393.PP.1061011.250	approx. 1 km to the southeast
PL.ZIPOP.1393.PP.1061011.249	approx. 1 km to the southeast
PL.ZIPOP.1393.PP.1061011.248	approx. 1 km to the southeast
PL.ZIPOP.1393.PP.1061011.247	approx. 1 km to the southeast
PL.ZIPOP.1393.PP.1061011.246	approx. 1.1 km to the south
PL.ZIPOP.1393.PP.1061011.292	approx. 1.5 km to the north

- Protected landscape areas

The closest protected landscape areas to the planned project are the Miazgi Valley near Andrespol at a distance of about 6 km and Protected Landscape Area Mrogi and Mrożyca at a distance of about 7.5 km from the planned project.

- Documentation sites

Near the planned project the closest documentation site is the geological test pit face in Niesułkowo Kolonia, located about 18 km from the planned project.

- Landscape-nature protected complexes

The following natural and landscape complexes are located in the vicinity of the planned project: Sources of the Ner River about 4 km to the southeast, Ruda Willowa about 7 km to the southwest, Sucha Dolina in Moskuly about 9.4 km to the north, Międzyrzecze Neru i Dobrzynki about 10.5 km to the southwest, Dolina Sokołówka about 11 km to the northwest.

The scale and type of the project means that its possible impact on protected areas is limited to the area directly occupied by the facility and consists in the interruption of its natural functions. Outside of this area, the impact of the WTE Plant will be limited to air emissions, which, however, will not cause an above-normal deterioration of air quality. The planned project is located outside of protected areas, including Natura 2000 areas, as well as outside of ecological corridors connecting protected areas. The planned project is of point nature and its further impact will be limited to the emission of gases and dust into the air, which, however, will not cause excessive deterioration of the environmental quality.

Project implementation will not have a negative impact on individual protected areas or their system.

8.2 Planned project impact on the natural environment

8.2.1 Environmental inventory of the site – Vegetation and fungi

Environmental inventory in terms of natural habitats and protected and endangered elements of vascular flora, bryophytes and fungi was conducted during several inspections of the planned project area that were conducted from February to June 2020.

During the penetration of the planned investment project area, positions of protected plant and fungi species were also sought, as referred to in the Regulation of the Minister of Environment of October 9, 2014 on the species protection of plants

and the Regulation of the Minister of Environment of October 9, 2014 on the species protection of fungi, as well as vascular plant and moss species listed in Annexes II and IV of the Council Directive 92/43/EEC of 21 May 1992 and in the Regulation of the Minister of Environment on natural habitats and species of Community interest, as well as on the criteria for selecting areas eligible for recognition or designation as Natura 2000 sites (Journal of Laws of 2014, item 1713). Mapping works will be carried out using orthophotomaps and a GPS receiver. A grid of subdivisions was used to determine the coverage of individual types of natural habitats.

The phytosociological nomenclature was adopted from Ratyńska et al (2010). Nomenclature of vascular plant species was adopted from Mirek et al. (2002) and mosses after Ochyra et al. (2003), nomenclature of macroscopic fungi from Wojewoda (2003), lichenizing fungi from Fałtynowicz and Kossowska (2016).

Figure 10 Investment project area with adjacent areas

Figure 11 Surveyed area

8.2.2 Survey results – Vegetation and fungi

Table 29 Plant survey results

Item	Species name	English name	Protection status	Area of protected species site/estimated number of individuals at the site	Location	Project impact assessment	Proposed mitigation measures
1	*Cladonia portentosa*	Reindeer lichen	Partial protection	1 m²	Dispersed over the entire area	Potentially negative, common species, locally	None, Applicant will obtain approval from RDOŚ for metaplantation prior to commencement of works
2	*Peltigera canina*	Dog-lichen	Partial protection	6 m²	N 51.745999 E 19.53314	Potentially negative, common species, locally	None, Applicant will obtain approval from RDOŚ for metaplantation prior to commencement of works
3	*Rhytidiadelphus squarrosus*	Square goose neck moss	Partial protection	2 m²	Dispersed over the entire area	Potentially negative, common species, locally	None, Applicant will obtain approval from RDOŚ for metaplantation prior to commencement of works
4	*Pleurozium schreberi*	Red-stemmed feathermoss	Partial protection	4 m²	Dispersed over the entire area	Potentially negative, common species, locally	None, Applicant will obtain approval from RDOŚ for metaplantation prior to commencement of works
5	*Helichrysum arenarium*	Dwarf everlast	Partial protection	25 m²	Dispersed over the entire area	Potentially negative, common species, locally	None, Applicant will obtain approval from RDOŚ for metaplantation prior to commencement of works

The investment project site is made of grasslands and thickets. They formed on soils lined with sand and concrete slabs.

An association of *Polygono-Poetum annuuae* class of annual meadow grass *Poetum annuae* was identified in the area occupied by concrete slabs. Among the class of sandy grasslands, *(Koelerio-Corynephoretea*), two communities can be found here: the association of redstem filaree and *Erodio-Senecietum vernais* (association of ruderal grasslands *Sileno conicae-Cerastion semidecandri*) and the impoverished community from the association of *Thero-Airion* (inland grasslands). A community of the *Stellarietea media* class of segetal and ruderal plants is the seaside barley *Hordeeum marini* assemblage.

The following communities were observed in both the area with slabs and the remaining area: *Rubo caesii-Calamagrostietum epigeji* grassy vegetation with wood smallreed, *Tanaceto-Artemisietum* herb vegetation with tansy and common mugwart, *Rudbeckia-Solidaginetium* association of coneflower and tall goldenrod and *Arthemisio campestris-Oenotheretum rubricaulis* association of field mugwort and weedy evening primrose *(Artemisietea vulgaris*).

Pioneer and grassland vegetation grows at road shoulders, lawns or paths. The *Polygono-Poetum annuuae* class is represented by the *Chenopodio glauci-Puccinellietum* association of oak-leaved goosefoot and alkali grass, the *Matricario matricarioidis-Polygonetum arenastri* pineappleweed and common knotgrass and the *Bryo argentei-Saginetum procumbentis* association of silver moss and procumbent pearlwort. The meadow community*(Molinio-Arrhenatheretea*) here is the association of perennial ryegrass and common goby *Lolio-Plantaginetum*x.

List of communities:

Class: *Koelerio-Corynephoretalia*

Order: *Corynephoretalia canescentis*

Alliance: *Sileno conicae-Cerastion semidecandri*

Association: *Erodio-Senecietum vernalis*

Alliance: *Thero-Airion*

Impoverished community from the *Thero-Airion* association

Class: *Molinio-Arrhenatheretea*

Order: *Trifolio repentis-Plantaginetalia majoris*

Alliance: *Cynosurion*

Association: *Lolio-Plantaginetum*

Class: *Artemisietea vulgaris*

Order: *Onopordetalia acanthii*

Alliance: *Onopordion acanthii*

Association: *Tanaceto-Artemisietum*

Association: *Arthemisio campestris-Oenotheretum rubricaulis*

Alliance: *Convolvulo-Agropyrion*

Association: ***Rubo caesii-Calamagrostietum epigeji***

Order: *Convolvuletalia sepium*

Alliance: *Senecionion fluviatilis*

Association: *Rudbeckio-Solidaginetum*

Class: *Stellarietea mediae*

Order: *Sisymbrietalia*

Alliance: *Sisymbrion*

Association: *Hordeeum murini*

Class: *Polygono-Poetea annuuae*

Order: *Polygono arenastri-Poetalia annuuae*

Alliance: *Saginion procumbentis*

Association: *Bryo argentei-Saginetum procumbentis*

Alliance: *Polygono-Coronopodion squamati*

Association: *Chenopodio glauci-Puccinellietum*

Association: *Matricario matricarioidis-Polygonetum arenastri*

Association: *Poetum annuae*

The area-dominant communities belong to the *Artemisietea vulgaris* class of nitrophilous overgrowing perennial vegetation (4 communities) and *Koelerio-Corynephoretea* class of pioneer sandy grasslands (2). Of lesser importance are associations of segetal and ruderal plant class *Stellarietea media* (1), meadow class *Molinio-Arrhenatheretea* (1) or plants of trodden areas *Polygono-Poetum annuae* (4).

Among the partially protected vascular plants, dwarf everlasts *Helichrysum arenarium* were found.

The survey revealed the presence of two species of partially protected lichens: reindeer lichen *Cladonia portentosa* and dog-lichen *Peltigera canina*.

Among the mosses, nine species were identified, including two partially protected species: square goose neck moss *Rhytidiadelphus squarrosus* and red-stemmed feathermoss *Pleurozium schreberi*.

Table 30 Lichen survey results

Item	Latin name	English name	Protection
1.	***Cladonia portentosa***	**Reindeer lichen**	**Partial**
2.	***Peltigera canina***	**Dog-lichen**	**Partial**

Table 31 Moss survey results

Item	Latin name	English name	Protection
1.	***Rhytidiadelphus squarrosus***	**Square goose neck moss**	**Partial**
2.	***Pleurozium schreberi***	**Red-stemmed feathermoss**	**Partial**
3.	*Brachythecium albicans*	Whitish feather-moss	None
4.	*Bryum argenteum*	Silvergreen bryum moss	None
5.	*Bryum caespiticum*	Tufted thread-moss	None
6.	*Ceratodon purpureus*	Redshank	None
7.	*Cirriphyllum piliferum*	Hair pointed feather-moss	None
8.	*Funaria hygrometrica*	Common cord-moss	None
9.	*Niphotrichum canescens*	Wideleaf racomitrium moss	None

8.2.3 Herpetofauna

Amphibians

As part of the preparatory work for the field inventory, any water bodies, floodplains, and stagnant water bodies that may provide amphibian habitat were selected. Water bodies were identified at this work stage using topographic maps (mainly 1:10,000), orthophotographic maps and satellite imagery (Google Earth). This way, 1 potential habitat has been identified – a water body in the western project part.

Field surveys were conducted in February–May 2020. They covered the entire investment project area along with adjacent areas. During a foot penetration of the area, the entire area was thoroughly checked.

The timing of the inspections at the turn of April and May 2020 was optimal for the survey of amphibian breeding sites, which was confirmed by numerous observations from the surveys carried out simultaneously in other projects.

Reptiles

As part of the preparatory works, several habitats potentially abundant in reptiles were selected away from the project.

Field surveys were conducted in February–May 2020. Any sunny habitat – open habitat with numerous boulders and/or piles of rocks – was checked in search of reptiles.

Data were also collected in the field on the habitat status of the identified reptile species according to

the methodology of the state environmental monitoring or by expert method for species for which no methodology has been developed. All observations were marked using a Garmin eTrex Legend HCx GPS receiver. During the survey, photographic documentation was made of the habitats of the reptile species found.

8.2.4 Survey results – Herpetofauna

During the site inspections, no amphibians or reptiles have been recorded on the project site.

In the immediate vicinity, no herpetofauna breeding or wintering sites have been found, and therefore it should be assumed that the analyzed area is not a habitat of amphibians or reptiles and, additionally, it is not located on a migration route.

It should be pointed out that in the area covered by the survey, in the western part (in the buffer outside the boundaries of the project), there is a water reservoir – no amphibians or reptiles have been found there.

The reservoir has steep walls, it is filled with water (about 10 cm) and the depth of the reservoir exceeds 5 m, so even if amphibians tried to get inside, they would not survive a fall from such a height.

Figure 12 Water reservoir in the vicinity of the investment project

Despite the lack of amphibians in the location in question, it is recommended to fence off the reservoir with a fine mesh or herpetological panels at the bottom so as to prevent amphibians and small mammals (hare) from entering.

8.2.5 Avifauna

The surveys were conducted during the birds' breeding season, therefore it was mainly aimed at assessing the occupancy of the project area and the area directly adjacent to the project by actively searching for birds' nests located in the area covered by the survey and listing all singing males. All birds within sight of the observer were recorded during the observation.

The site inspection was conducted on May 18, 2020. During the inspection, the entire investment project area was penetrated using the itinerary method, the inspection was conducted in the afternoon hours, observations were made during good weather conditions, during windless weather. Locus Map Pro was used to map the observations.

Surveys were conducted using optical equipment as well as by listening for bird voices. In the course of the surveys conducted, the following was used:

- Delta Optical Forest II 10x50 binoculars;

- Canon Eos 600D camera, Sigma 17–70 mm f/2.8–4 MACRO HSM lens, Sigma 70–200 mm f/2.8 lens.

8.2.6 Survey results – Avifauna

Table 32 Bird survey results

Item	Species name	English name	Protection status	Area of protected species site/estimated number of individuals at the site	Location	Project impact assessment	Proposed mitigation measures
1	*Parus major*	Great tit	Strict protection	Pair	Nesting in the lighting post in the northern part of the area	Potentially negative, very numerous species, prior to possible removal, the Applicant shall obtain RODS consent in the scope of derogation from the prohibitions, prior to the commencement of works	Works to be carried out beyond the breeding season
2	*Columba palumbus*	Common wood pigeon	Game bird	4	Four feeding specimens in the southern part of the site	Potentially negative due to reduction of foraging area	In biologically active areas, 10% of the area should be left as an extensively mown area, i.e. not more frequently than twice a year.
3	*Phoenicurus ochruros*	Black redstart	Strict protection	1	Singing male, no nest site		
4	*Passer montanus*	Eurasian tree sparrow	Strict protection	4	Four feeding specimens in the southern part of the site		
5	Corvus monedula	Western jackdaw	Strict protection	2	Through-flight of 2 specimens	none	none

Figure 13 One of the foraging common wood pigeons in the survey area

Figure 14 Interior of the lighthouse where the great tit nest was found

8.2.7 Entomofauna

Standard methods were used such as screening litter with an entomological sieve, scooping herbaceous plants with an entomological scoop and sampling tree bark and rotting wood. An important method for shell snails was to look for live individuals and empty shells.

In the case of protected butterflies, including the large copper, a search was conducted for potential habitats typical for these species – meadow communities with various species of caterpillar host plants.

The hermit beetle inventory methodology involved searching rotting wood microhabitat located in hollow trees growing on the project site and in the immediate vicinity. Searches were conducted to detect larvae, droppings, coccoliths or their remains, as well as remains of adult insects (the most characteristic body fragments of the hermit beetle are pronotum and elytra). Analysis of satellite imagery, supported by subsequent field observation, ruled out the presence of hermit beetle at the project site.

Visual inspection of the site revealed no potential for saproxylic beetles.

8.2.8 Survey results – Entomofauna

A number of invertebrate species from several systematic groups were identified from the surveys. These are mainly pioneer species, which is related to a small diversity of available niches, strong anthropogenic impact on the environment (regular mowing), small surface area, or lastly location in the city, hence there are no valuable areas from which animals can migrate. Despite this unfavorable situation, the site of the planned WTE Plant should be pointed out. The presence of concrete slabs, in addition to the strong heating, also provides large amounts of calcium (necessary for the production of snail shells), which is readily used by them. Very numerous presence of snails from the species Cepaea (Cepaea sp.), heath snail (Xerolenta obvia) and a small population of the partially protected Roman snail (Helix pomatia) were recorded. The hollow shells of cepea sp. were found to contain the Gold-fringed mason bee (Osmia aurulenta) of the family Megachilidae. This is a common species of bee that reproduces in abandoned shells. The spider Pellenes tripunctatus from the family Salticidae is also associated with snails. This spider builds cocoons in empty shells and uses them as breeding sites, daytime shelter and also as wintering sites. In the Red List of Threatened and Endangered Animals in Poland, it has the category VU and is found relatively rarely, but it is not subject to species protection. Ants are another group with a large impact on the fauna of the area. When building their nests, they bring captured prey, plant material and seeds. These nests become islands in structurally poor areas with far greater soil fertility, allowing for more demanding plant species. No protected species of mound ants have been found, but low-demanding species such as the common black ant Lasius niger, pavement ant Tetramorium caespitum and black slave maker Formica fusca are very abundant. Among other Hymenoptera, a nest of the partially protected common carder bee Bombus pascuorum was found under a decaying sleeper – interestingly, it was infested by Tetramorium caespitum ants and the nest cells were destroyed. Two dead specimens were found.

Figure 15 Old bumblebee nest under a railroad sleeper

A numerous appearance of the common blue butterfly Polyommatus icarus from the Lycaenidae family was observed. It is a species associated with warm areas, often transformed by humans, where its caterpillars feed on common plant species like clover and vetch. Another interesting species is Rhynocoris irracundus from the order Heteroptera bugs. This predatory, very colorful species is already known from one locality in Łódź, so we obtained confirmation of its occurrence on the border of a compact range covering the west and south of Poland.

The presence in the vicinity of the railroad line is connected with the presence of the spider Zodarion rubidum in the survey area – this species has several published localities in Poland and is known to move along railroad embankments, where it builds its characteristic cocoons under stones. However, the author is aware of over 100 unpublished localities collected as part of a project to monitor the invasion of this species in Poland, so it should not be treated as rare.

Several other species of spiders were also found, mostly associated with drylands or feeding on ants. Ant-eating species include Phrurolithus festivus from the Phrurolithiidae family, the previously mentioned Zodarion rubidum from the Zodariidae family and Thanatus arenarius from the Philodromidae family. Besides these, Aulonia albimana from the Lycosidae family, Zelotes electus and Drassyllus pusillus from Gnaphosidae, Argenna subnigra and Lathys humilis from Dictynidae, Euophrys frontalis and Phlegra fasciata from the Salticidae family, Mangora acalypha from Araneidae and Spiracme striatipes from the Thomisidae family were found.

Figure 16 Search for insects under stored railroad sleepers

To sum up, despite relatively rich species, only two species subject to partial protection and one species appearing on the Red List were found, namely spider (Pellenes tripunctatus – vulnerable VU). The presence of partially protected carder bee (Bombus pascuorum) does not require any mitigation measures; it is a mobile species. There are no rules of procedure for partially protected Roman snail (Helix pomatia), it is therefore recommended to move the specimens manually outside the project site when encountered during the works.

Table 33 Insect survey results

Item	Species name	Protection status	Area of protected species site/estimated number of individuals at the site	Location	Project impact assessment	Proposed mitigation measures
1	Whelk jumping spider Pellenes tripunctatus	Partial protection, red list, hazard category VU vulnerable	>100	species located throughout the project site	Potentially negative, locally not threatened	On biologically active areas, 20% of the area should be left as an extensively mown area, i.e. not more frequently than twice a year
2	Common carder bee Bombus pascuorum	Partial protection	variable, mobile species	migrating species from nearby areas, breeding has been reported (failed attempt)	Potentially negative, common species, no local impact	On biologically active areas, 20% of the area should be left as an extensively mown area, i.e. not more frequently than twice a year
3	Burgundy snail Helix pomatia	partial protection	approximately 100 individuals	strip along the fence from point 51.745726/19.534652 to point 51,745729/19,533678	Potentially negative, common species, no local impact	None, Applicant shall obtain the consent of RDOŚ to transfer

8.2.9 Mammals

Due to the nature of the planned project, the surveys covered the area of both the project and the adjacent areas, i.e. the potential impact of the investment on mammals. The surveys were designed to assess its presumed impact on animal populations found in the area and to evaluate the importance of these areas to local fauna.

Mammal surveys were performed using traditional methods that varied according to the specifics of each systematic group. They were conducted in different phenological periods to show the whole aspect of activity of these animals in the survey area.

Surveys were conducted in February-May 2020 along the entire section of the planned project and adjacent areas; a series of inspections focused on finding representatives of different mammal groups.

During the inspection, all signs of animal presence (direct observations, burrows, droppings, tracks, etc.) were searched for.

8.2.10 Survey results – Mammals

During site inspections, no protected species of mammals have been recorded.

The presence (direct observations and tracks) of common game species was observed;

- red fox Vulpes vulpes,
- European hare Lepus europaeus.

The project site within the area of the plot of the Combined Heat and Power Plant is not a breeding site for the aforementioned mammals, but a feeding site. However, it should be noted that the presence of animals was incidental. The project site is fenced off with a tight fence.

8.2.11 Vegetation survey

The purpose of the vegetation survey is to determine the species composition of the existing trees and shrubs on the WTE Plant site and to perform basic dendrometric measurements of the existing trees and shrubs.

The dendrological survey of the indicated area was conducted on May 16,

2020. During the dendrological survey, the names of the tree and shrub species were determined. The species nomenclature was adopted in accordance with the work of

Włodzimierz Seneta and Jakub Dolatowski (Dendrology, Wydawnictwo Naukowe PWN 2012).

Tree trunk circumference measurements were taken at 130 cm, and if a tree was at this height:

- and had several trunks – the circumference of each of these trunks was measured,
- and had no trunk – the circumference was measured directly below the tree crown.

Dendrological parameters were measured using a 10–12 mm fiberglass tape measure from STANLEY.

Determination of tree location was done using TOPCON HiPer SR receiver with TOPCON FC-5000 controller.

8.2.12 Survey results – Vegetation survey

The identified trees and shrubs include primarily dedicated row plantings of Austrian pine *Pinus nigra*, self-seeded black locust *Robinia pseudoacacia* and black cherry *Prunus serotina*

As part of the planned investment project there is a need to remove 267 m² of shrubs and 53 trees. These are exclusively Austrian pines Pinus nigra with survey No. 378-429. Trees with survey No. 384, 403, 407 and 424 do not require a removal permit issued by a competent nature conservation authority due to the tree circumference at the height of 5 cm, which does not exceed 50 cm.

In accordance with the provisions of the Act on nature protection, plantings were proposed to compensate for the loss of greenery in the environment in a number no smaller than the number of trees to be removed as part of the project and an area of shrubs no smaller than the area to be removed.

In order to maintain the continuity of composition of the entire CHPP facility, for the purpose of plantings, it is proposed to plant the following tree species: Norway maple 'Globosum' (Acer platanoides 'Globosum'), blue spruce (Picea pungens) and Norway spruce (Picea abies) as well as shrubs from the species wild privet (Ligustrum vulgare) – cultivated as a hedge. Replacement plantings of coniferous species are proposed for coniferous trees removed and compensatory plantings of deciduous species are proposed for deciduous trees removed.

Additionally, at the gatehouse building, it is suggested to provide plantings of scarlet firethorn of the variety 'Orange Charmer' or 'Orange Glow' variety Pyracantha coccinea and rockspray cotoneaster Cotoneaster horizontalis. A shrub with good frost resistance, effective for its original shoot arrangement, fruit color and autumn foliage discoloration.

In addition, plantings with Japanese ivy Parthenocissus tricuspidata have been envisaged.

Table 34 Replacement planting proposal

Designation on the map	English name	Latin name	Quantity
1	Norway maple 'Globosum'	*Acer platanoides 'Globosum'*	2 pcs
2	Norway spruce	*Picea abies*	26 pcs
3	blue spruce	*Picea pungens*	26 pcs
4	wild privet	*Ligustrum vulgare*	55 m^2
5	scarlet firethorn	*Pyracantha coccinea*	156 m^2
6	rockspray cotoneaster	*Cotoneaster horizontalis*	60 m^2
7	Japanese ivy	*Parthenocissus tricuspidata*	174 pcs

8.2.13 Project impact on the natural environment at the implementation, operation and decommissioning stage

The entire investment project site, including a buffer of up to 150 m, has been surveyed.

As part of the planned project it is planned to remove 267 m² of shrubs and 53 trees.

The surveyed area is a highly transformed, industrial area where no areas that are attractive in terms of environmental and biodiversity assets were found. Biologically active areas – lawns, which provide a habitat for insects.

The reservoir located on the Project site is very deep, has a high curb, and no amphibians or other animals have been observed.

The area undergoing direct conversion has no environmental assets.

<u>In terms of botany</u>

All syntaxa belong to common or frequent communities. No protected habitats were recorded. Destroying them will not harm the region's wildlife.

One species of partially protected vascular plant was found in the investment project area: dwarf everlast Helichrysum arenarium, two partially protected mosses: square goose neck moss Rhytidiadelphus squarrosus, red-stemmed feathermoss Pleurozium schreberi, and two partially protected lichens: reindeer lichen Cladonia portentosa and dog-lichen Peltigera canina.

Destruction of dispersed sites of species of partially protected plants and lichens should be avoided. Prior to the commencement of construction, the Investor shall re-inspect the area in order to determine the status of the environment and, if necessary, shall obtain permits for activities prohibited with respect to protected species.

<u>In terms of herpetofauna</u>

No measures are planned to minimize the project impact on amphibians and reptiles because the task implementation and subsequent operation will not cause impact on herpetofauna.

<u>In terms of avifauna</u>

Table 35 Assessment of the Investment Project impact on birds

<table>
<tr><th>Item</th><th>Species name</th><th>Project impact assessment</th><th>Proposed mitigation measures</th></tr>
<tr><td>1</td><td>Great tit</td><td>Potentially negative, very numerous species, prior to possible removal, the Applicant shall obtain RODS consent in the scope of derogation from the prohibitions.</td><td>Works to be carried out beyond the breeding season</td></tr>
<tr><td>2</td><td>Common wood pigeon</td><td rowspan="3">Potentially negative due to reduction of foraging area</td><td rowspan="3">In biologically active areas, 10% of the area should be left as an extensively mown area, i.e. not more frequently than twice a year.</td></tr>
<tr><td>3</td><td>Black redstart</td></tr>
<tr><td>4</td><td>Eurasian tree sparrow</td></tr>
<tr><td>5</td><td>Western jackdaw</td><td>none</td><td>none</td></tr>
</table>

<u>In terms of entomofauna</u>

Table 36 Assessment of the Investment Project impact on insects

Item	Species name	Project impact assessment	Proposed mitigation measures
1	Whelk jumping spider Pellenes tripunctatus	Potentially negative, locally not threatened	On biologically active areas, 20% of the area should be left as an extensively mown area, i.e. not more frequently than twice a year
2	Common carder bee Bombus pascuorum	Potentially negative, common species, no local impact	On biologically active areas, 20% of the area should be left as an extensively mown area, i.e. not more frequently than twice a year
3	Burgundy snail Helix pomatia	Potentially negative, common species, no local impact	None, the Applicant shall obtain the consent of the Regional Director of Environment Protection for transfer

8.3 Project impact on the climate

The need to include climate change mitigation and adaptation in environmental impact assessments is due to the effects of climate change observed in recent decades, including rising temperatures and increased frequency and magnitude of extreme weather events.

In the energy sector, climate change will have a direct impact on both energy supply and demand. Projections of the impact of climate change on precipitation and glacier melt indicate that an increase of at least 5% in hydropower production is possible in northern Europe, with a decrease of at least 25% in southern Europe. Less precipitation and heat waves are also expected to adversely affect the cooling process. In terms of demand, increasing record summer temperatures and the associated need for cooling and extreme weather events will particularly impact electricity distribution.

The impact of climatic conditions on the energy sector in terms of the planned project, which is the subject of this environmental impact reassessment report, refers to changes in demand for electricity and heat, where two trends are observed:

- decrease in differences in power demand during the winter and summer months,
- a gradual increase in power and energy demand throughout the year.

In recent years, there has been a clear trend of narrowing the gap between summer and winter power demand. In 2000, the difference between maximum and minimum average monthly power demand was about 6,500. MW. In 2011, it decreased to about 4,500 MW. The apparent increase in power demand during the summer months is due to an increase in the affluence of the population, and thus greater demands for thermal comfort in workplaces and homes.

Despite the apparent year-on-year increase in electricity consumption per capita in Poland, it is still twice as low as in other EU countries, so it can be assumed with high probability that it will continue to grow.

In the years to come, the demand for electricity is forecast to increase and as regards heat, the current needs are expected to remain unchanged or even decrease. The trend of maintaining the current demand is a result of two basic components: a continuous increase in the number of dwellings, combined with an increase in their area, and a simultaneous decrease in the unit heat demand of existing dwellings.

The impact of outside temperature on heat demand is usually dimensioned by the number of “degree days”. Climate projections show that by 2070, the number of degree-days, depending on the region of Poland, will decrease by about 17%, with spatial differences in heat needs decreasing across Poland. Reducing demand will benefit centralized district heating systems, as the disproportion between summer demand (hot water) and winter demand (additional heating) will weaken.

In terms of measures to reduce the adverse climate impact on the power sector, it is advisable here to take measures to reduce the number of failures and facilitate their recovery.

Adaptation to climate change should be understood as such a way of planning, implementation, operation and decommissioning of a project so that it is optimally adapted to progressive climate change, as well as so that it does not increase the vulnerability of environmental elements to climate change.

According to Poland's climate policy, activities related to reducing climate and environmental impacts should be carried out in line with economic and social policies.

One of the pillars of Poland's climate policy will be the development of district heating that will synergistically combine the systems of multi-fuel units and co-generation.

As a signatory to the United Nations Framework Convention on Climate Change and the Kyoto Protocol, Poland is obliged to reduce greenhouse gas emissions.

As a result of an agreement between EU member states and Iceland, Poland does not implement its individual reduction target. The above-mentioned countries have undertaken a common reduction target expressed as a commitment to achieve average annual emissions of 80% of the sum of all countries' emissions in the base years.

The EU's commitments by 2030 are to increase the reduction of greenhouse gas emissions to at least 40% compared to 1990.

There are various sources of greenhouse gas emissions in waste management. First, a significant source of methane emissions (as a stronger greenhouse gas than CO_2) is the landfilling of untreated organic and mixed waste. In landfills, under oxygen-poor conditions, and thus in the deeper layers, microbial activity results in the transformation of organic compounds, the ultimate product of which under anaerobic conditions is methane. Methane has a 20% contribution to causing the Earth's greenhouse effect over the past decade, even though its contribution to emissions is three times lower than CO_2. It is estimated that 5 to 10 percent of methane emissions come from untreated landfills.

In the context of climate change and projected scenarios of further changes, with regard to the National Waste Management Plan (NWMP) 2022, attention should be paid to:

- locating waste management plants, waste incineration plants and landfills in areas not threatened by landslides, flooding and inundation by floodwaters,
- adapting plant and incinerator structures to the potential for extreme weather events such as tornadoes and hurricanes,
- application of protection of landfills – against the risk of waste blowing away, smearing, creation of excessive amount of leachate as a result of heavy rainfall,
- application of safeguards against excessive overheating of incineration plant systems and uncontrolled production of landfill gases in high temperature conditions – prevention of spontaneous ignition of landfills and overheating of systems in incineration plants,
- securing proper sanitary conditions in municipal and biological waste treatment plants due to the risk of development of pathogenic microorganisms at high temperatures and uncontrolled proliferation of pests: rodents, insects,

- the use of treatment of residual waste left after the recovery of secondary raw materials and landfill gases captured from landfills for energy recovery, preferably in cogeneration of heat and power, as a way to reduce consumption of natural resources and greenhouse gas emissions – and thus mitigate climate change.

In conclusion, the WTE Plant project in question fits into the above assumptions by, among other things, reducing waste storage and methane emissions.

8.4 Project impact on landscape

8.4.1 Construction stage

Site leveling activities will be performed on a small scale. Such a change in land topography will not be of major importance and will not result in significant changes in the landscape of the area intended for industrial areas.

8.4.2 Operation stage

The project area is located in an industrial area, in close proximity to EC-4, which has 2 stacks dominating the landscape. The WTE Plant project also involves the construction of a stack that will not significantly impact the landscape due to the fact that the dominant feature of the surrounding landscape will be the aforementioned stacks.

The architectural form of the system will fit into the existing landscape of industrial areas.

8.4.3 Decommissioning stage

The decommissioning of the WTE Plant will take place in accordance with the legal requirements applicable in a given period, which will minimize the impact on the landscape. Moreover, with the use of appropriate land reclamation processes, it is possible to restore the landscape to the condition from before the implementation of the project.

8.5 Project impact on soil and ground surface

8.5.1 Construction stage

The anticipated impact on the soil subbase will occur primarily at the construction stage and will be associated with the removal of man-made deposits deposited within the WTE Plant site and the associated emission of pollutants during construction activities.

The excavated soil masses (and concrete slabs) will have to be removed to a pre-prepared site (quarry) at the EC-4 site.

Negative impacts will also include physical disturbance of the soil layer structure by heavy machinery and vehicle traffic. As a result, the construction site should be kept as confined as possible and inadvertent driving in adjacent land should be prevented. The impact of the construction works on the groundwater environment, due to the depth of the aquifers, should not cause a change in water relations in the area under consideration.

8.5.2 Operation stage

During the operation of the WTE Plant, no hazard to soil and ground surface is expected.

Soil contamination at the operation stage will not occur, it is not possible for incineration dusts to be exhausted outside, they will be transported to the storage tanks (equipped with filters). The only possible dusting can take place exclusively during slag loading onto trucks.

In case of possible exhaust, limiting measures will be applied, such as provision of slag storage protected against penetration into the soil and the groundwater environment.

8.5.3 Decommissioning stage

The decommissioning phase of the planned project is envisaged in a very distant time horizon. Decommissioning activities, if any, should be carried out in accordance with the legal acts in force at the time.

8.5.4 Mass movements of soil

There are no areas within the site designated for the proposed WTE Plant that are threatened by mass movements.

8.6 Project impact on ambient air

8.6.1 Construction stage

The following air emissions will occur during the execution phase of the planned Waste to Energy Plant in Łódź:

- emissions of fuel (Diesel oil) combustion products in construction machinery engines – mainly emissions of nitrogen oxides, sulfur dioxide, carbon monoxide, dust (including PM10 and PM2.5) and hydrocarbons;
- secondary dusting as a result of vehicle traffic in the construction area;
- dusting due to movement of soil masses, cement and construction aggregates.

The magnitude of emissions, and thus the extent of the adverse impact, will depend on the type of construction equipment used and its technical condition, the method of conducting the works, the meteorological conditions and the construction execution phase. Therefore, accurate determination of emissions during the construction phase is extremely difficult. The greatest emission of pollutants into the air will occur during the earthworks phase.

The volume of air emissions during the implementation phase was calculated based on the following specification of the expected number of heavy vehicles (including excavators, backhoe loaders, dozers, dump trucks, cranes, etc.) that will service the construction site and bring and haul materials and equipment during the various months of construction. The anticipated number of vehicles during construction in the most disruptive phase is shown below:

- sheet piling driving set – 1 piece;
- crawler backhoe loaders – 10 pieces;
- dozers – 10 pieces;
- cranes – 4 pieces;
- concrete pump – 4 pcs.

In total, this will mean the simultaneous operation of up to 29 pieces of heavy construction equipment during the most disruptive construction stage.

In addition, the most disruptive construction stage assumes 60 truck trips during the 8 least favorable hours of the day consecutively. It was assumed that during a full working day (between 6 a.m. and 10 p.m.), the number of trucks could be up to 80.

A detailed construction schedule will be developed for the project under consideration at the detailed design stage (hiring an EPC contractor). The following specification is based on actual data for another industrial facility of similar scale – it is expected that the work schedule will be similar for the plant under review.

The following assumptions were used to calculate air emissions:

- Investment project implementation time – up to 30 months,
- Works involving heavy construction equipment will be performed during daytime (from 6 a.m. to 10 p.m.), i.e. up to 16 hours a day.
- It is not ruled out that it will be possible for a small part of these construction, installation and erection works (e.g. pouring of concrete floors) to be carried out at night due to the nature and specificity of these works.
- Number of working days per month: 26,
- Typical fuel (diesel) consumption for 1 piece of heavy construction equipment: 6 dm^3/mth;
- The effective operating time of construction equipment for vehicles serving the construction site: 50%, i.e., each machine was assumed to work on average 1 mth (one operation hour) during 2 clock hours,
- Diesel weight: 0.82 kg/dm^3,
- The stay time of a truck (with engine running) that brings or hauls materials and equipment to or from the construction site during one trip: 15 minutes,
- Fuel sulfur content – 10 mg/kg (according to the Regulation of the Minister of Economy of October 9, 2015 on quality requirements for liquid fuels – Journal of Laws of 2015, item 1680, as amended). Complete oxidation of sulfur to SO_2 in the incineration process was assumed – sulfur dioxide emission factor of 0.02 g SO_2/kg fuel,

- Specific emissions of nitrogen oxides, non-methane volatile organic compounds, carbon monoxide and dust from the combustion of 1 kg of diesel fuel were adopted from the EMEP/EEA air pollutant emission survey guidebook 2019 (emission factors for the group "Non-road mobile sources and machinery"),
- It was assumed that 100% of the Non-Methane Volatile Organic Compounds (NMVOC) would be a mixture of hydrocarbons (HC) contained in the fuel that were not combusted; it was assumed that aromatic hydrocarbon emissions could account for up to 35% of total hydrocarbons (HC), with the remaining 65% being aliphatic hydrocarbons (Source: Ekologiczne problemy silników spalinowych [Ecological problems of internal combustion engines] Volume 1, Jerzy Merkisz, Wydawnictwo Politechniki Poznańskiej, 1998).

Periodically occurring fugitive emissions may occur with varying intensity, but given the temporary nature of the construction works, it should be concluded that this stage will not cause permanent negative changes to the environment. During the construction period, it is possible to reduce emissions significantly by using technical and organizational methods of execution of works.

The source of air emissions during the project implementation phase will be the operation of construction equipment and traffic of vehicles used at the construction site and transporting and hauling materials and equipment. Work machinery and vehicles will emit fuel combustion products into the air, including pollutants such as nitrogen oxides, sulfur dioxide, carbon monoxide, dust and hydrocarbons. There will also be the phenomenon of the secondary agitation of dust grains deposited on the ground due to vehicle traffic (secondary dusting) and dusting resulting from the movement of soil masses and construction aggregates.

Negative impact of the implementation phase on the state of air quality will be temporary, as a rule limited to the nearest vicinity of the construction site. Taking into account the temporary nature of construction works and the available technical and organizational methods of environmental protection, it must be concluded that this stage will not cause permanent negative changes in the environment. The decommissioning phase will have a similar impact.

During the project operation stage, the following air emissions will take place:

- point-source emission of thermal waste treatment process products – emission of dust (including PM10 and PM2.5), volatile organic compounds (i.e. total VOC understood as the total content of volatile organic compounds expressed as carbon in the air – identical to total organic carbon, TOC), hydrogen chloride, hydrogen fluoride, sulfur dioxide, carbon oxide, nitrogen oxides, heavy metals (cadmium, thallium, mercury, antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel, vanadium), dioxins and furans (PCDD/F) and dioxin-like PCBs; emissions of ammonia will also occur as a result of operation of the nitrogen oxide reduction (SNCR) plant,
- point-source emission of products of combustion of light fuel oil for the purpose of energy generation during the start-up of the plant – emission of dust (including PM10 and PM2.5), sulfur dioxide, carbon monoxide, nitrogen oxides,
- point-source emission of dust (including PM10 and PM2.5) from the process waste storage bunkers (fly ash and residues from flue gas cleaning) and ventilation exhaust vents of the slag valorization hall,
- point-source emission of products of combustion of diesel oil in an emergency power generating unit – emission of dust – including PM10 and PM2.5, sulfur dioxide, carbon monoxide, nitrogen oxides,
- emission of fuel combustion products in engines of vehicles moving on internal roads and maneuver yards, transporting waste to the Plant for the waste-to-energy process and consumables and exporting waste – mainly emission of nitrogen oxides, sulfur dioxide, carbon monoxide, dust (including PM10 and PM2.5) and hydrocarbons; these pollutants will be discharged through non-point sources,
- emission of fuel combustion products in machine engines: it is assumed that one loader and two forklifts will operate – mainly emission of nitrogen oxides, sulfur dioxide, carbon monoxide, dust (including PM10 and PM2.5) and hydrocarbons; these pollutants will be released into the air through non-point sources,
- fugitive emission of aliphatic hydrocarbons from the operation of refueling the loader with diesel oil.

8.6.2 Operation stage

During the operation stage of the planned Waste to Energy Plant in Łódź, the following air emissions will occur in the scope of pollutants for which the emission level or concentration in the air is normalized (for which BAT AEL levels, emission standards, admissible levels of substances in the air or reference values of substances in the air are determined):

- point-source emission of thermal waste treatment process products – emission of dust (including PM10 and PM2.5), volatile organic compounds (i.e. total VOC understood as the total content of volatile organic compounds expressed as carbon in the air – identical to total organic carbon, TOC), hydrogen chloride, hydrogen fluoride, sulfur dioxide, carbon oxide, nitrogen oxides, heavy metals (cadmium, thallium, mercury, antimony, arsenic, lead, chromium, cobalt, copper, manganese, nickel, vanadium), dioxins and furans (PCDD/F) and dioxin-like PCBs; emissions of ammonia will also occur as a result of operation of the nitrogen oxide reduction (SNCR) plant;
- point-source emission of products of combustion of light fuel oil for the purpose of energy generation during the start-up of the plant – emission of dust (including PM10 and PM2.5), sulfur dioxide, carbon monoxide, nitrogen oxides,
- point-source emission of dust (including PM10 and PM2.5) from the process waste storage bunkers (fly ash and residues from flue gas cleaning) and ventilation exhaust vents of the slag valorization hall,
- point-source emission of products of combustion of diesel oil in an emergency power generating unit – emission of dust – including PM10 and PM2.5, sulfur dioxide, carbon monoxide, nitrogen oxides,
- emission of fuel combustion products in engines of vehicles moving on internal roads and maneuver yards, transporting waste to the Plant for the waste-to-energy process and consumables and exporting waste – mainly emission of nitrogen oxides, sulfur dioxide, carbon monoxide, dust (including PM10 and PM2.5) and hydrocarbons; these pollutants will be discharged through non-point sources,
- emission of fuel combustion products in machine engines: it is assumed that one loader and two forklifts will operate – mainly emission of nitrogen oxides, sulfur dioxide, carbon monoxide, dust (including PM10 and PM2.5) and hydrocarbons; these pollutants will be released into the air through non-point sources,

- fugitive emission of aliphatic hydrocarbons from the operation of refueling the loader with diesel oil.

8.6.3 Decommissioning stage

The planned Waste to Energy Plant in Łódź will be operated on a long-term basis and at present the date of its hypothetical decommissioning is not known. The impact on air quality during the decommissioning stage will be, as during the construction stage, related to the operation of heavy equipment used for demolition works and the movement of trucks for debris removal. The extent of the impact of pollutants emitted into the air during demolition works during the decommissioning stage of the facility will be similar to that during the construction stage.

8.6.4 Accumulation of impacts

Based on analysis of calculations results for pollutant propagation it has been concluded that the designed operation of the WTE Plant, including the cumulative impact with the existing and designed emission sources of the EC-4 Combined Heat and Power Plant, will not result in exceeding the air quality standards.

The calculated values of maximum 1-hour concentrations of substances in the air are lower than the reference value D1 for PM10, sulfur dioxide and hydrogen chloride. For PM2.5, the current regulations do not specify a reference value averaged to 1 hour. In the case of nitrogen dioxide, arsenic and nickel, the calculated values of maximum 1-hour concentrations are higher than the reference values averaged to 1 hour, however, the calculated frequencies of exceeding the D1 values are much lower than the permissible values.

The calculated values of annual average concentrations are significantly lower than the disposable values for all substances. In the case of the critical pollutant, namely PM2.5, the calculated predicted average annual concentration of PM2.5 caused by emissions from WTE Plant and EC4 after implementation of the planned investment projects is relatively low – it is 0.707 µg/m^3, which is about 3.5% of the allowable concentration. This proves that the emission from WTE Plant and EC4 facilities will have little impact on the value of average annual concentration of PM-2.5 in the analyzed area. This is due to the significant elevation of particulate pollution emitted in an point (piped) manner. Concentrations of

PM2.5 in the air in the analyzed area are mainly affected by the so-called low-stack emissions, associated with the combustion of fuels in household furnaces and transport. In the long run, the construction of the WTE Plant and CCGT facilities will secure heat supply to the district heating network, which will enable its further expansion and connection of more buildings, which will simultaneously contribute to the reduction of the aforementioned low-stack emission.

The operation of the plant under consideration will allow for the recovery of the chemical energy contained in the pre-treated waste, which should be considered a positive effect for the environment. The analysis shows that the operation of the plant under consideration will not pose a threat to the environment in terms of the impact of pollutant emissions on air quality.

<u>The conducted calculations of pollutant propagation showed that the operation of the WTE Plant, taking into account the cumulative impact with the existing and designed emission sources of the EC-4 Combined Heat and Power Plant, will not result in exceeding the permissible levels of substances in the air as well as the reference values.</u>

8.7 Project's impact on environmental noise

8.7.1 Permissible values of environmental noise level

The types of areas subject to acoustic protection are defined in the Environmental Protection Law, while the permissible levels of noise in the environment, caused by particular groups of noise sources, have been established in the Regulation of the Minister of Environment on permissible levels of noise in the environment of June 14, 2007. Permissible noise level values are expressed in terms of $_{LAeq\ D}$ and $_{LAeq\ N}$ indices for the daytime (6 a.m. – 10 p.m.) and nighttime (10 p.m. – 6 a.m.), respectively. Sources of noise planned within the framework of the investment project should be included in the group including "other facilities and activities being a source of noise". For this group, a reference time interval T shall be used to assess the acoustic conditions, for daytime equal to 8 least favorable subsequent hours of the day and for nighttime a range equal to 1 least favorable hour of the night. Areas which are not listed in the Regulation of the Minister of Environment and the above table are not subject to protection against noise.

The investment project area and the adjacent areas are not included in the LSDP, therefore the Mayor of Łódź by letter No. DEK-OŚR-I.6254.30.2020 of May 20, 2020 determined the classification of areas adjacent to the investment project in accordance with Article 115 of the Environmental Protection Law.

Table 37 Permissible environmental noise levels based on the Regulation of the Minister of Environment

Item	Land function	Day	Night
		$L_{Aeq\ D}$	$L_{Aeq\ N}$
1	Single-family residential areas	50 dB	40 dB
2	Areas with multi-family buildings	55 dB	45 dB
3	Residential and service areas		
4	Farmstead areas		
5	Recreational and rest areas		--*

* as these areas are not used in accordance with their function at night, the permissible noise level at night is not binding.

The areas that are nearest in relation to the investment project and are subject to noise protection are recreational and leisure areas located to the north – allotment gardens at Andrzejewskiej street.

According to the report from periodic noise measurements carried out for the existing Combined Heat and Power Plant, as part of fulfilling the obligations under the decision on the integrated permit No. SR.VII-G/6617-2/PZ/30/2006 and subsequent amendments, i.e. Integrated Permit for Combined Heat and Power Plant EC-4 owned by Veolia Energia Łódź S.A., measurements are taken at the allotment gardens at the following locations:

Item	Location	Elevation of the measuring point above ground level [m]	Geographic coordinates	
			longitude	latitude
13	Andrzejewskiej – allotment gardens at the boundary of the plot	1.5	E 19°32’06.76”	N 51°44’53.06”
14	Andrzejewskiej – allotment gardens at the boundary of the plot	1.5	E 19°32’11.61”	N 51°44’54.02”

The key point for the investment project in question is point 13, located about 100 m away from the planned project, and point 14, located about 150 m away from the planned project.

8.7.2 Current acoustic environment

Currently, the area of plot No. 56/222 is not developed and it lacks noise sources.

The table below presents the results of periodic noise emission measurements from the existing plant at points located nearest to the planned project.

Table 38 Results of periodic noise measurements

Receptor	Type of development	Receptor – height [m]	Measured level		Permissible level		Exceeding
			Day	Night	Day	Night	
			L_{Aeq} (dB)	L_{Aeq} (dB)	L_{Aeq} (dB)	L_{Aeq} (dB)	
P13	Andrzejewskiej – allotment gardens at the boundary of the plot	1.5	51.3	-	55.0	-	No
P14	Andrzejewskiej – allotment gardens at the boundary of the plot	1.5	52.1	-	55.0	-	No

Below we present parts of the noise map for the city of Łódź.

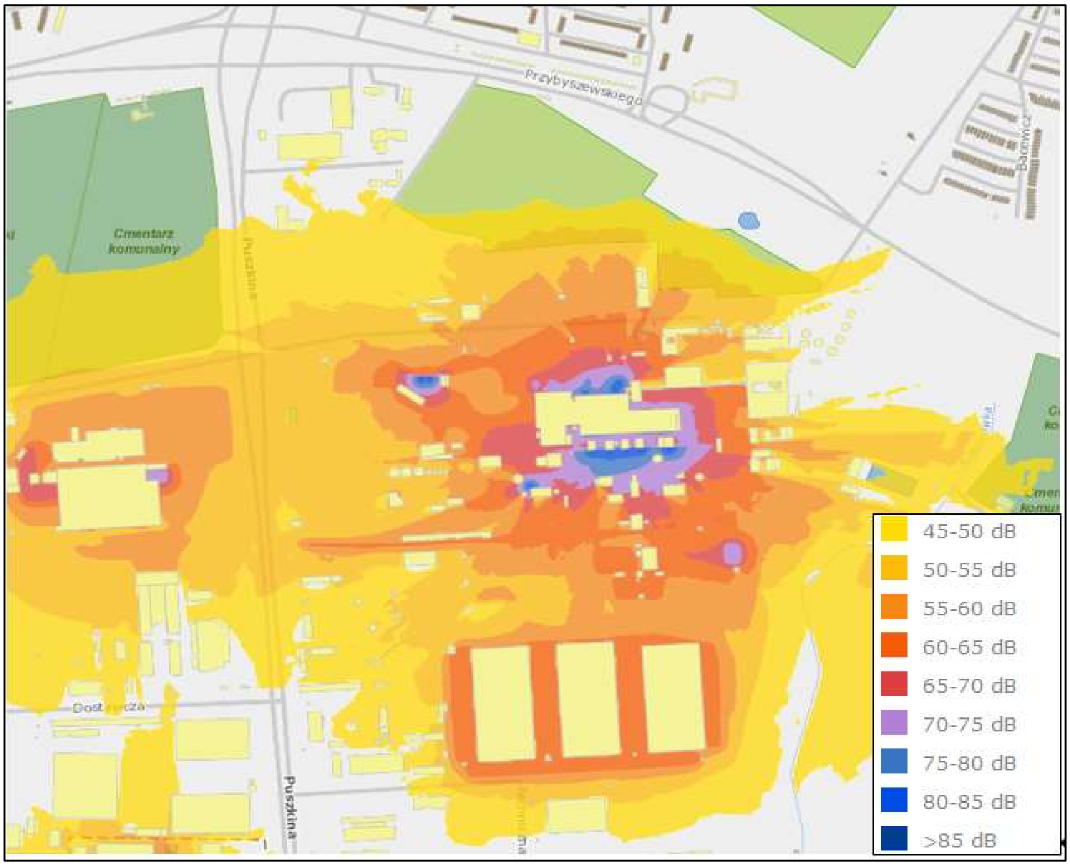


Figure 17 Industrial noise emission level LDWN [dBA] for the project area – (whole day) (source: https://mapa.lodz.pl/akustyczna/)

Figure 18 Industrial noise immission level LN [dBA] for the investment project site – (nighttime) (source: https://mapa.lodz.pl/akustyczna/)

8.7.3 Construction stage

The planned construction will involve temporary nuisance in the form of noise.

The noisiest stage of the construction will be during sheet piling. A high noise level will also be associated with the operation of many diggers, cranes, concrete pump and heavy-duty vehicles. During project implementation, a number of other auxiliaries will be operational, constituting sound emission sources, however in light of the work of the above-mentioned elements, these will have no impact on the level and range of noise emitted into the environment.

According to the plan, heavy equipment works will be carried out only during daytime hours (6:00 a.m. – 10:00 p.m.).

However, it is not ruled out that a small part of construction, installation and erection works that are not a significant source of noise will be carried out at night due to the nature and specificity of these works.

The table below shows the sound power and operating time of the machines and equipment used in the model:

Table 39 Construction site noise sources

No.	Type of machine/equipment	in 8 hours of daytime	in 1 hour of nighttime	Sound power. machinery/equipment [dBA]	Total equivalent sound power. groups [dBA]
B1	Slurry wall boarding kit	1 pc x 8h	-	106	106
	Tracked excavator-loader	10 pcs x 6h		103	111.8
	Bulldozer	10 pcs x 6h		103	111.8
	Cranes	4 pcs x 5h	-	103	107.0
	Concrete pump	4 pcs x 8h	-	108	114.0
Total equivalent sound power level for the construction site					118.1

Table 40 Sources of noise, vehicles – construction

No.	Type of source	in 8 hours of daytime	in 1 hour of nighttime	Sound power. machinery/equipment [dBA]	Total equivalent sound power. groups [dBA]
B2	Trucks, ride 20 km/h	7.5 rides per hour	-	78.8/m	523.71 m*78.8 dB= 106.2 dB

Table 41 Construction – noise level at the boundary of protected areas

Receptor	Type of development	Receptor – Height [m]	Calculated level		Permissible level		Exceeding
			Day	Night	Day	Night	
			L_{Aeq} (dB)	L_{Aeq} (dB)	L_{Aeq} (dB)	L_{Aeq} (dB)	
P13	Andrzejewskiej – allotment gardens at the boundary of the plot	1.5	**51.3**	not applicable	**55.0**	-	**No**
P14	Andrzejewskiej – allotment gardens at the boundary of the plot	1.5	**48.2**	not applicable	**55.0**	-	**No**

8.7.4 Operation stage

Table 42 Noise sources – operation – designed plant

No.	Name	Sound power											Resultant acoustic insulation of the divider		Noise level 1 m from the inside of the divider, in dB	Operation time [h]	
		Octave spectrum Hz, dBA									L_{WA}	L_{Wlin}	Part	Rw (C,Ctr)	L_{pA}	8 least favorable hours of the day	1 least favorable hour of the night
		31.5	63	125	250	500	1000	2000	4000	8000							
1	Unloading hall	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	**95.3**	no data available	Walls roof	**30 (-1,-4) for 500 Hz R=25dB**	80	**8**	**1**
													Entrance gates	**0**			
2	Waste bunker	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	**80.9**	no data available	Walls roof	**34(-1,-5) for 500 Hz R=30 dB**	80	**8**	**1**
3	Incineration building	no data available	70	80.4	89.1	94.5	96.2	94.2	89.3	81.6	**100.6**	104.4	Walls roof	**30 (-1,-4)**	85	**8**	**1**
													Vent. openings	**0**			
4	Energy recovery station	no data available	77.3	86.7	82.6	85	90	102.7	90.3	79	**103.4**	107.8	Walls roof	**25 (-1,-4)**	90	**8**	**1**
													Vent. openings	**0**			
5	Flue gas cleaning station	no data	no data	no data	no data	no data	no data	no data	no data	no data	**95.5**	no data	Walls roof	**25 (-1,-4) for 500 Hz R=20 dB**	80	**8**	**1**

No.	Name	Sound power											Resultant acoustic insulation of the divider		Noise level 1 m from the inside of the divider, in dB	Operation time [h]	
		Octave spectrum Hz, dBA									L_{WA}	L_{Wlin}	Part	Rw (C,Ctr)	L_{pA}	8 least favorable hours of the day	1 least favorable hour of the night
		31.5	63	125	250	500	1000	2000	4000	8000							
		available	available	available	available	available	available	available	available	available		available	Vent. openings	**0**	80	**8**	**1**
6	WTP – water treatment plant (in technical building environmental decision)	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	**96.3**	no data available	Walls roof	**30 (-1,-4) for 500 Hz R=25dB**	96.	**8**	**1**
7	Slag valorization hall	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	**96.4**	no data available	Walls roof	**30 (-1,-4) for 500 Hz R=25dB**	90	**8**	**1**
7'	Cyclone filter	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	**94**	no data available	not applicable	not applicable	n.d.	**8**	**1**
8	Slag seasoning hall	50.7	67.2	80.8	92.2	97.6	100.7	101.9	96.7	89.7	**106.1**	107.8	Walls and roof Steel 1)	**25 (-1,-4)**	76.2	**8**	**0**
													Opening	**0**	76.2	**8**	**0**
9	WTE Plant compressor station	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	no data available	**84.1**	no data available	Walls roof	**30 (-1,-4) for 500 Hz R=25dB**	85	**8**	**1**
10	WTE Plant stack	no data	no data	no data	no data	no data	no data	no data	no data	no data	**96**	no data	not applicable	not applicable	not applicable	**8**	**1**

No.	Name	Sound power											Resultant acoustic insulation of the divider		Noise level 1 m from the inside of the divider, in dB	Operation time [h]	
		Octave spectrum Hz, dBA									L_{WA}	L_{Wlin}	Part	Rw (C,Ctr)	L_{pA}	8 least favorable hours of the day	1 least favorable hour of the night
		31.5	63	125	250	500	1000	2000	4000	8000							
		available	available	available	available	available	available	available	available	available		available					
11	WTE Plant transformer	42.4	52.4	84.4	90.4	87.4	84.4	86.4	85.4	81.4	**95**	103.4	not applicable	not applicable	not applicable	**8**	**1**
12	Condenser [2)]	68.8	77.8	87.8	93.8	96.8	96.8	93.8	88.8	79.8	**102**	111.8	not applicable	not applicable	not applicable	**8**	**1**
13	Diesel generator set	60	74.4	85.7	94.5	99.9	103.1	107.4	110.3	108.2	**114.2**	114.9	no data available	not applicable	not applicable	**1**	**0**
14	Vent. equipment, control room	7.8	57.7	71.8	64.7	69.2	67.2	64.3	59.5	52.7	**77**	89.5	not applicable	not applicable	not applicable	**8**	**1**
15	Vent. equipment Administration building	4.8	54.6	68.8	61.7	66.2	64.2	61.3	56.5	49.7	**74.8**	86.5	not applicable	not applicable	not applicable	**8**	**1**

1) Because of very high sound reduction index, reinforced concrete walls with a thickness of 60 cm and a height of 6 m were not included in the model as a surface source of noise penetrating from inside of the slag seasoning hall.

2) The condenser was modeled according to information from a potential equipment supplier. Sound power of 102 dBA was assumed and installation height of the fan, which is the main source of noise, was 7.5 m. The aforementioned change to the

condition stipulated in the decision on environmental conditions issued for the WTE Plant at Jadzi Andrzejewskiej 5 in Łódź (L_{WA} ≤ 106 dB at the height of 14 m) is favorable in terms of impact on noise-sensitive areas.

Sources for which no information on the octave spectrum was available were modeled as a single 500 Hz band.

Table 43 WTE Plant noise sources – vehicle traffic

No.	Type of source	in 8 hours of daytime	in 1 hour of nighttime	Sound power. machinery/equipment day [dBA]	Sound power. machinery/equipment night [dBA]	Total equivalent sound power of group – daytime [dBA]	Total equivalent sound power of group – nighttime [dBA]
14	Trucks, ride 20 km/h	5.4 rides per hour	-	74.3dB/m	-	535.05 m*74.3 dB=101.6 dB	-
15	Passenger cars 20 km/h	1.5	12	48.3dB/m,	60.3dB/m	140.25 m*48.3.3 dB=69.7 dB	140.25 m*60.3.3 dB=81.8
15	Passenger car park 1	1 vehicle change	1 vehicle change	68.9	78dB	68.9	78dB
16	Passenger car park 2	1 vehicle change	1 vehicle change	68.9	78dB	68.9	78dB

Comment on the table above: The difference in sound power level for daytime and nighttime is due to the difference in reference time, which is 8 hours for daytime and 1 hour for nighttime.

The total equivalent sound power level of all sources used in the model for the daytime is 112.1 dBA
The total equivalent sound power level of all sources used in the model for the daytime is 108.8 dBA

In order to meet the permissible noise levels, noise barriers should be provided along the northern boundary of the plot:

Table 44 WTE Plant noise barriers

No.	Height [m]	Length [m]
EITPO1	8	52.1
EITPO2	5	36.8
EITPO3	2	22.2

In the model, to assess the least favorable situation:

The calculations take into account the operation of the Diesel generator set which will be activated approximately once a month for about 1 hour at daytime, as a confirmation of readiness for operation.

Table 45 Operation, noise level in noise-sensitive (protected) areas

Receptor	Type of development	Receptor – height [m]	Calculated level		Permissible level		Exceeding
			Day	Night	Day	Night	
			L_{Aeq} (dB)	L_{Aeq} (dB)	L_{Aeq} (dB)	L_{Aeq} (dB)	
P13	Andrzejewskiej – allotment gardens at the boundary of the plot	1.5	**48.5**	46.9	**55.0**	-	**No**
P14	Andrzejewskiej – allotment gardens at the boundary of the plot	1.5	**44**	42.5	**55.0**	-	**No**

Table 46 Contribution of individual sources to immission at receptors – operation – daytime

No.	Name	P13	
		L_{AeqD} [dB]	% share
	Aggregate level	48.5	100.00%
4	Energy recovery station	43.9	34.67%
8	Slag seasoning hall	41.5	19.95%
12	Condenser	39.4	12.30%
16	Trucks	38.9	10.96%
5	Flue gas cleaning station	35.6	5.13%
11	Transformer	34.1	3.63%
3	Incineration building	33.6	3.24%
7	Slag valorization hall	33.2	2.95%
6	WTP (Water Treatment Plant)	32.8	2.69%
10	Stack	31.5	2.00%
13	Diesel generator set	28.3	0.95%
1	Unloading hall	18	0.09%
17	Passenger cars	13.9	0.03%
18	Passenger car park 1	13.2	0.03%
19	Passenger car park 2	12.8	0.03%
14	Vent. equipment, control room	11.3	0.02%
7'	Cyclone filter	10.1	0.01%
2	Waste bunker	9.4	0.01%
15	Ventilation equipment in administration building	8.1	0.01%
9	Compressor station	3.4	0.00%

The conducted analysis showed that the key source of noise, jointly accounting for 34.7% of noise immission in receptor P13, is the energy recovery station, and above all the ventilation intakes of this building. The study also indicates a significant share of sources such as the slag seasoning hall, condenser, truck traffic, flue gas cleaning station and transformer jointly accounting for 51.98% of immissions.

8.7.5 Decommissioning stage

The Investor does not plan to decommission the project within an identifiable time limit.

At the stage of possible decommissioning, emissions of the same level as in the case of the project execution should be expected.

The noise emission will be related to the demolition of plants and civil structures, delivery and hauling of materials.

8.7.6 Accumulation of impacts

For the assessment of the cumulative impact, the emission from the designed new gas cogeneration unit in the CCGT configuration and the existing systems operating as part of the EC-4 in Łódź were taken into account.

The immission from the planned projects (WTE Plant and CCGT) was modeled in the acoustic software, and then the immission from the existing EC-4 facilities measured as part of the periodic measurements was added.

Table 47 Cumulative impact (WTE Plant+CCGT+EC-4) – Operation, noise level in noise-sensitive (protected) areas

Receptor	Type of development	Receptor height [m]	Calculated level WTE Plant+CCGT		Measured level EC4		Total level of WTE Plant + EC4		Total level of WTE Plant+CCGT+EC 4		Permissible level		Exceeding
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
			L_{Aeq} (dB)	L_{Aeq} (dB)	L_{Aeq} (dB)	L_{Aeq} (dB)	L_{Aeq} (dB)	L_{Aeq} (dB)	L_{Aeq} (dB)	L_{Aeq} (dB)	L_{Aeq} (dB)	L_{Aeq} (dB)	
P13	Andrzejewskiej – allotment gardens at the boundary of the plot	1.5	52.1	51.5	51.3	-	53.1		**54.7**		**55.0**	-	**No**
P14	Andrzejewskiej – allotment gardens at the boundary of the plot	1.5	48.5	48	52.1	-	52.7		**53.7**		**55.0**	-	**No**

8.8 Project's vibration impact

Vibrations (mechanical vibrations) are low-frequency acoustic vibrations that spread in solid state media. They are transmitted through direct contact with the vibrating source to individual human tissues or to the entire body. The sound accompanying the vibration is created by transferring part of the energy of the vibrating material particles through the air to the human hearing organ.

Due to the place of vibration penetration into the human body, vibrations are divided into two groups:

- General vibrations, which penetrate the human body through the legs, pelvis and back,
- Local vibrations, which affect the human body through the upper extremities.

Depending on the vibration type, we also divide vibration sources into two groups:

- General,
- Affecting the body through the upper extremities.

Vibrations affect the human body through energy that is transmitted to the tissue and causes irritation to nerve endings that perceive mechanical deformations. The more intense the vibration, the less pleasant the sensation associated with receiving it becomes. Vibrations at levels above the threshold of sensitivity can cause multiple sensations, up to the onset of pain.

Under the Regulation of the Minister of Economy and Labor of August 5, 2005 on occupational health and safety during works related to exposure to noise or mechanical vibration, action thresholds are defined for the values typical for mechanical vibration in the working environment:

- If it occurs in the form of local vibrations: for daily exposure expressed as energy equivalent for 8 hours of operation of the vector sum of effective, weighted frequencies of vibration accelerations, determined for three directional components (a_{hwx}, a_{hwy}, a_{hwz}) – the action threshold is 2.5 m/s^2,
- If they occur in the form of general vibrations: for daily exposure expressed as energy equivalent for 8 hours of effective, frequency-weighted vibration acceleration,

prevailing among vibration accelerations determined for three directional components with appropriate coefficients ($1.4a_{wx}$, $1.4a_{wy}$, a_{wz}) – the action threshold value is 0.5 m/s^2.

8.8.1 Vibration emission at the stage of construction works

Vibration emission caused by operating construction machines is an integral part of construction works. These are vibrations similar to those generated by truck traffic. These vibrations can be detrimental to the structure of buildings and can be a nuisance to people in the buildings and in the immediate vibration impact zone, but their occurrence is short-lived. The area where these vibrations can be felt is considered to be about 50 meters from the construction zone, the closest being the recreational and rest areas located to the north – the allotment gardens at Andrzejewskiej street – located at a distance of about 100 m from the investment project area, i.e. outside the area of vibration transmission.

Therefore it is not anticipated for the project execution to potentially induce any hazards resulting from the emission of vibrations during construction works of the WTE Plant.

8.8.2 Emission of vibrations at the stage of investment project operation

The operation stage of the plant involves vibrations due to the operation of mechanical equipment driven by motors. However, these vibrations will be separated from load-carrying structures, thus they will not penetrate into the environment.

Therefore, it should be considered that the operation of the plant in question will not be a source of vibrations that may endanger the environment.

8.9 Project impact on surface waters and groundwater – wastewater emission

8.9.1 Water demand

Calculation of potable water demand for welfare purposes resulting from employment

- n = 44 – number of people employed on the WTE Plant site,
- n_1 = 37 – number of technical workers using showers,
- q_1 = 120 dm^3/person/day – average unit consumption for personnel using showers,

- q_2 = 30 dm^3/person/day – average unit consumption for the remaining personnel,
- n_2 = 7 – number of technical workers not using showers,
- $Q_{d\ avg}$ – average daily water consumption.

$Q_{d\ avg} = n_1 \times q_1 + n_2 \times q_2 = 37 \times 120 \times 10^{-3} + 7 \times 30 \times 10^{-3} = 4.65\ m^3/d$

- $Q_{d\ max}$ – maximum daily water consumption

$Q_{d\ max} = Q_{d\ avg} \times N_d = 4.65 \times 1.2 = 5.58\ m^3/d$

where: N_d – daily minimum/maximum demand ratio

- $Q_{h\ avg}$ – average hourly water consumption

$Q_{h\ avg} = Q_{d\ max}/24 = 5.58/24 = 0.23\ m^3/h$

- $Q_{h\ max}$ – maximum hourly water consumption

$Q_{h\ max} = Q_{h\ avg} \times N_h = 0.23 \times 1.5 = 0.35\ m^3/h$

where: N_h – hourly minimum/maximum demand ratio

<u>Calculation of potable water demand for welfare purposes resulting from sanitary appliances</u>

Table 48 List of sanitary appliances

Type of draw-off outlet	Connection diameter	Quantity of appliances	Hot and cold water	
			Normative outflow	Total outflow
showers	15	5	0.30	1.50
wash basins	15	42	0.14	5.88
toilet	15	21	0.13	2.73
sinks	15	9	0.14	1.26
dishwasher	15	1	0.14	0.14
fume cupboard	15	1	0.14	0.14
urinals	15	6	0.30	1.80
Total for all facilities:				**11.95** (excluding showers)

To determine the design flow intensity, it was assumed that 100% of the showers would be active simultaneously. $\Sigma qn < 20$ dm^3/s was determined for the remaining sanitary appliances as for the office and administration building.

$\Sigma qn = 11.95$ dm^3/s excluding showers calculated at 100%, simultaneous flow intensity

$q = 0.682 \times (\Sigma qn)^{0,45} – 0.14$

$q = 0.682 \times (11.95)^{0.45} - 0.14 = 1.94$ dm^3/s + 1.5 dm^3/s (for showers) = 3.44 dm^3/s

Potable water demand for process purposes

- $Q_{tech.max}$.=26.0 m^3/h – maximum hourly demand for process purposes
- $Q_{tech.s}$ = 6.5 dm^3/s – demand for process purposes – seconds

Potable water demand for fire water tank filling purposes

Q_{tech}=13.5 m^3/h – demand for fire water tank filling purposes

Water intake for other purposes is not assumed when filling the fire water tank.

Potable water demand for safety showers and emergency eye washers

Only one safety set is assumed to be in operation at a time, for which the water demand is approximately 1.67 dm^3/s.

Since this is only emergency consumption, it is not included in the overall water balance.

Total demand for potable water

The total demand for potable water is:

Q_{sum} = 3.44 dm^3/s (demand for potable water resulting from sanitary appliances) + 6.5 dm^3/s (demand for process purposes) = 9.94 dm^3/s (10 dm^3/s assumed)

Fire water demand

The total fire water demand, taking into account the water demand for outdoor fire-fighting for 4 hours and the total water demand for fire protection systems for 2 hours, as well as the water reserve of 100 m^3 to supply the fire water supply system in the tall building, is 1300 m^3 in the fire water tank, with a minimum capacity of min. 132 dm^3/s.

8.9.2 Wastewater emission

Design flow intensity of gray and black water on the basis of appliances

Table 49 Design flow intensity of gray and black water on the basis of appliances

Item	Type of intake point	Quantity	Unit outflow (discharge) DU [dm^3/s]	Total ΣDU [dm^3/s]
1	Toilet	21	2.0	42.0
2	Sink	8	0.8	6.4
3	Wash basin	42	0.5	21.0
4	Urinal	6	0.5	3.0
5	Shower	5	0.8	4.0
6	Dishwasher (laboratory part)	1	1.0	1.0
7	Sink (laboratory part)	1	1.0	1.0
8	Fume cupboard (laboratory part)	1	1.0	1.0
			Total:	79.4
		q=	**K √ΣDU**	**4.46**
		K=	0.5	

Amount of gray and black water resulting from employment

The amount of gray and black water resulting from employment is 100% of the water demand for domestic purposes:

Table 50 Estimated amount of gray and black water discharged

Item	Type of consumption	Working hours	Amount of gray and black water			
			hourly		daily	annual
		[number of days]	dm^3/h	m^3/h	m^3/d	$m^3/year$
8.	**9.**	**10.**	**11.**	**12.**	**13.**	**14.**
1.	Average wastewater amounts	365	230	0.23	4.65	1,697
2.	Maximum wastewater amounts		350	0.35	5.58	2,037

Therefore, the total amount of wastewater will be:

- $Q_{maxs.} = 0.00446\ m^3/s$;
- $Q_{maxh.} = 0.35\ m^3/h$;
- $Q_{avg.d.} = 4.65\ m^3/day$
- $Q_{perm.max.y.} = 2037\ m^3/year$.

For more detailed information, see chapter 5.7 titled: "*External water supply, sewerage and fire* protection systems*.*"

8.9.3 Construction stage

Shallow groundwaters may be periodically contaminated by construction vehicles that will transfer soil particles on their wheels to access roads, which will be rinsed during precipitation and this water will be discharged to rain water drainage system.

In order to minimize the possibility of such a situation occurring, it is necessary to properly prepare the site back-up facilities, i.e. to designate paved parking spaces for construction equipment and to properly store all substances that may have a harmful impact on the groundwater environment.

With the purpose of reducing the impact of the planned undertaking construction on the groundwater environment, a number of mitigation measures have been identified that effectively reduce the impact of these works.

Taking into account the scale and type of the planned undertaking as well as proposed activities aimed at limiting these works, no negative impact on the groundwater environment, surface waters and groundwaters is expected.

8.9.4 Operation stage

No hazards for surface and underground water is forecasted during the WTE Plant operation. The selected technology of thermal waste treatment will generate effluent which will not be discharged into the environment. It will be used for process purposes, i.e. replenishing losses in the slag trap. Rain water and thaw water from leak-tight areas will be collected into a system of ducts and discharged, following pre-treatment, into a rain water sewerage system.

Rain gardens and green roofs are planned in the area of the investment project, the predominant task of which should be rain water retention.

“Wet” rain gardens, thanks to the accumulation of water from the environment and the possibility of its storage, retain it in the landscape. By using hydrophytic vegetation capable of removing pollutants by the plants, the quality of discharged water is increased. Any excess water is discharged by an emergency overflow to the rainwater drainage system with a significant delay, which eliminates the negative effects of precipitation. An additional advantage of creating rain gardens is an increase in biodiversity, which has a positive impact on the environment.

Detailed information on rain gardens and green roofs is presented in chapters 12.1.1 and 12.1.2.

8.9.5 Decommissioning stage

Undertaking decommissioning will be associated with similar risks as in terms of its construction. Hazards will be associated with the possibility of surface waters and groundwaters contamination with fuels and greases due to minor failures or poor technical condition of machines and vehicles. Contamination can also occur as a result of improper storage of petroleum substances, refueling, equipment repair and maintenance. To minimize the above hazards, demolition works should be arranged so as to limit the overflow of fuels and other chemicals during these works. Technical equipment should be approved for use and have the appropriate approvals.

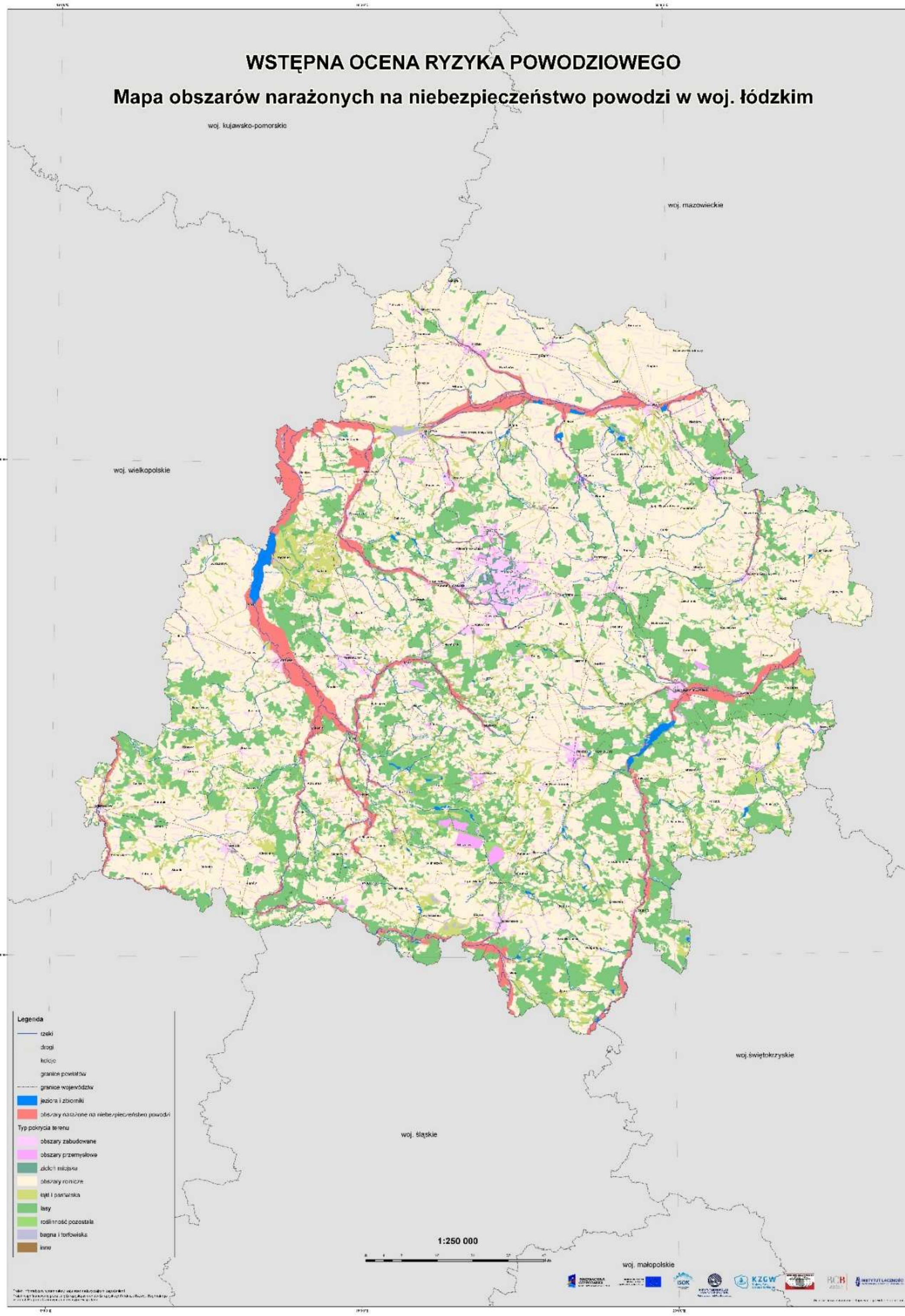
8.10 Flood and landslide hazard analysis

According to the information provided by the Municipal Council of Łódź, Department of Ecology and Climate, Division of Environmental Protection and Agriculture – letter ref. No. DEK-OŚR-I.604.18.2020 of June 15, 2020 – the area covered by the surveys "is not listed in the Database of Landslide Counteracting System SOPO, maintained by the Polish Geological Institute – National Research Institute in Warsaw at ul. Rakowiecka 4".

According to the "Preliminary Flood Risk Assessment (WORP)", it appears that the Jasień, Jasieniec, Olechówka, and Łódka rivers have been qualified for the preparation of flood hazard and risk maps due to anthropogenic changes in the area by December 22, 2019.

<u>There is no direct risk to the EC-4 site from flooding or groundwater flooding.</u>

<u>In addition, geodynamic phenomena and processes as well as filtration deformations were not observed in the area of the designed investment project.</u>


WSTĘPNA OCENA RYZYKA POWODZIOWEGO
Mapa obszarów narażonych na niebezpieczeństwo powodzi w woj. łódzkim
woj. kujawsko-pomorskie
woj. mazowieckie
woj. wielkopolskie
woj. świętokrzyskie
woj. śląskie
woj. małopolskie
Legenda
rzeki
drogi
kolejo
granice powiatów
granice województw
jeziora i zbiorniki
obszary narażone na niebezpieczeństwo powodzi
Typ pokrycia terenu
obszary zabudowane
obszary przemysłowe
zieleń miejska
obszary rolnicze
łąki i pastwiska
lasy
roślinność pozostała
bagna i torfowiska
inne
1:250 000

PL	EN

WSTĘPNA OCENA RYZYKA POWODZIOWEGO	PRELIMINARY FLOOD RISK ASSESSMENT
Mapa obszarów narażonych na niebezpieczeństwo powodzi w woj. łódzkim	Map of areas at risk of flooding in Łódź Voivodeship
woj. kujawsko-pomorskie	Kujawsko-Pomorskie Voivodeship
woj. mazowieckie	Mazowieckie Voivodeship
woj. wielkopolskie	Wielkopolskie Voivodeship
woj. świętokrzystkie	Świętokrzyskie Voivodeship
woj. śląskie	Śląskie Voivodeship
woj. małopolskie	Małopolskie Voivodeship
Legenda	Key
rzeki	rivers
drogi	roads
koleje	railways
granice powiatów	boundaries of districts
granice województw	boundaries of voivodeships
jeziora i zbiorniki	lakes and reservoirs
obszary narażone na niebezpieczeństwo powodzi	areas at risk of flooding
Typ pokrycia terenu	Type of land cover
obszary zabudowane	developed areas
obszary przemysłowe	industrial areas
zieleń miejska	urban green space
obszary rolnicze	agricultural areas
łaki i pastwiska	meadows and pastures
lasy	forests
roślinność pozostała	other vegetation
bagna i torfowiska	swamps and bogs
inne	other

Figure 19 Map of areas at risk of flooding in Łódzkie Voivodeship

Source: https://www.lodzkie.eu/page/1787,wstepna-ocena-ryzyka-powodziowego.html

8.11 Investment project's waste emission impact

8.11.1 Implementation stage

The waste source will primarily be the preparation of excavations for new investment projects and land leveling. These will be soil including stones (waste code 17 05 04). It is estimated that the waste amount will be at least 31,500 m^3 (excavated material).

In this case, the soil will be typical construction waste classified as 17 05 04 – soil and earth, including stones other than those mentioned in 17 05 03. In situations where there is a risk of contamination with hazardous substances in the earth masses, appropriate tests will be performed to correctly classify the waste.

Waste generated during the implementation stage according to the classification in accordance with the Regulation of the Minister of Climate on the Waste Catalog of January 2, 2020, and their estimated quantity:

Table 51 Waste emissions – implementation stage

Waste code	Waste type	Forecast/estimated amount of waste generated during the implementation stage [Mg] and [m^3]
17 01 01	Concrete waste and crushed concrete from demolitions and overhauls	1,150 m^3
17 01 07	Mixture of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	10 Mg
17 05 04	Soil and stones other than those mentioned in 17 05 03	31,500 m^3

Waste code	Waste type	Forecast/estimated amount of waste generated during the implementation stage [Mg] and [m^3]
17 02 03	Plastics	50 Mg
17 04 05	Iron and steel	2 Mg
15 01 01	Paper and cardboard packaging	2 Mg
15 01 02	Plastics packaging	0.2 Mg
15 01 10*	Packaging containing residues of or contaminated with hazardous substances	1,000 Mg
17 02 04*	Glass, plastic and wood waste containing or contaminated with hazardous substances	0.2 Mg

8.11.2 Operation stage

The type and quantity of process wastes generated from the operation of the WTE Plant that will predominate over other wastes occurring during the operation of an industrial facility such as the WTE Plant are listed in the table below. The waste types and quantities provided were estimated for thermal waste treatment at the WTE Plant in accordance with chapter 5.1 and the justification entered in the table in chapter 20.1.

The waste sent for recovery is a significant portion of slags and ferrous and non-ferrous scrap. Waste generated during gas cleaning and fly ashes should be collected by authorized entities in accordance with the Waste Act.

Table 52 Waste emissions – operation stage

Waste code	Waste type	Forecast/estimated amount of waste generated during the operation stage [Mg/year]
19 01 07*	Solid waste from flue gas cleaning	3,315
19 01 15*	Boiler dust containing hazardous substances	2,301
19 01 12	Furnace bottom slag and ash other than those mentioned in 19 01 11	58,910
19 01 02	Iron scrap removed from furnace ash	3,100

Wastes with codes 19 01 07* and 19 01 15* will be collected in process waste containers and further collected by specialized companies for disposal.

Waste with code 19 01 12 is waste after valorization and seasoning of slag, which will be used as highway aggregate.

Based on our calculations, it was assumed that 5% of the slags subjected to the valorization process would not meet the requirements for use as highway aggregate due to the fact that it would be recycled ferrous scrap. Waste with code 19 01 02 is ferrous scrap recovered during the slag valorization process.

In addition, non-ferrous metals will be recovered in small quantities during the slag valorization process (19 12 03 – non-ferrous metals).

During the operation of the WTE Plant, other wastes typical for any large industrial business activity listed below will occur in small quantities, for example:

- 13 01 11* – Synthetic hydraulic oils
- 13 02 05* – Mineral-based non-chlorinated engine, gear and lubricating oils

- 13 02 06* – Synthetic engine, gear and lubricating oils
- 13 02 08* – Other engine, gear and lubricating oils
- 13 05 07* – Oily water from oil/water separators
- 13 05 08* – Mixtures of wastes from grit chambers and oil/water separators
- 15 01 10* – Packaging containing residues of or contaminated by hazardous substances (e.g. plant protection agents of toxicity class I and II – highly toxic and toxic)
- 15 02 02* – Absorbents, filter materials (including oil filters not otherwise specified), wiping cloths (e.g. rags and cloths), protective clothing contaminated by hazardous substances (e.g. PCBs)
- 16 01 07* – Oil filters
- 16 02 13* – Discarded equipment containing hazardous components
- 07 02 13 – Plastic waste
- 07 02 99 – Wastes not otherwise specified
- 08 01 18 – Wastes from paint or varnish removal other than those mentioned in 08 01 17
- 08 03 18 – Waste printing toner other than those mentioned in 08 03 17
- 12 01 21 – Spent grinding bodies and grinding materials other than those mentioned in 12 01 20
- 12 01 13 – Welding wastes
- 15 01 01 – Paper and cardboard packaging
- 15 01 02 – Plastic packaging
- 15 01 03 – Wooden packaging
- 15 02 03 – Absorbents, filter materials, wiping cloths (e.g. rags and cloths) and protective clothing other than those mentioned in 15 02 02
- 16 01 22 – Components not otherwise specified (air filters)

- 16 02 16 – Components removed from discarded equipment other than those mentioned in 16 02 15
- 16 03 04 – Inorganic wastes other than those mentioned in 16 03 03 and 16 03 80
- 16 05 09 – Discarded chemicals other than those mentioned in 16 05 06, 16 05 07 or 16 05 08
- 16 06 04 – Alkaline batteries
- 16 06 05 – Other batteries and accumulators
- 16 80 01 – Magnetic and optical data carriers
- 19 09 04 – Used activated carbon – replacement of carbon filter cartridges
- 19 09 05 – Saturated or spent ion exchange resins
- 19 09 99 – Wastes not otherwise specified.

The waste listed above will be collected and disposed of in accordance with applicable regulations.

8.11.3 Decommissioning stage

The project decommissioning stage will be a significant source of waste. Generally, all demolition works generate significant amounts of waste. At the decommissioning stage, mainly waste from group 17 will be generated, including hazardous waste. It should be expected that the largest amount of concrete waste and concrete debris from demolitions and overhauls 17 01 01 and asphalt debris other than mentioned in 17 03 01 with code 17 03 02 will be generated. At the decommissioning stage, due to significant amounts of waste, special attention should be paid to recovery and neutralization of waste.

Similarly as in the case of waste generated at the stage of implementation and operation of the project, the waste generated at the decommissioning stage will be handed over to entities holding relevant permits in accordance with the Waste Act.

8.12 Project's electromagnetic radiation emission impact

The effects of electromagnetic fields on organisms depend on frequency.

Organism exposure to a low-frequency magnetic field leads to the induction of electric fields and the flow of electric current, which can lead to electrostimulatory effects.

Organism exposure to high-frequency electromagnetic fields leads to energy absorption, which can result in the release of significant amounts of heat.

The reference levels of environmental exposure to electromagnetic radiation emissions are closely related to the basic limits. They are determined in a manner that, regardless of the time spent in the area in which the requirements set for reference levels are met, the effects of exposure to electromagnetic fields did not exceed the basic limits, this means that if the reference level is not exceeded, there will certainly be no thermal effect. Radio frequency reference levels are defined by measurable quantities, including:

- Rms value of the field electric component E expressed in V/m,
- Power density value S expressed in W/m^2.

8.12.1 Introduction to electromagnetic field theory

According to Article 3 point 18 of the Act of July 19, 2019 – Environmental Protection Law, whenever the act refers to electromagnetic fields – they shall be understood as electric, magnetic and electromagnetic fields with frequencies from 0 Hz to 300 GHz.

The electromagnetic field is one of the fundamental elements of the natural world. It occurs near all electrically charged particles, moving charges, and permanent magnets. The moving component of the electromagnetic field is its excitations, which are the electromagnetic waves that carry the energy.

Electromagnetic waves can have different lengths, i.e., the distance between successive “ridges”, from which their frequency (a measure of how many times in a fixed unit of time, usually 1 second, a wave ridge passes through a given point) results. Energy is related to wavelength in an inversely proportional relationship, meaning that the longer the wavelength (lower the frequency) the lower the energy of one photon.

The division between ionizing and non-ionizing radiation is important. The term ionization shall be meant as the ability to initiate a reaction that causes an electrically neutral atom or chemical particle to change into a charged particle, i.e. ion, is understood. In practical terms, this means that ionizing radiation can cause chemical reactions that impact molecules (such as DNA) inside cells.

The basic quantities that allow for a quantitative description of the electromagnetic field are:

- Electric field strength – E
- Magnetic field strength – H
- Power density of electromagnetic wave – S

Waves traveling through space interact with objects in space in different ways. Therefore, multiple wave reflection, refraction, deflection, overlap (interference), attenuation and scattering occur. For this reason, the field strength at a given point, especially in an urban environment, is difficult to predict and can constantly change, even with a fixed source location.

8.12.2 Permissible values for physical parameters of electromagnetic fields in the environment

The permissible values of physical parameters of electromagnetic fields are defined by the Regulation of the Minister of Health of December 17, 2019, on the permissible levels of electromagnetic fields in the environment. The frequency of electromagnetic field, for which the physical parameters characterizing the impact of electromagnetic field on the environment are determined, and the permissible values of physical parameters have been differentiated into:

- Areas intended for housing development,

  Sites accessible to the public.

Table 53 Frequency range of electromagnetic fields for which the physical parameters characterizing the impact of electromagnetic field on the environment are determined and admissible levels of electromagnetic field characterized by admissible values of physical parameters, for areas intended for residential housing

Physical parameter Electromagnetic field frequency range		Electric component E (V/m)	Magnetic component H (A/m)	Power density S (W/m^2)
Item	1	2	3	4
1	50 Hz	1,000	60	N/A

Designations:

N/A – not applicable

Table 54 Frequency range of electromagnetic fields for which the physical parameters characterizing the impact of electromagnetic fields on the environment are determined and admissible levels of electromagnetic fields characterized by admissible values of physical parameters, for publicly available areas

Physical parameter Electromagnetic field frequency range		Electric component E [V/m]	Magnetic component H [A/m]	Power density S [W/m^2]
Item	1	2	3	4
1	0 Hz	10,000	2,500	N/A
2	From 0 Hz to 0.5 Hz,	N/A	2,500	N/A
3	From 0.5 Hz to 50 Hz,	10,000	60	N/A
4	From 0.005 kHz to 1 kHz,	N/A	3/f	N/A

Physical parameter / Electromagnetic field frequency range		Electric component E [V/m]	Magnetic component H [A/m]	Power density S [W/m^2]
5	From 1 kHz to 3 kHz,	250/f	5	N/A
6	From 3 kHz to 150 kHz,	87	5	N/A
7	From 0.15 MHz to 1 MHz,	87	0.73/f	N/A
8	From 1 MHz to 10 MHz,	87/f^{0,5}	0.73/f	N/A
9	From 10 MHz to 400 MHz,	28	0.073	2
10	From 400 MHz to 2000 MHz,	1.375 x f^{0,5}	0.0037 x f^{0,5}	f/200
11	From 2 GHz to 300 GHz,	61	0.16	10

Designations:

F – electromagnetic field frequency value from the same row of the column "Electromagnetic field frequency range"

N/A – not applicable

8.12.3 Electromagnetic field with frequency of 50 Hz

Electric and magnetic fields occur in the environment of power equipment and must be considered separately. From an environmental protection point of view, power lines and substations with rated voltages of at least 110 kV or higher are important. The basis for the above assumption was at what distance from the line electric and magnetic fields of strengths considered as significant could occur. The electromagnetic field magnetic component of a power line is directly proportional to the electric current and inversely proportional to the distance from the line cables. Its value near the ground surface is low and therefore its influence is negligible.

There are no confirmed scientific studies demonstrating that the electromagnetic field electric component from power lines operating at 50 Hz will affect human and animal health or life, and that such fields may have a negative impact on greenery. The impact area of such fields is usually limited to the space closest (immediately adjacent) to power cables and power equipment. From the available studies and literature data, it is determined that in a significant number of project tasks the values of field measurements (and respectively their components) are not exceeded, as required by the relevant legal documents and standards. It is therefore concluded that the fields in question, from the power grid and power equipment, will not have a significant and harmful effect on the environment.

8.12.4 Electromagnetic radiation in the medium wave range

Medium waves are those with frequencies from 300 kHz to 3000 kHz and lengths from 1000 m to 100 m.

Their sources are usually communication equipment such as transceiver stations, cellular base stations or CB radio transmitting antennas. No significant medium wave emissions are assumed during the operation period. In the case of the construction stage, the only source may be a geodetic GPS transceiver station used to locate geodetic points in the field. Such a device is characterized by a low radiant power that does not have the ability to cause any damage to the environment, or to pose any risk to the environment.

8.13 Project’s visible radiation emission impact

8.13.1 Implementation stage

No significant impacts on visible radiation emissions are anticipated at the project implementation stage. It is anticipated that the construction site will be illuminated, but this illumination will not cause an environmental nuisance, mainly due to its temporary nature.

8.13.2 Operation stage

During the operation stage, it is expected that lighting will be provided to the area where the project will be located. The lighting used will not emit scattered light with high UV emissions, which could minimally attract insects that could be prey for bats.

8.13.3 Decommissioning stage

No significant impacts on visible radiation emissions are anticipated at the project decommissioning stage.

9 DETERMINATION OF THE ANTICIPATED ENVIRONMENTAL IMPACT IN CASE OF A MAJOR INDUSTRIAL FAILURE, AS WELL AS THE POTENTIAL TRANSBOUNDARY IMPACT

9.1 Possibility of serious industrial failures

9.1.1 Introduction

The Regulation of the Minister of Development of January 29, 2016 on types and volumes of hazardous substances present in the plant, which decide on classification of a plant as a plant of increased or high risk of major industrial failure, together with related provisions of the Environmental Protection Law, implements the provisions of Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC (OJ EU L of 2012. No. 197, p. 1), hereinafter referred to as the SEVESO III Directive. According to their provisions, there are two categories of hazards that an investment project may be classified to:

- Lower-Tier Establishment (LTE),
- Upper-Tier Establishment (UTE).

Classification is carried out on the basis of the quantity of substances that may be present within the premises of the entire WTE Plant at the same time. In the course of classification, each substance is classified into one of the following categories that are grouped into 5 sections according to the properties of the substance:

- Section “H” – HEALTH HAZARDS,
- Section “P” – PHYSICAL HAZARDS,
- Section “E” – ENVIRONMENTAL HAZARDS,
- Section “O” – OTHER HAZARDS,
- Named substances (Table 2).

The substances are grouped in two tables:

- Table 1, with general categories of substances relating to their specific classification properties

- Table 2, with substances or groups of substances named explicitly, along with CAS identification number if possible.

These tables contain threshold values for individual substances that may be present at the plant. As provided for in the Regulation, each substance is considered for classification into each of the classification categories in Table 1 and the inventory in Table 2, after which appropriate threshold values are assigned – taking into account the specific cases described in the explanatory notes to the Regulation.

Classification shall be carried out four times for the entire plant:

- On the basis of the individual amount of the substance, according to its classification according to Table 1 or Table 2
- On the basis of the summation rule described in explanatory note 4, point a,
- On the basis of the summation rule described in explanatory note 4, point b,
- On the basis of the summation rule described in explanatory note 4, point c.

9.1.2 Substances present on the WTE Plant site

As part of the investment project, the following substances will be present on the plant site:

Table 55 List of chemical substances present on the planned WTE Plant site and their quantities

Item	Name of the substance	CAS index number	Maximum quantity that may occur at the plant [Mg]	Comments
1	Acetylene	74-86-2	0.0085	
2	Compressed nitrogen	7727-37-9	0.0085	Substance not regulated by Ordinance provisions
3	Extraction naphtha	8032-32-4	0.04	

Item	Name of the substance	CAS index number	Maximum quantity that may occur at the plant [Mg]	Comments
4	Carbon dioxide	124-38-9	0.03	
5	NaCl	7647-14-5	10	
6	NaOH	1310-73-2	0.13	
7	HCl	7647-01-0	0.07	
8	Diesel oil – fuel for the diesel generator set	68476-34-6	0.86	
9	Diesel oil – refueling of loaders	68476-34-6	3	
10	Ekoterm Plus light fuel oil – start-up fuel	Mixture	77.4	
11	Hydraulic oil for the turbine	64742-54-7	1	
12	Lubricating oil for the turbine	64742-54-7	10	
13	Hydraulic oil of boiler grates	64742-54-7	3	
14	Propylene glycol 50% solution	57-55-6	50	
15	Dry carbamide CO(NH2)2	57-13-6	64.09	
16	Activated carbon	7440-44-0	35	
17	Sodium bicarbonate (NaHCO3)	144-55-8	110	
18	Sodium phosphate Na3PO4	7601-54-9	3	
19	Elimin-Ox carbohydrazide – oxygen reducing agent	497-18-7	3	

9.1.3 Classification of substances

According to the safety data sheets of these substances, they belong to the following hazard categories according to the Regulation:

Table 56 List of chemical substances that may be present at the plant in case of expansion and classification of substances according to the Regulation

Item	Name of the substance	Classification of substances				
		H section	P section	E section	O section	Table 2
1	Acetylene	-	P2	-	-	19
2	Compressed nitrogen	-	-	-	-	-
3	Extraction naphtha	-	P5a	-	-	-
4	Carbon dioxide	-	-	-	-	-
5	NaCl	-	-	-	-	-
6	NaOH	H3	-	E1	-	-
7	HCl	H1, H2, H3	-	-	-	-
8	Diesel oil – fuel for the diesel generator set	-	P5c	E2	-	34
9	Diesel oil – refueling of loaders	-	P5c	E2	-	34
10	Ekoterm Plus light fuel oil – start-up fuel	-	P5c	E2	-	34
11	Hydraulic oil for the turbine	-	-	-	-	-
12	Lubricating oil for the turbine	-	-	-	-	-
13	Hydraulic oil of boiler grates	-	-	-	-	-
14	Propylene glycol 50% solution	-	-	-	-	-

Item	Name of the substance	Classification of substances				
		H section	P section	E section	O section	Table 2
15	Dry carbamide CO(NH2)2	-	-	-	-	-
16	Activated carbon	-	-	-	-	-
17	Sodium bicarbonate (NaHCO3)	-	-	-	-	-
18	Sodium phosphate Na3PO4	H2, H3	-	-	-	-
19	Elimin-Ox carbohydrazide – oxygen reducing agent	H2, H3	-	-	-	-

9.1.4 Classification of the plant on the basis of the quantity of each substance separately

The first step of the Regulation's classification is to check each substance individually against its threshold quantity. At this stage, the quantities of each substance at the plant are compared to the lowest classification threshold according to the categories assigned in the table above:

Table 57 Checking the plant classification based on the quantities of individual substances

Item	Name of the substance	Maximum quantity that may occur at the plant	Threshold value*		Classification fraction	
		[Mg]	IRP [Increased Risk Plant]	HRP [High Risk Plant]	IRP [Increased Risk Plant]	HRP [High Risk Plant]
1	Acetylene	0.0085	10.0	50.0	0.00085	0.00017
2	Extraction naphtha	0.04	10.0	50.0	0.004	0.0008
3	NaOH	0.13	50.0	200.0	0.0026	0.00065
4	HCl	0.07	5.0	20.0	0.014	0.0035

Item	Name of the substance	Maximum quantity that may occur at the plant	Threshold value*		Classification fraction	
		[Mg]	IRP [Increased Risk Plant]	HRP [High Risk Plant]	IRP [Increased Risk Plant]	HRP [High Risk Plant]
5	Diesel oil – fuel for the diesel generator set	0.86	2,500.0	25,000	0.000344	0.0000344
6	Diesel oil – refueling of loaders	3	2,500.0	25,000	0.0012	0.00012
7	Ekoterm Plus light fuel oil – start-up fuel	77.4	2,500.0	25,000	0.03096	0.003096
8	Sodium phosphate Na_3PO_4	3	50.0	200.0	0.06	0.015
9	Elimin-Ox carbohydrazide – oxygen reducing agent	3	50.0	200.0	0.06	0.015

According to the provisions of the Regulation, substances classified in Table 2 shall be considered according to the threshold quantities in Table 2, regardless of their classification into general categories in Table 1 of the Regulation.

As the table above indicates, none of the substances exceeds the threshold for classifying a plant as hazardous according to the Regulation.

9.1.5 Classification of a plant on the basis of the summation rule

The next step in the classification is to apply the summation procedure described in explanatory note 4 of the Annex to the Regulation. In this procedure, the classification fractions of each substance within the sections of Table 1 of the Regulation are added together with the substances classified under such sections in Table 2 of the Regulation. In accordance with the position of the Committee of Competent Authorities presented in document No. Ares(2016)1040025 of March 1, 2016, available on the website of the Chief Inspectorate of Environmental Protection (GIOŚ), the threshold quantities in Table 2 of the

Regulation are also used when conducting the summation procedure for substances in Table 2 of the Regulation.

Therefore, and given that all substances classified under more than one hazard category (sections H, P or O) are simultaneously substances listed in Table 2 of the Regulation, fractions in relation to the threshold quantities in Table 2 of the Regulation are used to calculate each of these totals.

9.1.5.1 *Classification of the plant on the basis of the sum for "H" Section:*

Table 58 Checking the classification of the plant on the basis of the sum for “H” section

Item	Name of the substance	Maximum quantity that may occur at the plant	Threshold value a)		Classification fraction	
		[Mg]	IRP [Increased Risk Plant]	HRP [High Risk Plant]	IRP [Increased Risk Plant]	HRP [High Risk Plant]
1	NaOH	0.13	50.0	200.0	0.0026	0.00065
2	HCl	0.07	5.0	20.0	0.014	0.0035
3	Sodium phosphate Na_3PO_4	3	50.0	200.0	0.06	0.015
4	Elimin-Ox carbohydrazide – oxygen reducing agent	3	50.0	200.0	0.06	0.015
TOTAL					0.16	0.03415

The sum of the substances classified under “P” section does not exceed the threshold for classifying the plant into a hazard category according to the Regulation.

9.1.5.2 Classification of the plant on the basis of the total for the "P" section

Table 59 Checking the classification of the plant on the basis of the sum for "P" Section

Item	Name of the substance	Maximum quantity that may occur at the plant	Threshold value a)		Classification fraction	
		[Mg]	IRP [Increased Risk Plant]	HRP [High Risk Plant]	IRP [Increased Risk Plant]	HRP [High Risk Plant]
1	Acetylene	0.0085	10.0	50.0	0.00085	0.00017
2	Extraction naphtha	0.04	10.0	50.0	0.004	0.0008
3	Diesel oil – fuel for the diesel generator set	0.86	2,500.0	25,000	0.000344	0.0000344
4	Diesel oil – refueling of loaders	3	2,500.0	25,000	0.0012	0.00012
5	Ekoterm Plus light fuel oil – start-up fuel	77.4	2,500.0	25,000	0.03096	0.003096
TOTAL					0.037354	0.0042204

The sum of substances classified in the "P" section does not exceed the threshold for classifying the plant into a hazard category according to the Regulation.

9.1.5.3 Classification of the plant on the basis of the sum for "E" Section

Table 60 Checking the classification of the plant on the basis of the sum for "E" Section

Item	Name of the substance	Maximum quantity that may occur at the plant	Threshold value a)		Classification fraction	
		[Mg]	IRP [Increased Risk Plant]	HRP [High Risk Plant]	IRP [Increased Risk Plant]	HRP [High Risk Plant]
1	NaOH	0.13	50.0	200.0	0.0026	0.00065
2	Diesel oil – fuel for the diesel generator set	0.86	2,500.0	25,000	0.000344	0.0000344

Item	Name of the substance	Maximum quantity that may occur at the plant	Threshold value a)		Classification fraction	
		[Mg]	IRP [Increased Risk Plant]	HRP [High Risk Plant]	IRP [Increased Risk Plant]	HRP [High Risk Plant]
3	Diesel oil – refueling of loaders	3	2,500.0	25,000	0.0012	0.00012
4	Ekoterm Plus light fuel oil – start-up fuel	77.4	2,500.0	25,000	0.03096	0.003096
TOTAL					0,035104	0,0039004

The sum of the substances classified under “E” section does not exceed the threshold for classifying the plant into a hazard category according to the Regulation.

9.1.6 Summary

As part of the procedure, the classification of the WTE Plant has been verified four times in compliance with the procedure:

- Based on the individual quantities of substances, the WTE Plant is classified as an unclassified plant;
- Based on the summation rule for the “H” section, the WTE Plant is classified as an unclassified plant;
- Based on the summation rule for the “P” section, the WTE Plant is classified as an unclassified plant;
- Based on the summation rule for the “E” section, the WTE Plant is classified as an unclassified plant.

Accordingly, the WTE Plant is classified as an unclassified plant.

It should be emphasized here that the planned WTE Plant and the planned investment project concerning the construction of a new gas cogeneration unit in a CCGT configuration (on the premises of EC-4) does not form and will not form a single plant, as they constitute two separate organizational, formal and legal units having significantly different economic objectives.

9.2 Transboundary impact

Operation of the Waste to Energy Plant may be a source of transboundary impacts mainly due to air emissions. In the case of the analyzed plant, transboundary impacts will not occur, as evidenced by the modeling analysis of the propagation of air pollutants.

10 DESCRIPTION OF THE PLANNED PROJECT'S ANTICIPATED IMPACTS ON THE ENVIRONMENT, INCLUDING DIRECT, INDIRECT, SECONDARY, PERMANENT AND TEMPORARY IMPACTS

10.1 Characteristics of direct, indirect and secondary impacts

The severity of negative impacts on the ground surface will be mainly related to the implementation phase of the project and depends on the amount of surface transformation and the area affected. Changes to the land surface, including relief and soils, will be an immediate, permanent, and partially irreversible phenomenon, as the duration of these transformations will depend on the long-term operation of the proposed project.

One of the key environmental components that will be indirectly affected by the project will be the landscape. However, every effort has been made to integrate the project into the surrounding landscape, if only by designing a green roof, as well as rain gardens, which will further enhance the surroundings of the planned project.

No clear indirect threats to the surrounding areas should be associated with the proposed investment project, this applies primarily to possible situations related to the emission of pollutants into the groundwater environment (fallout of air pollutants, diffuse rainwater runoff), as the projected emissions will not occur in quantities that would cause qualitative changes in the surrounding habitats. In terms of direct impacts, tree cutting should be mentioned, however, this will be compensated by replacement plantings.

In terms of acoustic impact, direct impact is related to the operation of the systems and equipment of the WTE Plant. The secondary impact in this case will be the acoustic impact of traffic generated by the transportation of waste and post-processing residues.

In the context of indirect impacts in the vicinity of the analyzed project, an increase in the concentration of oxidants formed from nitrogen oxides emitted from the WTE Plant in significant quantities and hydrocarbons present in the air mainly from line sources in the presence of sunlight is possible. As a result of photochemical oxidation of light saturated hydrocarbons, formaldehyde and nitrogen oxides, the organic peroxides can be formed, e.g. acetylnitrate, benzoylnitrate. Due to the multitude of chemical transformations that can occur in the air, it is impossible to estimate the scale and scope of potential indirect impacts on atmospheric air.

Secondary emissions will occur as a result of entrainment in turbulent air movements of solids deposited at the WTE Plant site. The magnitude of these impacts will depend on the current wind conditions, humidity and the amount of material deposited.

10.2 Characteristics of cumulative impacts

Cumulative impacts related to air emissions and noise emissions are described in chapters 8.6.4 and 8.7.6.

To sum up, the performed calculations of pollutant propagation and noise propagation showed that the operation of the WTE Plant, taking into account the cumulative impact with the existing and designed emission sources of the EC-4 Combined Heat and Power Plant, will not result in exceeding the permissible levels of substances in the air or the reference value, and will not result in exceeding the limits of noise emission to the environment.

The assessment of impact on atmospheric air quality included already existing emission sources taking into account the background of substances in the air according to the data received from the Chief Inspectorate of Environmental Protection, ref. No. DM/ŁD/063-1/300/20/DR, file No.: 723/ŁD, dated May 26, 2020

In the context of acoustic impact, cumulative impact should be understood as the impact of all noise sources that are or will be located in the area of the investment project location.

In the case of the analyzed project, there will be cumulative impacts of the existing EC-4 and the planned investment project concerning the construction of a new gas cogeneration unit in a CCGT configuration and other possible sources of both linear, point and surface emissions

10.3 Characteristics of short-, medium- and long-term impacts

Short-term impacts will occur only during the construction stage of the project. Then, a local increase in emissions of fuel (Diesel oil) combustion products in construction machinery engines – mainly emissions of nitrogen oxides, sulfur dioxide, carbon monoxide, dust (including PM10 and PM2.5) and hydrocarbons, should be expected. Additionally, emissions of fuel (Diesel oil) combustion products in construction machinery engines – mainly emissions of nitrogen oxides, sulfur dioxide, carbon monoxide, dust (including PM10 and PM2.5) and hydrocarbons, should be expected. In addition, there will also be secondary dusting from vehicle traffic in the construction area and dusting from the movement of earth masses, cement and construction aggregates. Similarly, in terms of other environmental components.

Changes to the land surface, including the various components of the environment associated with it, produced during earthworks, will be a permanent phenomenon, only partially reversible. This is because it is not possible, for example, to completely restore the original soil conditions in the natural sense. Changes to the land surface will occur only during the implementation of the planned project, which should be treated as a short-term impact, however, the direct transformations made during this time will persist throughout the multi-year period of operation of the proposed investment project.

Air and noise emissions, which are among the reversible impacts, should also be associated with the lifetime of the facility (about 30 to 40 years), and thus with long-term impacts. In this regard, the environment can be restored to its original state after completion of the plant operation.

11 DESCRIPTION OF FORECASTING METHODS

11.1 Methods of assessing the impact of the project on the acoustic climate

Calculations of the distribution of the acoustic field from noise sources associated with the designed plant, as well as those operating in the vicinity of its location, were carried out using the Cadna A 4.6.155 software, which allows to perform forecasts in accordance with Directive *2002/49/EC* of the European Parliament and of the Council of 25 June 2002 relating to the *assessment and management of environmental noise, and* in accordance with the method included in the Polish Standard PN ISO 9613-2:2002 “Acoustics – Attenuation of sound during propagation outdoors. Part 2. General method of calculation”.

For the purpose of the analysis, a 3D model was created that takes into account existing facilities, landforms and, in assessing cumulative impacts, the facilities being designed as part of the planned CCGT plant. Noise sources were modeled based on data from potential equipment suppliers.

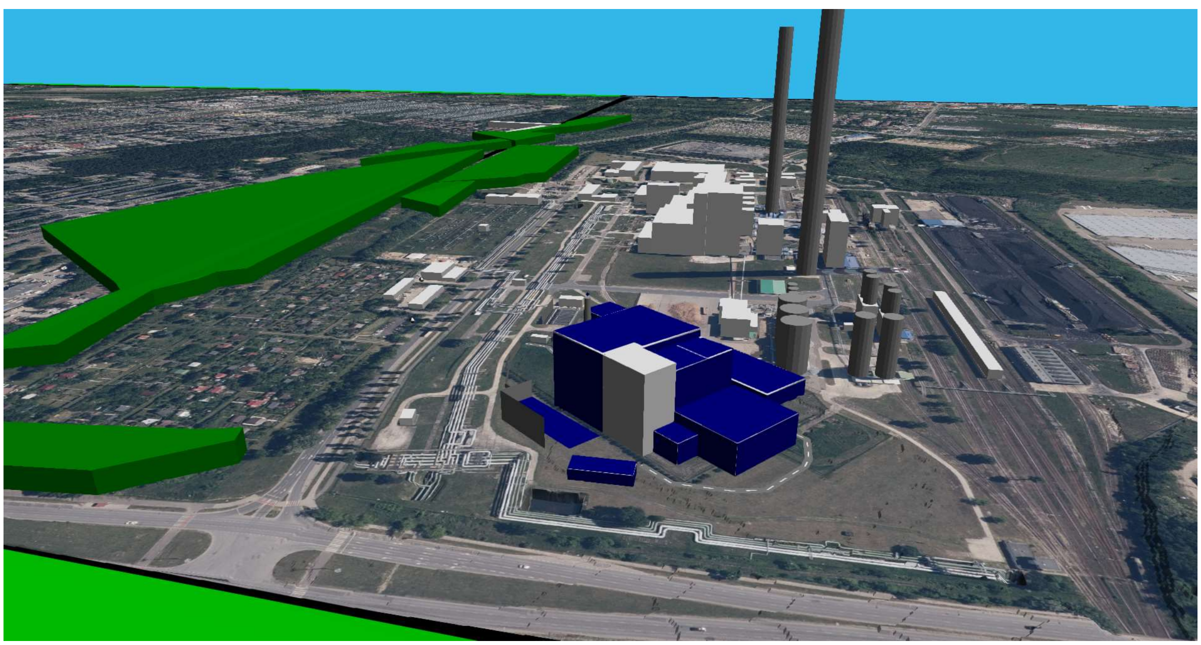


Figure 20 3D model created for analysis in CadnaA software

11.2 Methods of assessing the impact of the project on atmospheric air

In order to determine air emissions for the project in question, a detailed analysis of the data presented in the provided conceptual and design materials for the investment project was carried out, and an interview with the Investor (future user) of the designed plant was conducted.

Calculations of pollutant dispersion in the air were made using the "OPERAT FB" program for Windows v.8.1.2/2020 (extended version) by the company "PROEKO" Ryszard Samoć, in compliance with the reference calculation methodology specified in Appendix No. 3 to the Regulation of the Minister of the Environment of January 26, 2010 *on reference values for certain substances present in the air.*

The air quality in the area of the planned investment project was determined by the letter of the Chief Inspectorate for Environmental Protection, ref. No. DM/ŁD/063-1/300/20/DR, file No.: 723/ŁD, dated May 26, 2020

11.3 Methods of assessing the impact of the project on the land and soil surface

Taking into account the geomorphological and soil conditions determined based on hydrogeological documentation, the sites of possible significant disturbance of the land surface during the construction of the WTE Plant were analyzed.

The planned conceptual solutions for the construction of the new plant were recognized in terms of the anticipated needs for safeguards for the soil environment and the land surface. Consideration was taken to the current use of valuable soils and the need for safeguards during the course of erection and construction works.

Protective measures and safeguards for the soil environment and the land surface were suggested, by describing measures and suggestions for safeguards.

11.4 Methods of assessing the impact of the project on vegetation and fauna

An environmental inventory of the analyzed area in terms of natural habitats and protected and endangered elements of the flora of vascular plants, bryophytes and fungi was made during site inspections conducted from February to July 2020.

The entire investment project site, including a buffer of up to 150 m, has been surveyed.

The inventoried habitats were plotted on a natural habitat distribution map. Cartographic works were conducted using orthophotomaps and a GPS receiver. A grid of subdivisions was used to determine the coverage of individual types of natural habitats.

As part of the preparatory works for the field inventory, any habitats likely to potentially provide places of living for amphibians and reptiles were selected. Field surveys, consisting in penetration of the area on foot, were conducted in February–July 2020, and covered the entire area of the investment project including adjacent areas.

The avifauna surveys were conducted during the bird breeding season and were aimed at assessing the occupancy of the investment project area and the area immediately adjacent to the investment project by actively searching for nests of birds located in the area covered by the survey and listing all singing males. All birds within sight of the observer were recorded during the observation. During the inspection, the entire area of the investment project was penetrated using the itinerary method.

The inventory of entomofauna was carried out using standard methods, such as screening litter with an entomological sieve, taking samples of tree bark and punk wood, looking out.

The dendrological survey of the indicated area was conducted on May 16, 2020. During the dendrological survey, the names of the tree and shrub species were determined. The species nomenclature was adopted in accordance with the work of Włodzimierz Seneta and Jakub Dolatowski (Dendrology, Wydawnictwo Naukowe PWN 2012).

Tree trunk circumference measurements were taken at 130 cm, and if a tree was at this height:

- and had several trunks – the circumference of each of these trunks was measured,
- and had no trunk – the circumference was measured directly below the tree crown.

Dendrological parameters were measured using a 10–12 mm fiberglass tape measure from STANLEY.

Determination of tree location was done using TOPCON HiPer SR receiver with TOPCON FC-5000 controller.

During the field works, photographic documentation was taken.

The detailed methodology of the conducted natural surveys is indicated in Appendix No. 3 to this Report.

11.5 Methods of assessing the impact of the project on protected areas and objects, including Natura 2000 sites

For assessing the impact of the project on the identified protected areas and objects, including Natura 2000 sites, an analysis was carried out taking into account the following elements:

- the subject of protection for which the area was established. In this regard, first of all, the sensitivity of nature protected in the area (plant, animal and fungi species, plant communities, animal habitats, natural habitats, ecosystems, environmental connections, landscape) to various factors threatening its functioning and resulting from the implementation of the project was recognized,
- environmental connections between the project site and the protected area that may allow or promote the migration of pollutants or undesirable species;
- categories of potential impacts caused by the project.

By recognizing the interrelationships between the sensitivity of the environment, the potential migration path of pollutants and the category of impacts of the project, the impacts were determined and their nature, scale, range, possible effects and significance were assessed.

11.6 Methods of assessing the impact of the project on cultural assets

Historical monuments (architectural, urban and archaeological) in the given area were identified based on materials and information from the Voivodeship Monument Protection Office in Łódź. In addition, a field inspection was conducted in the project area. Historical as well as architectural and urban objects were recognized, taking into account their value for the cultural landscape.

The location of individual objects in relation to the project site was determined based on Archaeological Photographs of Poland, the possible effects of the project implementation on potentially identified objects located in the area covered by the works (construction stage) and in the vicinity of the project facilities (operation stage) were estimated.

11.7 Methods of assessing the impact of the project on the landscape

The concept of landscape is not unambiguous, and its definition varies depending on the scientific discipline from the point of view of which this concept is considered. Colloquially, the landscape is understood as the appearance of the Earth's surface. In nature protection and ecology, the landscape is understood as many separate elements (such as trees, fields, rivers, buildings, roads, etc.) that together form a certain whole. By many specialists (including landscape architects), the landscape is seen as a synthesis of the natural, cultural and visual environment. This study assumes that the landscape is a set of natural and cultural elements that form a coherent whole.

Pursuant to the Act of March 27, 2003 on spatial planning and development (Journal of Laws 2020, item 293, as amended), “landscape – should be understood as a space perceived by people, containing natural elements or products of civilization, formed as a result of action of natural factors or human activity”.

The area designated for the planned investment project is heavily altered by human activity and has no qualities valuable in landscape terms. The impact assessment was carried out based on available source materials and own observations.

11.8 Methods of assessing the impact of the project on living conditions and human health

When forecasting the impact on people, the influence of the impact on the environmental components, the effects of which may be felt by people, was taken into account and their potential impact on health was assessed.

12 MEASURES TO PREVENT OR REDUCE NEGATIVE ENVIRONMENTAL IMPACTS AND TO COMPENSATE HARMFUL ENVIRONMENTAL IMPACTS

12.1 Compensation of harmful environmental impacts

12.1.1 Rain gardens

“Wet” rain gardens were designed in the WTE Plant project to perform the function of water retention.

One of the compensatory measures proposed by the Investor, allowing for rainwater retention and thus counteracting the effects of climate change, are the rain gardens described below. This solution increases natural retention, preventing floods and drought and mitigating the formation of an “urban heat island”. In addition, the bioretention in question will allow for infiltration of water in the ground (cleaning the rainwater of pollutants), improving microclimate and increasing humidity.

Water retention contributes to groundwater and surface water conservation, increases groundwater resources. Further benefits from the retention function of rain gardens include reduced surface runoff and reduced land erosion. The retained water is gradually released, stays in the ground longer, reducing the risk of drought and supplies groundwater. This type of solution prevents flooding in case of heavy rain.

By collecting water from their surroundings and storing it, this water is retained in the landscape. By using hydrophytic vegetation capable of removing pollutants by the plants, the quality of discharged water is increased.

“Wet” rain gardens have a leak-tight bottom made of PVC film. The gardens are built directly into the ground. The sealing layer – PVC foil should be covered with a 20 cm layer of gravel to filter water and with a 10 cm layer of clean, washed sand on top. Afterwards, lay down a vegetation layer for plants consisting of a mixture of fertile soil and sand. Mix the soil in a 1:3 ratio – one part of fertile soil should be mixed with three parts of sand. In order to protect against washing out fertile parts of soil and water erosion, a 5 cm layer of stones with a fraction of 3-6 cm should be laid in the vegetation layer. Additionally, in places of water runoff with a warp stream to rain gardens, pebbles should be laid to protect the gardens against water erosion. Gardens should be equipped with a drainage pipe to carry away excess water. Any excess water is discharged by an emergency overflow to the rainwater drainage system with a significant delay, which eliminates the negative effects of precipitation. An additional advantage of creating rain gardens is an increase in biodiversity, which has a positive impact on the environment.

Hydrophytic plants will be planted in the rain gardens. These are plants that endure periods of drought and are flood tolerant, plus they purify water. In order to avoid annual plantings that may move drainage layers, the planned gardens have perennial plants, occurring naturally in the Polish plant communities, occurring in water ecosystems and periodically flooded ecosystems.

The proposed plant species are purple loosestrife (Lythrum salicaria), reed canarygrass (Phalaris arundinacea) and narrow-leaved water plantain (Alisma plantago-aquatica).

Figure 21 Purple loosestrife (Lythrum salicaria)

Source: https://floramis.pl/krwawnica-pospolita-robert

Figure 22 Reed canarygrass (Phalaris arundinacea)

Source: https://www.swiatkwiatow.pl/poradnik-ogrodniczy/mozga-trzcinowata-id1409.html

Figure 23 Narrow-leaved water plantain (Alisma plantago-aquatica)

Source: https://sadzawka.pl/Alisma_plantago_aquatica

Rain gardens will be constructed as follows:

- in accordance with the designated location on the green design, a place for creating the rain gardens should be prepared on site,

- gardens should be built directly into the ground and the bottom of the excavation should be sealed with PVC film so that the bottom of the garden does not allow water to enter the ground,
- the PVC film layer should be covered with a 20 cm layer of gravel,
- the gravel layer should be covered with a 10 cm layer of clean, washed sand,
- a vegetation layer for plants consisting of a mixture of fertile soil and sand in the ratio of 1:3 (one part of fertile soil should be mixed with three parts of sand) should be laid on top of the sand,
- in order to protect against washing out fertile parts of soil and water erosion, a 5 cm layer of stones with a fraction of 3–6 cm should be laid in the vegetation layer,
- in places of water runoff with a warp stream to rain gardens, pebbles will be laid to protect the gardens against water erosion,
- gardens should be equipped with a drainage pipe to carry away excess water,
- hydrophytic plants should be planted in the rain gardens.

12.1.2 Green roof

The project provides for the establishment of extensive green roofs on the designed gravel building. For planting plants on extensive green roofs, compositions of sedum species plants are proposed. Sedum is a plant that belongs to the succulents – i.e. plants that have adapted to live in harsh climatic conditions. They are characterized by a high ability to regenerate, they grow well horizontally, tightly covering the roof surface.

Figure 24 Stonecrops (Sedum)

Source: https://www.mojpieknyogrod.pl/artykul/rozchodnik-sedum-sylwetka-pielegnacja-stanowisko

Figure 25 Sedum acre – Goldmoss

Figure 26 Sedum ewersii – Wall-pepper

Figure 27 Sedum kamtschaticum – Orange stonecrop

Figure 28 Sedum cyaneum – Showy stonecrop

Vegetation on the extensive roof will reach the height of 10-20 cm. A green roof created according to the layers listed below will achieve a maximum water retention of about 50 l/m2. By collecting water from their surroundings and storing it, this water is retained in the landscape.

A green roof should consist of the following layers:

- vegetation,
- substrate – extensive substrate (8 cm thick layer),
- filter fabric (100 g/m2),
- drainage (2 cm layer),
- anti-root roof paper (approx. 5 mm thick),
- thermal insulation,
- adhesive for thermal insulation,
- vapor barrier, e.g. PE film,

The maintenance of vegetated roofs will involve regular weeding, especially at an early stage of plant growth before forming a compact group, plants watering during drought and plants fertilizing in spring.

Advantages of a green roof:

- retains rainwater,
- reduces rain water runoff,
- absorbs noise (increased sound absorption coefficient),
- in winter prevents large heat losses and in summer protects against excessive heating of the building (excellent thermal insulation),
- filters pollutants from the air and produces oxygen,
- provides a barrier to contaminants,
- produces oxygen and absorbs carbon dioxide,

- the microclimate created around the green roof prevents the creation of "heat islands",
- UV radiation does not damage the roof surface,
- is durable (roof durability).

Green roofs offer many environmental, economic and social benefits. Some of the benefits are rainwater harvesting, air purification and indoor temperature regulation, as well as increasing urban species diversity. Plants on green roofs clean the air by filtering airborne dust and converting CO_2 into oxygen. They reduce noise levels both inside and outside the building. The use of a vegetated roof also causes the extension of the roof durability, protecting the roof covering against external impacts such as: temperature, sun, wind and rain.

Various species of sedums, grasses and other plants provide perfect shelter for birds, butterflies and other insects. This is especially true in urban spaces, where concrete and asphalt are mainly found.

A natural feature of plants is that they contain a lot of moisture. A green roof allows to create a natural fireproof layer on building.

Green roof systems make it possible to hide installation devices located there, create homogeneous compositions by combining greenery at different levels.

12.1.3 Replacement plantings

In accordance with the provisions of the Act on nature protection, plantings were proposed to compensate for the loss of greenery in the environment in a number no smaller than the number of trees to be removed as part of the project and an area of shrubs no smaller than the area to be removed.

In order to maintain the continuity of composition of the entire CHPP facility, for the purpose of plantings, it is proposed to plant the following tree species: Norway maple 'Globosum' (Acer platanoides 'Globosum'), blue spruce (Picea pungens) and Norway spruce (Picea abies) as well as shrubs from the species wild privet (Ligustrum vulgare) – cultivated as a hedge. Replacement plantings of coniferous species are proposed for coniferous trees removed and compensatory plantings of deciduous species are proposed for deciduous trees removed.

Additionally, at the gatehouse building, it is suggested to provide plantings of scarlet firethorn of the variety 'Orange Charmer' or 'Orange Glow' variety Pyracantha coccinea and rockspray cotoneaster Cotoneaster horizontalis. A shrub with good frost resistance, effective for its original shoot arrangement, fruit color and autumn foliage discoloration.

In addition, plantings with Japanese ivy (Parthenocissus tricuspidata) have been envisaged.

Table 61 Replacement planting proposal (quantity and species)

English name	Latin name	Quantity
Norway maple 'Globosum'	*Acer platanoides 'Globosum'*	2 pcs
Norway spruce	*Picea abies*	26 pcs
blue spruce	*Picea pungens*	26 pcs
wild privet	*Ligustrum vulgare*	100 m^2
scarlet firethorn	*Pyracantha coccinea*	155 m^2
rockspray cotoneaster	*Cotoneaster horizontalis*	40 m^2
Japanese ivy	*Parthenocissus tricuspidata*	174 pcs

12.2 Prevention or mitigation of harmful environmental impacts

The purpose of this environmental impact report is to determine the impact of the planned project on various elements of the environment and people, while taking into account the location, design, technological, technical and organizational solutions adopted by the investor.

Preventive or mitigating actions for the environmental impact of the planned project are indicated below.

12.2.1 Atmospheric air protection

Implementation phase

In order to reduce the nuisance associated with air emissions during the construction stage, the works will be carried out in accordance with the following recommendations:

- emissions from construction equipment and trucks will be minimized by switching off the engines when stationary or loading,
- works will be conducted using equipment in good working condition,

- wherever possible, ready mixes manufactured at the plant will be used to minimize on-site mixing of aggregate and binder,
- it is planned to transport soil masses and construction aggregates with vehicles with tight boxes and tarpaulins to prevent dusting,
- vehicle wheel washing is planned at the exit of the construction site,
- in the event of adverse weather conditions (e.g. strong winds in the absence of rainfall), it is planned to cover heaps of bulk materials with tarpaulins and/or sprinkle then and sprinkle the excavated soil with water.

Operation phase

The planned Plant will be designed, equipped, built and operated in such a manner so as not to exceed the permitted emission values for exhaust gases.

The following flue gas cleaning systems will be used for the Waste to Energy Plant (WTE Plant):

- flue gas desulfurization by the dry method using hydrated lime $NaHCO_3$ to reduce acidic compounds of SO_2, HF, HCl, dust, combined with the stream and dust method using activated carbon to reduce heavy metals, dioxins and furans,
- dedusting of flue gases by means of a fabric filter with a dedusting efficiency of at least 99.8%,
- denitrification of flue gases by primary and secondary SNCR methods using solid carbamide solution to reduce NOx emissions.

The dry flue gas desulfurization system ensures thorough flue gas cleaning with optimum reacting substance consumption and moderate production of process residues. It is compliant with the BAT requirements.

Dry flue gas cleaning

The use of the dry flue gas cleaning method constitutes a change in relation to the provisions of the decision of the Mayor of the City of Łódź No. 51/U/2010 of June 28, 2010, ref. No. OŚR.III.7626/25/10 (in point II.24, the semi-dry method is indicated). Currently, the dry method has been significantly developed and is very effective and preferred by technology suppliers. This is a proven, widely used solution. On the other hand, the semi-dry method is known to cause significant operational problems. The finished limestone powder solution very often clogs the lines that transport this reacting substance. This has a negative impact on the correct operation of the flue gas cleaning plant as well as on the availability of the entire plant. Therefore, using the dry method, in which such problems do not occur, is a significantly better solution. The application of the dry method will allow to meet new emission requirements resulting from the BAT Conclusions for waste incineration.

The process of flue gas cleaning using the dry method, supported by a bag filter, will make it possible to meet the currently applicable and future standards thanks to a very efficient reduction of acidic components in flue gas (HCl, HF, SO_2), heavy metals, dust, dioxins and furans contained in flue gas, formed during the waste-to-energy process.

In the dry method, in the reaction chamber flue gas comes into contact with the reagent reducing acidic components of flue gas (HCl, HF, SO_2) and an adsorption reagent reducing heavy metals, dioxins and furans. The proposed reagents are sodium bicarbonate $NaHCO_3$ and activated carbon. Acidic pollutants will be neutralized through contact and reaction with fine alkaline particles.

Flue gas comes into contact with the powdered reagent in the reaction chamber in the presence of cooling water. Reactions with reagents are an active phase of the process.

Acidic gases, mainly HCl, HF and SO_2, are neutralized in contact with the reagent in accordance with the following reactions:

$$Na_2CO_3 + 2\ HCl \rightarrow 2\ NaCl + CO_2 + H_2O$$

$$Na_2CO_3 + 2\ HF \rightarrow 2\ NaF + CO_2 + H_2O$$

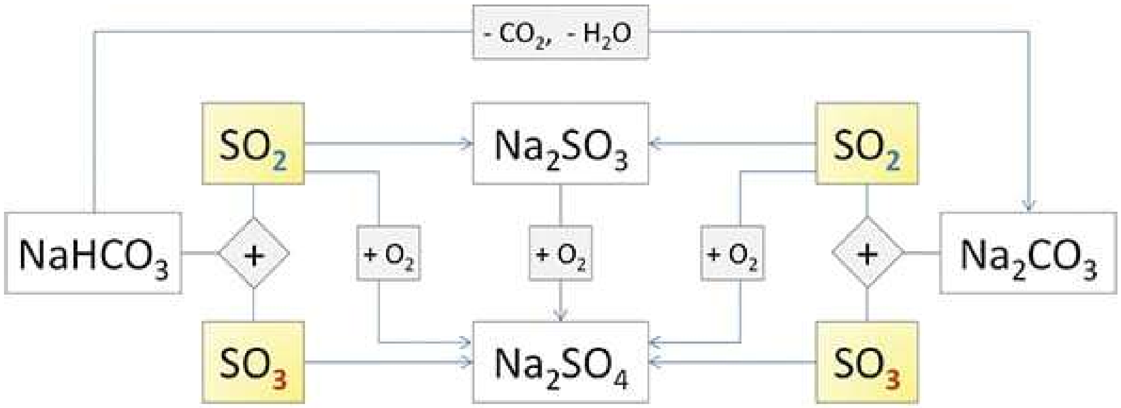


Figure 29 Diagram of chemical reactions leading to neutralization of acid components of flue gases

Activated carbon allows the reduction of heavy metals to be increased and dioxins and furans to be captured.

Fabric filter

Solid particles coming out of the homogenization duct will be deposited

on the surfaces of the filter bags. A bag filter constitutes an important stage in flue gas treatment because it not only dedusts the flue gas, but the excess of reagents present on bag surfaces will still react with flue gas. The flue gas passing through a solid residue layer formed by excess reacting substances (sodium bicarbonate $NaHCO_3$ and activated carbon), dusts and reaction products allow the continuation of neutralizing reactions in the filter. In the bag filter, flue gas percolation through a layer deposited on the bag surface increases the contact between pollutants and reagents, thus ending the reactions, as well as minimizing the consumption of reagents and the generation of solid residues.

Reagent circuit for dry flue gas cleaning

All reagents will be delivered to the WTE Plant by trucks and transported pneumatically to a suitable silo. The reagent will be transported from the silo to the flue gas duct.

Activated carbon cycle

Activated carbon stored in a metal silo common for both processing lines and introduced into the cycle via a dosing airlock.

Ash and reaction product cycle

Fly ash accumulated in hoppers under the grate and residues from the bag filter will be transported by means of mechanical or pneumatic conveyors to bunkers.

Reduction of nitrogen oxide emissions

In order to reduce the concentration of nitrogen oxides (NOx), a Selective Non-Catalytic Reduction (SNCR) process is proposed, allowing a problem-free achievement of the NOx emission level required by the BAT conclusions.

Compared to the SCR (Selective Catalytic Reduction) method, SNCR is less energy intensive, has lower investment and operating costs, and does not require an expensive cleaning or catalytic bed replacement process.

With the current development of the SNCR technology, it is possible to achieve NOx emission levels below 100 mg/m^3. This is achieved by careful monitoring of the combustion conditions and using a highly precise NOx reducing agent distribution system. Leading companies in the market offering flue gas cleaning system solutions, including SNCR-based NO_x reduction systems, guarantee a reduction in their emissions below 100 mg/m^3.

The reduction of nitrogen oxide concentrations can be achieved by two clearly different methods:

- through reduction, which we consider to be a primary method, consisting in the reduction in nitrogen oxides “at source” of their formation. It mainly consists in optimizing the incineration process,
- through reduction, which we consider to be a secondary method, consisting in the chemical reduction of nitrogen oxides as a result of being subjected to the action of carbamide $CO(NH_2)_2$ according to the reactions below (with carbamide):

$$4\,NO + 2\,CO(NH_2)_2 + O_2 \rightarrow 4\,N_2 + 4\,H_2O + 2\,CO_2$$
$$2\,NO_2 + 2\,CO(NH_2)_2 + O_2 \rightarrow 3\,N_2 + 4\,H_2O + 2\,CO_2$$

The products of the reduction reaction comprise gaseous environmentally neutral nitrogen and steam and carbon dioxide.

An SNCR arrangement with urea solution injection into the furnace chamber is proposed. The urea solution will be prepared from dry urea in solid form. This selective non-catalytic reduction enables proper control of reacting substance injection and good mixing with flue gas, thus reducing reacting substance consumption. Injection within the optimum temperature range will be monitored continuously by measuring temperature at the injection levels.

Reduction of dioxins and furans (PCDD/F)

Reduction of PCDD/F emissions will take place using primary and secondary methods. Primary methods involve optimizing the temperature of the combustion and postcombustion process. The secondary method uses activated carbon injection.

Studies show that PCDD/Fs decompose at temperatures above 800°C. The designed plant will be equipped with an after-combustion chamber (also referred to as a thermal reactor), equipped with an automatically activated burner controlled by a temperature sensor. This sensor ensures that the temperature required by the Polish and Community law is maintained in the after-combustion chamber. Flue gas will be held in this chamber for a period not shorter than 2 s, at a temperature not lower than 850°C. As a result of after-combustion of flue gas, the content of toxic substances contained in the gas will be significantly reduced. For further cleaning, flue gas will be transferred to the previously described dry flue gas cleaning plant. In this plant, the emission of dioxins and furans will be reduced further as a result of adsorption on activated carbon. The designed solution will ensure reduction of concentrations of dioxins and furans in flue gas to the level required by law.

Dedusting of air discharged from process waste bunkers and slag valorization hall

The process waste bunkers and air exhaust from the ventilation system of the IBA valorization hall will be equipped with dedusting filters. Dust extraction of air streams will be done by filter elements, which are usually made of polyester fabric. The dust-contaminated air passes through a filter that traps the dust particles and allows the air to continue to flow. Dust collected on the surface of the filter elements is periodically removed by the cleaning system. It is planned to use filters with an efficiency level allowing to meet the BAT requirements – the maximum dust concentration at the outlet of the dedusting filter of the slag valorization hall will not exceed 5 mg/Nm^3 (emission limit value arising from the BAT AEL BAT Conclusions WI), and the maximum dust concentration at the outlet of the dedusting filters of the process waste bunkers will not exceed 10 mg/m^3 (according to the BAT reference document for emissions from storage – BREF EFS).

Odor control

The main nuisance felt by people in waste management facilities is the emission of odors. Malodorous gases (e.g., thiols, disulfides, amines) are primarily generated during anaerobic methane digestion processes of biodegradable waste fractions. The amount of malodorous gas emissions, and thus the odorous nuisance of waste management facilities, depends primarily on the types of waste that are processed at a given facility, and secondarily on the extent of encapsulation and deodorization solutions applied.

Both standardized alternative fuel (RDF) and oversize calorific fraction from mechanical and biological processing (pre-RDF) is already processed waste, which, at the stage of delivery to the power plant, already has low biological activity. Therefore, the potential for odor-generating anaerobic digestion processes will be limited for the plant under review.

In order to eliminate potential odor impacts, the waste tipping stations and the waste bunker hall will be covered with a structure enabling complete separation of the process from the external environment. In these rooms, constant negative pressure will be maintained, which will prevent air leakage to the outside. Air sucked in from the aforementioned rooms in order to generate negative pressure in the rooms will be transferred to the boiler of the furnace system, where malodorous substances will be burnt. In case of an emergency shutdown of the plant, a deodorization system based on an activated carbon filter is planned.

12.2.2 Noise protection

<u>Noise protection methods during the implementation phase</u>

The analysis showed that the construction of the project would not result in exceeding the permissible noise levels in the environment.

There are no specified permissible noise levels for the night time for the nearest noise-sensitive (protected) areas (allotment gardens). It is anticipated that the works will be carried out during daytime hours, i.e. from 6:00 a.m. to 10:00 p.m., but it is emphasized that given the above restriction, it is not necessary to meet the permissible noise levels in the environment.

In addition, reduction of noise emissions from the Plant site to the environment can be achieved by applying the following principles:

- use of machinery and equipment that are sources of noise with high sound power levels, if possible, only during daytime,
- switching off unnecessary noise-producing equipment, machinery and tools that are not in use at the time,
- ensuring that equipment is in proper technical condition (working order), especially the equipment that is a significant source of noise on company premises,
- taking organizational measures limiting the emission of noise to the environment, such as, for example, deploying screening facilities like containers along the noise propagation path between noise source and the area protected against noise.

<u>Noise protection methods during the operation phase</u>

The conditions necessary to comply with environmental noise levels are listed below:

- The aggregate equivalent acoustic power of the whole project should not exceed 112.1 dBA.
- Noise barriers should be designed along the northern boundary of the site:
  - The barrier is 8 m high and approximately 52.1 m long. Barrier of WTE Plant 1
  - The barrier is 5 m high and approximately 36.8 m long. Barrier of WTE Plant 2
  - The barrier is 2 m high and approximately 22.2 m long. Barrier of WTE Plant 3

  The approximate location of the barrier is indicated by the above names and magenta color in Figures 10 and 11 of Appendix 2. The barriers should feature the insulation class B3 (PN-EN-1793-2) and the absorption class A4 (PN-EN-1793-1).

The sound powers specified above are determined with the equipment enclosures included. The enclosure is also defined as a building. The sound power of the enclosed devices themselves may be higher.

If the above conditions are met, the operation of the project will not result in exceeding the permissible noise levels in the environment.

<u>Noise protection methods at the decommissioning stage</u>

Currently, no decommissioning date is anticipated for the designed plant. It is assumed that it will operate for at least a dozen years. At the end of its lifetime, decommissioning will be carried out in accordance with the environmental requirements in force at the time. However, if necessary, it can be assumed that the investment project impact at this stage would be similar to that of the construction phase, although it is noted that the solutions should be adjusted to the classification of noise-sensitive (protected) areas that will be in force at the time of the works.

Maintaining the solutions specified above will result in adherence to acceptable levels of noise in the environment during the investment project implementation, operation and decommissioning.

12.2.3 Protection of surface water and groundwater

<u>Construction stage</u>

Construction works throughout the area under analysis should be carried out with due care and proper organization, which should prevent oil derivative substances from construction machinery and civil equipment from contaminating the environment. During the project implementation stage, one should ensure adequate:

- method of storing materials for the construction of individual elements of the project and the accompanying facilities,
- the method of collecting waste, moreover, the handling of waste, especially that classified as hazardous waste, should be in accordance with applicable regulations, in particular collection of particular types of waste in containers adapted for this purpose, transferring waste for transport, recovery or neutralization only to specialized companies, holding appropriate permits,
- use of technically efficient vehicles (with no fuel spills), which after finishing work or in case of breakdown should be removed to a parking place with a hardened surface preventing the penetration of oil contaminants both to the ground and to groundwater,
- equipping the construction crew with sorbents to neutralize any possible oil spills from machines and vehicles and conducting all repairs and maintenance of equipment at the contractor's permanent bases or at specialized service centers,

- solutions for water and sewage management (removal of domestic sewage to sealed tanks from the construction site, e.g. by using portable toilets with neutralizing liquid that are serviced by specialized slurry vehicles).

Places for parking and refueling construction machinery should be secured in such a way as to protect the groundwater environment from potential pollution due to equipment failures, such as oil spills.

Operation stage

At the operation stage, it is necessary to ensure proper handling of sanitary and industrial wastewater, as well as rainwater.

Solutions in the scope of rain gardens and vegetated roof will ensure the possibility of rainwater retention.

12.2.4 Protection of the groundwater environment and the ground and soils

Construction stage

It should also be borne in mind that, as in the case of protection of the groundwater environment, construction works throughout the area under analysis should be carried out with due care and attention to preserve the environment in the best possible condition. This will be achieved primarily by limiting works related to the transformation of the land surface to the minimum necessary for the proper functioning of the project.

The main measure to reduce the impacts of the planned investment project at the construction stage should be the proper organization of the works and the handling of excavated material during excavation.

To protect the land surface, it is recommended, among other things:

- to locate parking places for heavy equipment and yards for storing construction materials in such a way as to prevent direct penetration of contaminants into the ground,
- to properly designate and protect material bases, places for stopping or repairing machinery and equipment (hardened surface, securing an adequate amount of sorbents and filtering materials in the vicinity in case of a leak),

- to use machines and equipment that is in good working order, to perform regular inspections and ongoing repairs (at the bases) in order to eliminate the threat of failure with the risk of large oil spills,
- in the event of leakage of oils from construction machines and vehicle fleet, these substances should be collected and taken to units rendering them harmless, or they should be disposed of on site using sorbents intended for chemical disposal,
- to perform all equipment repairs and maintenance at the contractor's permanent bases or at specialized service centers,
- to equip the construction site with the necessary number of containers, garbage cans, baskets for waste collection, including tanks for leakproof collection of liquid waste,
- in order to eliminate additional changes in the plant cover and land transformation, the site of the performed works should be provided with access by using the existing access roads,
- native soil should be used for works related to backfilling of foundations.

Operation stage

The newly designed investment project will consist of facilities that will be equipped with leak-tight, concreted floors, preventing negative impacts on the groundwater environment.

Safety of the ground environment at the operation stage will be ensured by:

- leak-tight surface of the designed road infrastructure,
- capturing rainwater and thaw water in a sealed sewerage system and the water will be retained through rain gardens and a green roof,
- ongoing maintenance of rain and thaw water treatment devices and rain water drainage system to allow early detection of possible cracks and defects and prevent wastewater from entering the ground.

In addition, in the event of leakage of a harmful substance onto the ground, it is proposed to remove the top layer to prevent the substance from penetrating deep into the ground.

Solid and liquid wastes will be stored in designated tanks and containers. Hazardous waste storage areas will be protected from spills.

Operation of the planned investment project with respect to soil and ground, thanks to the applied flue gas cleaning technologies, shall not have a negative impact both on the adjacent areas and on the areas located within the boundaries of the plot to which the Investor is entitled. No excavations or interference with the ground or landscape are planned during the investment project operation phase. For the above mentioned reasons, no negative impact of the plant on the aforementioned environmental components is expected.

12.2.5 Protection of animate nature resources, including NATURA 2000 Sites

Protection of vegetation cover

If excavation works are carried out at the construction stage, it is recommended that the earthworks be carried out in a manner that does not cause damage to the flora existing in the vicinity, including the tree stand. Within the root system, excavations must be carried out manually (excavations should not result in lowering the groundwater level within root systems).

The size of excavations and embankments leading to changes in natural topography must also be minimized. Excavations should be carried out in such a manner that the topsoil layer is removed separately and stored for use during reclamation after the completion of works in order to restore the vegetative cover as soon as possible.

It is recommended to cut trees and start earthworks before or after the beginning of the breeding period.

Protection of fauna

For protection, excavations for foundations should be protected against the possibility of animals falling into them, in particular amphibians, reptiles and small mammals, and the duration of excavations should be limited to the minimum.

In addition, it is recommended to regularly inspect the excavations made during the construction works in order to protect the small fauna living near the area intended for the implementation of the investment project. Such inspections should be carried out every morning day prior to the commencement of further works, and the animals accidentally trapped in the excavation should be moved safely outside the work zone. If amphibians or reptiles are found in the project site or in the immediate vicinity, the site must be fenced off with a temporary herpetological fence. If necessary, amphibians should be caught (after obtaining a derogation decision) and transferred outside of the investment project area.

The pits prepared for the foundation may pose a threat to small animal species (e.g. amphibians, insectivorous mammals), exposed to falling into the pits, which can be eliminated by proper protection of such pits. Such protection can be provided e.g. by a system of fences surrounding excavations. Such fencing should be tight (e.g. 5 mm x 5 mm mesh or other plastic protecting against entrance of small animals) and should be approx. 50 cm high. It is recommended that the upper edge be slightly tilted outwards, in the opposite direction to the excavation, to prevent small animals from climbing. If, despite the protection, animals enter the excavations, they should be trapped and moved to a safe place outside the construction site.

In order to minimize the impact on birds and entomofauna on the premises of the WTE Plant, on biologically active areas, 20% of the site should be left as an extensively mown area, i.e. not more frequently than twice a year.

Protection of Natura 2000 areas

Based on the conducted analyses, it was concluded that there will be no significant negative impact on Natura 2000 areas in the vicinity of the planned project, either on the object or protection objectives in these areas, the integrity of any area or on the coherence of the Natura 2000 network.

The potential impacts of the project considered do not require the use of measures to prevent or minimize them.

Protection of green areas

Trees and shrubs that are not intended for removal and are located on the project site and in its immediate vicinity should be protected against damage. Proper protection prevents, among other things, bark stripping and trunk damage.

The protection should include the protection of all organs of trees or shrubs (i.e. trunks, crown, roots) and subsoil, e.g. by fencing the area.

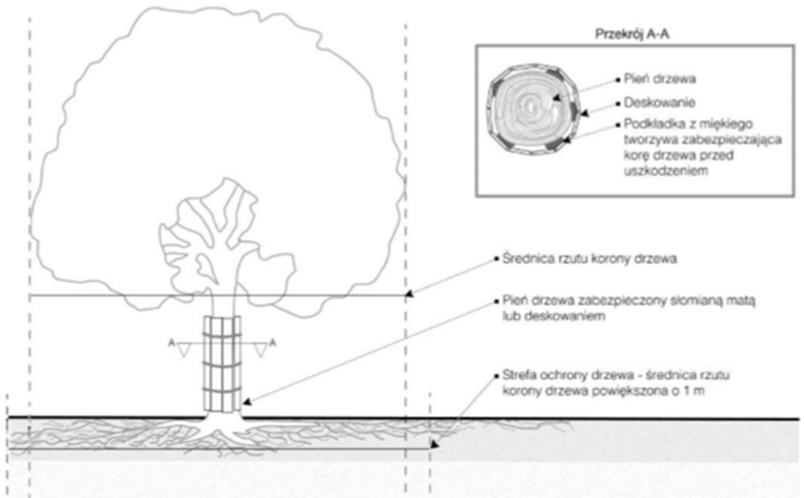
The installation of protections must be completed prior to the commencement of the project.

Comprehensive protection of trees and shrubs and protection of the ground under tree crowns from excessive compaction involves the installation of fencing. Fencing should be as far away from tree trunks as possible. In the case of a group of trees, it is necessary to group and provide a common fencing. The location of such fencing depends in particular on the path of the root system and root folding of individual pieces, their size, extent, tree crown height as well as the distance from elements of the planned infrastructure.

In exceptional cases, individual trunks of trees may be protected if it is not possible to use fencing. This can be done by wrapping tree trunks around with shock-absorbing boards, e.g. in the form of straw mats, non-woven fabrics, rubber tires, perforated drainage pipes (Fig. 2).

The following are specific guidelines for performing proper trunk protection:

- planks in formwork should be installed around the entire circumference of the trunk and at its full height,
- the bottom part of the plank should rest on the ground, or it can be slightly dug into the ground if the tree does not have root swellings – the planks should not rest directly on the bark of the tree,
- the clamps securing the cover should be deployed at several levels,
- in the case of trees with root swellings situated at ground level, the butt parts should be protected with an independent structure set on the ground and fixed to the subsoil (for protection against damage, e.g. when collecting soil with mechanical equipment), the root swelling must not be covered only with the subsoil as a protective layer,
- the use of soft material alone is not sufficient as the protection should be against mechanical damage.



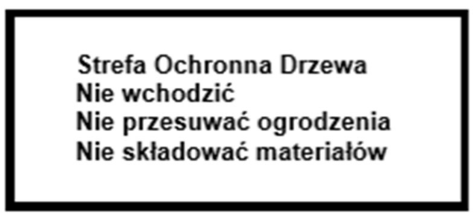
PL	EN
Przekrój A-A	Section A-A
Plan drzewa	Tree plan
Deskowanie	Formwork
Podkładka z miękkiego tworzywa zabezpieczającego korę drzewa przed uszkodzeniem	Soft plastic pad to protect tree bark from damage
Średnica rzutu korony drzewa	Diameter of the tree crown projection
Plan drzewa zabezpieczony słomianą matą lub deskowaniem	Tree plan secured with straw matting or decking
Strefa ochrony drzewa – średnica rzutu kory drzewa powiększona o 1 m	Tree protection zone – the diameter of the projection of the tree bark increased by 1 m

Figure. 2 Tree trunk protection [used when fencing cannot be installed]

Tree crowns can be protected by tying all branches exposed to damage to the central leader or to the upper boughs. It is advisable to implement local site communication solutions that prevent communication under tree crowns. This will eliminate the exposure of boughs and shoots to collisions with traffic and, consequently, mechanical damage. This solution should be applied when it is not possible to fence off the area where the trees are located. This protection of the crown must be used with simultaneous tree protection planking.

Vehicle traffic on the project site should be arranged outside the projections of tree crown in order to prevent excessive soil compaction. Temporary roads that run within the root system of trees should be routed in a manner that protects the roots. This can be done by laying down a layer of natural coarse gravel or wood chips and covering it with a wooden grate or plywood board. If there are no alternative solutions for moving the machines across root swelling, wooden beams must be laid on the swelling and a board on top for moving the construction equipment.

Effective protection of trees and shrubs on a construction site requires clear information about its scope, available to all participants in the construction process. This can be done by designating protection zones with information boards on what is protected and prohibited in that zone (Fig. 3). Another form may be information sheets placed in visible places, e.g. prohibiting the movement of machines in the root system zones, prohibiting the storage of construction materials in such zones, etc.



PL	EN
Strefa Ochronna Drzewa	Tree Protection Zone
Nie wchodzić	Do not enter!
Nie przesuwać ogrodzenia	Do not move the fence!
Nie składować materiałów	Do not store materials!

Fig. 3. Example of an information board

<u>Protection of the tree root system</u>

Earthworks within the reach of roots should be performed manually so as not to cause their amputation. If roots are exposed, a root cover should be provided to protect them against drying. Such a cover can be made of geotextile fixed in the ground with wooden pins and a layer of soil. The structure must be watered – soil must be moist all the time.

The organization of works in areas where trees are present should include in particular: tree watering at the construction site, replacement of compacted or contaminated soil within the tree root system to be carried out without mechanical damage to roots, as well as necessary cutting in the tree crown only to the extent compliant with the applicable law.

12.2.6 Protection of cultural assets

The requirements for the protection of cultural assets are governed by the Act of July 23, 2003 on the protection and care of historical monuments, including the implementing regulations.

In the areas of the analyzed project there are no areas under conservation protection or historical buildings entered in the register of monuments of Łódzkie Voivodeship, also elements of the technical infrastructure of the designed project will be located outside the area of the conservation protection zone. The operation of the WTE Plant will not affect archaeological sites. Due to the distance of the investment project from the location of historic buildings, the implementation of the investment project will not have a direct impact on such buildings.

Therefore, the examined potential impacts of the project on cultural assets do not require preventive or minimizing measures.

12.2.7 Protection of landscape assets

Implementation of the subject project will not significantly alter the landscape assets of the analyzed area. The site designated for the proposed facility is heavily altered by human and is not distinguished by landscape assets.

In addition, pro-environmental water retention solutions, such as rain gardens and a green roof, have been used to preserve landscape assets and will fit perfectly into the surrounding landscape.

Therefore, the examined potential impacts of the project on landscape assets do not require preventive or minimizing measures.

12.2.8 Waste management

Management of waste generated both at the stage of implementation, operation and decommissioning of the project should be carried out in accordance with the Waste Act of 14 December 2012 and its secondary legislation.

Construction stage

It is necessary to equip the construction site and technical and social facilities with containers to ensure separate waste collection according to types, opportunities for further management or transport.

Sites for temporary storage of waste prior to final recovery or disposal should be properly prepared, i.e:

- fence off the storage area and mark it appropriately,
- do not allow mixing of different types of waste, especially hazardous waste,
- protect against leaching, blowing away of waste.

Municipal waste should be collected separately and handed over to authorized entities.

Soil and earth from excavations, provided that they are not contaminated and their geotechnical parameters allow it, may be used to level the area and recreate the humus layer after the completion of construction works. Excess soil can also be used in other ways.

Operation stage

The handling of waste generated at the WTE Plant site will be in accordance with the waste management principles, as defined in the Environmental Protection Law and the provisions of the Waste Act of December 14, 2012, which indicates that the waste generator is obliged to take actions to prevent and minimize the amount of waste produced, as well as to limit its negative impact on human life and health and the environment.

Use waste management policies and practices to reduce nuisances, such as:

- waste prevention and/or minimization of waste generation at the project site,
- proper operation of equipment and systems located in the project area,
- proper storage of waste at the project site,
- prioritizing the recycling of waste and designating for landfilling only the waste that is not valuable as a secondary raw material,

- separate storage of waste in a manner adapted to the chemical and physical properties of the waste and the hazard that the waste may cause,
- transfer of waste for recovery or disposal to entities holding relevant waste management decisions,
- regular inspection of the operation of machinery and equipment at individual workstations.

Due to the fact that for the WTE Plant it is not planned to install a system for chemical stabilization and solidification of fly ash and residues from flue gas cleaning, it should be pointed out that the generated process waste will be stored in dedicated bunkers. This waste will be collected by tankers adapted for this purpose. The entire system for transport of process waste from the waste to energy plant to the bunkers and the system for loading tankers from the bunkers will be executed in such a way as to prevent penetration of process waste to the environment. In addition, filters will be installed on the bunkers, and dust emission from these filters will amount to maximum 10 mg/m^3.

13 COMPARISON OF THE PROPOSED TECHNOLOGICAL SOLUTIONS WITH THE TECHNOLOGY COMPLYING WITH THE REQUIREMENTS REFERRED TO IN ARTICLES 145–143 OF THE ENVIRONMENTAL PROTECTION LAW

Pursuant to Article 143 of the Environmental Protection Law, the technology used in newly commissioned or significantly modified systems and equipment should meet the requirements, which include in particular:

- Use of substances with low hazard potential,
- Effective generation and use of energy,
- Ensuring rational consumption of water and other raw materials, materials and fuels.
- Use of waste-free and low waste technology and possibility of waste recovery,
- Emission type, range and value,
- Using comparable processes and methods which have been effectively applied on industrial scale,
- Scientific and technical progress.

Referring to the aforementioned requirements, the compliance was described.

During the operation of the Waste to Energy Plant, substances classified as hazardous will be used (Chapter 9.1), but in quantities that do not classify it as a plant with an increased or high risk of industrial failure.

The energy recovery and generation system ensures its effective use. The flue gas heat recovery system shall make maximum use of the heat contained therein in order to heat feed water and generate steam. Electricity generation in the generator coupled with the turbine as well as heat production in the heating module will allow for satisfying the auxiliaries and reselling the remaining part of energy to the power grid and heating network. All systems used shall ensure effective generation and use of energy.

In order to confirm the energy efficiency requirements of Directive 2008/98/EC, which are described in Chapter 2.1.1, the energy efficiency ratio for the WTE Plant was calculated. Taking into account the assumptions for the operation of the WTE Plant, including in particular the production of electricity and heat as described in Chapter 5.1.13, the **energy**

efficiency ratio for the WTE Plant will be about 0.92. This value is higher than the threshold value of 0.65 specified in the aforementioned directive.

Table 62 WTE Plant energy efficiency data

Ratio	Unit	Value
Electricity	GJ/year	651,011
Thermal power	GJ/year	500,040
Ep	GJ/year	2,242,674
Ef	GJ/year	6,152
Ei	GJ/year	7,304
Ew	GJ/year	2,500,000
Energy efficiency R1	**-**	**0.92**

The process regime of the plant assumes such operation so that the consumption of all raw materials, water, materials and fuel is as low as possible. Metering of the elements related to the flow of utilities, monitoring of the consumption of reacting substances in the flue gas cleaning system, water used in the steam circuit, monitoring of the consumption of fuel oil in the furnace will ensure rational consumption of the materials used.

The extent and magnitude of the emissions are described in individual chapters of the Report.

The proposed thermal waste treatment technology together with the flue gas cleaning system are technologies widely used in EU countries. They are subject to continuous development and improvement.

All such technologies take into account scientific and technical progress.

The newly constructed Waste to Energy Plant shall be equipped with the latest, proven solutions in the field of waste incineration, energy recovery and flue gas cleaning.

Bearing in mind the provisions under Article 18 of the Waste Act of December 14, 2012, the waste generator is obliged to carry out activities aimed at preventing and minimizing the amount of waste produced, as well as reducing its negative impact on human life and health and the environment.

Low-waste technologies will be used at every stage of the investment project's implementation and operation, and the waste generated will be collected selectively and recovered whenever possible.

The handling of waste generated during operation will consist in its selective collection in specially designated containers, storage of waste in designated places for the period specified in the Waste Act, and transfer of waste to authorized recipients for recovery or disposal holding appropriate permits.

All waste generated will be subject to the required waste records, in accordance with the applicable regulations.

All technological solutions planned for implementation for this investment project shall be the current best available solutions (according to BAT).

The newly-built plant will use the most recent proven energy solutions, following the development of cleaner technologies, including energy recovery, flue gas cleaning and safe management of post-process residues.

14 COMPARISON OF THE PROPOSED SOLUTIONS WITH THE BEST AVAILABLE TECHNIQUES (BAT)

According to the Environmental Protection Law (hereinafter referred to as EPL), in order to receive administrative decision on environmental protection for new facilities, it is a necessary to meet the environmental protection requirements arising from the Best Available Techniques (BAT).

According to the definition contained in the aforementioned Act, the best available technique means the most effective and advanced level of development of technology and methods of carrying out an activity, indicating the possible use of particular techniques as the basis for setting emission limit values and other permit conditions aimed at preventing or, if not possible, reducing emissions and the impact on the environment as a whole. However, it means both the technique used and the way in which a facility is designed, constructed, operated and decommissioned. According to the Environmental Protection Law, available techniques mean the techniques that have the same level of development as is practicable in the relevant industrial field, taking into account the economic and technical conditions and the cost-benefit analysis, and which can be obtained by the operator of the activity in question. Best technique, on the other hand, means the most effective technique in achieving a high overall level of environmental protection as a whole.

Commission Implementing Decision (EU) 2019/2010 of 12 November 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration – No C(2019) 7987) was promulgated on December 3, 2019.

Pursuant to Article 3 section 6 of the Act of April 27, 2001 – Environmental Protection Law, to which the regulations of the IED Directive have been transposed, a facility is understood to be:

- stationary technical equipment,
- a set of stationary technical equipment technologically interconnected the legal title to which is held by the same entity and located in the area of one production plant,
- structures not being technical equipment and their sets whose operation may cause emission.

Based on the Best Available Techniques (BAT) conclusions for waste incineration, the following table was prepared to assess the compliance of techniques and methods of operating the Waste to Energy Plant with the BAT recommendations.

Table 63 Technical and organizational methods of environmental protection

BAT requirements (from BAT conclusions for waste incineration)	How the facility complies with BAT requirements
BAT 1 Implementation and compliance with an environmental management system for, among other things: i. commitment, leadership and accountability of the management, including senior management, to implement an effective environmental management system; ii. an analysis that includes defining the context of the organization, identifying the needs and expectations of the stakeholders, identifying the characteristics of the facility that involve possible risks to the environment (or human health), as well as applicable environmental legal requirements; iii. defining an environmental policy that includes the continuous improvement of the environmental performance of the plant; iv. defining targets and performance indicators for significant environmental aspects, including ensuring compliance with applicable legal requirements; v. planning and implementing the necessary procedures and actions (including corrective and preventive actions, if necessary) to achieve environmental objectives and avoid environmental risks; vi. defining structures, roles and responsibilities with respect to environmental aspects and objectives, and providing the necessary financial and human resources; vii. ensuring the necessary competence and awareness of employees whose work may have an impact on the environmental performance of a facility (e.g. through information and training); viii. internal and external communication;	BAT 1. The investor plans to implement the PN-EN ISO 14001:2015 environmental management system. The final scope of the system will be clarified at the integrated permit stage and during ISO certification.

ix. working to engage employees in good environmental management practices; x. developing and using a management manual and written procedures to control activities with significant environmental impacts, as well as appropriate records; xi. effective operations planning and efficient process control; xii. implementing appropriate maintenance programs; xiii. emergency preparedness and response protocols, including preventing or mitigating adverse impacts of emergencies (on the environment); xiv. in case of a (re)design of a (new) facility or part thereof, consideration of its environmental impact during operation, which includes construction, maintenance, operation and decommissioning; xv. implementing a monitoring and measurement program; refer to the Reference Report on Monitoring of Air and Water Emissions from IED facilities for information as needed; xvi. applying sectoral benchmarking on a regular basis; xvii. periodic independent (as far as practicable) internal audits and periodic independent external audits to assess environmental performance and determine whether the environmental management system conforms to planned arrangements and is properly implemented and maintained; xviii. assessing the causes of nonconformities, implementing corrective actions in response to instances of nonconformity, reviewing the effectiveness of corrective actions and determining whether similar nonconformities exist or have a potential to occur; xix. periodic review, by senior management, of the environmental management system and its continuing suitability, adequacy and effectiveness; xx. (monitoring and addressing the development of cleaner technologies. xxi. for WTE Plants – waste stream management (see BAT 9); xxii. for furnace ash treatment plants, quality management of the treatment waste (see BAT 10);	

<table>
<tr>
<td>xxiii. a residue management plan, including measures to:
a) reduce the generation of residues to a minimum;
b) optimize reuse, remanufacturing, recycling or energy recovery from residues;
c) ensure proper treatment of residues:
xxiv. for WTE Plants – a management plan for conditions other than normal operating conditions (see BAT 18);
xxv. for WTE Plants – an emergency management plan (see section 2.4);
xxvi. for furnace ash treatment plants – managing diffuse dust emissions (see BAT 23);
xxvii. odor management plan – where odor annoyance is expected or proven to be experienced at sensitive facilities (see section 2.4);
xxviii. a noise management plan (see also BAT 37) where noise nuisance is expected or proven to be experienced at sensitive facilities (see section 2.4).</td>
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<tr>
<td>BAT 2. BAT should specify either the gross electrical efficiency, the gross energy efficiency or the boiler efficiency of the WTE Plant as a whole or the efficiency of all relevant parts of the WTE Plant. For grate WTE Plants, the FDBR RL 7 guidelines may be used.</td>
<td>It WTE Plant will be characterized by gross electric efficiency at the level of approx. 28% in the case of operation for condensation (without heat generation) as well as gross energy efficiency at the level of approx. 75% in co-generation mode.
These values will be confirmed by the selected technology provider and will not be lower than those specified for the new equipment assemblies listed in Table 2 of BAT 20.</td>
</tr>
<tr>
<td>BAT 3. As part of the BAT key process parameters should be monitored, which are relevant for emissions to air and water, including those given below.
<table>
<tr><td>Stream/location</td><td>Parameter(s)</td><td>Monitoring</td></tr>
<tr><td>Flue gas from waste incineration</td><td>Flow, oxygen content, temperature, pressure, steam content</td><td rowspan="2">Continuous measurement</td></tr>
<tr><td>Combustion chamber</td><td>Temperature</td></tr>
</table>
</td>
<td>The WTE Plant will be equipped with continuous measurement of flue gas parameters and temperature in the incineration chamber according to BAT 3.
Measurement on the wastewater side of the flue gas cleaning wet method is not applicable due to the planned dry method of flue gas cleaning.
Measuring wastewater from furnace ash treatment plants is not applicable. The project does not include a furnace ash treatment plant.</td>
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<tr><td>Wastewater from wet flue gas cleaning</td><td>Flow, pH, temperature</td><td rowspan="2"></td></tr>
<tr><td>Wastewater from furnace ash treatment plants</td><td>Flow, pH, conductivity</td></tr>
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<td>
BAT 4. BAT is to monitor channeled emissions to air with at least the frequency given below and in accordance with EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.
<table>
<tr><th>Substance/
Parameter</th><th>Standard(s) (1)</th><th>Minimum monitoring frequency (2)</th></tr>
<tr><td colspan="3">Process – Incineration of waste</td></tr>
<tr><td>NOX</td><td>General EN standards</td><td>Continuous</td></tr>
<tr><td>NH3</td><td>General EN standards</td><td>Continuous</td></tr>
<tr><td>N2O</td><td>EN 21258 (3)</td><td>Once a year</td></tr>
<tr><td>CO</td><td>General EN standards</td><td>Continuous</td></tr>
<tr><td>SO2</td><td>General EN standards</td><td>Continuous</td></tr>
<tr><td>HCl</td><td>General EN standards</td><td>Continuous</td></tr>
<tr><td>HF</td><td>General EN standards</td><td>Continuous (4)</td></tr>
<tr><td>Dust</td><td>General EN and EN 13284-2 standards</td><td>Continuous</td></tr>
<tr><td>Metals and metalloids except for mercury (As, Cd, Co, Cr, Cu, Mn, Ni, Pb, Sb, Tl, V)</td><td>EN 14385</td><td>Once every six months</td></tr>
<tr><td>Hg</td><td>General EN standards and EN 14884</td><td>Continuous (5)</td></tr>
<tr><td>Total VOC</td><td>General EN standards</td><td>Continuous</td></tr>
</table>
</td>
<td>
BAT 4 The WTE Plant will provide all channeled air emissions monitoring measurements consistent with BAT 4 for the waste incineration process.
It is noted that according to BAT 4, PBDD/Fs will not be monitored since the waste to be incinerated will not contain brominated flame retardants and continuous bromine injection will not be used.
In addition, if any of the cases listed in the footnotes to the table are confirmed, the scope and frequency may change.
Dust emission measurements at the outlet from the dust extraction filter cyclone in the slag valorization system will be performed once a year for the furnace ash treatment process.
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</table>

PBDD/F (6)	No EN standard	Once every six months
PCDD/F	EN 1948-1, EN 1948-2, EN 1948-3	Once every six months for short-term sampling
	No EN standard for long-term sampling EN 1948-2, EN 1948 3	Once a month for long-term sampling (7)
Dioxin-like PCBs	EN 1948-1, EN 1948-2, EN 1948-4	Once every six months for short-term sampling (8)
	No EN standard for long-term sampling EN 1948-2, EN 1948-4	Once a month for long-term sampling (7) (8)
benzo(a)pyrene	No EN standard	Once a year
Process – furnace ash treatment		
Dust	EN 13284-2-1	Continuous

(1) The general EN standards for continuous measurement are EN 15267-1, EN 15267-2, EN 15267-3 and EN 14181. EN standards for periodic measurements are given in the table or in footnotes.
(2) For periodic monitoring, the monitoring frequency does not apply where plant operation would be for the sole purpose of performing an emission measurement.
(3) If continuous monitoring of N_2O is applied, the general EN standards for continuous measurements apply.

<table>
<tr><td>(4) The continuous measurement of HF may be replaced by periodic measurements with a minimum frequency of once every six months if the HCl emission levels are proven to be sufficiently stable. No EN standard is available for the HF periodic measurements.
(5) For plants incinerating waste with a proven low and stable mercury content (e.g. mono-streams of waste of a controlled composition), the continuous monitoring of emissions may be replaced by long-term sampling (no EN standard is available for long-term sampling of Hg) or periodic measurements with a minimum frequency of once every six months. In the latter case the relevant standard is EN 13211.
(6) The monitoring only applies to the incineration of waste containing brominated flame retardants or to plants using BAT 31(d) with continuous injection of bromine.
(7) The monitoring does not apply if the emission levels are proven to be sufficiently stable.
(8) The monitoring does not apply where the emissions of dioxin-like PCBs are proven to be less than 0.01 ng WHO-TEQ/Nm^3.</td><td></td></tr>
<tr><td>BAT 5. BAT should adequately monitor channeled emissions to air from WTE Plants in conditions other than normal operating conditions.</td><td>The channeled to-the-air emission monitoring system will be adapted to operation in conditions other than normal operating conditions.</td></tr>
<tr><td>BAT 6. BAT is to monitor emissions to water from flue gas cleaning (FGC) or from furnace ash treatment at least at the frequency given below and according to EN standards. If EN standards are not available, BAT is to use ISO, national or other international standards that ensure the provision of data of an equivalent scientific quality.
<table>
<tr><td>Substance/ Parameter</td><td>Process</td><td>Standard(s)</td><td>Minimum frequency of monitoring</td></tr>
<tr><td>Total organic carbon (TOC)</td><td>Flue gas cleaning (FGC)</td><td>EN 1484</td><td>Once a month</td></tr>
</table></td><td>Due to the planned dry flue gas cleaning method and the lack of furnace ash treatment plants, BAT 6 requirements are not applicable to WTE Plant.</td></tr>
</table>

	Furnace ash treatment		Once a month (1)
Total suspended matter (TSM)	Flue gas cleaning	EN 872	Once a day (2)
	Furnace ash treatment		Once a month (1)
As	Flue gas cleaning	Various EN standards available (e.g. EN ISO 11885, EN ISO15586 or EN ISO 17294-2)	Once a month
Cd	Flue gas cleaning		
Cr	Flue gas cleaning		
Cu	Flue gas cleaning		
Mo	Flue gas cleaning		
Ni	Flue gas cleaning		
Pb	Flue gas cleaning		Once a month
	Furnace ash treatment		Once a month (1)
Sb	Flue gas cleaning		Once a month
Tl	Flue gas cleaning		
Zn	Flue gas cleaning		
Hg	Flue gas cleaning	Various EN standards available (e.g. EN ISO 12846, EN ISO 17852)	
Ammonium nitrogen (NH4-N)	Furnace ash treatment	Various EN standards available (e.g. EN ISO	Once a month (1)

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<tr><td></td><td></td><td>11732, EN ISO 14911)</td><td rowspan="3"></td></tr>
<tr><td>Chlorides (Cl^-)</td><td>Furnace ash treatment</td><td>Various EN standards available (e.g. EN ISO 10304-1, EN ISO 15682)</td></tr>
<tr><td>Sulfates ($SO4^{2-}$)</td><td>Furnace ash treatment</td><td>EN ISO 10304-1</td></tr>
<tr><td rowspan="2">PCDD/F</td><td>Flue gas cleaning</td><td rowspan="2">No EN standard</td><td>Once a month (1)</td></tr>
<tr><td>Furnace ash treatment</td><td>Once every six months</td></tr>
</table>
(1) Minimum monitoring frequency may be reduced to once every six months if emission levels are shown to be sufficiently stable. (2) Daily measurements from 24-hour flow-proportional composite samples may be substituted for daily measurements from instantaneous samples.
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BAT 7. BAT is to monitor the content of unburned substances in slags and furnace ash in the WTE Plant at least at the frequency given below and according to EN standards.
<table>
<tr><td>Substance/ Parameter</td><td>Standard(s)</td><td>Minimum monitoring frequency</td></tr>
<tr><td>Loss on ignition (1)</td><td>EN 14899 and EN 15169 or EN 15935</td><td rowspan="2">Once every three months</td></tr>
<tr><td>Total organic carbon (1) (2)</td><td>EN 14899 and EN 13137 or EN 15936</td></tr>
</table>
</td>
<td>The content of unburned substances in slag and furnace ash will be monitored in accordance with BAT 7 during WTE Plant operation.</td>
</tr>
</table>

(1) Either loss on ignition or total organic carbon is monitored. (2) Elemental carbon (e.g. determined according to DIN 19539) can be subtracted from the measurement result.	
BAT 8. For the incineration of hazardous waste containing POPs, BAT should determine the POP content of the output streams (e.g., furnace ash and slag, flue gas, wastewater) after the WTE Plant is commissioned and after any change that may significantly affect the POP content of the output streams.	BAT 8 is not applicable. WTE Plant will not process hazardous waste.
BAT 9. To improve the overall environmental efficiency of the WTE Plant through waste stream management (see BAT 1), BAT should use all techniques a) to c) listed below and, where applicable, also techniques d), e) and f). a) Identification of the types of waste that can be incinerated b) Development and implementation of waste characteristics and pre-adoption procedures c) Development and implementation of waste acceptance procedures d) Development and implementation of a waste tracking and recording system e) Waste sorting f) Verification of waste compliance prior to mixing or combining hazardous waste	BAT 9. The following techniques will be used: a) Identification of the types of waste that can be incinerated b) Development and implementation of waste characteristics and pre-adoption procedures c) Development and implementation of waste acceptance procedures d) Development and implementation of a waste tracking and recording system e) The WTE Plant process will mainly use RDF and pre-RDF, mixed municipal waste will not be used. f) Not applicable
BAT 10. To improve the overall environmental efficiency of a furnace ash treatment plant, BAT should include treatment waste quality management functions in the environmental management system (see BAT 1).	Ashes will not be processed in the plant. They will be transferred to a specialist company for disposal. Part of the ash will enter the slag handling system and will be processed as part of slag valorization process. The environmental management system will include the slag quality management function.
BAT 11. To improve the overall environmental efficiency of WTE Plants, BAT should monitor waste deliveries as part of waste acceptance procedures (see BAT 9 c), including – depending on the risk posed by the waste supplied – the elements shown below. Type of waste | Monitoring of waste deliveries	For WTE Plant, only the section on other non-hazardous waste applies. The received waste will be pre-processed to RDF and pre-RDF. At the entrance to the facility, a gatehouse with two weighing stations (entry and exit) will be located. The weighing stations will enable visual inspection and control of the quantity of imported / exported materials.

Municipal solid waste and other non-hazardous waste	— Radioactivity detection — Weighing of waste deliveries — Visual inspection — Periodic sampling of waste deliveries and analysis of key properties/substances (e.g., net calorific value, halogen and metal/metalloid content). For municipal solid waste, this involves a separate discharge.	Additionally, a radiation portal monitor will be installed at the entrance in order to detect potential radioactive waste. Wastewater sludge, hazardous waste and medical waste will not be incinerated.
Wastewater sludge	— Weighing of waste deliveries (or flow measurement if waste sludge is delivered by pipeline) — Visual inspection – as technically feasible – Periodic sampling and analysis of key properties/substances (e.g. net calorific value, water content, ash and mercury content)	
Hazardous waste other than medical waste	— Radioactivity detection — Weighing of waste deliveries — Visual inspection – as technically feasible — Inspection and comparison of individual waste deliveries with the waste producer's representation — Sampling of content of: — all tanker lorries and trailers, — packaging waste (e.g., in drums, IBC tanks, or smaller packages), and analysis of: — combustion parameters (including net calorific value and flash point), — waste compliance to detect possible hazardous reactions when wastes are combined or mixed prior to storage (BAT 9 f),	

<table>
<tr><td>
<table>
<tr><td></td><td>— key substances, including POPs, halogens, sulfur, metals/semi-metals,</td></tr>
<tr><td>Medical waste</td><td>— Radioactivity detection
— Weighing of waste deliveries
— Visual inspection of the packaging tightness</td></tr>
</table>
</td><td></td></tr>
<tr><td>BAT 12. To reduce the environmental risks associated with the receipt, storage and handling of waste, all the following techniques should be used within the scope of BAT.
a) Impervious surfaces with adequate drainage infrastructure
b) Adequate waste storage capacity</td><td>Surfaces related to receipt and storage of waste will be impervious and equipped with a proper drainage infrastructure.
The bunker will have a usable capacity of approx. 11,500 m^3. For nominal net calorific value (12.5 MJ/kg) and waste density of 300 kg/m^3, this capacity is sufficient for 5.6 days. For nominal net calorific value and waste density of 250 kg/m^3, the bunker capacity is sufficient for 4.7 days.</td></tr>
<tr><td>BAT 13. Lists techniques to reduce environmental risks associated with medical waste storage and handling.</td><td>Not applicable to the undertaking described</td></tr>
<tr><td>BAT 14. To improve the overall environmental efficiency of waste incineration, it is recommended to reduce the content of unburned substances in slags and furnace ash, and reduce emissions to air from waste incineration. An appropriate combination of the following techniques should be used withing the scope of BAT.
a) Waste combination and mixing
b) Advanced control system
c) Incineration process optimization
<table>
<tr><td>Parameter</td><td>Unit</td><td>BAT-AEPL</td></tr>
<tr><td>TOC content in slags and furnace ashes (1)</td><td>% by weight</td><td>1–3 (2)</td></tr>
<tr><td>Loss on ignition of slags and furnace ashes (1)</td><td>% by weight</td><td>1–5 (2)</td></tr>
</table>
</td><td>Waste in the bunker will be mixed and transported to the boiler loading chambers using two overhead cranes (one of which will be a back-up overhead crane). Process parameters will be continuously monitored to optimize the combustion process by optimizing waste feed rate and composition, temperature, and flow rate and injection points of primary and secondary combustion air for efficient oxidation of organic compounds.
BAT-AEPL values for TOC content in slags and furnace ashes as well as for loss on ignition of slags and furnace ashes will be met.</td></tr>
</table>

(1) Either BAT-AEPL for TOC content or BAT-AEPL for loss on ignition applies. (2) The lower limit of the BAT-AEPL range can be achieved by using fluidized bed furnaces or rotary furnaces in slagging mode	
BAT 15. To improve the overall environmental efficiency of WTE Plants and reduce emissions to air, procedures to regulate the WTE Plant settings should be developed and implemented within the scope of BAT, e.g., through an advanced control system (see description in section 2.1), as needed and feasible, based on waste characteristics and control (see BAT 11).	Operation of the boilers and the flue gas cleaning system will be managed by the DCS. For combustion efficiency control and to prevent and/or reduce emissions. This system will also include the use of highly efficient monitoring of performance parameters and emissions.
BAT 16. To improve the overall environmental efficiency of the WTE Plant and reduce emissions to air, operating procedures (e.g., organization of the supply chain, the use of a continuous loading system instead of batch loading) should be developed and implemented within the scope of BAT to reduce the number of start-ups and shutdowns as much as possible.	The plant will operate 24 hours a day 7 days a week. The bunker enables waste storage for approx. 5 days, which secures the continuity of operation. The number of start-ups and shutdowns will be limited to the technical minimum.
BAT 17. To reduce emissions to air from WTE Plants and, where applicable within the scope of BAT, it should be ensured that the flue gas cleaning system and wastewater treatment plant are appropriately designed (e.g., taking into account maximum flow rates and pollutant concentrations), in the designed scope, and maintained to ensure optimal availability.	The flue gas cleaning system and wastewater treatment plant are designed taking into account maximum flow rates and pollutant concentrations The systems will be maintained to ensure optimum availability.
BAT 18. To reduce the incidence of conditions other than normal operating conditions and emissions from the WTE Plant to air and, where relevant, to water, under conditions other than normal operating conditions, a risk-based management plan for conditions other than normal operating conditions as part of an environmental management system should be developed and implemented within the scope of BAT (see BAT 1), which includes all the following: — identification of potential conditions other than normal operating conditions (e.g., failure of equipment critical in terms of environmental protection ("equipment of critical significance"), their causes and potential consequences, and regular review and update of	Based on the risk assessment, a management plan for conditions other than normal use conditions will be developed as part of the environmental management system that will include all the following elements: — identification of potential conditions other than normal operating conditions (e.g., failure of equipment critical in terms of environmental protection ("equipment of critical significance"), their causes and potential consequences, and regular review and update of the list of identified conditions other than normal operating conditions following the periodic assessment below:

the list of identified conditions other than normal operating conditions following the periodic assessment below: — proper design of equipment of critical significance (e.g., bag filter division, flue gas preheating techniques, eliminating the need to bypass the bag filter during start-up and shutdown, etc.); — development and implementation of a preventive maintenance plan for critical equipment (see BAT 1 xii); — monitoring and recording emissions in conditions other than normal operating conditions and related circumstances (see BAT 5); — periodic evaluation of emissions in conditions other than normal operating conditions (e.g., frequency of events, duration of events, amount of pollutants emitted) and implementation of corrective actions, if appropriate.	— appropriate design of equipment of critical significance (e.g. the installation of separate bag filters for each boiler is assumed; to reduce the content of unburned parts and CO in flue gases afterburning is applied); — development and implementation of a preventive maintenance plan for critical equipment (see BAT 1 xii); — monitoring and recording emissions in conditions other than normal operating conditions and related circumstances (see BAT 5); — periodic evaluation of emissions in conditions other than normal operating conditions (e.g., frequency of events, duration of events, amount of pollutants emitted) and implementation of corrective actions, if appropriate.
BAT 19. To improve resource management efficiency in WTE Plants, a heat recovery steam generator should be used within the scope of BAT.	Heat recovery steam generators will be used. The boilers will be designed in accordance with EN-12952-1; 12952-7; EN-12952-15.
BAT 20. To increase the energy efficiency of the WTE Plant, an appropriate combination of the following techniques should be used within the scope of BAT. a) Sewage sludge drying b) Reduction of flue gas flow rate c) Minimization of heat losses d) Boiler design optimization e) Low-temperature flue gas heat exchangers f) High steam parameters g) Cogeneration h) Flue gas condenser i) Handling of furnace ash from a dry slag handling system BAT-associated energy efficiency levels (BAT-AEELs) for waste incineration BAT-AEEL [%]	The following techniques will be used to increase the energy efficiency of the WTE Plant: b) Reduction of flue gas flow rate c) Minimization of heat losses d) Boiler design optimization e) Low-temperature flue gas heat exchangers f) High steam parameters g) Cogeneration Design plant efficiency: • Gross electrical efficiency for condensing operation: according to BAT 25–35%. The exact value will be determined by the selected WTE Plant technology provider.

<table>
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<tr><td colspan="3"></td></tr>
<tr><td rowspan="2">Equipment assembly</td><td colspan="2">Municipal solid waste, other waste other than hazardous and wood waste constituting hazardous waste</td></tr>
<tr><td>Gross electrical efficiency (2) (3)</td><td>Gross energy efficiency (4)</td></tr>
<tr><td>New equipment assembly</td><td>25–35</td><td>72–91 (5)</td></tr>
</table>
(1) BAT-AEEL is only applicable if a heat recovery steam generator is used.
(2) BAT-AEELs for gross electrical efficiency apply to assembly of equipment or parts of equipment assemblies that generate electricity using condensing turbines.
(3) The upper limit of the BAT-AEEL range can be achieved applying BAT 20 f.
(4) BAT-AEELs for gross energy efficiency apply to equipment assemblies or parts of equipment assemblies that generate only heat or electricity using backpressure turbines and heat using steam leaving the turbine.
(5) Gross energy efficiency exceeding the upper limit of the BAT-AEEL range (even above 100%) can be achieved if a flue gas condenser is used.
(6) For waste sludge combustion, the efficiency of the boiler is highly dependent on the water content of the waste sludge fed to the furnace.
</td>
<td>• Gross energy efficiency when operating with heat production: according to BAT 72–91%. The exact value will be determined by the selected WTE Plant technology provider.</td>
</tr>
<tr>
<td>BAT 21. To prevent or reduce diffuse emissions, including these emitting odor, from WTE Plants, the following actions should be taken within the scope of BAT:</td>
<td>The waste will be stored in the bunker under controlled negative pressure conditions.</td>
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</table>

— store solid and semi-liquid wastes, which give off odors or may release volatile substances, in enclosed buildings under controlled vacuum and use the extracted air from these spaces for combustion, or direct it to another suitable emission reduction system in case of risk of explosion; — store liquid waste in tanks under adequate pressure and connect tank valves through channels to the combustion air supply system or connect using other suitable emission reduction system; — control the risk of odor emissions during periods of complete shutdown when no combustion capacity is available, such as by: — directing air discharged by ducts or extracted air to an alternative emission reduction system such as a wet gas scrubber or permanent adsorption bed, — minimizing the amount of waste stored, e.g., by interrupting, reducing, or redirecting waste deliveries as part of waste stream management (see BAT 9), — storage of waste in properly sealed bales.	In order to protect ambient air, a solution has been adopted to take primary and secondary combustion air from the bunker. Air will enter the bunker from the tipping hall through open dampers of the loading pits and/or an additional louver in the wall separating these facilities. In order to allow for the same air circulation during boiler downtime, air suction from the bunker is designed using an additional exhaust system, equipped with an air deodorization system – carbon filter.
BAT 22. To prevent diffuse emissions of volatile substances resulting from the handling of gaseous and liquid wastes that give off odors or may release volatile substances in WTE Plants, these wastes should be introduced into the furnace by direct loading within the scope of BAT.	Not applicable. Liquid and gaseous wastes will not be burned in the WTE Plant.
BAT 23. To prevent or reduce diffuse dust emissions to air from the treatment of slag and furnace ash, the following elements related to the diffuse dust emissions should be taken into account in the environmental management system (see BAT 1) within the scope of BAT: — identification of the most relevant diffuse dust emission sources (e.g. using EN 15445), — identification and implementation of appropriate actions and techniques to prevent diffuse emissions or reduce them for a specified period.	The slag valorization hall will be equipped with a process dedusting system; a unit with a cyclone filter and bag filters will be installed next to the building. It is assumed that the dedusting unit will have guaranteed dedusting efficiency up to the level resulting from the BAT requirements, i.e. the maximum dust concentration at the emitting device outlet will amount to 5 mg/Nm^3.

BAT 24. To prevent or reduce diffuse dust emissions to air from the treatment of slags and furnace ashes, an appropriate combination of the following techniques should be used within the scope of BAT. a) Equipment closing and covering b) Drop height limitation c) Protection of heaps against wind gusts from the prevailing direction d) Use of water showers e) Moisture content optimization f) Operation under vacuum	To prevent or reduce diffuse dust emissions to air from the treatment of slags and furnace ashes, the following techniques will be used: a) Equipment closing and covering – slag conveyors between the incineration station and the slag valorization and seasoning halls will be covered; the slag valorization hall will be an enclosed building; furnace ash will be transported in a sealed manner to sealed temporary process waste containers; b) Protection of heaps against wind gusts from the prevailing direction – the hall in which the slag will be stored will have a canopy and solid walls on the side of the plot boundaries and partial walls on the side of the internal road; e) Moisture content optimization – slag from the boilers will be quenched and cooled in slag traps with a water seal; then, after transporting it to the slag valorization and seasoning halls, it will wait in a heap until it reaches the moisture content appropriate for the valorization process
BAT 25. To reduce organized emissions of dust, metals, and semi-metals from waste incineration to air, one or a combination of the following techniques should be used within the scope of BAT. a) Bag filter b) Electrostatic precipitator c) Dry sorbent injection d) Wet gas scrubber e) Adsorption onto a fixed or moving bed Emission levels associated with the best available techniques (BAT-AELs) for organized emissions of dust, metals and semi-metals from waste incineration to air	To reduce organized emissions of dust, metals and semi-metals to air from waste incineration, the following techniques will be used a) Bag filter c) Dry sorbent injection The process of flue gas desulfurization using the dry method, supported by a bag filter, will allow for meeting the current and future emission standards, due to a very efficient reduction in the amount of acidic components of flue gas (HCl, HF, SO_2), heavy metals, dusts, dioxins and furans contained in flue gas, generated during the waste incineration process. BAT-AEL requirements will be met.

<table>
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<table>
<tr><td>Parameter</td><td>BAT-AEL (mg/Nm^3)</td><td>Averaging period</td></tr>
<tr><td>Dust</td><td>< 2–5 (1)</td><td>Daily average</td></tr>
<tr><td>Cd+Tl</td><td>0.005–0.02</td><td>Sampling period average</td></tr>
<tr><td>Sb+As+Pb+Cr+Co+Cu+Mn+Ni+V</td><td>0.01–0.3</td><td>Sampling period average</td></tr>
</table>
(1) In the case of existing equipment assemblies designed to incinerate hazardous waste and in relation to which a bag filter is not applicable, the upper limit of the BAT-AEL range is 7 mg/Nm^3.
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<td>
BAT 26. To reduce organized dust emissions to air from the closed treatment of slags and furnace ashes through air extraction (see BAT 24 f) a bag filter for dedusting the air extraction system should be used within the scope of BAT
<table>
<tr><td>Parameter</td><td>BAT-AEL (mg/Nm^3)</td><td>Averaging period</td></tr>
<tr><td>Dust</td><td>2–5</td><td>Sampling period average</td></tr>
</table>
</td>
<td>The slag valorization hall will be equipped with the main/general ventilation system and the process dust removal system cooperating with it, e.g. a unit with a cyclonic filter with bag filters installed next to the building. BAT-AEL requirements will be met.</td>
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<td>
BAT 27. To reduce organized emissions of HCl, HF and SO_2 to air from waste incineration, one or a combination of the following techniques should be used as part of BAT.
a) Wet gas scrubber
b) Semi-wet absorber
c) Dry sorbent injection
d) Direct desulfurization
e) Sorbent injection into the boiler
</td>
<td>
To reduce organized emissions of HCl, HF and SO_2 to air from waste incineration, technique C) of dry sorbent injection will be used.
Flue gas desulfurization will be implemented using a dry method with the use of sodium bicarbonate ($NaHCO_3$) to reduce acidic compounds of SO_2, HF, HCl, dust, combined with the stream and dust method using activated carbon to reduce heavy metals, dioxins and furans;
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<td>BAT 28. To reduce peak level of organized emissions of HCl, HF and SO_2 to air from waste incineration while reducing the use of reacting substances and the amount of residue generated from injection of dry sorbent and semi-wet absorbers, technique a) or both of the following techniques should be used within the scope of BAT.
a) Optimized and automated reacting substance dosing
b) Recirculation of reacting substances
BAT-associated emission levels (BAT-AELs) for organized emissions of HCl, HF and SO_2 to air from waste incineration
<table>
<tr><td>Parameter</td><td>BAT-AEL New equipment assembly (mg/Nm^3)</td><td>Averaging period</td></tr>
<tr><td>HCl</td><td>< 2–6 (1)</td><td>Daily average</td></tr>
<tr><td>HF</td><td>< 1</td><td>Daily average or sampling period average</td></tr>
<tr><td>SO_2</td><td>5–30</td><td>Daily average</td></tr>
</table>
1) The lower limit of the BAT-AEL range can be achieved with the use of a wet gas scrubber; the upper limit of the range may be associated with the use of dry sorbent injection.</td>
<td>To reduce peak level of organized emission of HCl, HF and SO_2 to air from waste incineration while reducing reacting substance consumption, both of the following techniques will be used.
a) Optimized and automated reacting substance dosing
b) Recirculation of reacting substances
Dosing of reacting substances will be optimized and automated as part of the DCS. Optimization will also take place by recirculating a part of the collected ash in the fabric filters. The captured ash will contain part of unreacted reacting substances. In order to “activate” it, the intermediate pressure steam stream will be used.
BAT-AEL requirements will be met.</td>
</tr>
<tr>
<td>BAT 29. To reduce organized NO_x emissions to air while reducing CO and N_2O emissions from waste incineration and NH_3 emissions from the use of SNCR or SCR, an appropriate combination of the following techniques should be used within the scope of BAT.
a) Incineration process optimization
b) Flue gas recirculation
c) Selective non-catalytic reduction (SNCR)
d) Selective catalytic reduction (SCR)
e) Catalytic bag filters
f) Optimization of design methods and operation of SNCR/ SCR
g) Wet gas scrubber</td>
<td>The following techniques will be used to reduce organized NO_x emissions to air while reducing CO and N_2O emissions from waste incineration and NH_3 emissions:
a) Incineration process optimization
b) Selective non-catalytic reduction (SNCR).

To reduce the concentration of nitrogen oxides NO_x, a selective non-catalytic reduction (SNCR) process is proposed, allowing for a problem-free achievement of the NO_x emission standard level. The 40% dry carbamide solution will be used as the reacting substance. BAT-AEL requirements will be met.</td>
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<td>BAT-associated emission levels (BAT-AELs) in relation to organized NO_x and CO emissions to air from waste incineration and for organized NH_3 emissions to air from the use of SNCR or SCR
<table>
<tr><td>Parameter</td><td>BAT-AEL New equipment assembly (mg/Nm^3)</td><td>Averaging period</td></tr>
<tr><td>NO_X</td><td>50–120 (1)</td><td rowspan="3">Daily average</td></tr>
<tr><td>CO</td><td>10–50</td></tr>
<tr><td>NH_3</td><td>2–10 (1)</td></tr>
</table>
(1) The lower limit of the BAT-AEL range can be achieved with the use of SCR. It may not be possible to achieve the lower limit of the BAT-AEL range when incinerating wastes with high nitrogen content (e.g., residues from the production of organic nitrogen compounds).</td>
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<td>BAT 30. To reduce organized emissions of organic compounds to air, including PCDD/Fs and PCBs from waste incineration, techniques a), b), c), d) and one of the below techniques or a combination of techniques e)-i) should be used within the scope of BAT.
a) Incineration process optimization
b) Waste batching control
c) Cleaning of a running and out-of-service boiler
d) Rapid flue gas cooling
e) Dry sorbent injection
f) Adsorption onto a fixed or moving bed
g) SCR
h) Catalytic bag filters
i) Carbon sorbent in wet gas scrubbers
Emission levels (BAT-AELs) associated with the best available techniques in relation to the organized emissions of total VOC, PCD/Fs, and dioxin-like PCBs to air from waste incineration</td>
<td>To reduce organized emissions of organic compounds to air, including PCDD/Fs and PCBs from waste incineration, the following techniques will be used:
a) Incineration process optimization
b) Waste batching control
c) Cleaning of a running and out-of-service boiler
d) Rapid flue gas cooling
e) Dry sorbent injection.
BAT-AEL requirements will be met.</td>
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<tr><td>Parameter</td><td>Unit</td><td>BAT-AEL New equipment assembly</td><td>New equipment assembly</td></tr>
<tr><td>Total VOC</td><td>mg/ Nm3</td><td>< 3–10</td><td>Daily average</td></tr>
<tr><td rowspan="2">PCDD/F (1)</td><td rowspan="2">ng I-TEQ/Nm^3</td><td>< 0.01–0.04</td><td>Sampling period average</td></tr>
<tr><td>< 0.01–0.06</td><td>Long-term sampling (2)</td></tr>
<tr><td rowspan="2">PCDD/F (polychlorinated dibenzo-p-dioxins and furans) + dioxin-like PCBs (1)</td><td rowspan="2">ng WHO-TEQ/Nm^3</td><td>< 0.01–0.06</td><td>Sampling period average</td></tr>
<tr><td>< 0.01–0.08</td><td>Long-term sampling (2)</td></tr>
</table>
(1) Either BAT-AEL for PCDD/Fs or BAT-AEL for PCDD/Fs + dioxin-like PCBs applies.
(2) BAT-AEL does not apply if the emission levels are proven to be sufficiently stable.
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<td>BAT 31. To reduce organized mercury emissions to air (including peak levels of mercury emissions) from waste incineration, one or a combination of the following techniques should be used within the scope of BAT.
a) Wet gas scrubber (low pH)
b) Dry sorbent injection
c) Injection of special, highly reactive activated carbon
d) Bromine addition to the boiler
e) Adsorption onto a fixed or moving bed</td>
<td>To reduce organized mercury emissions to air (including peak levels of mercury emissions) from waste incineration, the following techniques will be used:
b) Dry sorbent injection
c) Injection of special, highly reactive activated carbon
BAT-AEL requirements will be met.</td>
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BAT-associated emission levels (BAT-AELs) for organized mercury emissions to air from waste incineration (µg/Nm^3)
<table>
<tr><td>Parameter</td><td>BAT-AEL New equipment assembly (mg/Nm^3)</td><td>New equipment assembly</td></tr>
<tr><td rowspan="2">Hg</td><td>< 5–20 (2)</td><td>Daily average or sampling period average</td></tr>
<tr><td>1–10</td><td>Long-term sampling</td></tr>
</table>
(1) BAT-AEL in relation to daily average or sampling period average, or BAT-AEL in relation to long-term sampling applies. BAT-AEL related to long-term sampling may apply to WTE Plants with proven low and consistent mercury content (e.g., homogeneous waste streams with controlled composition).
(2) The lower limit of the BAT-AEL range can be achieved in the case of:
— incineration of waste with proven low and stable mercury content (e.g. homogeneous waste streams with controlled composition), or
— using special techniques allowing for preventing or reducing peak mercury emissions during incineration of wastes other than hazardous waste. The upper limit of the BAT-AEL range may be associated with the use of dry sorbent injection.
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<tr>
<td>BAT 32. To prevent contamination of unpolluted water, reduce emissions to water, and increase effective resource management, wastewater streams should be separated and treated separately based on their characteristics within the scope of BAT.</td>
<td>To prevent contamination of unpolluted water, reduce emissions to water, and increase effective resource management, wastewater streams will be separated. Industrial wastewater generated as a result of the functioning of the WTE Plant will be handled as follows:
• wastewater from the water treatment plant (from filter cleaning, from RO) will be directed to process water tank No. 2 and then used to make up losses in the slag trap,</td>
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</table>

	• blowdown and bottom blowdown from boilers flowing out of the atmospheric tank will be directed to process tank No. 1 and then used to produce demineralized water and/or to make up losses in the slag trap, • condensate from the sampling systems will be directed to process water tank No. 2 and then used to make up losses in the slag trap, • wastewater from the washing of the dirty surfaces of the unloading hall will be pretreated in the industrial wastewater pretreatment plant consisting of an oil/water separator and then it will be directed to process water tank No. 2, where it will be used to make up losses in the slag trap, • other process wastewater, i.e. condensate from the stack, drains from the incineration station, drains from the energy recovery station, drains from the flue gas cleaning plant, drains from the grate and cooling circuit of the energy generation segment and the slag trap will be directed to process water tank No. 2, where they will be used to make up losses in the slag trap.
BAT 33. To reduce water consumption and prevent or reduce the generation of wastewater from the WTE Plant, BAT should use one or a combination of the following techniques. a) Flue gas cleaning (FGC) techniques that do not generate wastewater b) Flue gas cleaning wastewater injection (FGC) c) Water reuse/recycling d) Management of bottom ash from a dry slag handling system	The following techniques will be used to reduce water consumption and prevent or reduce the generation of wastewater from the WTE Plant: a) Flue gas cleaning (FGC) techniques that do not generate wastewater b) Water reuse/recycling Dry flue gas desulfurization system will be used.

<table>
<tr><td></td><td>Wastewater from the water treatment plant (from filter cleaning, from RO), surface blowdowns and bottom blowdowns from the boilers discharged from the atmospheric tank, condensate from the sampling system, wastewater from washing the dirty surfaces of the tipping hall, condensate from the stack, drains from the incineration station, drainage from the energy recovery station, drainage from the flue gas cleaning station, drainage from the grate and cooling circuit of the power generation section and slag trap will be used to make up losses in the slag trap.</td></tr>
<tr><td>BAT 34. To reduce emissions to water from the flue gas cleaning (FGC) system or the storage and treatment of bottom ash and slag, BAT should use an appropriate combination of the following techniques and secondary techniques as close to the source as possible to avoid dilution.
<table>
<tr><td>Technique</td><td>Typical target contaminants</td></tr>
<tr><td colspan="2">Basic techniques</td></tr>
<tr><td>a) Optimization of the incineration process (see BAT 14) or a flue gas cleaning (FGC) system (e.g. SNCR/SCR, see BAT 29 (f))</td><td>Organic compounds, including PCDD/Fs (polychlorinated dibenzo-p-dioxins and furans), ammonia or ammonium</td></tr>
<tr><td colspan="2">Secondary techniques (1)</td></tr>
<tr><td colspan="2">Preliminary and primary treatment</td></tr>
<tr><td>b) Equalization</td><td>All pollutants</td></tr>
<tr><td>c) Neutralization</td><td>Acids, alkalis</td></tr>
<tr><td>d) Physical separation, e.g. screens, sieves, grit separators, primary settlement tanks</td><td>Gross solids, suspended solids</td></tr>
<tr><td colspan="2">Physico-chemical treatment</td></tr>
</table></td><td>Due to the dry method of flue gas cleaning, no wastewater will be generated in this process.
Industrial wastewater will be returned to make up the water in the slag trap and will not be discharged into the sewage system of the Water Supply and Sewage Disposal Company. In emergency situations, wastewater will be collected by an authorized collecting company (septic tanker).</td></tr>
</table>

e) Adsorption on activated carbon	Organic compounds, including PCDD/F, mercury
f) Precipitation	Dissolved metals/metalloids, sulfates
g) Oxidation	Sulfides, sulfites, organic compounds
h) Ion exchange	Dissolved metals/metalloids
i) Stripping	Purgeable contaminants (e.g. ammonia or ammonium)
j) Reverse osmosis	Ammonia/ammonium, metals/metalloids. sulfates, chlorides, organic compounds
Final solids removal	
k) Coagulation and flocculation	Suspended solids and metals/metalloids in dust
l) lSedimentation	
m) Filtration	
n) Flotation	

Emission levels associated with best available techniques for indirect emissions to a receiving waterbody

Parameter		Process	Unit	BAT-AEL (1) (2)
Metals and metalloids	As	Flue gas cleaning	mg/l	0.01–0.05
	Cd	Flue gas cleaning		0.005–0.03
	Cr	Flue gas cleaning		0.01–0.1

	Cu	Flue gas cleaning		0.03–0.15
	Hg	Flue gas cleaning		0.001–0.01
	Ni	Flue gas cleaning		0.03–0.15
	Pb	Flue gas cleaning Furnace ash treatment		0.02–0.06
	Sb	Flue gas cleaning		0.02–0.9
	Tl	Flue gas cleaning		0.005–0.03
	Zn	Flue gas cleaning		0.01–0.5
PCDD/F		Flue gas cleaning	ng I-TEQ/l	0.01–0.05

(1) The averaging periods are defined in the "General considerations".

(2) The BAT-AELs may not apply if the wastewater treatment plant is designed and equipped appropriately to remove the pollutants concerned, provided that this does not lead to a higher level of pollution in the environment.

BAT 35. In order to increase resource efficiency, BAT is to handle and treat bottom ashes separately from FGC residues.	The amount of ash is assumed to be at the level of 3-4% of the processed waste stream. From this stream, approx. 13-15% of ash enters the IBA handling system. Approx. 41% of the remaining ash stream will be collected in the boiler hoppers and approx. 59% will be retained in the bag filters in the flue gas cleaning system. In order to optimize the consumption of reacting substances, a part of the collected

	ash will be recirculated in the fabric filters. The captured ash will contain part of unreacted reacting substances. In order to "activate" it, the intermediate pressure steam flow rate from the IP steam header will be used.
BAT 36. In order to increase resource efficiency for the treatment of slags and bottom ashes, BAT is to use an appropriate combination of the techniques given below based on a risk assessment depending on the hazardous properties of the slags and bottom ashes. a) Screening and sieving b) Crushing c) Aeraulic separation d) Recovery of ferrous and non-ferrous metals e) Seasoning/Ageing f) Washing	As part of the WTE Plant, it is planned to construct an IBA valorization plant in which the following processes will take place: screening, crushing, recovery of ferrous and non-ferrous metals and seasoning/ageing. Slag after the valorization and seasoning/ageing process may be used, e.g. as aggregate for road and highway base-courses.
BAT 37. In order to prevent or, where that is not practicable, to reduce noise emissions, BAT is to use one or a combination of the techniques given below. a) Appropriate location of equipment and buildings b) Operational measures c) Low-noise equipment d) Noise attenuation e) Noise-control equipment/infrastructure	The following techniques will be used to prevent or, if not possible, reduce noise emissions: a) Appropriate location of equipment and buildings (e.g. entrance to the unloading hall, diesel generator set), located as far as possible from acoustically protected areas b) Operational measures c) Low-noise equipment (acoustic power will be one of the important criteria for the selection of equipment) d) Noise attenuation (noise screens will be applied) e) Noise-control equipment/infrastructure (space dividers will be made of sandwich panels with appropriate sound insulation values, the condenser will be partially enclosed on the side of acoustically protected areas).

15 INDICATION OF POSSIBLE SOCIAL CONFLICTS ASSOCIATED WITH THE PLANNED PROJECT AND THE NEED TO ESTABLISH A LIMITED USE AREA

15.1 Analysis of potential social conflicts

Social conflicts associated with the project in question can be divided according to their source into the following groups:

- relating to noise and air emissions – concern about deterioration of the acoustic climate and aerosanitary conditions;
- relating to residents' sense of hazard to residential development due to increased truck traffic in the area of the plant location;
- resulting from ecological views;
- relating to reluctance to changes in the immediate environment.

The impact of the proposed plant on the surrounding population is derived from the impact on the various components of the environment. Any of the negative impacts on soil, water, atmospheric air or acoustic climate are automatically transferred to people as users of these assets. Such dependence creates conflict situations associated with the investment process.

Past experience shows that during the location or construction of waste management projects there is a risk of protests and social conflicts. Particular emotions are aroused by the waste-to-energy plant which, in contrast to highly developed countries, is little known in Poland, and the available information about it in the mass media, which usually falsely exaggerate its harmful effects on people and the environment. This is mainly due to the lack of knowledge about the principles of operation of the plant, the permissible values of pollutant emissions and ignorance of administrative procedures. Such situations are observed in each of the waste-to-energy plant investments currently taking place in Poland.

15.2 Method of informing the public about the planned project

The Veolia Group, the producer and supplier of system heat to Łódź, has been optimizing the company in the technological and organizational areas for many years. The company takes measures to ensure effective operation in changing market conditions. One of the key elements of the strategy of Veolia is to diversify the fuels used in the production of system heat and electricity in cogeneration.

Veolia Energia Łódź, in accordance with the mission and strategy of Veolia Group, bearing in mind the environmental challenges facing the energy sector, has been consistently implementing its strategy adopted in 2009. It assumes the gradual decarbonization of Łódź district heating system and the use of alternative fuels in the production of system heat and electricity at combined heat and power plants in Łódź, which will translate into a significant reduction in CO_2 emissions.

As part of the strategy of Veolia Energia Łódź, a plant using biomass, in the form of waste from the wood industry and agricultural crop residues, as fuel for energy production, was launched at the EC-4 CHPP in 2011. In 2015, due to, i.a., environmental considerations and the changing local heat market, the EC-2 CHPP was decommissioned.

Mission of Veolia "We are resources" is based on a vision of a world where resources are not wasted and are used sustainably. Waste also has value, and when it is reused and managed effectively, it is an environmentally friendly energy source.

Under current conditions and the growing waste management problems, Veolia is preparing a project to extend the EC-4 CHPP to include a WTE Plant. The Plant will use, i.a., alternative fuel, the so-called pre-RDF, i.e. the refuse-derived fuel produced after the municipal waste recovery and recycling processes, the so-called calorific fraction, the disposal of which causes problems and poses a significant challenge for local authorities.

The investment of Veolia Group in the WTE Plant in Łódź at ul. Jadzi Andrzejewskiej 5, on the site of the EC-4 WTE Plant, is a continuation of the project planned for implementation by the City of Łódź in 2010, and is part of the strategy of Veolia Energia Łódź to decarbonize the Łódź district heating system and systematically reduce CO_2 emissions.

Accordingly, the process of communication with the external environment (city residents) and internal environment (employees) has been divided into several stages:

- STAGE I: communication and public consultation stage from 2008 to 2010, conducted by the Łódź Municipal Office,
- STAGE II: communication stage conducted by the investor – Veolia Group:
  - expert communication on the WTE Plant from November 2019 to January 2020 (preliminary phase of building the information background for the WTE Plant in Poland),
  - information about the decarbonization project of the Łódź district heating system and Veolia's investment decision, and the building permit design of the WTE Plant provided at a press conference on January 30, 2020 and at a press conference combined with a site visit for local media representatives at EC-4 – February 7, 2020,
  - information and education campaign concerning the transformation of the heating generation sector and decarbonization, environmental protection and ecology – in the press, radio, television and on the Internet,
  - changing the assumptions of the information and education campaign and related activities in connection with the declaration of epidemic and outbreak states – from March 2020. (transformation to web-only activities), which meant abandoning a planned event for Łódź residents in the form the "Zero waste" picnic.
  - planned continuation of communication activities to key stakeholders and city residents.

STAGE I COMMUNICATION AND PUBLIC CONSULTATION FROM 2008 TO 2010, RUN BY THE ŁÓDŹ MUNICIPAL OFFICE:

The City of Łódź conducted communication aimed at minimizing social conflicts in the following phases:

- preliminary actions: on June 10, 2008 and December 14, 2009, meetings were held with residents and environmental organizations. An information desk and a thematic website was created at www.czystemiasto.uml.lodz.pl,

- in December 2009, a public opinion poll was conducted using the CATI method, by the TNS OBOP studio on a representative group of residents, which showed that 81% of residents believed that thermal waste neutralization was less harmful than waste accumulation in landfills, and 90% believed that it should be combined with energy recovery. Almost 70% of them believed that the decision on the location of such an investment project should be made by experts. Concerns included gas emissions, toxicity and health effects,
- from April 20, 2010, an information campaign on the project in question was conducted for 10 months,
- prior to the issuance of the decision, the public participation procedure was carried out in accordance with Article 33 Section 1 of the Act on the provision of information about the environment and its protection, public participation in environmental protection and environmental impact assessments: public announcement in the period from April 22 to May 13, 2010, deadline for comments and applications – from April 29, 2010 to May 31, 2010. The applications and how they were handled are described in the environmental decision (pages 22–30). Meetings with residents were held on May 22, 2010 and June 22, 2010, on May 18, 2010 a meeting was held with representatives of the housing development councils – auxiliary units of the City of Łódź,
- these activities are described extensively in chapter 13 of the original environmental impact assessment report developed by Socotec. It drew attention, i.a., to the NIMBY phenomenon, in which residents neighboring with such investment projects as the project in question, while agreeing with the need for their existence, do not agree with their locations in their neighborhood. Residents' fears are often fueled by information disseminated by people without proper education and qualifications (including on the Internet) about the harmfulness of such plants. This was facilitated by the relatively small number of such plants in Poland compared to other European countries. 50% of protesters objected due to the lack of knowledge. The NIMBY phenomenon is counteracted based on:
  - conducting an information campaign,

- promoting the understanding of the need to solve the problems of waste management, the principles of operation of facilities such as the project in question and guarantees of their safety,
- implementation of the compensation program,
- principle of transparency.

STAGE II SOCIAL COMMUNICATION CONDUCTED BY THE INVESTOR – VEOLIA GROUP COMPANY:

Communication aimed at informing about the decarbonization project, investment plans and minimizing social conflicts was based on the assumption of the need for an information and education campaign addressing the following issues:

- European Union directive on waste and the so-called European Green Deal,
- transformation requirements of the heating generation sector in the face of tightening EU environmental policy and the transformation of district heating systems to energy efficiency, and thus the need to look for new, greener technologies, one possibility of which covers investments in energy recovery plants, the heat from which would cover the needs of municipal heat distribution networks,
- growing problem of waste management (including a series of fire at landfills and temporary waste storage facilities in 2018), as well as the implementation of EU directives setting recycling levels, the increase in landfilling costs (marshal fee) and the prospect of reducing the amount of waste at landfills. An investment not so much in "waste incineration plants" as in modern energy recovery plants will help modernize the heating sector and meet EU environmental regulations. The retrofit of CHPPs comprises, on the one hand, the use of fuels alternative to coal, including the so-called pre-RDF, i.e. the calorific residual fraction of municipal waste, and on the other hand, it is a response to the environmental challenges of reducing CO_2 emissions and significantly reducing emissions of other substances. Experts emphasize that the overriding criterion for the decision to build this type of plant should be a preference for those that provide heat collection to the municipal heat distribution network. Experts of Izba Gospodarcza Ciepłownictwo Polskie [Polish

Heating Sector Chamber of Commerce] stress that energy recovery plants are also an important instrument for transforming the heating sector,

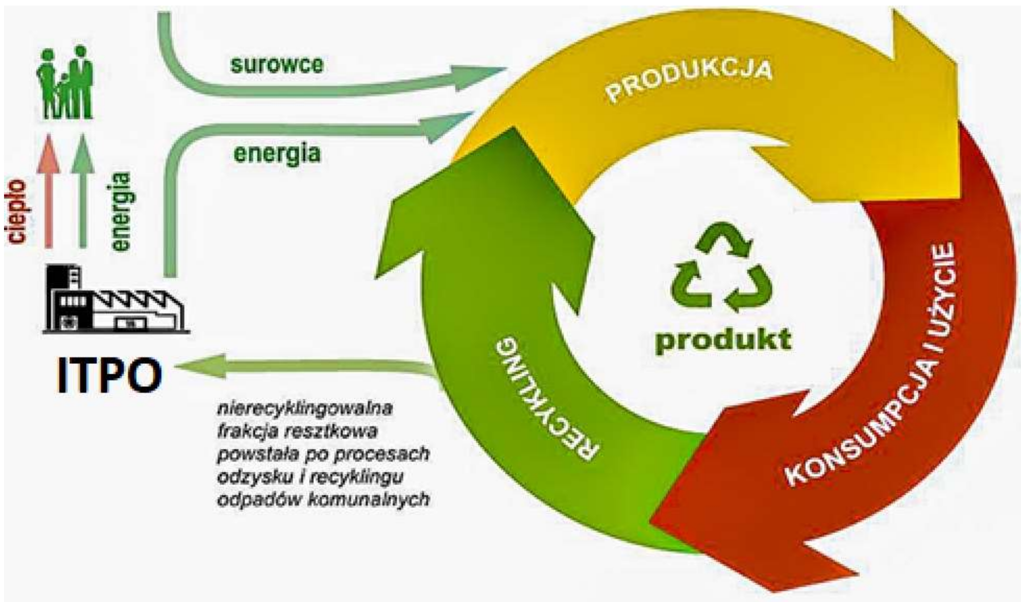
- Energy Recovery Plants used in the heating sector will help solve at least a few problems, both those of the heating sector and environmental or social problems.
  - ✓ Firstly, it is an efficient method of managing landfill-impossible waste while exploiting its potential to produce system heat and electricity in cogeneration.
  - ✓ Secondly, it is a method to become independent of external suppliers of conventional fuels.
  - ✓ Thirdly, it is a change in the fuel mix for heat and power production, and thus avoiding the cost of CO_2 emission allowances. Experts point out that the energy recovery plant emission requirements are more stringent than those of many operating district heating or CHP plants, where coal is the main fuel. Using the calorific residual fraction from municipal waste to generate heat and electricity will also reduce waste management expenses for local governments.
  - ✓ Fourthly, it provides benefits for local governments, associated with the waste-to-energy process for municipal waste: solving the waste problem, specifically the oversupply of the calorific residual fraction created after the recycling process, which cannot be landfilled. Its oversupply is one of the reasons for the rising price of waste collection, and this also affects prices for residents.
  - ✓ Fifthly, new energy recovery plants are “tailor-made” to meet local district heating network and infrastructure needs. They make it possible, through the use of the calorific fraction, to use the waste to secure part of the demand for heat and domestic hot water in summer and winter.

PL	EN
RECYKLING	RECYCLING
FRAKCJA RESZTKOWA	RESIDUAL FRACTION
PRAWO	LAW
CEMENTOWANIE	CEMENT PLANTS
KOSZTY	COSTS
MAGAZYNY	STORAGES
60% do 2035 r.,	60% by 2035,
ok. 2-3 mln ton rocznie	approx. 2–3 million tons per year
Brak mocy	Unavailable capacity
rosnące	growing
pożary	fire
Rygorystyczne cele dotyczące recyklingu odpadów komunalnych	Strict municipal waste recycling objectives
Nadpodaż nierecyklingowalnych frakcji resztkowych pochodzących z przetwarzania odpadów komunalnych tzw. pre-RDF	Oversupply of non-recyclable residual fractions from municipal waste processing, the so-called pre-RDF
Ustawowy zakaz składowania pre-RDF o wartości opałowej powyżej >6 MJ/kg	Statutory prohibition to store pre-RDF with a net calorific value above >6 MJ/kg
Praktyczny brak możliwości zwiększenia odbiory pre-RDF w przetargach publicznych	Practical impossibility of increasing pre-RDF consumption in public tenders
Wysoki i ciągle wzrastający koszt zagospodarowania pre-RDF w przetargach publicznych	High and ever-increasing cost of pre-RDF management in public tenders
Problem „płonących" tymczasowych magazynków pre-RDF	Problem of "burning" temporary pre-RDF storages

Figure 30 Current situation and requirements for the management of the non-recyclable calorific fraction of municipal residual waste

The information and education campaign is conducted on the basis of broad outreach to the city residents through the media, local government institutions, community organizations and directly. It was based on the following key messages:

- the need to transform the CHPP by its extension (hence the rationale for locating it in an industrial zone integrated into the landscape) to include plants providing fuel alternative to coal (decarbonization), thereby reducing CO_2 emissions affecting the greenhouse effect and negative climate change, maximizing energy efficiency and cost rationalization, making full use of resources, operating various scenarios towards Transformation 2050 – a zero-carbon economy (part of the strategy of Veolia Group in Poland) in line with the European Green Deal as a complement to the Closed Circuit Economy through the use of calorific non-recyclable fractions of municipal residual waste (pre-RDF).



PL	EN
ciepło	heat
energia	power
surowce	raw materials
ITPO	WTE Plant
PRODUKCJA	MANUFACTURING
RECYKLING	RECYCLING
KONSUMPCJA I UŻYCIE	CONSUMPTION AND USE
produkt	product
Nierecyklingowalna frakcja resztkowa powstała po procesach odzysku i recyklingu odpadów komunalnych	Non-recyclable residual fraction generated after municipal waste recovery and recycling processes

Figure 31 Circular Economy Diagram including pre-RDF energy recovery.

- the need to ensure energy security and continuity of delivery for the city and residents,
- investor credibility built on concrete commitment to the local community and ecology understood as a whole,

Figure 32 Example of advertisement placed in conventional and electronic media

- focusing on cooperation with the Łódź Municipal Office as part of Ekopakt (Ecological Pact) for the benefit of residents: solving local problems related to, i.a., low emissions, development of new energy sources (Łódzki Klaster Fala Energii), environmental education, biodiversity and green space development, electromobility development, air quality monitoring (sensors in the city),
- creating a brand for the transformation/decarbonization process “New Energy for Łódź”,

Figure 33 New Energy for Łódź project logo

- The WTE Plant as part of the decarbonization project implemented since 2009. – biomass-fired plant at EC-4, decommissioning of inefficient EC2 CHPP, retrofit of grid infrastructure and construction of smart grids, combined cycle power plant at EC-4, use of torrefied biomass at EC3, integration of distributed energy sources (photovoltaics),

PL	EN
Odchodzenie od węgla	Abandonment of coal
Dziś	Today
Jutro	Tomorrow
biomasa	biomass
Wyłączenie EC2	EC2 decommissioning
Inteligentna sieć	Smart grid
Z.O.E.	Z.O.E.
Blok gazowo-parowy	Combined cycle power plant
Czarny pellet	Black pellets
Dekarbonizacja	Decarbonization
WYZWANIA EUROPEJSKI ZIELONY ŁAD / TRANSFORMACJA 2050	CHALLENGES EUROPEAN GREEN DEAL / TRANSFORMATION 2050

Figure 34 Diagram of Łódź CHPP decarbonization process

- architectural concept of the WTE Plant building including green walls, rainwater retention and use, murals, educational path.

Communication activities are carried out in the following phases:

- Initial phase: communication about the Waste-to-Energy Plant and the role of this type of plant in the Closed Circuit Economy – from November 26, 2019 to January 8, 2020, there were more than 20 releases, TV and radio reports (some of them below)


Dziennik Łódzki

Turystyka Wiadomości Na sygnale Kultura Strona kobiet Wideo Więcej

Ceny za odbiór zmieszanych śmieci rosną do nieba, bo za mało jest w Polsce spalarni odpadów

Rozmowa z prof. dr hab. Grzegorzem Wielgosińskim, kierownikiem Zakładu Technik Inżynierii Środowiska na Wydziale Inżynierii Procesowej i Ochrony Środowiska Politechniki Łódzkiej

Panie profesorze, jeszcze kilka lat temu na hasło „spalarnia śmieci" mógłby Pan wymienić jedną jedyną, niewielką spalarnię w Warszawie. Dziś mamy osiem funkcjonujących spalarni w kilku miastach Polski. Czy powinny powstać następne? Jakie znajduje Pan argumenty za inwestowaniem w ten segment utylizacji odpadów?

Inwestowanie w kolejne spalarnie jest konieczne i postaram się wyjaśnić, dlaczego. Zacznijmy od tego, że polski system gospodarowania odpadami komunalnymi oparty jest o tzw. instalacje mechaniczno-biologicznego przetwarzania. Trafia tam strumień odpadów komunalnych, odebrany mieszkańcom w postaci tzw. odpadów zmieszanych lub resztkowych, które nie nadawały się do selektywnej zbiórki. Najnowsze dane mówią, że na 12,5 mln ton odpadów komunalnych rocznie, w Polsce udaje się zebrać selektywnie około 3,5 mln ton. Reszta albo jest spalana w tych kilku zaledwie spalarniach, albo – i dotyczy to zdecydowanej większości odpadów zmieszanych – trafia do wspomnianych instalacji. Tam z kolei dzielona jest na trzy frakcje:

Figure 35 Examples of press releases from the initial phase

- CATI survey conducted from November 21 to 28, 2019 by SW RESEARCH agency using the computer-assisted telephone interviewing (CATI) method. The survey included 812 questionnaires with residents of Łódź who had lived in the city for at least 5 years, 170 of whom were residents of the Widzew district, i.e the immediate area where the WTE Plant is to be built.

	Residents of Łódź	**Residents of Widzew**	Residents of other districts
Does the increasing amount of waste have an impact on the steady increase in collection fees?	YES – 60%	**YES – 56%**	YES – 64%
Does the increasing amount of waste have an impact on the environmental pollution?	YES – 60 %	**YES – 66 %**	YES – 56 %
Do the problems caused by the increasing amount of waste have an impact on the new segregation obligations?	YES – 51 %	**YES – 50 %**	YES – 54 %
Is the construction of industrial incineration plants a good idea to	YES – 85 %	**YES – 80 %**	YES – 87 %

solve the problem of increasing amount of waste?			

- The idea of construction of an incineration plant in Łódź is viewed negatively by 23% of Łódź residents (more often residents of Widzew than other districts), including:

	Residents of Łódź	**Residents of Widzew**	Residents of other districts
They are concerned about environmental pollution	61%	**56%**	64%
They are concerned about the nuisance of the operation of the incineration plant and its negative impact on the landscape	45%	**47%**	44%
They would change their opinion about the incineration plant if they were sure it did not threaten the environment and people	60%	**67%**	58%
They would support the idea of construction of the incineration plant if the price of waste collection increased several times	57%	**57%**	57%
They would agree to the construction of the incineration plant if the amount of waste in the area was unbearable	55%	**63%**	53%

Implementation phase:

- information on the decarbonization project of the Łódź district heating system, investment decisions of Veolia and the project to extend the EC-4 CHPP to include a WTE Plant – provided at a press conference on January 30, 2020 (more than 10 publications, and radio and TV reports) and a press conference combined with a site visit at EC-4 – February 7, 2020, Selected publications:

Veolia chce rozbudować EC4 i odzyskiwać energię

Łódź
Andrzej Gębarowski
a.gebarowski@dziennik.lodz.pl

Veolia Energia Łódź, główny dostawca ciepła w mieście, zamierza wybudować na terenie widzewskiej elektrociepłowni EC4 Zakład Odzysku Energii (ZOE), wykorzystujący paliwo alternatywne zamiast węgla.

Nowym paliwem ma być tzw. frakcja resztkowa odpadów komunalnych, czyli te odpady, które nie dają się już odzyskać w procesie recyklingu, a z powodzeniem są wykorzystywane w wielu krajach świata jako źródło energii. I właśnie Veolia powołuje się na swoje światowe doświadczenie w budowie nowoczesnych ZOE, które są instalacjami o bardzo niskiej emisyjności, porównywalnej z emisją do atmosfery powstającą przy spalaniu gazu. Dodatkowe korzyści to pozbycie się ogromnej masy niechcianych przez nikogo odpadów oraz zmniejszone spalanie węgla - szacuje się, że ZOE, który ma powstać w Łodzi, ograniczy spalanie węgla o 2 tysiące wagonów rocznie.

Nowa inwestycja będzie kolejnym krokiem w procesie przestawiania się Veolii na paliwa alternatywne w stosunku do węgla, po uruchomieniu w 2011 roku instacji wykorzystującej biomasę pochodzenia rolnego w EC4.

Resztkowe odpady będą dowożone do elektrociepłowni nie bezpośrednio śmieciarkami, lecz specjalnie przystosowanym transportem kołowym (40 ciężarówek dziennie). Jeśli Veolii uda się uzyskać wymagane pozwolenia, ZOE zostanie uruchomiony w 2024 roku.

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lata – w takim czasie Veolia planuje wybudować w Łodzi na terenie EC4 Zakład Odzysku Energii

Wczoraj w Centrum Nauki i Techniki EC1 szefowie łódzkiej Veolii przedstawili etapy dekarbonizacji systemu ciepłowniczego Łodzi

Paliwa alternatywne

Chcą odzyskiwać energię z odpadów i rozbudować EC4

Zakład Odzysku Energii (ZOE), wykorzystujący paliwo alternatywne zamiast węgla zamierza wybudować na terenie widzewskiej elektrociepłowni EC4 Veolia Energia Łódź, główny dostawca ciepła w mieście.

Paliwem dla instalacji ma być tzw. frakcja resztkowa odpadów komunalnych, czyli te, które nie dają się już odzyskać w trakcie recyklingu, a są wykorzystywane w wielu krajach jako źródło energii. Veolia powołuje się na swoje światowe doświadczenie w budowie nowoczesnych ZOE, które są instalacjami o bardzo niskiej emisyjności, porównywalnej z tą podczas spalaniu gazu.

Szacuje się, że ZOE, który ma powstać w Łodzi, ograniczy spalanie węgla o około 2 tys. wagonów rocznie.Dodatkowe korzyści to pozbycie się masy niechcianych odpadów. Mają one być dowożone do elektrociepłowni nie bezpośrednio śmieciarkami, lecz specjalnie przystosowanymi ciężarówkami.

Veolia czeka obecnie na wymagane pozwolenia. Jeśli je otrzyma, ZOE ma być uruchomiony w 2024 r. Inwestycja to kolejnym krok Veolii w procesie przestawiania się na paliwa alternatywne, po uruchomieniu w 2011 r. instalacji wykorzystującej biomasę pochodzenia rolnego w EC4. **(R)**

Etapy dekarbonizacji systemu ciepłowniczego Łodzi przedstawili wczoraj szefowie łódzkiej Veolii.

Na terenie EC4 ma powstać zakład odzysku energii wykorzystujący odpady.

Lepiej spalić, niż składować

Nowoczesne spalarnie śmieci na razie działają w ośmiu miastach. Do ich budowy przymierzają się kolejne.

Szymon Bujalski

ŁÓDŹ

Spółka Veolia do 2024 r. chce uruchomić w Łodzi spalarnię, która będzie przetwarzać to, czego nie udało się zrecyklingować. Trafi do niej rocznie ok. 200 tys. ton odpadów, co pozwoli zmniejszyć ilość spalanego węgla o 120 tys. ton rocznie.

Miasto nie mówi budowie „nie", ale stawia warunek. To zastosowanie najnowszych rozwiązań technologicznych redukujących do zera negatywny wpływ instalacji na środowisko naturalne.

Argumenty na „tak"...

W Polsce działa osiem nowoczesnych spalarni. Pierwsza stanęła w Warszawie na początku tego wieku. Po 2015 r. kolejne powstały w Białymstoku, Bydgoszczy, Koninie, Krakowie, Poznaniu, Szczecinie i Rzeszowie.

Ale to nie koniec. W ramach partnerstwa publiczno-prywatnego zakłady odzysku energii zostaną zbudowane w Gdańsku i Olsztynie. Pierwszy ma już pozwolenie na budowę, w przypadku drugiego podpisano umowę z wykonawcą. Obie inwestycje – dofinansowane przez Unię Europejską – mają się rozpocząć w pierwszej połowie tego roku.

Nad budową zastanawiają się również Ruda Śląska, Żywiec i Stalowa Wola.

Jednym z argumentów przemawiających za tymi inwestycjami jest zwiększająca się ilość odpadów. Jeszcze w 2014 r. na jednego Polaka przypadało 268 kg śmieci, a w 2018 r. – już 325 kg. Średnia dla Unii Europejskiej wynosi ok. 500 kg.

Pożary na składowiskach

W 2018 r. skrócono dopuszczalny czas magazynowania śmieci – z trzech lat do 12 miesięcy. Właśnie wtedy mieliśmy do czynienia z plagą pożarów na składowiskac, bo w całym 2018 r. było ich 243. Największy – w Zgierzu – przez kilka dni gasiło 250 strażaków. Przyczyną było podpalenie.

Inny powód to koszty. Jak wylicza prof. Grzegorz Wielgosiński z Wydziału Inżynierii Procesowej i Ochrony Środowiska Politechniki Łódzkiej, dziś za zagospodarowanie tony śmieci trzeba zapłacić 700-900 zł. Cena w spalarni to 230-320 zł.

...i na „nie"

– Naszym celem powinno być ograniczenie produkcji śmieci, a nie ich produkowanie i spalanie. To leczenie objawów, a nie choroby. Dlaczego mamy jako konsumenci płacić za produkt, a potem za śmieci, które nam producent razem z nim sprzedał? Trzeba zmienić myślenie – przekonuje Magdalena Gałkiewicz z zarządu krajowego Zielonych.

Jej zdaniem Polska powinna stawiać na gospodarkę w obiegu zamkniętym, czyli segregować śmieci u źródła, utrzymywać produkty jak najdłużej w obiegu, traktować odpady jak surowce, a dopiero w ostateczności poddawać je recyklingowi.

Idealizm vs. pragmatyzm

– Mamy zderzenie idealizmu z pragmatyzmem. Łatwo powiedzieć, że powinniśmy ograniczać śmieci, ale w rzeczywistości to niewykonalne. Zwłaszcza w dużych miastach – ocenia prof. Wielgosiński. – Nikomu nie udaje się poddać selektywnej zbiórce 100 proc. odpadów. Z powodu braku odpowiednich technologii jest problem z tworzywami sztucznymi, których nie da się przetwarzać w nieskończoność. Zawsze będziemy mieli więc odpady resztkowe. Lepiej je spalić, niż składować.

Z sondaży przeprowadzonych w różnych polskich miastach wynika, że zdecydowana większość popiera budowę spalarni. W Gdańsku „za" było ponad 90 proc. mieszkańców, a w Szczecinie – prawie 85 proc.

Obecnie w zakładach odzysku energii spalane jest ok. 1,1 mln ton odpadów rocznie. Zdaniem prof. Wielgosińskiego docelowo powinno to być 2,5-3 mln ton, dlatego powinniśmy zbudować przynajmniej drugie tyle spalarni.

Spalarnia odpadów działa w Białymstoku od czterech lat

FOT. AGNIESZKA SADOWSKA / AGENCJA GAZETA

Figure 36 Sample press releases following January-February 2020 press conferences

- information and education campaign concerning the transformation of the heating generation sector and decarbonization – in the press, radio, television and on the Internet,

Efektywne Dzień dobry dla Ziemi

BIZNES I KLIMAT

Trwały efekt jest możliwy tylko przy wspólnych, spójnych działaniach

Przedsiębiorstwa mające świadomość społecznej odpowiedzialności biznesu od lat konsekwentnie pracują razem z Centrum UNEP/GRID-Warszawa na rzecz powstrzymania negatywnego wpływu cywilizacji na środowisko.

Anna Kędziora-Szwagrzak

Artur Bieńkowski

Katarzyna Byczkowska

Iwona Dominiak

Magdalena Brzezińska

Dziennik Łódzki

Wiadomości Koronawirus Na sygnale Kultura Strona kobiet Wideo

Sprawdź czystość powietrza

MATERIAŁ INFORMACYJNY VEOLIA · 4 maja

ZOBACZ GALERIĘ

Veolia Energia Łódź, główny dostawca ciepła dla Łodzi, pomaga mieszkańcom w zorientowaniu się, czy nie zagraża im smog i jaki jest stopień zanieczyszczenia powietrza w różnych częściach miasta. Veolia we współpracy z firmą Airly zamontowała dwadzieścia czujników pomiaru czystości powietrza na łódzkich budynkach. Dzięki nim mieszkańcy naszego miasta mogą szybko i łatwo sprawdzać jakość powietrza i zdecydować na przykład, czy warto wybrać się z dzieckiem na spacer, czy jednak lepiej pozostać w domu. Szczególnie niebezpieczne są wyżowe pogody zimą, gdy nie ma wiatru. Warto wtedy spojrzeć na wskazania czujnika.

Gdzie są są czujniki pomiaru czystości powietrza

Projekt został podzielony na trzy etapy. W pierwszym etapie partnerami Veolii zostały: Spółdzielnia Mieszkaniowa im. Stefana Batorego, Robotnicza Spółdzielnia Mieszkaniowa Bawełna, Miejskie Przedsiębiorstwo Komunikacyjne oraz Instytut Centrum Zdrowia Matki-Polki. W drugim etapie w projekt włączyły się spółdzielnie: Botanik, Teofilów, Ogniwo, Radogoszcz Wschód i Radogoszcz Zachód.


4 Docieplenia i termomodernizacje

Nowoczesne technologie i systemy

Ekologiczne ciepło z sieci

Ciepło systemowe wytwarzane w elektrociepłowniach jest najlepszym sposobem na walkę ze zjawiskiem tzw. niskiej emisji, odpowiedzialnej za powstawanie smogu. Im więcej odbiorców będzie korzystać z ciepła z sieci, tym skuteczniej będziemy dbać o jakość powietrza i warunki życia w miastach.

Veolia produkuje ciepło i energię elektryczną w tzw. kogeneracji. Uzyskujemy ograniczenie zużycia paliw o ok. 30 proc., co przekłada się na zmniejszenie emisji i oddziaływanie na środowisko


Odnawialne źródła energii – efektywnie dla środowiska

Efektywne korzystanie z surowców, ich niemarnowanie oraz odzyskiwanie i ponowne użycie w procesie produkcji energii i ciepła dla mieszkańców, stosowanie na większą skalę odnawialnych źródeł energii jest kluczową częścią m.in. projektu Nowa Energia dla Łodzi, w ramach którego Veolia będzie stopniowo ograniczać spalanie węgla w łódzkich elektrociepłowniach.

transformacja2050.pl

Czy jest szansa na świat bez odpadów? Gospodarka obiegu zamkniętego

Funkcjonujemy dzisiaj według modelu wzrostu produkcji i konsumpcji. A im więcej wytwarzamy i im więcej produktów kupujemy, tym zużywamy coraz więcej zasobów i wytwarzamy coraz więcej odpadów. W takich okolicznościach, mając na uwadze zachodzące zmiany klimatyczne i ograniczenie wpływu działalności człowieka na środowisko, optyka rozwoju i korzystania z zasobów musi ulec zmianie.

Wszyscy powinniśmy współpracować na rzecz powstrzymania globalnego ocieplenia, efektywnie korzystać z zasobów i ich nie marnować, a wręcz odzyskiwać i wykorzystywać je ponownie w procesie produkcji, w tym energii i ciepła. Filozofia firm przemysłowych powinna iść w kierunku **gospodarki obiegu zamkniętego,** a stanem idealnym jest osiągnięcie sytuacji, w której odpadów, zgodnie z filozofią zero waste, po prostu nie będzie. W dobie wyczerpujących się zasobów naturalnych i postępującej urbanizacji, gospodarka obiegu zamkniętego staje się podstawowym kierunkiem zrównoważonego rozwoju świata.

Gospodarka obiegu zamkniętego to nie tylko dbałość o możliwie najmniejsze zużycie zasobów, ale również dbałość o ich regenerację. Ten sposób myślenia musi przełożyć się na każdy etap życia produktów: od ich projektowania z wykorzystaniem wyłącznie materiałów, które mogą zostać ponownie użyte, poprzez produkcję opartą w jak największym stopniu o odnawialne źródła i zasoby, po konsumpcję szanującą środowisko i zagospodarowującą ponownie przetwarzane surowce.

Wyzwania producentów i konsumentów

Wyzwania, jakie stawia gospodarka obiegu zamkniętego, są celem, którego osiągnięcie zależy od spełnienia szeregu warunków. **Część z nich leży po stronie producentów** – z czego będą wytwarzać oni swoje produkty, na ile będą one możliwe do naprawy czy regeneracji, jak łatwo będzie można z nich odzyskać pełnowartościowe surowce wtórne. **Wiele zależy również od postawy konsumentów** – zaczynając od tego, jak będą zmieniać się nawyki zakupowe, poprzez to, czy będziemy potrafili nie marnować zasobów i konsekwentnie segregować odpady. **Na koniec, nie bez znaczenia, jest rozwój całej sfery zajmującej się zagospodarowaniem odpadów.**

Nowa Energia dla Łodzi

Wyzwania środowiskowe stawiane przedsiębiorstwom branży ciepłowniczej oraz zmieniający się rynek ciepła powodują, że firmy przeobrażają się pod względem technologicznym i organizacyjnym. Wdrażane są projekty mające na celu systematyczne ograniczanie wpływu ich działalności na środowisko naturalne. **Kluczowy jest proces stopniowego odchodzenia od spalania węgla na rzecz odnawialnych źródeł energii i zastosowania alternatywnych paliw w procesie produkcji ciepła systemowego i energii elektrycznej.**

W obliczu tych wyzwań, **Veolia Energia Łódź tworzy i wdraża rozwiązania, których celem jest poprawa dostępu do zasobów, przy jednoczesnym zapewnieniu ich ochrony i odnowy.** W ramach projektu **Nowa Energia dla Łodzi** firma rozważa różne warianty produkcji ciepła systemowego i energii elektrycznej dla miasta, dzięki którym wyeliminowane zostanie spalanie węgla w łódzkich elektrociepłowniach i tym samym znacząco ograniczone zostaną emisje. W ramach dywersyfikacji paliwowej Veolia prowadzi analizy projektów, dzięki którym będzie możliwe zastąpienie węgla gazem, odnawialnymi źródłami energii i paliwami alternatywnymi. **Celem jest zero węgla w procesie produkcji ciepła i energii elektrycznej dla miasta.**

Realizacja projektu Nowa Energia dla Łodzi zagwarantuje spełnienie wymagań środowiskowych określanych na poziomie ustawodawstwa krajowego i unijnego oraz pozwoli poprawić efektywność instalacji i urządzeń w łódzkim systemie ciepłowniczym.

Energia powinna wracać

Dzisiaj znajdujemy się na swego rodzaju etapie przejściowym. Będziemy w tym czasie wykorzystywać coraz więcej surowców wtórnych z odpadów, nie unikniemy jednak takich, z których nie jesteśmy w stanie nic odzyskać poza zgromadzoną w nich energią. Wobec tego **termiczne wykorzystanie odpadów nienadających się do ponownego wykorzystania, zagospodarowanie ich frakcji kalorycznej, która powstaje w procesie sortowania i recyklingu, wpisuje się w schemat gospodarki obiegu zamkniętego.** A odzyskana z odpadów energia, jak i pozostałe surowce z nich pochodzące, powinny być wykorzystywane w tym samym obiegu do produkcji nowych produktów.

Odzyskaj co Twoje
zerowasterzy.pl

wyborcza.pl

Nowoczesne technologie i systemy. Ekologiczne ciepło z sieci

NAJCZĘŚCIEJ CZYTANE

Ciepło systemowe wytwarzane w elektrociepłowniach i dostarczane sieciami ciepłowniczymi jest najlepszym sposobem na walkę z niebezpiecznym zjawiskiem tzw. niskiej emisji, odpowiedzialnej w polskich miastach za powstawanie smogu. Im więcej odbiorców będzie korzystać z ciepła z sieci, tym skuteczniej będziemy dbać o jakość powietrza i generalnie warunki życia w miastach.

Figure 37 Sample press releases as part of the information and education campaign

- meetings and presentations of the project for formal and informal groups, including: at Forum Zarządców Nieruchomości Spółdzielczych [Cooperative Real Property Administrator Forum], for managers and employees of Veolia Energia Łódź (more than 1,000 people), associations and other NGOs, meetings and presentations at the Łódź Municipal Office,

Figure 38 Information leaflet distributed at meetings

- changing the assumptions of the information and education campaign and related activities in connection with the declaration of epidemic and outbreak states – from March 2020.
- the need to cancel face-to-face meetings and events of environmental specificity,
- cancellation of the planned event in the form of the “Zero waste” picnic,
- campaign in local media and on the Internet, the use of digital tools: infographics, videos, animations, published both on our own (fb, www) and partners' news channels – for example, a series of videos on energy conversion from CNiT EC1 or a series with Gazeta Wyborcza of interviews with children and experts on clean air, energy conversion or climate,
- launching on June 24, 2020 the website for the project at: https://nowaenergiadlalodzi.pl/ and on July 6, 2020 a Facebook profile dedicated to the project: https://www.facebook.com/NowaEnergiaDlaLodzi/, which by the end of August already had more than 1,400 fans, with a total monthly reach of 200,000 users.

Figure 39 View of the website and Facebook profile of the New Energy for Łódź project

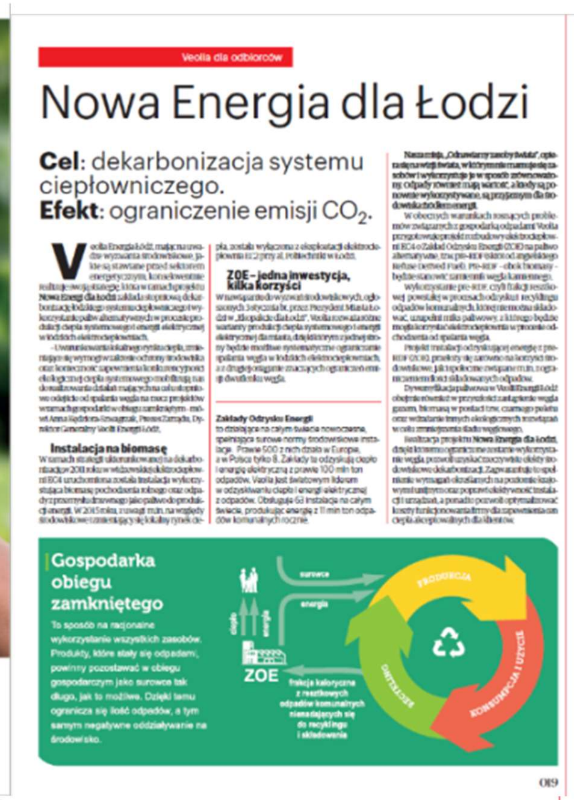
- teleconferences with social organizations and selected residents for preliminary diagnosis of possible causes of social conflicts and preparation of measures to reduce them. These contacts diagnosed the following possible conflicting issues: transport (analysis of traffic volume with no impact on the current situation), odor and disorder associated with waste (no landfill, use of pre-RDF fuel only), origin of waste (economic justification of the proximity principle and legal restrictions),
- environmental education activities: competitions of the Veolia Foundation and UNEP (http://zielonemiasto.online): Dzielnica Bioróżnorodności [Biodiversity District], Dobrze zapakowani [Well-packed], 6R in practice combined with bicycle walks with the Zielona Łódź [Green Łódź] Facebook profile (about 70 participants); the actions were promoted in the press, on the website and profile of New Energy for Łódź, on the Ecoportal of Łódź Municipal Office, on the Zielona Łódź [Green Łódź] profile,

Figure 40 Examples of Zielona Łódź Facebook stories of actions relating to environmental education

- speech by a representative of the Veolia Foundation at a citizen panel in connection with EkoPakt [Ecological Pact]
- speech by Veolia at TOGETAIR Climate Summit https://togetair.eu/

<u>Phase of further planned actions:</u>

- printed informational materials for residents,
- distribution of Veolia magazine co-produced with Polska Press.



Veolia dla odbiorców

Nowa Energia dla Łodzi

Cel: dekarbonizacja systemu ciepłowniczego.
Efekt: ograniczenie emisji CO_2.

ZOE – jedna inwestycja, kilka korzyści

Instalacja na biomasę

Zakłady Odzysku Energii

Veolia dla odbiorców

Skąd się bierze ciepło w naszych mieszkaniach i domach

Rozmowa

W miastach ogrzewanych z elektrociepłowni jakość powietrza jest lepsza

Wywiad z prof. Grzegorzem Wielgosińskim z Politechniki Łódzkiej o wyższości ciepła systemowego nad ciepłem lokalnym.

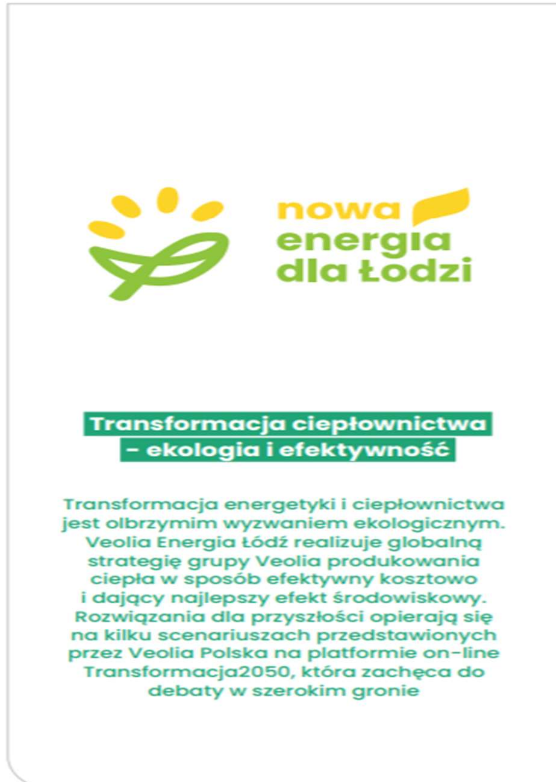
Prof. Grzegorz Wielgosiński

Rozbudowując sieć ciepłowniczą, eliminujemy źródła „niskiej emisji".

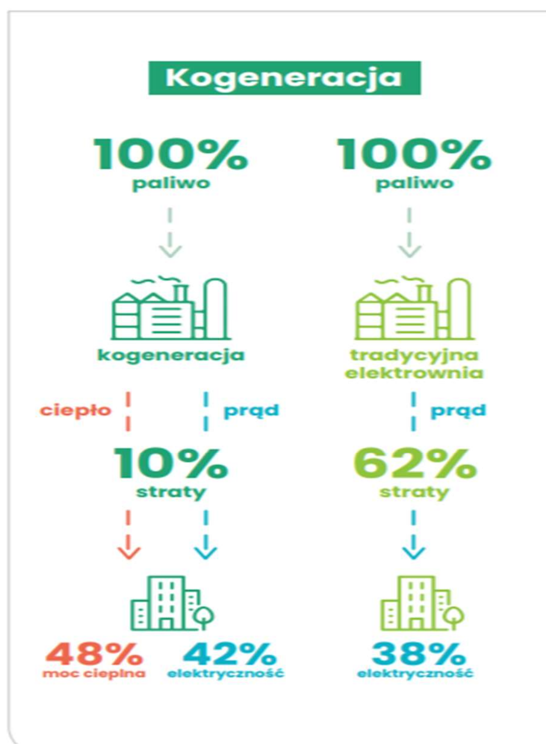
Figure 41 Veolia storage – Energy for the city

- publications and programs co-created with local media (topics relating to heat and electricity production, environmental issues and energy transformation in Poland, decarbonization of the Łódź district heating system),
- meetings with councilors of housing development councils – auxiliary units of the City of Łódź,
- leaflet,


Działamy
na rzecz
ekomiasta
nowa
energia
dla Łodzi
operated by
VEOLIA


nowa
energia
dla Łodzi
Transformacja ciepłownictwa
– ekologia i efektywność
Transformacja energetyki i ciepłownictwa
jest olbrzymim wyzwaniem ekologicznym.
Veolia Energia Łódź realizuje globalną
strategię grupy Veolia produkowania
ciepła w sposób efektywny kosztowo
i dający najlepszy efekt środowiskowy.
Rozwiązania dla przyszłości opierają się
na kilku scenariuszach przedstawionych
przez Veolia Polska na platformie on-line
Transformacja2050, która zachęca do
debaty w szerokim gronie


Po pierwsze
Efektywnie i systemowo
EC3
Łódź
EC4
Konstantynów
Łódzki
Veolia Energia Łódź wdraża zasadę efektywnego
wykorzystania zasobów i niemarnowania energii
poprzez kogenerację, czyli współprodukcję energii
i ciepła, która pozwala oszczędzić ok. 30% paliwa,
poprzez wymianę infrastruktury na taką, która po-
zwala unikać strat w przesyłaniu ciepła (ponad 90 km
nowej sieci). Kolejne budynki przyłączane są do tzw.
ciepła systemowego, dzięki czemu eliminowane są
szkodliwe emisje z pieców starej generacji, zarówno
u odbiorców indywidualnych jak i instytucjonalnych.
Zamykane są nieefektywne kotłownie węglowe
(np. kotłownia na Stokach) i zakłady (jak EC2).


Kogeneracja
100%
paliwo
100%
paliwo
kogeneracja
tradycyjna
elektrownia
ciepło
prąd
prąd
10%
straty
62%
straty
48%
moc cieplna
42%
elektryczność
38%
elektryczność

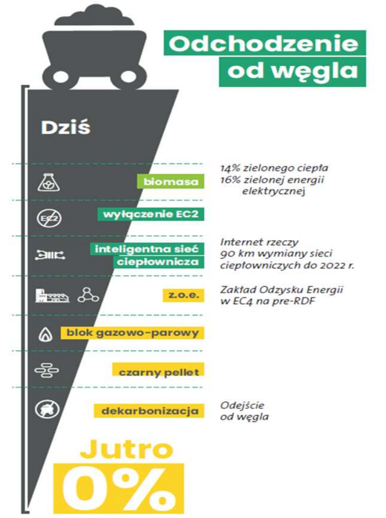
Veolia zapewniła również mieszkańcom konkretne narzędzia do monitorowania jakości powietrza. W 2019 roku wspólnie z firmą Airly, we współpracy ze spółdzielniami mieszkaniowymi, zainstalowała w Łodzi 20 czujników badających jakość powietrza. Kolejne będą instalowane już wkrótce, tym razem na obiektach użyteczności publicznej.

Do ciepła systemowego mogą być dołączane również tzw. **rozproszone źródła energii,** jak panele fotowoltaiczne instalowane przez spółdzielnie mieszkaniowe i instytucje miejskie. Takie rozwiązania są obecnie testowane przez Veolię.

Systemowe rozwiązanie pozwala efektywnie gospodarować ciepłem niezależnie od tego, gdzie powstaje, regulować jego dopływ w zależności od pogody czy potrzeb.

W fazie wdrażania jest telemetria czyli system zdalnego monitorowania i zarządzania ciepłem z udziałem odbiorców - zarządców budynków, przy wykorzystaniu tzw. Internetu Rzeczy (IoT). Jest nim objętych już ponad 70% łódzkich węzłów cieplnych. Monitorując je elektrociepłownia analizuje dane dotyczące temperatury, ciśnienia, przepływu i stanu sieci wykonanych w technologii rur preizolowanych. Dzięki telemetrii jest możliwość zdalnego odczytu liczników ciepła oraz zdalnego włączania i wyłączania centralnego ogrzewania. Klienci, przyłączeni do sieci ciepłowniczej Veolii, mają dostęp do danych za pomocą dedykowanej aplikacji.

Cyfryzacja i sztuczna inteligencja są przyszłością nowoczesnego ciepłownictwa.



biomasa – odnawialne źródło energii pochodzenia rolnego i pozostałości z przemysłu drzewnego

pre-RDF – nierecyklingowalne frakcje resztkowe z przetwarzania odpadów komunalnych

Po drugie
Odejście od węgla

Kluczowe dla ciepłownictwa jest dzisiaj odejście od węgla.

Veolia dochodzi do rozwiązań stopniowo wdrażając od 2009 r. strategię miksu paliwowego, w tym również ze źródeł odnawialnych. Już dziś dzięki zastosowaniu biomasy jako paliwa ok. 15% ciepła i energii dostarczanych przez Veolię Energia Łódź pochodzi z Odnawialnych Źródeł Energii. W kolejnych etapach planowane jest wdrożenie takich rozwiązań paliwowych jak Zakład Odzysku Energii z frakcji kalorycznej odpadów komunalnych po recyklingu, blok gazowo-parowy czy torefakt, czyli uszlachetniona biomasa. Kolejne etapy tego programu pozwolą całkowicie wyeliminować węgiel jako paliwo i zmniejszyć trzykrotnie emisję CO_2 do środowiska.

Do misji wdrażania ekologicznych rozwiązań Veolia podchodzi systemowo, kompleksowo i we współpartnerstwie.

Prace badawcze i wymiana doświadczeń w zakresie efektywnego gospodarowania energią i ciepłem realizowane są m.in. w ramach klastra Fala Energii, we współpracy z Politechniką Łódzką i Polską Akademią Nauk. Kolejne podmioty przystępują do klastra, ostatnio m.in. spółdzielnie mieszkaniowe, z którymi Veolia współpracuje również przy podnoszeniu efektywności energetycznej budynków.

gazowo-parowy – blok parowo-gazowy o mniejszej emisji zanieczyszczeń przy wyższej efektywności produkcji energii elektrycznej

czarny pellet – biomasa poddana procesowi uszlachetniania w celu uzyskania lepszych parametrów energetycznych

Dbamy o środowisko naturalne i zasoby

Dekarbonizujemy łódzki system ciepłowniczy

Wdrażamy rozwiązania systemowe

Współpracujemy z miastem, instytucjami, organizacjami i społecznością lokalną w celu wypracowania najlepszych rozwiązań

Działamy wspólnie

Prowadzimy działania edukacyjne i społeczne na rzecz ochrony klimatu i poprawy warunków życia w mieście

nowaenergiadlalodzi.pl

Veolia również włącza się w programy edukacji ekologicznej, sportowej, zdrowotnej online zarówno dla dzieci jak i dla seniorów.

Przykładem takich działań jest jest cykl „lekcji ciepła" online dla szkół, a także program „#ZzielonąEnergią dla Łodzi" realizowany przez Centrum UNEP/GRID oraz Fundację Veolia Polska pod Honorowym Patronatem Pani Prezydent Hanny Zdanowskiej. W ramach tego programu realizowane są obecnie trzy Konkursy: *„Dzielnica Bioróżnorodności", „Dobrze Zapakowani"* i *„6R w praktyce"*. Szczegóły tych akcji można znaleźć na platformie interaktywnej ZieloneMiasto.online. Veolia Energia Łódź jako producent i dostawca ciepła systemowego aktywnie wpisuje się w rozwój miasta. Jako jedna z pierwszych firm Veolia zadeklarowała aktywne włączenie się w EkoPakt dla Łodzi ogłoszony przez prezydent Miasta Łódź. Więcej informacji o działaniach Veolii Energia Łódź w ramach transformacji ciepłownictwa i podejmowaniu wyzwań ekologicznych na stronie nowaenergiadlalodzi.pl oraz na profilu facebookowym.

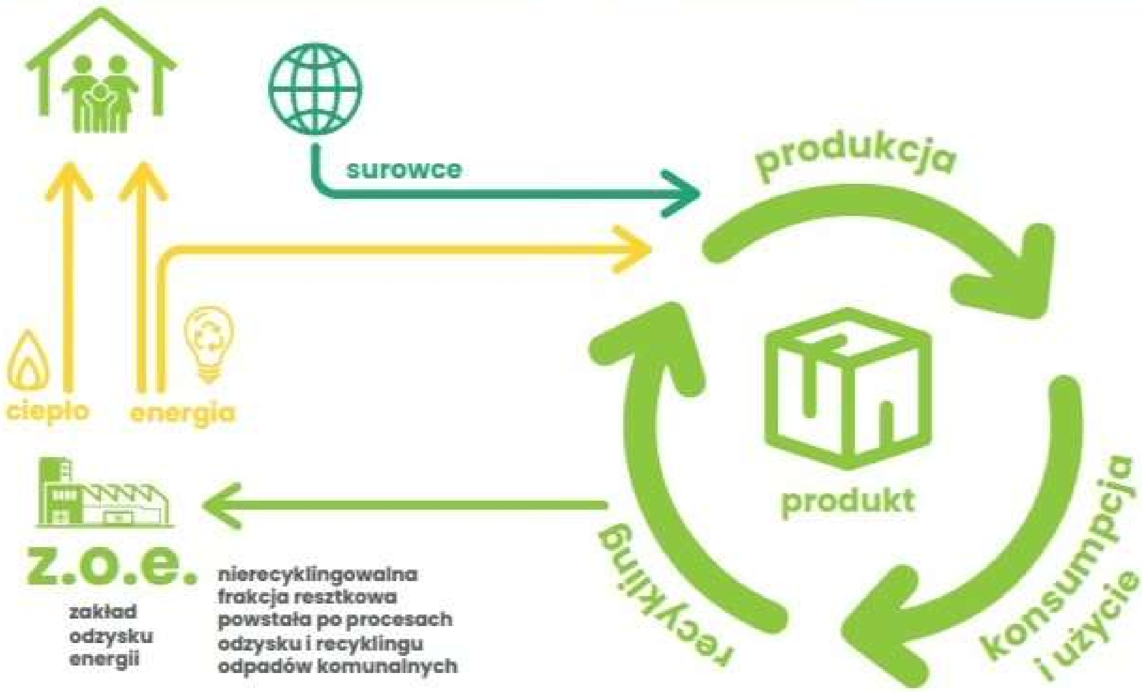
„Lekcje ciepła" z Czerwonym Kapturkiem

Gospodarka obiegu zamkniętego

Gospodarka obiegu zamkniętego to nie tylko dbałość o możliwie najmniejsze zużycie odnawialnych zasobów naturalnych, ale także sposób ich eksploatacji, zapewniający ich regenerację. Ten sposób myślenia musi przełożyć się na każdy etap życia produktów: od ich projektowania z wykorzystaniem wyłącznie materiałów, które mogą zostać ponownie użyte, poprzez produkcję opartą w jak największym stopniu o odnawialne źródła i zasoby, po konsumpcję szanującą środowisko i zagospodarowującą ponownie przetwarzane surowce.

Blok gazowo-parowy

W ramach projektu Nowa Energia dla Łodzi planowana jest również rozbudowa elektrociepłowni EC4 o nowoczesny blok gazowo-parowy (CCGT – Combined Cycle Gas Turbine) przewidziany do współpracy z akumulatorem ciepła. Emituje on znacznie mniej zanieczyszczeń niż blok oparty na węglu przy jednocześnie wyższej efektywności produkcji elektrycznej. Bloki takie charakteryzują się również niską awaryjnością połączoną z dużą dyspozycyjnością oraz dużą elastycznością w zakresie warunków pracy – w porównaniu do bloków węglowych.



Veolia Energia Łódź

Veolia Energia Łódź jest jednym z największych przedsiębiorstw energetycznych w Polsce, którego podstawową działalnością jest wytwarzanie ciepła systemowego i energii elektrycznej w kogeneracji oraz zarządzanie siecią ciepłowniczą w Polsce. Veolia Energia Łódź kontynuuje ponad 110-letnią historię łódzkiej energetyki, będąc uznanym partnerem miasta i wpisując się w rozwój jego infrastruktury. Spółka, realizując założenia polityki zrównoważonego rozwoju grupy, tworzy i wdraża innowacyjne rozwiązania efektywne energetycznie, optymalne dla środowiska i społeczności lokalnych.

Elektrociepłownia EC4

Nowa Energia dla Łodzi

Ideą programu Nowa Energia dla Łodzi realizowanego przez Veolia Energia Łódź jest całkowite odejście od węgla, a w efekcie poprawa jakości życia mieszkańców Łodzi dzięki zdrowszemu powietrzu.

Figure 42 Information leaflet No. 2 to be distributed at meetings

- cooperation with the City of Łodź on public consultations, possibly modeled on the online citizen panel model, preceded by a survey or poll,
- alternatively, the establishment of a Consultative Social Council,
- diagnosing areas of possible social compensation,
- Breeam certification for the WTE Plant,
- flexible response scenarios depending on the COVID situation,

close cooperation with specialists in the field of environmental protection science, including expert debates in the media.

15.3 Need for setting up a limited use area

In accordance with Article 135 Section 1 of the Environmental Protection Law, “if the environmental review or the environmental impact assessment required under the provisions of the Act of October 3, 2008 on access to information on the environment and its protection, public participation in environmental protection and on environmental impact assessments or the post-project analysis show that, despite the application of available technical, process and organizational solutions, the environmental quality standards outside the premises of the plant or other facility cannot be met, then a limited use area is created for a wastewater treatment plant, municipal waste landfill, composting plant, circulation route, airport, power line and substation, gas network facilities, as well as a radiocommunication, radionavigation and radiolocation systems.”

In addition, according to Article 135 section 6 of the Environmental Protection Law, a limited use area is also created for systems that require an integrated permit, other than those listed above, for which a building permit was issued before 1 October 2001, and whose use was commenced no later than 30 June 2003, if, despite the application of the best available techniques, the permissible noise levels outside the site cannot be met.

At the same time, Article 144 section 2 of the above-mentioned law says that the operation of a system causing the introduction of gases or dust into the air, noise emission and generation of electromagnetic fields shall not result in exceeding the environmental quality standards outside the site to which the system operator has legal title.

In the area of the City of Łódź, a limited use area has been established for the Collective Wastewater Treatment Plant of the Łódź Urban Agglomeration in Łódź due to the impossibility of meeting the environmental quality standards, despite the application of available technical, technological and organizational solutions; restrictions on land use resulting from the provisions of Regulation No. 6/2003 of the Łódź Voivode of August 22, 2003 are in force. In this area, i.a., there is a total prohibition of location of new facilities, as well as of the extension, construction of superstructures and reconstruction of facilities located in areas with noise protection functions or those relating to the conduct of business activities whose operation may increase the noise level in the environment or increase the extent of the depression cone in the area.

On the basis of the results of this document and, in particular, on the basis of the analyses of the conducted simulations of the propagation of noise and air pollutants, it can be concluded that there are no reasonable grounds for the creation of a limited use area. There is no risk of failure to meet environmental quality standards outside the plant.

16 IMPACT ON HUMAN HEALTH

16.1 Emissions to water

No hazards for surface and underground water is forecasted during the WTE Plant operation.

<u>The methods of surface water and groundwater protection during the implementation, operation and decommissioning phases of the project are described in chapter 12.2.3.</u>

16.2 Air emissions

The analysis shows that the operation of the plant under consideration will not pose a hazard to the environment (an thus to people) in terms of the impact of pollutant emissions on air quality.

The conducted calculations of pollutant propagation showed that the operation of the WTE Plant, taking into account the cumulative impact with the existing and designed emission sources of the EC-4 Combined Heat and Power Plant, will not result in exceeding the permissible levels of substances in the air as well as the reference values.

<u>The methods of air protection during the implementation, operation and decommissioning phases of the project are described in chapter 12.2.1.</u>

16.3 Noise emission

The analysis shows that the operation of the plant under consideration will not pose a hazard to the environment (an thus to people) in terms of the impact of noise emission.

The conducted pollutant propagation calculations showed that the operation of the WTE Plant, taking into account the cumulative impact with the existing and designed emission sources of the EC-4 Combined Heat and Power Plant, will not result in exceeding the acceptable noise levels in the environment.

<u>The methods of noise protection during the implementation, operation and decommissioning phases of the project are described in chapter 12.2.2.</u>

16.4 Increase in road traffic

When analyzing the propagation of noise and pollutants delivered to the air, it was found that at the construction stage, one of the main sources of the aforementioned pollutants will be related to traffic.

The operation of trucks will result in the delivery of harmful compounds to the air, originating from fuel combustion, such as nitrogen dioxide, sulfur dioxide, carbon monoxide, aliphatic hydrocarbons. These emissions will be local and variable at different periods of time. It is estimated that the highest intensity of works will take place during the first phase of the WTE Plant construction (about 30 months). As construction progresses, the intensity will decrease.

Therefore, the impact of the WTE Plant on atmospheric air during the implementation phase will not constitute a significant air nuisance, and will not cause changes in air pollution around the WTE Plant. Due to the local and variable nature of the impacts, the construction of the WTE Plant will also not pose a hazard to the life and health of nearby residents.

Road traffic will cause increased noise pollution in the area. At the operation stage, an increased traffic of trucks with a total number of approx. 50-60 trucks per day (transporting waste and related, among others, to slag, ash, urea) is assumed. Due to the industrial nature of the area and lack of Local Area Development Plan (MPZP), it is not assumed that the noise will be exceeded and that the residential development will be adversely affected.

<u>The methods of noise protection during the implementation, operation and decommissioning phases of the project are described in chapter 12.2.2.</u>

16.5 Electromagnetic radiation

The consequences of the hazard to the natural electromagnetic environment can be divided into two groups:

- in the low-frequency range: these hazards are associated with the effects of electromagnetic fields directly on electrochemical processes in cells,
- in the medium and high-frequency range and microwave radiation: the main hazard is associated with the thermal impact of this radiation on tissues and cells.

Such impacts were observed only under laboratory conditions, at extremely high electromagnetic field intensity – this applies in particular to low-frequency fields. The fields that were encountered at that time are not found in the natural environment, and can only be found in specialized scientific and research centers.

As shown by epidemiological studies to date, no direct effects of electromagnetic fields generated by high and extra-high voltage lines on the health and life of residents have been found so far. The normative values specified in the regulations, however, reflect concern for the population living in the vicinity of such facilities. Against the background of global regulations on limitations concerning field emissions and electromagnetic radiation, Polish regulations are characterized as those most restrictive.

Therefore, on the basis of available study results, it is concluded that the impact of the designed high-voltage power infrastructure on the health and life of the population will be negligible, will not contribute to the deterioration of their health.

16.6 Health and safety of employees

The WTE Plant employees will be bound by the plant regulations and OH&S rules that are adapted to the specificity of WTE Plant operation and ensure the safety of their work.

Hygienic assessment of working conditions is hampered by the variability and complexity of pollutants emitted during the thermal treatment process. The envisaged technological process will be significantly automated, which will reduce possible hazards to employees. The following risks to WTE Plant employees can be distinguished:

- Chemical agents and organic dust. Organic dust is characterized by high concentration in the waste delivery and waste storage bunker areas. Reducing the impact through negative pressure and limitation of the need for maintenance.
- Microbiological agents may be present in the hall where the combustion chamber and other equipment relating to the waste-to-energy process and the cleaning of gases generated in the process will be located. The following bacteria can be distinguished: Escherichia coli, Proteus mirabilis, Clostridium spp. or Actinomyces spp. There may also be numerous species of fungi that exhibit strong allergenic effects. At slag storage and collection areas, high hermetic sealing of technological processes is observed, which significantly reduces the hazard level.

In order to ensure adequate safety for employees, the best air cleaning technologies will be used and all standards will be followed to limit, as much as possible, the impact of the aforementioned factors on human health.

The OH&S issues are governed by separate regulations. In accordance with the Labor Code, the employer is obliged to assess and document the occupational risk associated with the work performed at each position and apply the necessary preventive measures to reduce this risk. In addition, the employer shall inform the employees about the occupational risk in the workplace and of the safety rules.

16.7 Economic prosperity

The prosperity is the degree to which a person feels happy or satisfied with their life. Its essential element is to assess the level of well-being resulting from the available economic, cultural, political and environmental conditions.

In a market economy, economic prosperity is achieved by meeting the following conditions:

- Stable economy and sustained existence of conditions for its long-term development,
- Ensuring conditions for economic growth,
- Implementation of the desired structural changes,
- Consideration of ecological boundaries in economic development,
- Making adjustments in the distribution of wealth.

Economic prosperity is one of the main determinants of health. Material resources result in improved health and increased life expectancy in the context of individuals, communities or countries. This is an indirect impact because, owing to a good financial standing, the public has the opportunity to increase financial expenditures on aspects of their lives that directly affect their health, including diet, availability of medical care, physical activity, and appropriate mental health care, adequate rest and care for the immediate environment.

The WTE Plant investment project can affect the prosperity to a varying degree.

The construction of the WTE Plant is associated with technological development in waste management at a voivodeship and national scale.

The investment project will involve the creation of new workplaces. The recipients of this profit will mainly be the surrounding municipalities.

It is assumed that mainly operation and plant maintenance personnel will work at the WTE Plant. The WTE Plant will operate continuously, in accordance with a mixed work system. People to maintain the plant will work in a balanced work system of 12 hours each on a 4-team basis, while the rest of the staff will be employed on an 8-hour basis. It is expected that the proportion of women in the staff will be about 20%.

Employment of people with disabilities will be possible at office positions.

The total number of persons planned to be employed is 44.

The investment project will also enable the development of other companies, as much of the tasks required to maintain the WTE Plant will be performed by external companies.

<u>The methods of protection of cultural assets and landscape values during the implementation, operation and decommissioning phases of the project are described in chapters 12.2.6 i 12.2.7.</u>

16.8 Social capital

Social capital is defined as all the social relations within a community. According to P. Bourdieu and R. Putnam, trust is the most essential attribute.

From the point of view of an average citizen, the WTE Plant is considered a project that causes deterioration of air quality and thus endangers health. The opinion was based on outdated technologies that are not used in today's plants. It should be remembered that this is not true – the plant will be environmentally friendly and it will generate energy and heat from precipitation, thus solving waste management problems.

<u>The methods of protection of cultural assets and landscape values during the implementation, operation and decommissioning phases of the project are described in chapters 12.2.6 i 12.2.7.</u>

16.9 Stress and well-being of residents

The current WTE Plants have incomparably smaller impact on the deterioration of air quality in the area than the plants using outdated technologies.

By using the current technologies and the best possible techniques, the disproportion between actual emissions and the opinion of residents will be huge.

For this reason, special attention should be paid to the risks associated with stress and the poor well-being of residents, rather than physical and chemical impacts.

In psychology, the most commonly cited definition of stress is that of R.S. Lazarus: Stress is a specific interaction between a person and the environment, which is assessed by the person as burdening or exceeding their resources and threatening their well-being.

We distinguish between two types of stress:

- Incidental – being an intense but short-term stressor
- Chronic – extending over longer periods of time

While low- to moderate-level stressors may not violate the homeostatic balance, prolonged or intense stressors may result in biological breakdown.

As long as there is no understanding or acceptance of the emerging investment project, residents in the surrounding areas will be subjected to chronic stress. According to the classic Lazarus theory, the key element determining the intensity of stress is cognitive appraisal. It proceeds in two stages:

- Primary appraisal – the process in which events are interpreted as threatening, challenging or beneficial.
- Secondary appraisal – the process of recognizing and assessing the extent to which resources enable an effective response to given events

The most common mistake made by the public, the media or even experts is to focus on easily identifiable hazards, such as health effects (emission of pollutants, toxicological hazards, etc.), instead of analyzing psychological and social consequences, which occur regardless of the actual impact of projects on the environment and human health. The consequences of this hazard may damage health in a manner comparable to actual exposure to chemicals (e.g. harmful dust emissions from landfills). Therefore, it is important to spend as much time and funds as possible to educate people about the real impacts of investment projects such as the WTE Plant. This task cannot be carried out by the Investor alone due to residents' fear of bias. State and local government authorities, due to the trust of the public, should also strive, to the greatest extent possible, to develop and educate the public about the real risks that may occur during the implementation of this type of investment projects.

The methods of protection of cultural assets and landscape values during the implementation, operation and decommissioning phases of the project are described in chapters 12.2.6 i 12.2.7.

16.10 Conclusions

Veolia Energia Łódź S.A. has been contributing to the improvement of air quality in the City of Łódź for many years, through the implementation of many environmental protection investment projects on the premises of its plants – caring for local residents.

The environmental protection equipment at the Company's disposal is retrofitted to adapt them to environmental requirements. The investment projects improving air quality in the recent years at the EC-4 Combined Heat and Power Plant comprise the retrofit of the flue gas desulfurization plant of K2 and K7 boilers, completed in 2015. In addition, a reduction in nitrogen oxide (NOx) emission was carried out by primary and secondary methods, and an electrostatic precipitator was retrofitted in 2017 in the K2 boiler. In 2018, the electrostatic precipitator for the BFB boiler (K3) was retrofitted, while the K6 boiler was retrofitted along with the electrostatic precipitator. In 2019–20 works were performed to further reduce nitrogen oxide emission by building catalytic converters on the flue gas lines of the K2 and K7 boilers.

Veolia Energia Łódź also carries out investment tasks in the field of improving air quality, energy efficiency and reducing low emission in the City of Łódź. Over the past 5 years (2015–2019), Veolia Energia Łódź replaced nearly 38 km of district heating networks. As of 2017, the replacement of district heating networks took place within the framework of the so-called ZIT Strategy (Integrated Territorial Investment Projects), concerning integrated measures for sustainable urban development. In the coming years, Veolia Energia Łódź plans to continue the replacement/retrofit of the network at a 43-kilometer section. The above-mentioned measures have a significant impact on improving the air quality in the City of Łódź and were therefore included in the Low Emission Management Plan for the City of Łódź, adopted by the City Council of Łódź, in the resolution of November 20, 2019.

In addition, Veolia Energia Łódź cooperates with the City of Łódź in the field of elimination of low emission sources as part of the “Mia100 kamienic” and downtown area revitalization projects. New city facilities, such as the Łódź Fabryczna train station and the city stadium at al. Piłsudskiego are also being connected to the Company's district heating network.

In addition, in 2019, Veolia Energia Łódź completed a project to install 20 Airly sensors to measure air quality in various parts of the City of Łódź. The sensors are located, i.a., in Łódź's housing cooperatives, in the vicinity of the EC-4 Combined Heat and Power Plant and the “Giewont” district heating plant. Sensor readings are available to Łódź residents through a website and via a phone application.

17 MONITORING PROPOSALS

17.1 Monitoring of impact at the project implementation stage

At the project implementation stage, records of waste generated during construction should be kept in accordance with the environmental decisions/policies obtained by the contractor.

17.2 Monitoring of impact at the project operation stage

In accordance with the *"Decision on environmental conditions of the implementation of the project involving the construction of the Waste-to-Energy Plant at ul. Jadzi Andrzejewskiej 5 in Łódź, on the plot with cadastral number 56/222, geodetic district W-32"* issued by the Mayor of the City of Łódź – decision No. 51/U/2010, letter No. OŚR.III.762/25/10 of June 28, 2010:

- The WTE Plant must be equipped with continuous monitoring of air emissions, allowing continuous viewing of current and archived process data by authorized institutions. Continuous measurements of the exhaust gas for the two waste-to-energy process line should be conducted for the following parameters:
    - total dust,
    - NO_x nitrogen compounds (converted to NO_2),
    - carbon monoxide,
    - hydrochloric acid,
    - fluoric acid,
    - organic substances in the form of gases and vapors, expressed as total organic carbon concentration,
    - mercury,
    - ammonia,
    - dust at the outlet of the slag valorization emitter,
    - oxygen,

- flue gas flow rate or flue gas dynamic pressure,
- flue gas temperature at the measuring cross-section,
- static flue gas pressure,
- humidity coefficient.

The plant will be equipped with continuous emissions monitoring system (CEMS) in accordance with the requirements of the BAT conclusions. The continuous emission monitoring system is described in detail in chapter 5.2.2.7.

- The WTE Plant should be equipped with full monitoring of process parameters and monitoring of waste gas emissions into the air. In the event of a failure, the process must be stopped and can only be restarted when the failure has been rectified.

The plant will be equipped with a monitoring and automatic distributed control system (DCS), which will be configured to meet the indicated requirements.

- Periodically, at least once every six months, measurements must be taken of flue gases for the content of the following: lead, chromium, copper, manganese, nickel, arsenic, cadmium, mercury, cobalt, tungsten, antimony, dioxins and furans.

The plant design includes locations to allow for sampling for periodic flue gas testing.

- The WTE Plant should be equipped with automatic monitoring of treated process wastewater at the point of its introduction into the sewerage system.

The WTE Plant will be equipped with automatic monitoring of treated process wastewater at the point of discharge into the sewerage system.

- The incineration process monitoring should be installed at the WTE Plant for at least the following parameters:

  a) temperature in the combustion chamber in the area after the last air supply, near the outer walls of the combustion chamber and at other representative places of the combustion chamber that will be indicated in the building permit,

  b) oxygen and water (steam) content in the flue gas,

  c) temperature and pressure of the flue gas stream.

The monitoring and automatic incineration distributed control system (DCS) will be configured to meet the indicated requirement.

- Monitoring of the amount of imported, thermally transformed and generated waste should be installed at the WTE Plant.

The facility will be equipped with monitoring of the quantity of imported, thermally transformed and generated waste in accordance with the requirements for BDO Waste Database maintenance.

- Water consumption monitoring should be installed at the WTE Plant by installing water meters on the municipal network.

Water intake will be monitored by installing water meters on the municipal network.

- Soil and groundwater quality monitoring should be installed at the WTE Plant based on approved hydrogeological documentation.

In accordance with "Hydrogeological documentation specifying hydrogeological conditions in the subsoil of the planned Waste to Energy Plant on the premises of Veolia Nowa Energia Sp. z o. o., at ul. J. Andrzejewskiej 5 in Łódź" prepared by GEOTEKO in June 2020, it was found appropriate to conduct groundwater monitoring for the Primary Aquifer. "Monitoring should include 3 test openings (piezometers) drilled to a depth of about 30.0 m, located at the periphery of the plot according to the following pattern: 1 opening at the inflow and 2 openings at the outflow of water.

Monitoring should be ensured during the project implementation period and at least 5 years after the project handover for operation. Sampling should be conducted once every six months (at the end of snowmelt and in late summer/early fall, before fall rains).

The scope of groundwater monitoring should include:

- physical indicators:

specific electrolytic conductivity (SEC), pH reaction, COD ($KMnO_4$).

- inorganic indicators:
- chlorides (Cl), sulfates (SO_4), bicarbonates (HCO_3), sodium (Na), potassium (K), magnesium (Mg), calcium (Ca), nitrate (NO_3), fluorides (F), phosphates (PO_4), ammonia (NH_4), nitrites (NO_2), iron (Fe), manganese (Mn).

- micro-elements:

lead (Pb), cadmium (Cd), zinc (Zn), chromium (Cr), cobalt (Co), boron (B), mercury (Hg),

- organic indicators:

TOC (total organic carbon), Total Petroleum Hydrocarbon (TPH), Adsorbable Organic Halides (AOX) (halogenated substances)".

As no signs of contamination were found in the soil samples tested (taken from two depths), it is not planned to install soil quality monitoring.

- Control measurements of noise levels in the environment must be carried out within three months after the plant is put into operation. The Investor is obliged to submit the results of these measurements to the competent environmental protection authority.

The investor confirms that within three months from the date of the plant handover for operation, it will perform control measurements of noise levels in the environment and that the results of these measurements will be submitted to the competent environmental protection authority.

In addition, pursuant to chapter X of the decision on environmental conditions, the Investor was obligated to carry out the post-execution analysis – within 12 months from the date of the WTE Plant handover for operation, in order to check the actual project's impact on the air condition, acoustic climate, condition of the groundwater environment, water and wastewater management, waste management. The analysis should be submitted to the Mayor of the City of Łódź within 18 months from the date of commissioning the facility.

This condition will be met, the Investor will carry out the post-execution analysis within 12 months from the date of handing over the WTE Plant for operation.

17.2.1 Monitoring of emissions to the air

The monitoring of emissions of pollutants into the air will be carried out on the basis of continuous and periodic measurements of emissions, which the operator of the plant in question shall perform in accordance with the Commission Implementing Decision (EU) 2019/2010 of November 12, 2019 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for waste incineration (notified under document C(2019) 7987) (OJ L 312, 3.12.2019) and the Regulation of the Minister of the Environment of October 30, 2014 on the requirements for emission measurements and measurements of the quantity of water consumed. The detailed scope of emission monitoring will be specified in an integrated permit.

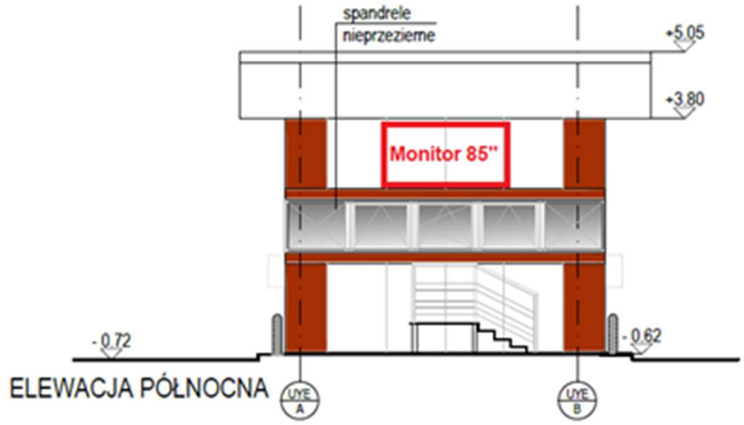
The results of emission size measurements will be reported to the competent environmental protection authorities and to the Provincial Inspector for Environmental Protection in accordance with the Regulation of the Minister of Environment of November 19, 2008 on types of results of the measurements performed regarding the operation of the plant or equipment and of other data, as well as time limits and methods of their presentation.

Moreover, information on the types and amounts of pollutants introduced into the air shall be provided to the competent authorities every year as part of reporting related to the calculation of environmental fees and in the form of annual reports entered into the National Center for Emissions Management (KOBiZE) database. The emission information will also be reported to the E-PRTR system, through which it will be subsequently made publicly available.

In addition, monitoring will consist in the ongoing inspection of the technical condition of the equipment and its proper maintenance.

The air quality level in the analyzed area shall be monitored by the services of the competent Voivodeship Inspectorate of Environmental Protection as part of the National Environmental Monitoring.

Digitalized data on emissions to air from the plant shall be presented on-line on an electronic information board located on the premises of the WTE Plant – on the gatehouse building (northern facade) – from the entrance to the premises of the WTE Plant. The board shall ensure good visibility of the displayed emission data – it shall be a 85” monitor suspended on the front facade of the WTE Plant gatehouse building.



PL	EN
Spandrele nieprzezierne	Opaque spandrels
Monitor 85”	85" screen
ELEWACJA PÓŁNOCNA	NORTHERN FACADE

Figure 43 Illustrative location of the display panel that will serve as an information board containing data on WTE Plant air emissions

17.2.2 Waste storage or dumping place control system

In accordance with the Regulation of the Minister of Environment of August 29, 2019 on the vision-based control system of the waste storage or disposal site, there **will be monitoring** (waste storage or landfilling place control system) at the WTE Plant, which will cover plants and facilities of major importance for the observations. These will be:

- The area around the WTE Plant fence,
- Gatehouse building,
- Control room building,
- Unloading hall building,
- Systems in the turbine hall building,
- Office and staff welfare building,
- Bunker building,
- Slag handling yards,

- Entry/exit from the plant premises,
- Parking area for vehicles in which hazardous materials are detected.

Central elements of the system (a rack with recorders) shall be located in the technical room (equipped with fixed fire-fighting equipment) in the administration building in accordance with the Ordinance of the Minister of the Environment of August 29, 2019 on the video control system of the waste storage or landfilling location.

18 DETERMINATION OF ASSUMPTIONS FOR RESCUE ARCHAEOLOGICAL SURVEYS AND THE PROGRAM OF SECURING EXISTING MONUMENTS

Assumptions for rescue archaeological surveys are determined only for roads that are projects always likely to have a significant impact on the environment, hence in the case of the present investment project there is no need to determine such assumptions.

In case of discovery of immovable or movable archaeological relics during earthworks, the Investor is obliged to immediately notify the appropriate monument protection services. During possible rescue archaeological surveys, all discovered historical objects and immovable objects, and cultural stratifications are subject to protection under the provisions of the Act of July 23, 2003 *on the protection and care of historical monuments*

19 DESCRIPTION OF DIFFICULTIES RESULTING FROM TECHNOLOGICAL DEFICIENCIES OR GAPS IN CURRENT KNOWLEDGE ENCOUNTERED WHEN PREPARING THE REPORT

During the preparation of this document, there were no difficulties that could be an obstacle to the preparation of a report for the purpose of reassessment of the project impact on the environment.

During the implementation of the submitted report, the team of authors used materials provided by the Investor, archival resources of many offices and institutions, as well as their own observations and experiences. No difficulties were encountered and no significant gaps were found in the materials or information provided or obtained.

The acquired knowledge concerning the investment project in question was sufficient to determine the expected environmental impacts at the stage of conducting the environmental impact reassessment which determines the obtaining of the building permit.

20 SUMMARY, RECOMMENDATIONS AND FINAL CONCLUSIONS

20.1 Compliance with the decision on environmental conditions

The table below was prepared on the basis of the conditions stipulated in the *"Decision on environmental conditions of the implementation of the project involving the construction of the Waste-to-Energy Plant at ul. Jadzi Andrzejewskiej 5 in Łódź, on the plot with cadastral number 56/222, geodetic district W-32"* issued by the Mayor of the City of Łódź – Decision No. 51/U/2010, letter ref. No. OŚR.III.7626/25/10 of June 28, 2010 in order to demonstrate compliance or deviation from the aforementioned decision.

Table 64 Compliance with the decision on environmental conditions

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
Project type and location		
5. Process residue management station consisting of: -(…) – the chemical stabilization and solidification system for ash and solid residues from the flue gas cleaning process, with a roofed storage yard.	Derogation	The stabilization systems implemented so far in Poland on the premises of the Waste to Energy Plant show low efficiency and availability. Moreover, the market lacks customers for processed stabilized ash. Undoubtedly, the transfer of ashes and solid residues from the flue gas cleaning process to specialized companies dealing with comprehensive neutralization of such waste will be safer, more reliable and more beneficial for the environment. Transport will be carried out using dedicated tankers, thus eliminating the risk of dust spreading during its transport. Loading will be carried out by means of a loading sleeve to tankers. The sleeve is first lowered from the stand-by position into the inlet port of the tanker. Once the bellows outlet cone is seated on the tanker inlet, a slack cable knuckle mounted outside the transmission box stops the bellows lowering. A limit switch in the transmission box stops both expansion and shortening of the bellows. Material loading begins when the hopper outlet valve is opened. During tanker loading, the polymer coating of the outlet cone acts as an ideal dust seal. The slack cable knuckle triggers further stretching of the bellows as the tanker settles as its weight increases. A level monitoring device installed in the center of the outlet cone signals the maximum level of material in the tanker chamber and commands the tank outlet valve to close. After about 10 seconds, the bellows begin to shorten and return to the standby position so that the external filter can extract the

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
		remaining dust. When the bellows are fully shortened, the cable limit switch in the transmission box stops the unit operation.
The water treatment plant will be equipped with a dosing station comprising: – sodium phosphate (V) (Na_3PO_4) dosing stand with a dosing pump injecting the preparation into the steam tank in order to control the boiler water pH value, – oxygen reducing agent (hydrazine or equivalent) dosing stand with a dosing pump injecting the preparation into the suction pipes of the feed water pumps.	Derogation	Hydrazine is no longer used as an oxygen reducing agent in new plants due to the fact that it is a strong carcinogen. Currently carbohydrazide is used e.g. Elimin-Ox, which is not a carcinogen. This substance will be an equivalent substance in accordance with the above-mentioned environmental decision.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
Conditions of the land use during the implementation and production phase with the particular consideration of the necessity concerning the natural value, natural resources, natural and built heritage conservation, as well as nuisance constrains for the neighboring areas		
Plan all construction work using construction equipment and machinery that – in accordance with the Regulation of the Minister of Economy of December 21, 2005 on the essential requirements for equipment used outdoors in terms of noise emission into the environment (Journal of Laws No. 263, item 2202) – are subject to requirements regarding the limitation of noise emission (bulldozer, dumper, excavator) or the indication of the guaranteed sound power level (winch, concrete mixer)	Compliance	The requirement will be included in the work method statement.
Use equipment in good working order	Compliance	The requirement will be included in the work method statement.
Limit the construction time to daytime only	Derogation	Noisy construction activities will be limited to daytime hours. However, it is allowed to perform works that are not a significant source of noise also at night. It should be noted that for the nearest noise protected areas – allotment gardens – only admissible noise levels for daytime apply. Carrying out such works shall not cause nuisance to people and animals.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
Organize the construction site and its facilities in such a way as to ensure soil protection, in particular by following the principle of minimizing the occupation of the site and transformation of its surface and the reclamation obligation	Compliance	The requirement will be included in the work method statement.
Protect the area from contamination caused by possible spills from vehicles, machinery and equipment.	Compliance	The requirement will be included in the work method statement.
Transport services should be assumed for the facility during the daytime between 6:00 a.m. and 4:00 p.m., max. 205 trips by vehicles with a load capacity >10 t	Compliance	Transport services will be provided between 6:00 a.m. and 4:00 p.m. The number of vehicles will not exceed 205. The approximate number of vehicles is expected to be: • 43 vehicles/day - waste collection • approx. 8 / day - slag disposal, • 5 transports / week on average Transport of process waste (boiler dust and solid waste from flue gas cleaning) • 1 vehicle / month - activated carbon transport • 2 vehicles / month – transport of $NaHCO_3$ (sodium bicarbonate) • 5 vehicles / year - transport of light fuel oil and diesel oil • 2 vehicles / month - transport of chemicals to WTP • 1 vehicle / year - industrial waste water transport • 3 vehicles / year - diesel fuel transport for loader
Water for the WTE Plant will be drawn from the municipal water supply system, in accordance with the conditions set by the system operator or fire water tank	Compliance	Compliance with the condition of the decision on environmental conditions – In accordance with the technical requirements issued for the connection to the municipal water supply and sewerage system of plot No. 56/222 at

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
		Andrzejewskiej street in Łódź – Waste-to-Energy Plant, ref. No.: WTT.424.1589.2020/W/SZ of June 24, 2020.
Rainwater and thaw water from paved areas should be collected in an internal sewage system and, after cleaning in a separator of oil-derivative substances and suspended solids, discharged to: – municipal rainwater drainage network, in accordance with the conditions specified by the administrator of this network, or – fire water tank	Compliance	The design provides for an internal sewer system that includes an oil and suspended solids separator. Pretreated water will be discharged to the external rainwater drainage system in accordance with the technical requirements issued for the connection to the municipal water supply and sewerage system of plot No. 56/222 at Andrzejewskiej street in Łódź – Waste-to-Energy Plant, ref. No.: WTT.424.1589.2020/W/SZ of June 24, 2020. In addition, rain gardens and a green roof have been designed to serve a retention function.
Sanitary sewage should be discharged to the municipal sanitary sewage system on terms and conditions determined by network administrator	Compliance	Sanitary wastewater will be discharged to the municipal sanitary sewerage network in accordance with the technical requirements issued for the connection to the municipal water supply and sewerage system of plot No. 56/222 at Andrzejewskiej street in Łódź – Waste-to-Energy Plant, ref. No.: WTT.424.1589.2020/W/SZ of June 24, 2020.
Industrial wastewater (from blowdown of boilers, cleaning of filters of the water treatment plant, washing of dirty surfaces of the unloading hall, process building, etc.) should be discharged to pretreatment in the separator of petroleum substances and suspensions, and then used for slag quenching	Compliance	• wastewater from the water treatment plant (from filter cleaning, from RO) will be directed to process water tank No. 2 and then used to make up losses in the slag trap, • blowdown and bottom blowdown from the atmospheric tank will be directed to process tank No. 1 and then used to produce demineralized water and/or to make up losses in the slag trap,

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
		• condensate from the sampling systems will be directed to process water tank No. 2 and then used to make up losses in the slag trap, • wastewater from the washing of the dirty surfaces of the unloading hall will be pretreated in the industrial wastewater pretreatment plant consisting of an oil/water separator and then it will be directed to process water tank No. 2, where it will be used to make up losses in the slag trap, • other process wastewater, i.e. condensate from the stack, drains from the incineration station, drains from the energy recovery station, drains from the flue gas cleaning plant, drains from the grate and cooling circuit of the energy generation segment and the slag trap will be directed to process water tank No. 2, where it will be used to make up losses in the slag trap.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
The Contractor should prepare a documentation determining hydrogeological conditions in the area of the designed plant, including in the area of the designed heating oil tank, and submit it for approval by the Mayor of the City of Łódź. The documentation should be prepared pursuant to the Act of February 4, 1994 – Geological and Mining Law (consolidated text: Journal of Laws of 2005 No. 228, item 1947, as amended). Based on the developed documentation, the need for piezometric borings to observe the state of the ground-water environment will be confirmed or eliminated.	Compliance	“Hydrogeological documentation specifying hydrogeological conditions in the subsoil of the planned Waste-to-Energy Plant on the premises of Veolia Nowa Energia Sp. z o.o., at ul. J. Andrzejewskiej 5 in Łódź” was prepared by GEOTEKO in June 2020.
Waste to be thermally treated, once delivered to the Waste to Energy Plant site, should be placed in a concrete bunker designed to provide storage of waste to allow the Waste to Energy Plant to operate for a minimum of three to a maximum of five days. The bunker should be equipped with thermal imaging cameras to monitor the temperature distribution inside of the bunker and with an automatic fire fighting system.	Compliance	The volume of the bunker was selected to meet the indicated requirements and is a maximum of 11,500 m^3. The project also includes thermal imaging cameras to monitor the temperature distribution inside of the bunker and an automatic fire fighting system.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
A detector for the detection of radioactive substances should be installed at the entrance of vehicles to the weighing bridge (scales) in order to eliminate radioactive substances from the waste stream sent for thermal treatment	Compliance	The project includes a facility of a dosimetry gate in place of truck weighing bridge (scales) to detect radioactive substances.
The bunker building and the unloading hall should be constructed as sealed rooms. An air extraction system must be installed in the bunker and the unloading hall to transfer the air to the combustion chamber in order to exclude the emission of odors from the bunker and the unloading hall.	Compliance	The bunker building and the unloading hall will be constructed as sealed rooms. They will be equipped with sealed gates to control traffic inside of the hall and the process of unloading waste from trucks into the bunker. It is planned in the project that during operation of the plant, the incineration (combustion) air fans will draw air from the bunker building and unloading hall, this way maintaining negative pressure, which will inhibit odor emissions.
A system to control and monitor odor levels should be installed in the bunker area and at the intermediate waste storage and pre-treatment (crushing) station.	Compliance	The plant will be equipped with an odor control and monitoring system.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
The Waste-to-Energy Plant should be equipped with two process lines, independent of each other. The ability to operate the WTE Plant should be ensured even if one of the process lines is shut down. Continuous operation of the plant (24/7) with a maximum capacity of 200,000 Mg/year and a net calorific value of 8.5 MJ/kg should be ensured.	Compliance	The plant will be equipped with two independent process lines. It will be possible to operate one while shutting down the other. Continuous process operation will be available 24 hours a day for 7 days a week. Act of December 14, 2012 on waste (Journal of Laws of 2013 item 21) in Article 158 section 3 prohibits the transfer of non-segregated (mixed) municipal waste for thermal treatment as of June 30, 2021. Therefore, the WTE Plant is currently planning to use mainly RDF and pre-RDF, which have a high calorific value. For the WTE Plant, the specified heating value at the nominal point will be 12.5 MJ/kg.
The WTE Plant should be designed, constructed and operated in a manner ensuring that the controlled temperature of the flue gas stream mixed uniformly with air equals at least 850°C in least favorable operational conditions of the plant in the zone downstream the last air supply vent to the combustion chamber and the time of flue gas presence at such temperature is at least 2 seconds.	Compliance	The plant will be designed, constructed and operated to meet the indicated condition.
At least one auxiliary burner should be used in each of the incineration (combustion) process lines, making it possible to keep a minimum temperature of 850°C for the flue gas stream in the zone above the last air supply to the incineration (combustion) chamber.	Compliance	Each process line will be equipped with at least one auxiliary burner.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
During the shutdown, the temperature above the required minimum temperature of 850°C must be maintained at representative points of the incineration (combustion) chamber by means of an auxiliary burner as long as there is still untreated waste in the incineration (combustion) chamber.	Compliance	During operation, appropriate operating procedures will be implemented to meet this requirement.
The WTE Plant should be equipped with a system of process monitoring and automatic control of the incineration process so that it is possible to block the feeding of waste to the incineration (combustion) chambers if:(a) the temperature at the representative points of the incineration (combustion) chamber during the plant start-up fails to reach the required minimum of 850°C,b) when the temperature at the representative points of the combustion chamber drops below the required minimum value of 850°C,(c) if the emission monitoring system detects that the admissible level of emission into air of at least one pollutant subject to monitoring is exceeded.	Compliance	The monitoring and automatic incineration distributed control system (DCS) will be configured to meet the indicated requirement.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
The system should enable preheating of air in the situation when wet and low calorific value waste is incinerated. Air should be heated by heat exchangers supplied in steam drawn from the turbine bleed or by a pressure regulator directly from the fresh steam manifold.	Compliance	The system will be equipped with air heaters.

The grate furnace section integrated with the heat recovery steam generator must consist of the following units: a waste hopper, mechanism for dosing sludge onto the grate, incineration (combustion) zone, waste after-combustion zone, waste flow guide vanes in radiant-type passes, slag quenching and removing duct, primary and secondary air supply (recirculation flue gas) duct, passing through the grate, fly ash discharge units. In addition, the WTE Plant must have: a) a modular structure of the grate surface with unified dimensional series (length and width), with the possibility of independently controlling each individual grate surface segment – arranged consecutively along the grate, with respect to the movement direction of the waste incinerated on the grate, b) a primary air supply introduced tangentially or perpendicularly to the waste layer on the grate, c) control of the amount of air fed into the respective sections of the grate, depending on the instantaneous changes in the combustion process, d) control of combusted waste movement speed at the individual sections along the grate surface,e) control of the position of the maximum waste incineration zone on the grate (along the grate and transverse to the movement of the waste combusted on the grate) in order to optimally "place" it in relation to the first line of the heat recovery steam generator.	Derogation	Air drawn from the bunker hall or boiler hall is used as secondary air in the grate boilers, which is a common solution for the grate technology. Indicating the requirement to use flue gas recirculation for the needs of secondary air is irrelevant from the point of view of the environmental impact. Flue gas recirculation is no longer used. A more common solution is a separate fan of air drawn from the bunker for the needs of secondary air.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
The WTE Plant is to ensure that the waste is incinerated in such a way that the content of organic parts in the solid products of the combustion process (slag and ash), as determined by the amount of total organic carbon (TOC) or by loss on ignition, does not exceed 3% or 5%, respectively, of the dry weight of these combustion products.	Compliance	The plant will be designed and operated in such a way that the TOC organic carbon content does not exceed the values indicated in the decision and BAT conclusions.

The WTE Plant will be made in the process variant based on the semi-dry flue gas cleaning method.	Derogation	A dry method for flue gas cleaning using $NaHCO_3$ (sodium bicarbonate) and activated carbon is proposed. Currently, the dry method has been significantly developed and is very effective and preferred by technology suppliers. This is a proven, widely used solution. On the other hand, the semi-dry method is known to cause significant operational problems. The finished limestone powder solution very often clogs the lines that transport this reacting substance. This has a negative impact on the correct operation of the flue gas cleaning system as well as on the availability of the entire plant. Therefore, using the dry method, in which such problems do not occur, is a significantly better solution. Sodium bicarbonate $NaHCO_3$ will be used as the reacting substance. Currently, the preferred method is a dry method that meets BAT requirements: – reduction of metals and metalloids – BAT point 1.5.2.1 – HCL, HF and SO_2 reduction – point 1.5.2.2 – reduction of organic compounds emission – point 1.5.2.4 – reduction of mercury emission – point 1.5.2.5 Compliance with BAT is described in detail in Chapter 14 of this report.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
The WTE Plant treatment assembly segment system should be equipped with: a) a flue gas dedusting unit with fabric filter with efficiency not less than 98%, b) a unit for reduction of acidic inorganic components of the flue gas pollutants, c) a unit for reduction of emissions of heavy metal compounds in the form of gases and dusts, d) a DeNOx nitrogen oxide reduction unit (SNCR methods),e) a dioxin and furan reduction unit.	Compliance	The following flue gas cleaning systems will be used for the Waste to Energy Plant (WTE Plant): • flue gas desulfurization using the dry method with the use of sodium bicarbonate $NaHCO_3$ to reduce acidic compounds of SO_2, HF, HCl, dust, combined with the stream and dust method using activated carbon to reduce heavy metals, dioxins and furans; • • flue gas dedusting using a fabric filter. Dedusting efficiency of 99.8%; • denitrification of flue gases by primary and secondary SNCR methods using solid carbamide solution to reduce NOx emissions.
The flue gas system – from the grate firebox to the exhaust fan downstream of the last flue gas cleaning stage – must be operated under negative pressure so that the flue gases cannot escape in case of leakage.	Compliance	Each process line will be equipped with its own exhaust fan (ID fan).

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
Pollutants from waste incineration in the WTE Plant should be discharged via an emitting device with the following parameters: – stack material – steel stack, thermally insulated, – stack outlet height – 60 m above the ground level, – stack outlet diameter – 2.1 m, – type of outlet – vertical, unroofed, – flue gas temperature at the stack outlet – 433 K, – flue gas volume at the stack outlet – 199,000 m^3/h, – flue gas outlet velocity – 16 m/s.	Derogation	As presented in the calculations of pollutant emissions during the operation stage, a 50 m stack is sufficient. The least favorable operating conditions of the plant were assumed for the calculations, i.e.: – flue gas temperature at the stack outlet – 397 K; – the highest possible flow rate of flue gas from a single process line (90,000 m^3u/h – dry flue gas at oxygen content of 11% – reference conditions). For process reasons, the stack should be equipped with two ducts (separate for each process line) with a diameter of 1.5 m each, in order to ensure appropriate conditions for the process and for the correct settlement of the pollutants emitted to the atmosphere.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
Slag resulting from thermal waste treatment at WTE Plant should be treated and seasoned (in a valorization plant) at the Municipal Waste to Energy Plant in Łódź. The slag valorization process should be conducted in halls or buildings, and the slag maturation process should be conducted in storage yards that are covered and bounded by walls with a hardened surface	Compliance	The plant design includes a facility for slag crushing, ferrous and non-ferrous metal separation and space for slag seasoning.
Post-process hazardous waste generated in the WTE Plant, such as: fly ash and solid waste from flue gas cleaning, should undergo the process of solidification and chemical stabilization in the WTE Plant in Łódź. The processes of solidification and chemical treatment of post-process waste shall be carried out in a building with a paved base, preventing the penetration of substances into the ground and water. Then, the waste shall be transported to the storage yard. Before transport to the storage yard, the waste should be stored in silos.	Derogation	The stabilization systems implemented so far in Poland on the premises of the Waste to Energy Plant show low efficiency and availability. Moreover, the market lacks customers for processed stabilized ash. Undoubtedly, the transfer of ashes and solid residues from the flue gas cleaning process to specialized companies dealing with comprehensive neutralization of such waste will be safer, more reliable and more beneficial for the environment. Transport will be carried out using dedicated tankers, thus eliminating the risk of dust spreading during its transport. Loading will be carried out by means of a loading sleeve to tankers. The sleeve is first lowered from the stand-by position into the inlet port of the tanker. Once the bellows outlet cone is seated on the tanker inlet, a slack cable knuckle mounted outside the transmission box stops the bellows lowering. A limit switch in the transmission box stops both expansion and shortening of the bellows. Material loading begins when the hopper outlet valve is opened. During tanker loading, the polymer coating of the

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
		outlet cone acts as an ideal dust seal. The slack cable knuckle triggers further stretching of the bellows as the tanker settles as its weight increases. A level monitoring device installed in the center of the outlet cone signals the maximum level of material in the tanker chamber and commands the tank outlet valve to close. After about 10 seconds, the bellows begin to shorten and return to the standby position so that the external filter can extract the remaining dust. When the bellows are fully shortened, the cable limit switch in the transmission box stops the unit operation.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
When operating the WTE Plant, there is an obligation, under the provisions of the Waste Act of April 27, 2001 (consolidated text: Journal of Laws of 2007, No. 39, item 251, as amended) to: – provide separate collection of waste generated as a result of the facility operation, – temporarily collect waste in a manner safe for people and the environment, - transfer waste only to licensed waste collectors, who have a permit for managing the received waste, – obtain a permit for waste generation.	Compliance	The construction of a shelter on the WTE Plant site to store waste generated as a result of the plant operation is planned. Waste will be sorted, temporarily collected in a manner safe for people and the environment, transferred only to licensed collectors and a waste generation permit will be obtained in accordance with the applicable regulations.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
All hazardous substance tanks and storage areas on the WTE Plant site should be secured and ventilated, and marked in accordance with applicable requirements. Tanks should be seated on suitable "trays" capable of holding the entire contents of the tank in the event of a leak. Appropriate equipment and neutralizing substances should be located in the vicinity of the storage facilities for hazardous substances in accordance with fire protection regulations. The method of filling and emptying tanks intended for the storage of hazardous substances should ensure the hermetic seal of the handling and distribution processes, which will eliminate the possibility of environmental contamination.	Compliance	The project provides the solutions indicated in this condition of the environmental decision.
Fuel oil for start-up and auxiliary burners should be stored in a sealed tank with a capacity sufficient to provide a reserve of fuel oil for one start-up and to support the thermal waste treatment process for at least 24 hours.	Compliance	The design anticipates a light fuel oil system along with a sealed tank and pumping station.
Drainage of excavations should be carried out by means of wellpoints or dewatering wells.	Compliance	The project provides the solutions indicated in this condition of the environmental decision.
Requirements regarding environmental protection necessary to be taken into account in the building permit design		

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
It is recommended to use external noise barrier (envelope) components in enclosed structures with the following isolation values: – in the unloading hall with insulation value of >25 dB; A noise level will not exceed 80 dB, – in the combustion building with insulation value of >25 dB; A noise level will not exceed 85 dB, – in the waste bunker with insulation value of >30 dB; A noise level will not exceed 80 dB, – in the technical building with insulation value of >25 dB; A noise level will not exceed 96 dB, – in the waste solidification building with insulation value of >25 dB, A noise level will not exceed 80 dB, – in the slag valorization building with insulation value of >25 dB; A noise level will not exceed 90 dB.	Compliance	The noise barrier (envelope) components were designed using sandwich panels that meet the requirements of the decision on environmental conditions. The issue is described in detail in point 6.3 of Appendix No. 2 to the report. It should be noted that: the design abandoned the solidification building.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
Equipment that is an outdoor noise source should not exceed the following sound power levels: – steam condenser to be installed at the height of 14 m – sound power level Lwa = <106 dB, – other external sources of noise (ventilation system of enclosed structures, belt conveyors) – the sound power level will not exceed 65 dB.	Compliance	The height at which the condenser will be installed needs clarification. The stated height of 14 m is an incorrect value. Such equipment is a steel structure placed on a foundation. Air fans, which are a source of noise, are usually installed at a level of about 8 m. However, the entire structure will be approximately 21 m high. The acoustic model assumes fans with a total sound power of 102 dBA mounted at a height of 7.5 m according to the data sheet obtained from the potential equipment supplier.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
Along the northern plot boundary where the plant will be located an acoustic barrier must be constructed with a minimum height of 2 m and acoustic properties ensuring acoustic protection, as required by law, of the area of employee allotment gardens adjacent to the WTE Plant. The applied solution should be approved by the Research Institute of Roads and Bridges and the acoustic barrier design should be submitted to the Mayor of the City of Łódź for approval.	Compliance	The design anticipates the installation of an acoustic barrier along the northern plot boundary. The barrier will consist of 8 m, 5 m and 2 m high sections. The barriers shall feature the insulation class B3 (PN-EN-1793-2) and the absorption class A4 (PN-EN-1793-1).
The conditions and method of management of earth masses removed or relocated in the process of the investment project's construction should be specified, taking into account soil and ground quality standards.	Compliance	The requirement will be included in the work method statement. The manner of managing earth masses removed or relocated at the stage of the investment project implementation stage will be in accordance with the regulations in force – having regard to the Waste Act, which excludes from the provisions of this Act – *non-contaminated soil and other naturally occurring materials excavated during the construction works, provided that the material will be used for construction purposes in its natural condition in the area where it was excavated.* Construction works will be performed in accordance with the applicable regulations.
The approved hydrogeological documentation should be submitted to the Mayor of the City of Łódź.	Compliance	The documentation will be submitted with the WTE Plant Building Permit application.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
Documentation related to the survey of groundwater conditions should be attached.	Compliance	The documentation will be submitted with the WTE Plant Building Permit application.
Geoengineering documentation specifying geotechnical conditions for the foundation of civil structures should be prepared and attached to the application for the issue of a building permit	Compliance	The documentation will be submitted with the WTE Plant Building Permit application.
At the combustion line, an activated carbon silo (expected capacity of 50 m^3) shall be designed with a filter installed on a vent, with a minimum dedusting efficiency of 99.9%.	Compliance	The design anticipates the installation of an activated carbon silo, which will be equipped with a filter.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
At the incineration line, a burnt lime silo (expected capacity of 160 m^3) should be designed with a filter installed on a vent, with a minimum dedusting efficiency of 99.9%.	Derogation	A dry method for flue gas cleaning using sodium bicarbonate $NaHCO_3$ and activated carbon is proposed. Currently, the dry method has been significantly developed and is very effective and preferred by technology suppliers. This is a proven, widely used solution. On the other hand, the semi-dry method is known to cause significant operational problems. The finished limestone powder solution very often clogs the lines that transport this reacting substance. This has a negative impact on the correct operation of the flue gas cleaning system as well as on the availability of the entire plant. Therefore, using the dry method, in which such problems do not occur, is a significantly better solution. The dry method using sodium bicarbonate $NaHCO_3$ will be used in this project because of its environmental benefits.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
A cement silo (expected capacity of 120 m^3) with a filter installed on a vent, with a minimum dedusting efficiency of 99.9% should be designed in the post-process waste solidification and stabilization system.	Derogation	The stabilization systems implemented so far in Poland on the premises of the Waste to Energy Plant show low efficiency and availability. Moreover, the market lacks customers for processed stabilized ash. Undoubtedly, the transfer of ashes and solid residues from the flue gas cleaning process to specialized companies dealing with comprehensive neutralization of such waste will be safer, more reliable and more beneficial for the environment.
A process residue silo (expected capacity of 100 m^3) with a filter installed on a vent, with a minimum dedusting efficiency of 99.9% should be designed in the post-process waste solidification and stabilization system.	Derogation	The stabilization systems implemented so far in Poland on the premises of the Waste to Energy Plant show low efficiency and availability. Moreover, the market lacks customers for processed stabilized ash. Undoubtedly, the transfer of ashes and solid residues from the flue gas cleaning process to specialized companies dealing with comprehensive neutralization of such waste will be safer, more reliable and more beneficial for the environment.
The storage tank for reacting substances used in the flue gas cleaning system should be equipped with filters on the vents.	Compliance	The design anticipates the installation of filters on the vents of the reacting substance storage tanks.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
Prevention, limitation and monitoring of the investment project's environmental impact		
The waste bunker should be divided into sections which – in case of autoignition of the stored waste prior to its feeding onto the boiler grate – will limit fire transfer from one section to the other.	Derogation	Resignation from the division of the bunker into sections is justified by the benefits described below: – automatic fire extinguishing systems are designed to extinguish entire bunkers; this is a solution commonly used in many waste-to-energy plants in Europe and worldwide, – without a partition, waste can be stored more easily and properly mixed for homogenization and self-ignition prevention.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
To protect against the potential danger of autoignition of waste stored in the bunker, appropriate protections in the form of a two-stage lock of the bunker space should be used. Additionally, digital thermal imaging cameras should be installed in the bunker ceiling to monitor the surface of the waste layer in the bunker. It is advisable to install an automatic extinguishing system in the bunker that, when activated, can cover the surface of the stored waste with a layer of foam	Compliance	The bunker space will be equipped with a detection system using thermal imaging cameras conducting continuous temperature analysis of the waste stack and water and foam cannons. The water and foam cannons will be activated automatically by a signal from the fire alarm system initiated by thermal imaging detection system at an early stage of a waste fire. There will also be a possibility of manual control of the water and foam cannons from the control room with the overhead crane operator stations.
The unloading hall should also be equipped with fire extinguishing systems, i.e. fire dampers cutting off the air supply to the hall.	Compliance	The design anticipates fire dampers to cut off the air supply to the unloading hall.
The WTE Plant should be equipped with early fire detection and notification system in case of fire.	Compliance	The WTE Plant will be equipped with early fire detection and notification system in the event of a fire.
The WTE Plant should be equipped with a power generating unit (diesel generator set), which will be an emergency power source for the plant, securing the supply of electricity in case of a power grid failure.	Compliance	The design anticipates the installation of a power generating unit (diesel generator set) to provide emergency power to the plant.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
The WTE Plant should be provided with a cooling unit, the purpose of which is an emergency take-off of heat generated by the power generating unit (separating plate heat exchanger), activated in a situation when the heat take-off by the hot water system does not work or when it is insufficient.	Compliance	In accordance with the provisions of the Decision in point I, sub-point 3. The energy recovery station will be equipped with an extraction and condensing turbine.When emergency heat take-off is required, it is more appropriate to block the steam flow to the DH exchangers and direct the entire steam flow from the turbine to the air condenser.The design anticipates the installation of an air condenser.
The WTE Plant should be equipped with full monitoring of process parameters and monitoring of waste gas emissions into the air. In the event of a failure, the process must be stopped and can only be restarted when the failure has been rectified.	Compliance	The plant will be equipped with a monitoring and automatic distributed control system (DCS), which will be configured to meet the indicated requirements.
The WTE Plant should be equipped with two independent process lines. Each process line must enable the entire process to be carried out.	Compliance	The plant will have two independent process lines that can operate independently.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
The WTE Plant should be equipped with a sewage system equipped with a buffer (septic) tank with a capacity of 50 m^3. Fire water run-off that may be produced during fire fighting operations in the facility area will be discharged to that tank. The tank is intended to protect the facility's rain water and sanitary drainage system from the inflow of fire water run-off.	Compliance	The WTE Plant will be equipped with a sewage system and a buffer (septic) tank with a capacity of 50 m^3. Fire water run-off that may be produced during fire fighting operations will be discharged to that tank.
Wastewater collected in the buffer tank must be transported from the collection site to a collection point by an entity authorized to dispose of wastewater.	Compliance	Wastewater collected in the buffer tank will be transported from the collection site to a collection point by an entity authorized to dispose of wastewater.
Municipal waste may not be stored on the WTE Plant site in areas other than the waste bunker.	Compliance	As the main fuel, the WTE Plant system will use shredded residual fraction waste, the so-called RDF / pre-RDF, which are assigned waste codes 19 12 10 and 19 12 12, respectively, in accordance with the Regulation of the Minister of Climate of January 2, 2020 on the waste catalog (Journal of Laws of 2020, item 10). Additionally, the WTE Plant will be allowed to thermally treat waste with codes 19 12 08 (textiles), 19 12 07 (wood other than that mentioned in 19 12 06), 19 12 04 (plastic and rubber) and 19 12 01 (paper and cardboard).

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
In case of failure of the WTE Plant thermal treatment line or if the moat is full to the extent preventing delivery of subsequent batches of municipal waste, waste should be transported to other plants within the waste management system.	Compliance	Appropriate procedures will be implemented during the operational stage to meet this requirement.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
The WTE Plant must be equipped with continuous monitoring of air emissions, allowing continuous viewing of current and archived process data by authorized institutions. Continuous measurements of the exhaust gas for the two waste-to-energy process line should be conducted for the following parameters: – total dust – nitrogen compounds NO_x (expressed as NO_2), – carbon monoxide,– sulfur dioxide,– hydrochloric acid, – fluoric acid,- organic substances in the form of gases and vapors, expressed as total organic carbon concentration, – oxygen – flue gas flow rate or flue gas dynamic pressure,– flue gas temperature or flue gas dynamic pressure, – flue gas temperature at the measurement section, - specific humidity.	Compliance	The plant will be equipped with continuous emissions monitoring system (CEMS) in accordance with the requirements of the BAT conclusions.
Periodically, at least once every six months, measurements must be taken of flue gases for the content of the following: lead, chromium, copper, manganese, nickel, arsenic, cadmium, mercury, cobalt, tungsten, antimony, dioxins and furans.	Compliance	The plant design includes locations to allow for sampling for periodic flue gas testing. According to the new BAT conclusions (BAT 4), mercury emissions from waste incineration will be measured continuously.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
The WTE Plant should be equipped with automatic monitoring of treated process wastewater at the point of its introduction into the sewerage system.	Compliance	The WTE Plant will be equipped with automatic monitoring of treated process wastewater at the point of discharge into the sewerage system.
The incineration process monitoring should be installed at the WTE Plant for at least the following parameters: a) temperature in the combustion chamber in the area after the last air supply, near the outer walls of the combustion chamber and at other representative places of the combustion chamber that will be indicated in the building permit, b) oxygen and water (steam) content in the flue gas, c) temperature and pressure of the flue gas stream.	Compliance	The monitoring and automatic incineration distributed control system (DCS) will be configured to meet the indicated requirement.
Monitoring of the amount of imported, thermally transformed and generated waste should be installed at the WTE Plant.	Compliance	The plant will be equipped with monitoring of the quantity of delivered, thermally processed and generated waste in accordance with the requirements for BDO Waste Management Database maintenance, pursuant to the Regulation of the Minister of Climate of June 10, 2020, on the operation of the Database on products and packaging and waste management (Journal of Laws of 2020, item 1071)
Water consumption monitoring should be installed at the WTE Plant by installing water meters on the municipal network.	Compliance	Water intake will be monitored by installing a water meter on the water supply connection.

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
Optimal transport of waste through the city of Łódź in terms of environmental nuisance should be ensured.	Compliance	Appropriate procedures will be implemented during the operational stage to meet this requirement. It should be emphasized that as indicated in the analysis "Assessment of the impact of the planned project on atmospheric air (...) the number of trucks entering and leaving the area of the designed WTE Plant will be approximately 54 trucks/day. Assuming that that traffic would occur between 6 a.m. and 4 p.m. (10 hours/day), the average hourly traffic volume would be 5.4 vehicles/hour. Therefore, it should be concluded that the increase in traffic volume will not be significant.
Soil and groundwater quality monitoring should be installed at the WTE Plant based on approved hydrogeological documentation.	Compliance	In accordance with "Hydrogeological documentation specifying hydrogeological conditions in the subsoil of the planned Waste to Energy Plant on the premises of Veolia Nowa Energia Sp. z o. o., at ul. J. Andrzejewskiej 5 in Łódź" prepared by GEOTEKO in June 2020, it was found appropriate to conduct groundwater monitoring for the Primary Aquifer. "Monitoring should include 3 test openings (piezometers) drilled to a depth of about 30.0 m, located at the periphery of the plot according to the following pattern: 1 opening at the inflow and 2 openings at the outflow of water. Monitoring should be ensured during the project implementation period and at least 5 years after the project handover for operation. Sampling should be conducted once every six months (at the end of snowmelt and in late summer/early fall, before fall rains). The scope of groundwater monitoring should include: • physical indicators: electrolytic conductivity, pH reaction, COD ($KMnO_4$), • inorganic indicators:

Conditions resulting from the decision on environmental conditions	Compatibility/Deviation	Justification
		chlorides (Cl), sulfates (SO_4), bicarbonates (HCO_3), sodium (Na), potassium (K), magnesium (Mg), calcium (Ca), nitrates (NO_3), fluorides (F), phosphates (PO_4), ammonia (NH_4), nitrites (NO_2), iron (Fe), manganese (Mn), micro-elements: lead (Pb), cadmium (Cd), zinc (Zn), chromium (Cr), cobalt (Co), boron (B), mercury (Hg), • organic indicators: TOC (total organic carbon), Total Petroleum Hydrocarbon (TPH), Adsorbable Organic Halides (AOX) (halogenated substances)". As no signs of contamination were found in the soil samples tested (taken from two depths), it is not planned to install soil quality monitoring.
The investor is obliged to ensure that the techniques used for thermal waste treatment comply with the best available techniques (BAT).	Compliance	Compliance is demonstrated in chapter 14 of this report related to BAT.
Control measurements of noise levels in the environment must be carried out within three months after the plant is put into operation. The Investor is obliged to submit the results of these measurements to the competent environmental protection authority.	Compliance	Within three months from the date of commissioning the facility, the Investor will perform control measurements of noise levels in the environment and the results of these measurements will be submitted to the competent environmental protection authority.

20.2 Summary and conclusions

Due to the construction and operation of the WTE Plant in the area under consideration, no significant impacts on the environment and human health and life are expected.

Considering the issue of construction and operation of the WTE Plant in a broad area context, the implementation of the undertaking will be associated with a positive impact on humans and all other components of the natural environment. The inclusion of waste management in a well-organized system, of which the WTE Plant will be the most important element, will allow waste management that is safer for human health.

As shown by the analysis of the impact of the designed investment project on all components of the environment, including, i.a., air and acoustic climate (i.e. potentially the ranges in which the greatest direct or indirect impact of the investment project on living organisms is possible), stringent standards of permissible emissions and imissions will be met, and therefore the operation of the planned investment project will not have a negative impact on humans.

The WTE Plant is designed in accordance with OH&S and sanitary regulations, and therefore does not pose a risk to users, who will mandatorily undergo on-the-job training.

The educational path for non-employees will lead along safe routes adapted in terms of OH&S for visitors.

The WTE Plant site is expected to welcome visitors, including tours that will travel along the educational path. The following stages are envisaged within the educational path: presentation of the plant in the conference room, then going to the unloading hall and getting acquainted with the waste reception station – observation of waste loading into the bunker. The final stage is a tour of the control room, where the participants will observe the work of the plant staff, including the process of loading waste onto the boiler grate.